CALPINE

FOURMILE HILL GEOTHERMAL DEVELOPMENT PROJECT

Environmental Impact Statement
Environmental Impact Report

Volume III: Final EIS/EIR
Response to Comments
on the Draft EIS/EIR

State Clearinghouse No. 96062042

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FOREST SERVICE
U S
DEPARTMENT OF AGRICULTURE

County of Siskiyou
AIR POLLUTION CONTROL DISTRICT

BONNEVILLE
POWER ADMINISTRATION

FOURMILE HILL GEOTHERMAL DEVELOPMENT PROJECT

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September 1998

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Final EIS/EIR
Table of Contents

EXECUTIVE SUMMARY

The Executive Summary includes a description of the purpose and need for the proposed project and alternatives, a summary of key issues raised by the public during the comment period, and a summary of the environmental impacts of the proposed project.

VOLUME I: FINAL EIS/EIR

1: Introduction and Purpose and Need
2: Alternatives, Including the Proposed Project
3: Description of the Affected Environment
4: Environmental Consequences and Mitigation Measures
5: Mitigation Monitoring and Reporting Program
6: List of Preparers and Agencies and Persons Contacted
7: References
8: Index

Volume I of the Final EIS/EIR includes the revised text of the Draft EIS/EIR. The revisions to the document include errata, staff-initiated changes, and additional clarifications, as identified in the responses to public comments.

VOLUME II: FINAL EIS/EIR APPENDICES

A: Mailing List for Draft and Final EIS/EIR
B: Scoping Materials
C: Biological Resources
D: Visual Resources
E: Meteorological Data
F: Air Quality Impact Assessment

Volume II includes the appendices that were included in the Draft EIS/EIR. The appendices have been provided as a separate volume due to the increased size of the EIS/EIR. Similar to Volume I, Volume II reflects revisions due to errata, staff-initiated changes, and additional clarifications.

VOLUME III: FINAL EIS/EIR RESPONSES TO COMMENTS ON THE DRAFT EIS/EIR

1: Introduction
2: Agencies, Organizations, and Persons Commenting on the Draft EIS/EIR
3: Responses to Comments on the Draft EIS/EIR
4: Responses to NEPA/CEQA Issues Comments
5: Responses to Project Preference Comments
6: Responses to General Comments
7: Comment Index
8: Index

Volume III presents all public comments on the Draft EIS/EIR as well as comments on other issues, and the agency responses to all of these comments. Public comments were submitted in writing, and heard verbally at public hearings that were held for the Draft EIS/EIR. Individual comments have been organized by parameter in order to provide complete response on all issues.

VOLUME IV: FINAL EIS/EIR COMMENTS ON THE DRAFT EIS/EIR

1: Original Comment Letters
2: Comment Index

Volume IV provides copies of the original comment letters that were received on the Draft EIS/EIR. This volume also includes copies of the transcripts from the Draft EIS/EIR public hearings.

Volume III: Final EIS/EIR Responses to Comments on the Draft EIS/EIR
Table of Contents

NOTE TO READERS v
KEY TO ACRONYMS vii

1: INTRODUCTION 1-1
1.1 Organization of the Final EIS/EIR 1-1
1.2 Organization of Volume III 1-2
1.3 Project Overview 1-3
1.4 NEPA/CEQA Compliance 1-8
1.5 Summary of Key Comment Topics 1-13

2: AGENCIES, ORGANIZATIONS, AND PERSONS COMMENTING ON THE DRAFT EIS/EIR 2-1
2.1 List of Agencies, Organizations, and Persons Who Submitted Written Comments 2-1
2.2 List of Individuals Who Attended the Public Hearings 2-6

3: RESPONSES TO COMMENTS ON THE DRAFT EIS/EIR 3-1
3.1 Introduction and Purpose and Need 3-3
3.2 Alternatives, Including the Proposed Action 3-39
3.3 Geology and Soils 3-74
3.4 Hydrology 3-86
3.5 Geothermal Resources 3-207
3.6 Cultural Resources 3-228
3.7 Traditional Cultural Values 3-250
3.8 Vegetation 3-278
3.9 Wildlife 3-325
3.10 Visual Quality 3-388
3.11 Plans and Policies 3-415
3.12 Land Use and Recreation 3-443
3.13 Transportation 3-473
3.14 Air Quality 3-477
3.15 Noise 3-561
3.16 Human Health and Safety 3-612
3.17 Socioeconomics 3-642
3.18 Cumulative Effects 3-659
3.19 Other Statutory Sections 3-706
3.20 Mitigation Monitoring and Reporting Program 3-712

4: RESPONSES TO NEPA/CEQA ISSUES COMMENTS 4-1
4.1 Introduction 4-1
4.2 NEPA/CEQA Issues 4-1

5: RESPONSES TO PROJECT PREFERENCE COMMENTS 5-1
5.1 Introduction 5-1
5.2 Project Preference 5-1

6: RESPONSES TO GENERAL COMMENTS 6-1
6.1 Introduction 6-1
6.2 General Comments 6-1

7: COMMENT INDEX 7-1
7.1 Comments and Responses Organization 7-1
7.2 How to Find Your Comments 7-2
7.3 Comment Index 7-3

List of Tables

Table 1.5-1: Status of Previously Drilled Geothermal Wells at the Glass Mountain KGRA 3-27
Table 3.3-5: Shallow Groundwater Data 3-108
Table 3.3-7: Chemical Analyses for Groundwater Wells, Groundwater Springs, and Geothermal Well Near the Project Area 3-125
Table 4.3-3: Deposition of Air Emission on Medicine Lake 3-172
Table 4.3-4: EPA Water Quality Criteria for the Protection of Aquatic Life 3-177
Table 3.3-2a: Water Quality of Surface Waters in the Project Area 3-198
Table 3.4-1: Chemical Analyses of Geothermal Fluids from Wells 87-13, 68-8, and 31-17—Medicine Lake Caldera 3-216
Table 3.5-1: Examples of Geothermal Power Plants with Extended Periods of Production 3-224
Table 4.7-1a: Invasive Exotic Plants Known to Occur on the Modoc National Forest 3-299
Table 4.3-4: EPA Water Quality Criteria for the Protection of Aquatic Life 3-383
Table C-2: Summary of Methodology of Botanical and Wildlife Studies Referenced in the EIS/EIR 3-386
Table 3.14-2: Ambient Noise Levels at Medicine Lake 3-580
Table 4.17-2: Comparison of Individual and Cumulative Impacts of the Fourmile Hill and Telephone Flat Geothermal Projects 3-679
Table 4.17-2a: Habitat Disturbance Associated with the Fourmile Hill Project and the Telephone Flat Project 3-691
Table 4.17-3: Estimated Noise Levels ($dBAL_{eq}$) During Concurrent Construction of Worst-Case Periods of the Fourmile Hill and Telephone Flat Projects 3-703

List of Figures

Figure 1: Regional Location Map 1-4
Figure 2: Project Area and Proposed Transmission Line Route 1-5
Figure 3: Power Plant and Wellfield Area 1-7
Figure 4: Proposed and Alternative Transmission Line Segments 1-9
Figure 3.4-4a: Locations of Isothermal Cross Sections 3-104
Figure 3.4-4b: Distribution of Temperature with Depth through the Medicine Lake Highlands 3-105
Figure 3.4-4c: Distribution of Temperature with Depth through the Medicine Lake Highlands 3-106
Figure 2.2-4a: Typical Well Casing Profile 3-136
Figure 4.3-1: Location of Groundwater Monitoring Wells 3-201
Figure 3.14-2: Tionesta Sensitive Noise Receptor Locations 3-585

NOTE TO READERS

This document provides responses to comments on the Draft EIS/EIR received from the public and various state and Federal agencies for the proposed Fourmile Hill Geothermal Development Project. The purpose of this document is to provide further information on the proposed project, and to clarify issues that may have been unclear to readers. In addition, the responses highlight the changes that have been made to the EIS/EIR.

Comments and Responses Organization

COMMENTS

A total of 270 comment letters were received on the Draft EIS/EIR. Most of the letters contained several comments on a variety of topics. Additional comments were made at the five public hearings that were held after the Draft EIS/EIR was published. Each comment letter or source has been assigned an alphabetical designation for easy reference (see Section 2.1 of this document). After the 24th letter (Letter "Z"), the code continues as "AA, AB, AC, ..." and so on. Letters were ordered alphabetically in three broad categories, in the following order:

1. Comment letters from regulatory agencies
2. Comment letters from other organizations
3. Comment letters from individuals

Each comment in each letter was assigned a number code. Thus, each comment has a unique alphanumeric code, representing the comment letter (the letter code) and the individual comment within each letter (the number code). For example, the third comment in the second letter would have the code "B.3."

Many of the comments received addressed the same topic (e.g., potential for effects on Fall River Mills water quality and quantity). The lead agencies determined that the most effective way to respond to the comment letters was to group individual comments by topic area, rather than to respond separately to each comment letter. This format is intended to provide readers with a more comprehensive and concise discussion of each topic area.

Comment letters were converted to electronic form by scanning or typing. The content of each letter was fully preserved. Individual comments in each letter were then separated and categorized by broad environmental parameter (e.g., hydrology, vegetation, etc.). The comments were then grouped by these parameters. In many cases, comments addresses several topics at once (i.e., in the same sentence). In these cases, comments were assigned to the primary environmental topic addressed. In cases where

there was no primary comment (e.g., a list of topics), the comment was assigned the topic that appeared first in the sentence. Within each environmental topic, the comments were further organized into subtopics addressing specific areas of each environmental parameter (e.g., "Effects of Well Venting on Vegetation").

ORGANIZATION OF COMMENTS

The environmental parameters are presented in the same order in which they appear in the EIS/EIR. Subtopics are then organized within each environmental parameter. For each subtopic, there are two sections: comments (organized alphabetically and numerically), and their responses.

RESPONSES

The responses address all individual comments. The text of the responses was written to provide a thorough discussion of the issues raised by the comments, rather than segmented answers to isolated issues. Where appropriate, responses reference specific comments by alpha-numeric designation (e.g., "In response to comment A.9,...") in order to address specific issues. The Comment Index provides a listing of comment letters with corresponding alphabetical designations, as well as numeric designations for each individual comment.

How to Find Your Comments

The index is organized alphanumerically. For each comment, its comment number and the name of the commentor is identified, the section of Volume III in which the comment is located is provided, and the page number on which the comment is located is identified.

1. Turn to the Comment Index in Chapter 7 of this volume (the Comment Index also appears in Volume IV, which contains the original comment letters). The pages of the index are tan for easy identification.
2. Find your name or the name of your organization (alphabetized). Please note that letters IV through JJ were received after the comment period had ended, and are therefore not alphabetical with the rest of the letters.
3. Identify your letter's letter designation (e.g., Q, AL, BA, JJ, etc.).
4. Find your comment letter in Volume IV (the table of contents in Volume IV identifies the page on which the letters begin), which contains all original comments letters with individual comments identified by the letter designation and number.
5. Using the Comment Index, identify the page number on which your comments appear.
6. Turn to the pages in this volume where your comments are located. The responses will follow the comments.

An alternative method of using this document is to turn to a topic of interest, review the comments received on the topic and read the responses.

KEY TO ACRONYMS

ACRONYM	DEFINITION
AAQS	Ambient Air Quality Standard
AC	Alternating Current
ACGIH	American Conference of Governmental Industrial Hygienists
ACHP	Advisory Council on Historic Preservation
AIRFA	American Indian Religious Freedom Act
AMA	Adaptive Management Area
ANSI	American National Standards Institute
APCD	Air Pollution Control District
APLIC	Avian Power Line Interaction Committee
AQMD	Air Quality Management District
ATC	Authority to Construct
BACT	Best Available Control Technology
BEA	Bureau of Economic Analysis
bgs	Below Ground Surface
BLM	U.S. Department of the Interior, Bureau of Land Management
BOPE	Blowout Prevention Equipment
BPA	Bonneville Power Administration
°C	Degrees Celsius
CA	California
CAA	Clean Air Act
CalEnergy	CalEnergy Company, Inc.
Cal EPA	California Environmental Protection Agency
CAPCOA	California Air Pollution Control Officers' Association
CARB	California Air Resources Board
CCAA	California Clean Air Act
CCR	California Code of Regulations
CDF	California Department of Forestry
CDFG	California Department of Fish and Game
CDMG	California Division of Mines and Geology
CDOG	California Division of Oil and Gas
CEGC	California Energy General Corporation
CEQ	Council of Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CHP	California Highway Patrol
cm/sec	Centimeter per Second
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society

CO	Carbon Monoxide
CO_2	Carbon Dioxide
COTP	California-Oregon Transmission Project
CPUC	California Public Utilities Commission
CVRWQCB	Central Valley Regional Water Quality Control Board
CWF	Circulating Water Flow
CWHR	California Wildlife Habitat Relationships System
dB	Decibel
dBA	Decibels A-weighted
dbh	Diameter Breast Height
DC	Direct Current
DLG	Digital Line Graph
DWR	Department of Water Resources
EA	Environmental Assessment
EHR	Erosion Hazard Rating
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMF	Electromagnetic Field
EPA	U.S. Environmental Protection Agency
°F	Degrees Fahrenheit
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FESA	Federal Endangered Species Act
FHWA	Federal Highway Administration
FLPMA	Federal Land Policy and Management Act of 1976
FMRP	Freeport-McMoRan Resource Partners
FONSI	Finding of No Significant Impact
FTB	Fluidized Thermal Backfill
FWARG	Far Western Anthropological Research Group, Inc.
GERA	G.E. Raleigh & Associates
g/MW-hr	Grams per Megawatt-hour
gpm	Gallons per Minute
gr/ACF	Grains per Actual Cubic Foot
GRO	Geothermal Resources Operational Order
GUP	Geothermal Utilization Permit
H_2S	Hydrogen Sulfide
H_2SO_4	Sulfuric Acid
HDPE	High Density Polyethylene
HI	Hazard Index
HPFF	High Pressure Fluid Filled
hz	Hertz
I-5	Interstate 5
IP	Interested Parties
IRPA	International Radiation Protection Association
IS	Initial Study
ISO	International Standards Organization
K	Soil-Erodibility Factor
KGRA	Known Geothermal Resource Area
Khz	KiloHertz
km	Kilometer

KOP	Key Observation Point
kph_m	Thousand Pounds per Hour, Mass Flow
kV	Kilovolt
L_{dn}	Day-Night Average Noise Level
L_{eq}	Average Hourly Equivalent Sound Level over a 24-hour Period
lb/day	Pounds per Day
LRMP	Land and Resource Management Plan
MCL	Maximum Contaminant Level
MDB&M	Mount Diablo Base and Meridian
mG	Milligauss
MIS	Management Indicator Species
MLSA	Managed Late Successional Area
mm	Micrometer
MMRP	Mitigation Monitoring and Reporting Program
MOU	Memorandum of Understanding
mph	Miles per Hour
MSDS	Material Safety Data Sheets
m/sec	Meters per Second
msl	Mean Sea Level
MW	Megawatt
n/a	Not Available
NAGPRA	Native American Graves Protection and Repatriation Act
NAWS	Naval Air Weapons Station
NCRWQCB	North Coast Region Water Quality Control Board
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
No.	Number
NO	Nitric Oxide
NO_X	Nitrogen Oxides
NO_2	Nitrogen Dioxide
NOI	Notice of Intent
NOP	Notice of Preparation
NPAB	Northeast Plateau Air Basin
NPS	National Park Service
NRHP	National Register of Historic Places
NSR	New Source Review
O_2	Molecule of Oxygen
O_3	Ozone
OEPC	Office of Environmental Project Compliance
OSHA	Occupational Safety and Health Act
Pb	Lead
PDEIS	Preliminary Draft Environmental Impact Statement
PG&E	Pacific Gas and Electric Company
PM_{10}	Particulate Matter Less Than 10 Microns
POO	Plan of Operation
POU	Plan of Utilization
ppb	Parts per Billion
ppm	Parts per Million
ppm_w	Parts per Million by Weight

PSD	Prevention of Significant Deterioration
PST	Pacific Standard Time
PTO	Permit to Operate
PUHCA	Public Utility Holding Company Act
PURPA	Public Utility Regulatory Policies Act
RCRA	Resource Conservation and Recovery Act
REL	Reference Exposure Level
Rh	Relative Humidity
RMA	Recreation Management Area
ROD	Record of Decision
ROG	Reactive Organic Gases
ROS	Recreation Opportunity Spectrum
ROW	Right-of-Way
RV	Recreational Vehicle
RWQCB	Regional Water Quality Control Board
SCAPCD	Siskiyou County Air Pollution Control District
SCEC	Soil Conservation and Erosion Control Plan
SCFF	Self Contained Fluid Filled
SCS	Soil Conservation Service
SD	Solid Dielectric
SHPO	State Historic Preservation Office
SIA	Special Interest Area
SL	Site License
SNARL	Suggested No-Adverse-Response Level
SO_x	Sulfur Oxides
SO_2	Sulfur Dioxide
SO_4	Sulfate Component of PM_{10}
TOG	Total Organic Gases
$\mu g/m^3$	Micrograms per Cubic Meter
URF	Unit Risk Factor
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
USFS	U.S. Department of Agriculture, Forest Service
USFWS	U.S. Department of the Interior, Fish and Wildlife Service
USGS	U.S. Department of the Interior, Geological Survey
UTM	Universal Transverse Mercator
v/M	Volts per Meter
VMS	Visual Management System
VQO	Visual Quality Objective
VRM	Visual Resources Management
wf/pp	Wellfield and Power Plant Area
WHR	Wildlife Habitat Relationship

1: INTRODUCTION

This document is Volume III of the Final Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) for the Fourmile Hill Geothermal Development Project. This volume provides lead agency responses to public and agency comments on the Draft EIS/EIR, which was circulated for public review in July 1997. The following information is provided in this chapter of Volume III:

- Organization of the Final EIS/EIR
- Organization of Volume III
- Project Overview
- NEPA/CEQA Compliance
- Summary of Key Comment Topics

1.1 Organization of the Final EIS/EIR

The Final EIS/EIR for the Fourmile Hill geothermal project is presented in four volumes:

- Volume I: EIS/EIR
- Volume II: Appendices to the EIS/EIR
- Volume III: Responses to Comments on the Draft EIS/EIR
- Volume IV: Public Comment Letters

Volume I of the Final EIS/EIR includes the revised text of the Draft EIS/EIR. The revisions to the document include errata, staff-initiated changes, and additional clarifications, as identified in the responses to public comments.

Volume II includes the appendices that were included in the Draft EIS/EIR. The appendices have been provided as a separate volume due to the increased size of the EIS/EIR. Similar to Volume I, Volume II reflects revisions due to errata, staff-initiated changes, and additional clarifications.

Volume III (this volume) presents all public comments on the Draft EIS/EIR as well as comments on other issues, and the agency responses to all of these comments. Public comments were submitted in writing, and heard verbally at public hearings that were held for the Draft EIS/EIR. Individual comments have been organized by parameter in order to provide complete response on all issues.

Volume IV provides copies of the original comment letters that were received on the Draft EIS/EIR. This volume also includes copies of the transcripts from the Draft EIS/EIR public hearings.

1.2 Organization of Volume III

This volume of the Final EIS/EIR (Volume III) is organized into seven chapters. Chapter 1 of Volume III describes the organization of the Final EIS/EIR, provides a brief overview of the project, and discusses the process that has been undertaken to ensure compliance of the Final EIS/EIR with NEPA and CEQA. Chapter 1 also provides a summary of the key clarifications and revisions to the Final EIS/EIR.

Chapter 2 of this volume provides a list of all agencies, organizations, and persons who provided written comments on the Draft EIS/EIR during the Draft EIS/EIR public review and comment period. This chapter also identifies individuals who attended Draft EIS/EIR public hearings. A total of 270 comment letters were received on the Draft EIS/EIR, and five public hearings were held. Approximately 2,300 individual comments have been identified from the comment letters and public hearings.

Chapter 3 includes all comments that were received on the Draft EIS/EIR (both in writing and verbally), and provides responses to these comments. For this Final EIS/EIR, each comment letter that was received has been assigned an alpha designation (e.g., Letter A), and each individual comment in each letter has been assigned a comment number (e.g., comment A.1). The public hearings for the Draft EIS/EIR were each assigned a special alphanumeric designation (e.g., public hearing PH1). The individual verbal comments that were taken at the hearings were each assigned a comment number, following the style used for written comments (e.g., comment PH1.1).

All Draft EIS/EIR comments were either scanned or typed as computer files. The comments were then organized by environmental parameter in Chapter 3, in the sequence that these parameters are addressed in the Draft EIS/EIR. Similar comments that address the same general topic within a given parameter are grouped together, and one response is provided for these comments. The comments are provided verbatim, with only minor and occasional corrections of misspellings.

Where appropriate, reference is made in the responses in Chapter 3 to specific comments. These references are usually made when a comment raises an issue that is not directly related to the main topic being addressed in the response, yet the issue merits a direct response. Any necessary revisions to the text of the Draft EIS/EIR are described in the responses.

Chapters 4 through 6 provide responses to public comments that do not address the Draft EIS/EIR; these chapters are organized similar to Chapter 3. Chapter 4 presents comments and responses on issues related to NEPA and CEQA compliance. Chapter 5 identifies comments that express a project preference, and provides responses to these comments. General comments and responses are provided in Chapter 6.

Chapter 7 includes an index of all comments on the Draft EIS/EIR. This index is provided to facilitate the location of specific comments and their associated responses.

The index is organized in alphanumeric order. For each comment, its comment number and the name of the commentor is identified, the section of Volume III in which the comment is located is provided, and the page number on which the comment is located is identified.

1.3 Project Overview

The proposed project would involve the construction and operation of a geothermal power plant and wellfield (with an associated transmission line) at the Glass Mountain Known Geothermal Resource Area (KGRA). This section provides the project location, describes the proposed project and project alternatives, and identifies the lead agencies and their roles.

PROJECT LOCATION

The proposed project would be located on the Klamath and Modoc National Forests, in Siskiyou and Modoc Counties, California (see Figure 1). The proposed geothermal power plant and wellfield would be located on Federal geothermal leases in the Glass Mountain KGRA on the Klamath National Forest. The proposed transmission line would extend east from the geothermal power plant to a connection with the existing BPA Malin-Warner transmission line. Figure 2 illustrates the proposed power plant and wellfield location and transmission line route. Figure 3 shows the power plant and wellfield area in greater detail.

PROPOSED PROJECT AND ALTERNATIVES

In 1996, Calpine Corporation submitted a Plan of Utilization for geothermal development to the U.S. Bureau of Land Management (BLM) and the U.S. Forest Service (USFS). The proposed project would consist of:

- A 49.9 megawatt (MW) gross geothermal power plant
- Five production well pads, three injection well pads, and associated access roads
- Geothermal production and injection pipelines
- A 230-kilovolt (kV) transmission line with associated access roads

The proposed project has been identified as Alternative 1. Six alternatives to the proposed project (including the No Action alternative) have also been identified. Alternatives 2 through 6 utilize the same power plant and wellfield location, but involve alternate transmission line routes. Figure 4 (on page 1-9) illustrates the alternative transmission line routes. These alternatives were identified to avoid or eliminate environmental effects of the proposed project. Alternative 7 is the No Action alternative.

At the time of Draft EIS/EIR release, Alternative 7 was identified as the environmentally preferable alternative from all of the alternatives. From among the "action" alternatives, Alternative 6 was identified as the environmentally preferable alternative. Subsequent to release of the Draft EIS/EIR for the project, the lead agencies identified Alternative 6 as the lead agencies' preferred alternative. This alternative transmission line would use transmission line Segment A3 instead of Segments A1 and

Figure 1: Regional Location Map

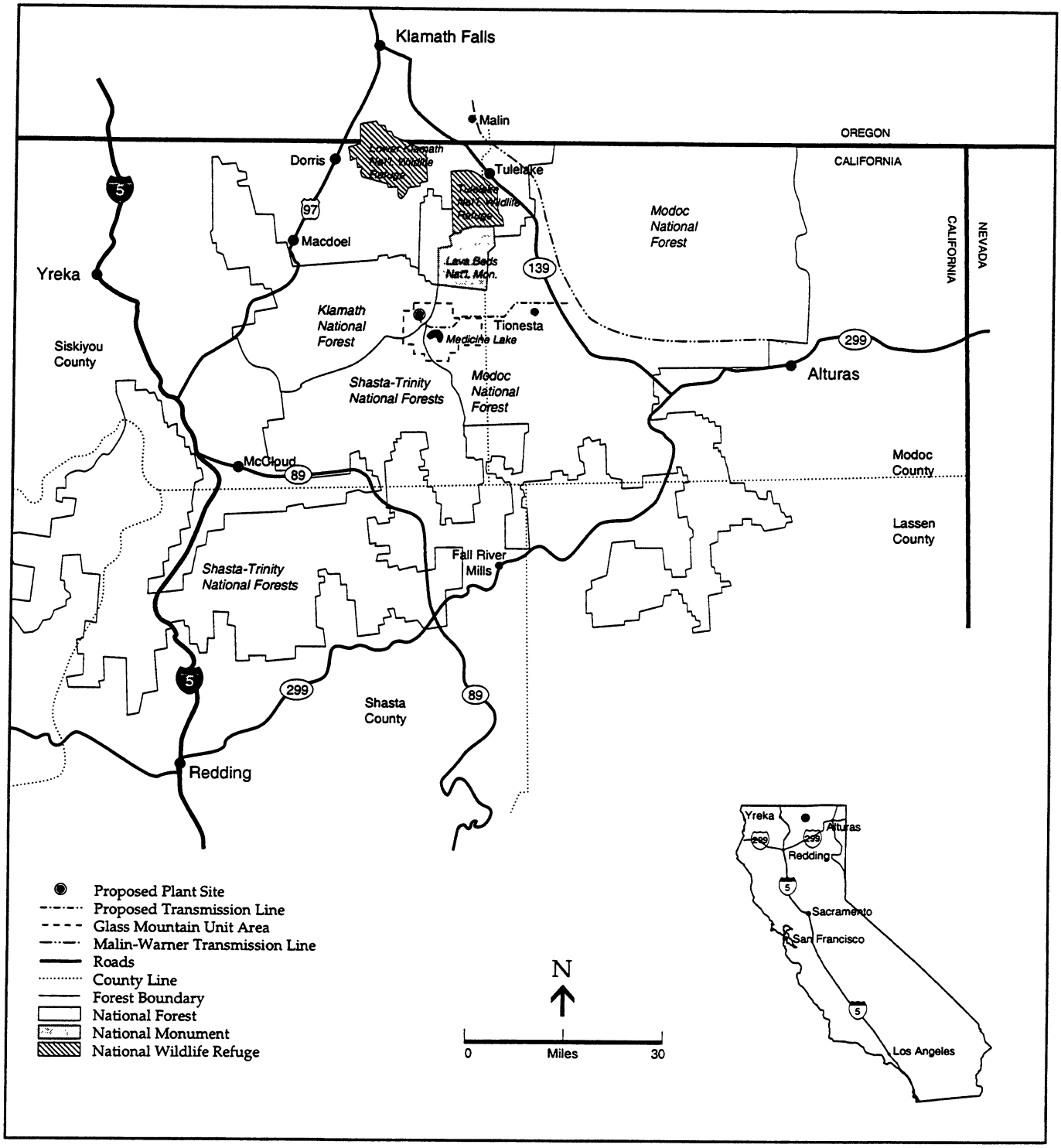


Figure 2: Proposed Power Plant and Transmission Line Routes

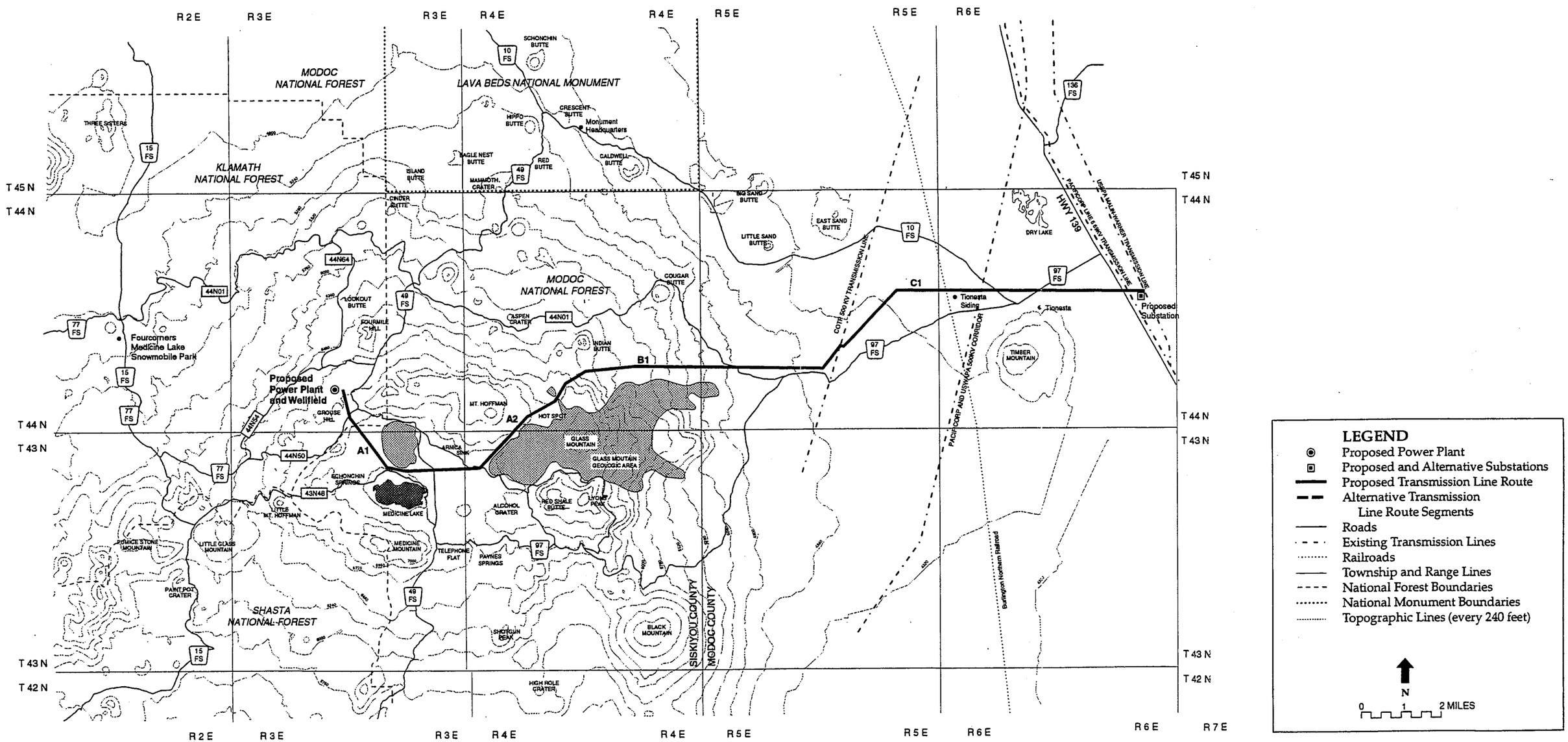
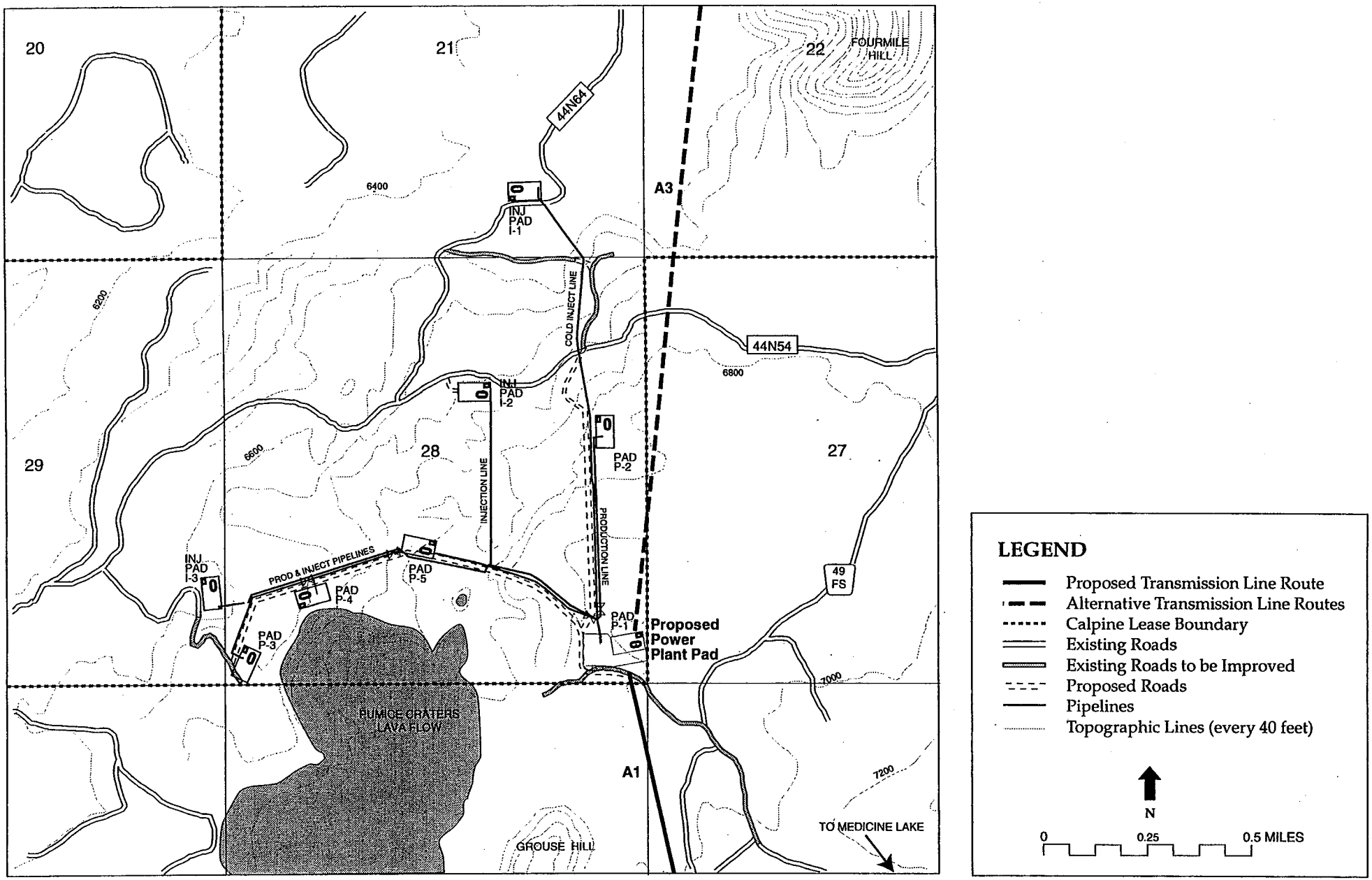


Figure 3: Power Plant and Wellfield Area



MHA *Environmental Consulting, Inc.*

SOURCE: Calpine

A2 proposed as part of the proposed action, and would use Segment C2 instead of Segment C1 (see Figure 4). Segment A3 would be routed north from the proposed power plant to avoid the Medicine Lake area, and Segment C2 would be located in the vicinity of Dry Lake to avoid Tionesta and Timber Mountain.

A full description of the proposed project and alternatives can be found in Volume I, Chapter 2 of the EIS/EIR.

LEAD AGENCIES

The project would be located on Federal geothermal leases under the jurisdiction of the BLM. The leases are located on National Forest land, where the USFS is the surface-managing agency. These agencies are therefore the NEPA lead agencies for the proposed project. The BLM will use this EIS/EIR in making a decision whether to grant approvals and permits for the proposed project. The USFS will consider whether to issue authorizations, enact Klamath and Modoc Land and Resource Management Plan (LRMP) amendments, and take other actions.

The U.S. Department of Energy, Bonneville Power Administration (BPA) is a Federal agency responsible for purchasing, developing, and marketing electrical power. The BPA must decide whether to purchase power from the proposed project and transmit this power over BPA lines. The BPA is serving as a cooperating Federal agency under NEPA.

The proposed project would require permits from the Siskiyou County Air Pollution Control District (APCD). The Siskiyou County APCD must consider the effects of their actions and is acting as the CEQA lead agency.

The lead agencies and their roles are further described in Volume I, Chapter 1 of the EIS/EIR.

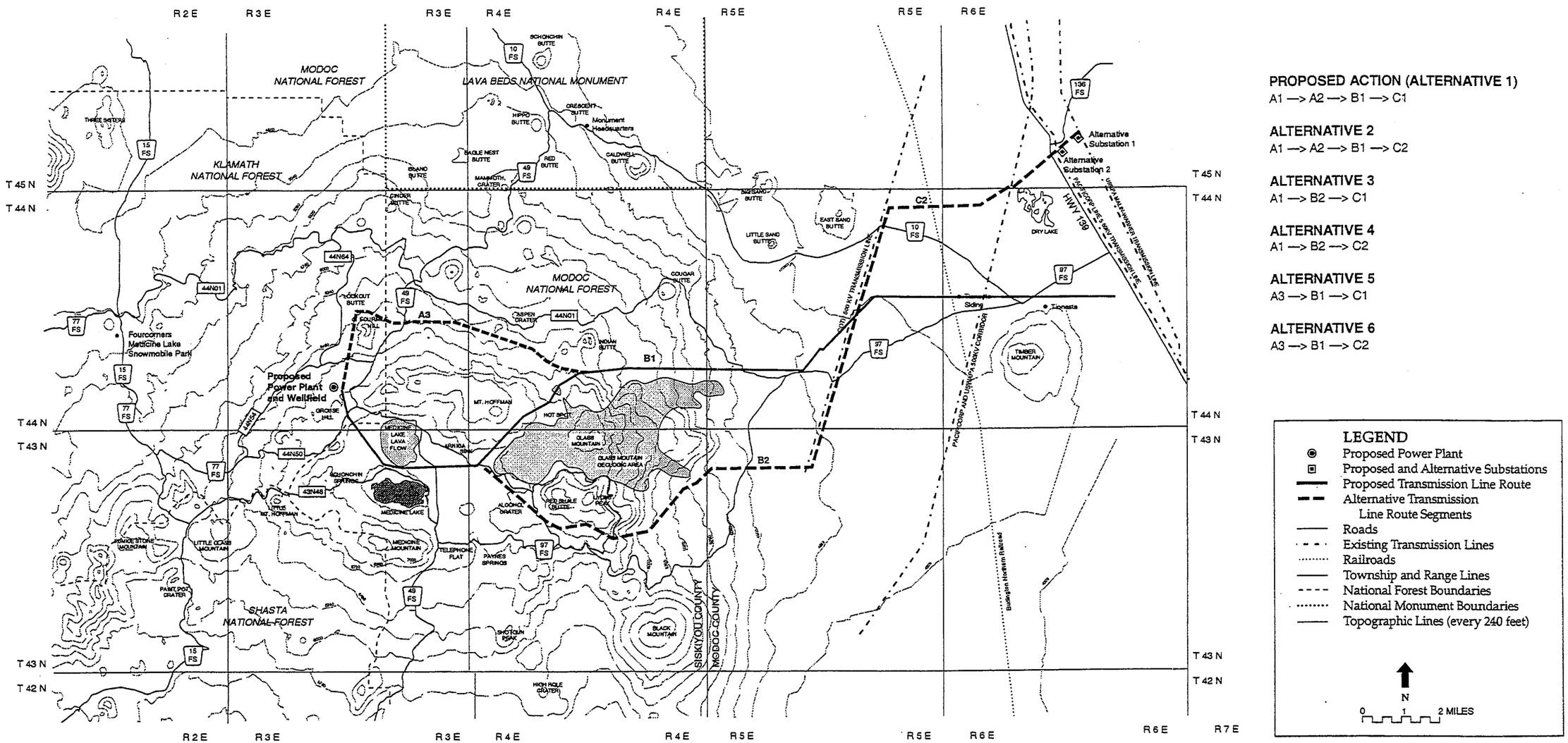
1.4 NEPA/CEQA Compliance

NEPA/CEQA REQUIREMENTS

Both NEPA and CEQA require that a Draft EIS/EIR be made available to the public for review and comment. NEPA encourages the solicitation of comments on a Draft EIS from individuals or organizations that may be interested or affected, and CEQA requires that notices of the availability of a Draft EIR be made to all individuals and organizations that have requested such notice. The goal is to provide the public with an opportunity for meaningful review of the Draft EIS/EIR, as well as an opportunity to comment on the potential environmental effects of a proposed project. Both NEPA and CEQA allow for public hearings to be held at the discretion of the lead agencies, but such meetings are not required.

This Final EIS/EIR is an informational document prepared by the lead agencies, that must be considered by decision makers before these agencies can approve or deny their respective discretionary permits for the project. Both NEPA and CEQA require that substantive comments on a Draft EIS/EIR shall be included in the Final EIS/EIR, and that responses to these comments be provided. This document has been prepared pursuant to the requirements of NEPA and CEQA.

Figure 4: Proposed and Alternative Transmission Line Segments



PUBLIC NOTICING

The lead agencies conducted an extensive public participation program in accordance with NEPA and CEQA. The program was designed to assist the lead agencies in fully addressing the public's concerns about the environmental impacts of the proposed project, and obtaining comments on the adequacy of the environmental analysis in the Draft EIS/EIR.

Public notices were issued at several stages in the preparation of the Draft EIS/EIR to ensure that the public had adequate opportunities to learn about the project and express the concerns about environmental issues. The following public notices were issued:

- In June 1996, an Interested Parties letter was mailed to approximately 800 individuals, agencies, and groups as part of the scoping process; this letter included a return mailer to the USFS that allowed Interested Parties to request to be kept on the mailing list and notified of the project and Draft EIS/EIR.
- On July 11, 1997, a Notice of Completion for the Draft EIS/EIR was submitted to the State Clearinghouse.
- On July 11, 1997, a request was submitted to the EPA for filing of a notice of availability for the Draft EIS/EIR in the Federal Register.
- On July 16, 1997, the USFS issued a news release regarding the availability of the Draft EIS/EIR and the beginning of the public review period for the document.
- On July 18, 1997, the EPA filed a notice of availability for the Draft EIS/EIR in the Federal Register, which officially began the public review period for the document.

DRAFT EIS/EIR DISTRIBUTION

A total of over 375 copies of the Draft EIS/EIR for the Fourmile Hill project were distributed to approximately 330 individuals, agencies, and groups. The Draft EIS/EIR was initially distributed for public and agency review on July 10, 1997. At that time, copies of the Draft EIS/EIR were sent to each individual, agency, and organization that requested to be kept notified of the project and the Draft EIS/EIR, as well as those individuals, agencies, and organizations that specifically requested a copy of the Draft EIS/EIR.

Subsequent to the Draft EIS/EIR release date, additional requests for copies of the Draft EIS/EIR were received by the lead agencies. Approximately 45 copies of the Draft EIS/EIR were distributed in response to these requests.

The Draft EIS/EIR was also made available for public review at all of the lead and cooperating agency offices, including:

- USFS offices in Alturas, Macdoel, and Tulelake
- BLM offices in Alturas
- Siskiyou County APCD offices in Yreka
- BPA offices in Portland, Oregon

In addition, the Draft EIS/EIR was available for public review at public libraries in Siskiyou and Modoc Counties, California, and Klamath County, Oregon.

PUBLIC REVIEW PERIOD

Following distribution of the Draft EIS/EIR, a public review period was held during which the public could review and comment on the Draft EIS/EIR. Although the Draft EIS/EIR was distributed on July 10, 1997, the public review period for the document officially began on July 18, 1997 when the EPA published a Notice of Availability for the Draft EIS/EIR in the Federal Register.

The lead agencies initially intended to hold a 60-day public review period for the Draft EIS/EIR. The review period was scheduled to close on September 16, 1997. In response to numerous requests, however, the public review period was extended by two weeks and officially closed on September 30, 1997. Notice of the review period extension was provided on September 10, 1997 to all recipients of this extension. Thus, the official public review period for the Draft EIS/EIR was 74 days.

PUBLIC HEARINGS

Public hearings to receive comments on the Draft EIS/EIR were held at the following locations:

- Dorris, California on August 5, 1997
- Klamath Falls, Oregon on August 6, 1997
- Yreka, California on August 7, 1997
- Mt. Shasta, California on August 29, 1997
- Medicine Lake, California on August 30, 1997

MEETINGS WITH AGENCIES

In addition to the five public hearings, several meetings were held to discuss comments and questions related to the Draft EIS/EIR. Meetings were held with staff from the following agencies:

- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- National Park Service, Lava Beds National Monument
- North Coast Regional Water Quality Control Board
- Central Valley Regional Water Quality Control Board
- California Department of Fish and Game
- Siskiyou County

MEETINGS WITH AMERICAN INDIAN TRIBES

Meetings with the Klamath Tribes (after distribution of the Draft EIS/EIR) were held on the following dates:

- August 6, 1997
- September 9-13, 1997 (ethnographic interviews with tribal members)
- October 6-11, 1997 (ethnographic interviews with tribal members)
- November 2-4, 1997 (ethnographic interviews with tribal members)
- April 1, 1998

Meetings with the Pit River Tribe (after the distribution of the Draft EIS/EIR) were held on the following dates:

- September 9-13, 1997 (ethnographic interviews with tribal members)
- October 3, 1997
- October 6-11, 1997 (ethnographic interviews with tribal members)
- November 2-4, 1997 (ethnographic interviews with tribal members)
- March 17, 1998
- April 10, 1998

Consultations with the Klamath and Pit River Tribes regarding the project will continue through the time when a decision is made for the project.

1.5 Summary of Key Comment Topics on the Draft EIS/EIR

This section summarizes the topics of public and agency comments on the Draft EIS/EIR, and the key clarifications and revisions made in this Final EIS/EIR. Key issues and concerns raised by the public are identified, and how these issues and concerns are addressed in the responses is summarized. In addition, information that has become available since the release of the Draft EIS/EIR is summarized; the added information supports the conclusions that were drawn in the Draft EIS/EIR. No new impacts have been identified, and no changes have been made to significance determinations. For detailed comments and responses, see Chapter 3 of this volume of the Final EIS/EIR.

INTRODUCTION AND PURPOSE AND NEED

The topic areas of comment on introduction and purpose and need issues were:

- Purpose and Need for the Proposed Action
- Agency Roles and Authorizations
- Other Required Permits and Approvals
- Previous Geothermal Activities
- Geothermal Definition
- Economic Justification for and Viability of the Proposed Action

Several commentors questioned the purpose of the project and whether there is a demonstrated need for the project. Many of these commentors also requested information on the economic justification for the proposed action, and questioned the viability of project. Some commentors requested clarification about the roles and approvals of the lead agencies, as well as other permits and approvals. Commentors also asked about previous geothermal exploration activities in the vicinity, as well as the environmental documentation and public notification for these activities. The definition of geothermal power as renewable or "green" power was questioned.

The responses further explain the purpose and need for the project, and provide additional support for the purpose and need. Neither NEPA nor CEQA require that economic justification for a project be provided, and this information has not been presented in the Final EIS/EIR since it is proprietary. The responses further explain the lead agencies roles and approvals, and clarify the roles of the North Coast and Central

Valley Regional Water Quality Control Boards (RWQCB). Additional details about previous geothermal exploration activities are provided, and environmental documentation and public notification for these activities is summarized. Finally, the responses further elaborate on the basis for considering geothermal to be a renewable or green resource.

Only minor text changes to the EIS/EIR resulted from the responses to comments on introduction and purpose and need issues. Information about the Draft EIS/EIR distribution, Draft EIS/EIR public review period, and additional interested parties meetings has been added to Chapter 1, Introduction and Purpose and Need, of the EIS/EIR.

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

The topic areas of comment on alternatives issues were:

- Project Description
- Well Testing, Design and Maintenance
- Transmission Line Design and Capacity
- Decommissioning
- Alternatives to the Proposed Action
- Alternatives Considered but Eliminated from Detailed Study

Several of the commentors raised questions about the size of the proposed project and the proposed drilling, testing, and maintenance of the geothermal wells. Other comments asked about the design, capacity and reliability of the proposed transmission line. Comments also raised concerns about the consideration of alternatives for the proposed action.

The responses clarify the size of the proposed project and the proposed protocol for the testing, drilling, and maintenance of the geothermal wells. A representative schematic cross-section of the proposed production wells is provided to further illustrate the integral strength of these wells. The proposed design, capacity, reliability, routing, and decommissioning of the transmission lines are further explained in the responses. Responses also provide clarification on the development and consideration of alternatives to the proposed action.

GEOLOGY AND SOILS

The topic areas of comment on geology and soils issues were:

- General
- Potential Effects to Caves
- Geologic Hazards
- Potential Effects to Soils

Several commentors questioned whether the proposed project would increase seismic or volcanic activity in the area. Other commentors questioned whether the project would affect the stability of slopes or create landslides or ground subsidence. Some

commentors questioned the effects on soils from either erosion or deposition of air emissions.

The responses explain that the proposed project may induce microearthquakes that could not be felt by humans and that volcanic activity would not increase. The responses also highlight the erosion-control measures that are part of the project that would minimize soil erosion and eliminate the chance of landslides. The substrate in the area is stable and would not experience substantial ground subsidence.

HYDROLOGY

The topic areas of comment on hydrology issues were:

- General
- Regulatory Information
- Local Groundwater and Effects from Groundwater Use
- Local Groundwater and Effects from Geothermal Fluid Use
- Regional Groundwater
- Surface Waters and Effects from Construction Activities
- Surface Waters and Effects from Groundwater Use
- Surface Waters and Effects from Geothermal Fluid Use
- Surface Waters and Effects from Deposition
- Hydrology Mitigation
- Hydrology Monitoring Plan

The responses to comments on hydrology is one of the longest sections in the Final EIS/EIR. The majority of commentors questioned the impacts of the proposed project from the use of either groundwater or geothermal fluids or from the deposition of air emissions. Most commentors questioned whether these uses would affect groundwater, the geothermal reservoir, or surface water, either locally (i.e., in the project area) or regionally. There were many commentors who asserted that the project could affect the water quantity or quality of the springs at Fall River.

The responses provide an extensive discussion of the project's use of both geothermal fluids and groundwater and how this use might affect each resource, both locally and regionally. Additional data are provided to support the conclusions in the Draft EIS/EIR regarding the potential hydrologic impacts of the project. In addition, there is an extensive discussion of the potential effects of air emissions on surface waters in the vicinity of the project.

Because of the number of commentors who asserted that the project would have an adverse effect on the Fall River springs, the response to these comments is extensive. Several hydrology reports were prepared subsequent to release of the Draft EIS/EIR that support the Draft EIS/EIR conclusions about the lack of potential for significant effect. The response to Fall River springs comments summarizes the conclusions drawn earlier in the hydrology section and provides additional support for the conclusion that the project would not have a measurable effect on the springs at Fall River.

The deposition analysis in the Draft EIS/EIR was revised in response to refinement of the estimates of air emissions from the project. In addition, the revised analysis incorporated a new, more realistic assumption into the model. The results of this revised analysis did not change the conclusions in the Draft EIS/EIR. In response to these comments, several mitigation measures were revised to clarify their intent.

Calpine collected water samples from local surface waters in the area (including Medicine Lake) in November 1997. The water quality analysis of these samples has been added to the Draft EIS/EIR. Calpine has also developed a water quality monitoring program in the power plant and wellfield area since publication of the Draft EIS/EIR that has been preliminarily reviewed by the U.S. Environmental Protection Agency (EPA) and Central Valley and North Coast RWQCBs for adequacy. Details of this program are also included in the responses and in the Final EIS/EIR.

GEOTHERMAL RESOURCES

The topic areas of comment on geothermal resources issues were:

- Data on Geothermal Resource
- Effects on Life Expectancy of the Geothermal Resource
- Effects on Regional Thermal Features

Most commentors questioned either the chemical composition of the geothermal fluids or the life expectancy of the geothermal resource. Several commentors also questioned the temperature gradient data and expressed frustration that some of these data were proprietary and not available for public review. Other commentors expressed concern about potential effects of the project to the Hot Spot.

The responses clarify the chemical composition of the geothermal fluids and provide new information that became available after publication of the Draft EIS/EIR. The life expectancy of the geothermal resource would be adversely but not significantly affected by the project, as demonstrated by data from other geothermal fields that have been in operation for up to 50 years. Minor changes to the Draft EIS/EIR have been made to clarify this discussion.

The responses also clarify the nature of the temperature gradient data, and explain that a thorough review has been conducted of the proprietary data by third parties. The Hot Spot is a surface feature that has no direct connection with the geothermal reservoir and would therefore not be affected by the project.

CULTURAL RESOURCES

The topic areas of comment on cultural resources issues were:

- General
- Section 106 Process
- Tribal Participation
- Survey Methodology
- Potential Impacts at the Power Plant and Wellfield Areas
- Potential Impacts Along the Transmission Line

- Mitigation Measures

The responses clarify the USFS implementation of the National Historic Preservation Act Section 106 process, confirm participation of the tribes in the process, and clarify the mitigation measures. The responses also explain that a Class III cultural resource inventory was conducted for the power plant and wellfield area. A Class III inventory of the transmission line would not be conducted prior to a decision on the project in order to avoid unnecessary effects to cultural resources, and to avoid the expense of surveying routes that are not selected. The Section 106 process will be completed prior to the agencies making a decision on the project in accordance with USFS policy.

Minor additions to the EIS/EIR were made to clarify that the entire wellfield and power plant area were inventoried for cultural resources and to clarify a mitigation measure.

TRADITIONAL CULTURAL VALUES

The main topics of comments on traditional cultural values issues were:

- General
- Importance of the Project Region
- Regulatory Compliance
- Impacts
- Mitigation Measures
- Ethnographic Report

Many commentors expressed opposition to the project based on the sanctity of the region. The commentors identified the Medicine Lake Highlands region and individual sites in the region as areas with religious and spiritual values. Commentors also questioned whether the project complied with the many laws pertaining to protection of cultural resources and Native American heritage, culture, and values. The commentors also identified project impacts to traditional use sites in the region (no new impacts were identified).

The responses acknowledge the traditional cultural values of the area and summarized the tribal participation in the environmental review process. The responses describe the various laws that apply to the project and the consistency with the laws. The responses to comments further clarify that the project would not prevent access to or use of traditional sites, but acknowledge the tribal comments that the project would have a significant adverse effect on the sites and the use of the sites.

Section 3.6, Traditional Cultural Values, in the EIS/EIR has been updated to reflect the second phase of the ethnographic study, which was conducted subsequent to the release of the Draft EIS/EIR. Phase II of the ethnographic study included additional literature review, additional tribal interviews, and field verification of traditional use sites identified in interviews.

Mitigation Measure 4.6.3b was expanded to further define noise control measures.

VEGETATION

The topic areas of comment on vegetation issues were:

- General
- Effects of Emissions on Vegetation
- Other Effects on Vegetation
- Potential Impacts to Special-Status Plants
- Impacts to Specific Plant Communities
- Vegetation Mitigation

Many commentors expressed concern about the potential effects of air emissions on vegetation or about the effects of the project on specific plant communities such as wetlands. Other commentors questioned the adequacy of mitigation measures for impacts to special-status plants and to sensitive plant communities.

The responses clarify the analysis of the potential effect of air emissions on vegetation (particularly for boron) that was presented in the Draft EIS/EIR. Wetland habitats would not be affected by the project because the transmission line would be rerouted to avoid these habitats (there are no wetlands in the power plant and wellfield area). The responses also highlight the mitigation measures designed to avoid or reduce impacts to special-status plants and sensitive plant communities. Minor changes to several mitigation measures were made in response to comments in this section.

WILDLIFE

The topic areas of comment on wildlife issues were:

- General
- Potential Impacts to Special-Status Wildlife
- Impacts to Specific Special-Status Wildlife
- Wildlife Mitigation

The responses summarize the consultations with regulatory agencies to date and explained their role in environmental review process. The USFWS and CDFG have been frequently consulted regarding potential effects to threatened and endangered wildlife species. The Draft EIS/EIR did not include an exhaustive discussion of the habitat requirements of all wildlife because this information was included in biological reports already prepared (some specifically for this project), which were incorporated by reference. However, more information on some species' habitat requirements was provided in the responses.

A new mitigation measure was added to this section to ensure that wildlife would not come in contact with the contents of the sumps. The responses also discuss the amount of noise that would be generated by the project and the potential for this noise would disturb wildlife. Several mitigation measures were highlighted that reduce noise effects. The responses also clarify which roads would be open to the public and to hunting, which might adversely affect wildlife.

The responses provide additional support for the conclusion in the Draft EIS/EIR that the transmission line would not cause bird electrocution and would not significantly affect the chance of bird collisions. The special-status bird with the highest chance of colliding with the line is the sandhill crane. Mitigation in the EIS/EIR was modified to address this species. The responses also provide extensive discussion of the potential effects of the project on the bald eagle, osprey, northern spotted owl, and other raptors.

The Draft EIS/EIR was slightly modified to clarify the discussion of wildlife, particularly for bats. Several mitigation measures were clarified in response to comments in this section. Three other mitigation measures were added to this section that direct Calpine to conduct preconstruction surveys for special-status mollusks.

VISUAL QUALITY

The topic areas of comment on visual quality issues were:

- General
- Methodology
- General Impacts of Project Facilities
- Impacts from Specific KOPs
- Consistency with VQOs
- Mitigation Measures

Most of the comments raised concerns about the visual effect of night lighting, steam plumes, and the transmission line, particularly from vantage points in the vicinity of Medicine Lake. Other commentors were concerned about views of the project from Tionesta, Lava Beds National Monument, and the Little Mt. Hoffman Lookout. Some commentors questioned the determination of VQO consistency at various key observation points (KOPs). One commentor proposed an alternate method for analyzing visual effects.

The responses clarify the potential visual effect of the project at various KOPs, and further explain the VQO consistency of the project. The lighting control guidelines in Mitigation Measure 4.9.2c have been clarified, and an additional mitigation measure (Measure 4.9.5c) has been added to further reduce the potential for night-lighting effects in the Medicine Lake vicinity. Since the visual analysis method used in the Draft EIS/EIR provided a fair and representative evaluation of potential impacts, use of an alternate method for analyzing visual effects is not warranted.

The responses also explain that Alternative 6 has been identified in the Final EIS/EIR as the lead agencies' preferred alternative. This alternative would implement transmission line Segment A3 instead of Segments A1 and A2 (which are proposed as part of the proposed action). Alternative 6 would therefore avoid the significant unavoidable visual effects that would occur at Medicine Lake KOPs under the proposed action.

PLANS AND POLICIES

The topic areas of comment on plans and policies issues were:

- General
- Land and Resource Management Plans
- Northwest Forest Plan
- Released Roadless Areas

Many commentors asserted that the proposed project was not consistent with either the Klamath or Modoc Land and Resource Management Plan (LRMP). Other commentors questioned whether the proposed project was consistent with various aspects of the Northwest Forest Plan. Many commentors expressed a desire to designate portions of the project area as an "old-growth reserve." Many commentors also expressed concern about the potential impacts of the project on the Mt. Hoffman released roadless area.

The responses explain that the proposed project is consistent with the Klamath and Modoc LRMPs after mitigation. The Klamath LRMP would be amended to bring the plan into consistency with the American Indian Religious Freedom Act. The Klamath LRMP would also be amended to make the plan consistent with the Modoc LRMP regarding utility corridors. The responses also explain in detail how the project is consistent with the provisions of the Northwest Forest Plan.

The comments regarding designating the area as an old-growth reserve are beyond the scope of the EIS/EIR and were referred to USFS staff. The lead agencies for this project have chosen Alternative 6 as their preferred alternative. This alternative does not include Segment A2, which passes through the Mt. Hoffman released roadless area. Thus, there would be no impact to this area if the lead agencies' preferred alternative is selected. If an alternative that contains Segment A2 is selected, it would not substantially alter the character of the Mt. Hoffman released roadless area.

LAND USE AND RECREATION

The topic areas of comment on land use and recreation issues were:

- General
- Effects on the Overall Recreation Experience
- Effects on Dispersed Recreation
- Effects on Developed Recreation Use Areas
- Effects on Residential Areas

The majority of commentors expressed concern about the effects of the project on either the recreational experience in and near Medicine Lake or the experience of snowmobile users. Other commentors expressed concern about the potential effects of the project on hunting.

The responses clarify the potential effects of the project on the recreational experience in and near Medicine Lake and provide additional support for the conclusion that the project would not significantly affect uses in this area. The lead agencies for the project have selected Alternative 6 as their preferred alternative. This alternative does not

include transmission line Segment A1; this segment would pass near Medicine Lake and would cross a developed trail. Since Alternative 6 would not use Segment A1, this alternative would avoid effects to recreation at Medicine Lake.

The responses also clarify the proposed project and how it would affect the use of snowmobiles in winter. Due to plowing, approximately seven miles of Forest Road 44N01 would be closed to snowmobile use as a result of this project. The effects of plowing on snowmobile use in the power plant and wellfield area are also discussed. A mitigation measure was modified to clarify how access would be maintained for snowmobiles within this area.

Mitigation Measure 4.15.8b was also clarified to state that "no shooting" signs would be posted in the power plant and wellfield area. This is the only area in which hunting would be partially restricted and would not represent a significant decline in hunting opportunities on the Klamath or Modoc National Forests.

TRANSPORTATION

The topic areas of comment on transportation issues were:

- Vehicular Trips Generated by the Project
- Road Safety
- Effects on the Four Corners-Medicine Lake Snowmobile Park

Most commentors raised concerns about road safety in the project vicinity and parking issues for the Four Corners-Medicine Lake Snowmobile Park. Commentors were also concerned about the volume of traffic generated by the project.

The responses to transportation comments address the issue of road safety in the project area and explain that specific mitigation measures to ensure safety would be implemented if the project were approved. The responses also clarify that the Four Corners-Medicine Lake Snowmobile Park would not be used as a carpool area for the proposed project. The project-generated traffic volumes are also further explained.

AIR QUALITY

The topic areas of comment on air quality issues were:

- Regulatory Issues
- Significance Thresholds
- Methodology
- Potential for Climatic Changes
- Air Quality Analysis
- Emissions
- Air Quality Impacts
- Odor Impacts
- Health Impacts
- Visibility Impacts
- Monitoring and Reporting

- Enforcement of Laws, Regulations, and Permit Conditions
- Mitigation Measures

The responses clarify the various impacts associated with dust, pollutants, noise and odors from the project. The responses also discuss the possibility for various forms of precipitation to be generated by the project. Further elaboration of the potential health impacts associated with the project is provided, the adequacy of the emissions calculations, modeling methodology, and proposed mitigation measures are supported. Project emission calculations have been refined, and minor changes have been made to the emission estimates provided in the Air Quality Section of the Draft EIS/EIR. No changes to the conclusions in this section have been made.

NOISE

The primary areas of comment on noise issues were the following:

- General
- Methodology
- Significance Criteria
- Noise Sources During Construction
- Noise Impacts During Construction
- Noise Sources During Operation
- Noise Impacts During Operation
- Noise During Decommissioning
- Potential Vibration Impacts
- Alternatives
- Mitigation Measures

The responses to comments clarify the methodology used to evaluate potential noise impacts associated with the proposed project. The designation of sensitive receptor sites in the proposed project area was further explained and information was clarified regarding the locations of sensitive receptors in the Tionesta area.

Many commentors expressed objection to the use of the county noise standard associated with actively-used recreational areas (as opposed to passively used open spaces) when evaluating potential noise impacts. The responses explain that the area supports recreational uses that are considered active-uses, such as motor boats and snowmobiles. Thus, the county noise standard associated with active-use is the more appropriate county noise standard to use when evaluating noise impacts associated with the project. Furthermore, it was demonstrated that even if the county noise standard associated with passively used areas was applied to the proposed project, project noise levels would not exceed this standard.

The responses clarify the well drilling and operational noise analysis by explaining the methods used to obtain key noise levels and to determine project-related noise levels at sensitive receptor sites in the area. Minor revisions to the EIS/EIR were made to clarify definitions presented in the noise analysis.

HUMAN HEALTH AND SAFETY

The main topics of comments on human health and safety issues were the following:

- Hazardous Materials
- Well Blowout Hazards
- Fire Hazards
- Electric and Magnetic Field Hazards
- Wellfield Facility Hazards
- Aircraft Hazards
- Threat of Disease
- Mitigation Measures

The primary areas commentors questioned were hazardous waste production and disposal, transport of hazardous materials, accidental release of hazardous materials, and hazards associated with the wellfield facility.

The responses explain that wastes associated with the proposed project would be treated in order to be classified as non-hazardous. However, if wastes deemed hazardous were produced by the project, disposal and transport of these materials would be consistent with all state and Federal regulations. The responses also clarify the procedures and safety plans that would be implemented to prevent accidental release of hazardous materials, and explain that emergency plans would be enacted if an accidental release were to occur.

Commentors expressed concern with the safety of the power plant and wellfield facility. The responses explain that the power plant would have restricted access and that the well pads would be constantly monitored. Furthermore, new roads into the wellfield would be gated and locked, preventing unauthorized access to the area.

Minor revisions to Mitigation Measure 4.11.4a were made to clarify the location of a cold water injection pipeline. In addition, the EIS/EIR was revised to reflect the change in cooling water treatment method from chlorine to sodium hypochlorite.

SOCIOECONOMICS

The main areas of comment on socioeconomics issues were:

- General
- Employment
- Short-Term Housing
- Effects on Minority and Low-Income Populations
- Property Values
- Effects on Tourism
- Public Services
- Solid Waste Disposal
- Public Finance

Several commentors expressed concerns regarding the proposed project's potential to reduce property values in the Medicine Lake and Tionesta areas. The responses provide information obtained from published studies regarding the effects of transmission lines on property values in rural areas. This information supports the findings in the EIS/EIR. Minor revisions to the EIS/EIR were made to clarify that the proposed project would have a less-than-significant effect on property values in the Medicine Lake area.

Commentors also expressed concern regarding the need for additional police services to patrol residential areas in the Medicine Lake area as a result of the proposed project. The responses clarify that there would be ample police services during the summer months when construction occurred, and that there would be no additional roads maintained or built which could provide access to these areas during the winter months.

CUMULATIVE EFFECTS

The topic areas of comment on cumulative effects issues were:

- Cumulative Projects
- Cumulative Effects

The responses clarify why the Fourmile Hill and Telephone Flat projects are the only reasonably foreseeable geothermal development at the Glass Mountain KGRA at this time. The responses also expand upon the discussion of potential cumulative effects from the Telephone Flat project that was provided in the Draft EIS/EIR. Subsequent to release of the Fourmile Hill Draft EIS/EIR, specific details on the size, surface disturbance, and potential environmental effects of the proposed Telephone Flat project were made available through the Telephone Flat Draft EIS/EIR (released for public review in May 1998). The description in the Draft EIS/EIR of the Telephone Flat project was revised to provide these details, as well as clarify the role of the previously approved Glass Mountain exploration wells. The possible cumulative effects of the cumulative projects on various individual environmental parameters have been further explained, and these effects have been revised to incorporate quantitative information from the Telephone Flat Draft EIS/EIR.

OTHER STATUTORY SECTIONS

The topic areas of comment on other statutory section issues were:

- Growth-Inducing Impacts
- Short-Term Use Versus Long-Term Productivity
- Significant Irreversible Environmental Changes

The responses further support the conclusions proved in the Draft EIS/EIR regarding the possibility of additional growth in the area occurring due to development of the project. The responses also discuss the analysis of short-term and long-term impacts that might be caused by the project, as well as the possibility of significant irreversible environmental changes occurring if the project is developed as proposed.

MITIGATION MONITORING AND REPORTING PROGRAM

Comments on Mitigation Monitoring and Reporting Program (MMRP) issues were discussed under one heading entitled "Comments and Responses." There were only three commentors on the MMRP. The comments on the MMRP requested that:

- The type and amount of mitigation be clarified
- The specialists chosen for the project be selected by the USFS
- The mitigation measures be enforced

The responses clarified the type of mitigation to be used, the selection process for the specialists to be used on the project, and the enforcement protocol for the proposed mitigation measures. The MMRP has been revised to clarify that the mitigation measures apply to Alternatives 1 through 6, except as noted.

NEPA/CEQA ISSUES

The topic areas of comment on NEPA/CEQA issues were:

- NEPA/CEQA Adequacy
- EIS/EIR Approach
- Draft EIS/EIR Public Involvement
- Plan to Act Against Project Approval

The responses clarify the document's adequacy under the provisions of NEPA and CEQA. In addition, the responses address the general adequacy of the document as an informational tool, as well as the adequacy of the mitigation measures proposed. Finally, the responses articulate the roles of the lead agencies in ensuring NEPA and CEQA compliance.

PROJECT PREFERENCE

The topic areas of comment on project preference were:

- Alternative Preference
- Project Opposition
- Project Support

The commentors generally expressed opinions either supporting or opposing construction of the proposed project. The responses provided commentary where appropriate, but primarily served to acknowledge the commentors' viewpoints, and reference these viewpoints to the responsible decision-making agencies.

GENERAL

The topic areas of comment on general issues were:

- Public Requests
- General Concern About Project Effects
- Incorporation of Other Comments by Reference
- Statements and Opinions

- Other General Comments

The responses provided information, clarifications, and further explanation in response to these comments where appropriate. Opinions and statements made in the comments were noted, and refered to the responsible decision-making agencies for their consideration.

2: AGENCIES, ORGANIZATIONS, AND PERSONS COMMENTING ON THE DRAFT EIS/EIR

2: AGENCIES, ORGANIZATIONS, AND PERSONS COMMENTING ON THE DRAFT EIS/EIR

2.1 List of Agencies, Organizations, and Persons Who Submitted Written Comments

The comment letters received on the Draft EIS/EIR were grouped by agencies, organizations, and individuals. The letters from organizations and individuals are listed in alphabetical order.

Each comment letter has an alphabetic designation and the individual comments in each letter are numbered. The Comment Index in Chapter 7 of this volume lists the Volume III section and page location of each comment in each letter. Original comment letters can be found in Volume IV of this EIS/EIR. The complete list of commentors (and the alpha designation of the letter) is provided below. Please note that letters IV through JJ were received after the comment period ended, and are therefore not alphabetical with the rest of the letters.

AGENCIES		AUTHORS
A	U.S. Environmental Protection Agency	Deanna M. Weiman (contact: Karl Kanberg)
B	U.S. Fish and Wildlife Service	Ronald A. Iverson (contact: Nadine R. Kanim)
C	U.S. Geological Survey	Julie Donnelly-Nolan
D	California Department of Fish and Game	Richard L. Elliot (contact: Terri Weist)
E	Siskiyou County Planning Department	Richard D. Barnum
F	North Coast Regional Water Quality Control Board	John R. Hannum
G	State Office of Historic Preservation	Cherilyn E. Widell (contact: Chuck Whatford)

ORGANIZATIONS		AUTHORS
I	CalEnergy International Ltd.	Dale R. Schuster
J	California Native Plant Society	Vivian Parker

	ORGANIZATIONS	AUTHORS
K	California Wilderness Coalition	Ryan Henson
L	Desert Survivors	Steve Tabor
M	Fall River Resource Conservation District	Rick Poore, et al.
N	Fall River Wild Trout Foundation	Robert J. Baiocchi
O	Friends of the River	Katherine Kowatch
P	Kalapooya Sacred Circle Alliance	Carol Logan
Q	Klamath Forest Alliance	Lori J. Cooper
R	The Klamath Tribes	Dino Herrera
S	Lawrence Livermore National Laboratory	M. Lee Davisson and Timothy P. Rose
T	Medicine Lake Citizens for Quality Environment	Linda L. Blum
U	Medicine Lake Citizens for Quality Environment	Janie and Rob Painter
V	Medicine Lake Citizens for Quality Environment	Carol Plank
W	Medicine Lake Citizens for Quality Environment	Carole Plank
X	Mount Shasta Area Audobon Society Board of Directors	Michael Hauptman
Y	Mount Shasta Bioregional Ecology Center	Michelle Berditschevsky
Z	Mount Shasta Sno-mobilers Inc.	Eileen K. Maier
AA	Mount Shasta Tomorrow	Dale LaForest
AB	Native Coalition for Cultural Restoration of Mount Shasta	Michelle Berditschevsky
AC	North Coast Environmental Center	Tim McKay
AD	Pit River Tribe	Floyd J. Buckskin
AE	Pit River Tribe	Arnold Wilkes
AF	Pacific Gas and Electric Company (PG&E)	John Sandhofner (contact: Dave Bowers)
AG	Plumbers & Steamfitters U.A. Local 342, Plumbers and Pipefitters U.A. Local 228, and Individual Union Members	Lizanne Reynolds, et al.
AH	Santa Cruz Rainforest Action Group	Ray Newkirk
AI	Renewable Northwest Project	Rachel Shimshak, et al.
AJ	Tionesta Residents	Larry Hearne, et al.
AK	Wise Earth Council	

PERSONS

AL	Allen, Barbara	AT	Beatty, Kenneth and Leona
AM	Anderson, Clifford E.	AU	Bernotte, Jackie
AN	Aquila, John	AV	Bish, Dave and Laurie
AO	Aquila, Mildred J	AW	Blakeney, Marian and Jack
AP	Ashalyn	AX	Bradfield, Susan
AQ	Barr, Barbara J.	AY	Brady, Theresa
AR	Barrow, Marcia	AZ	Brightwell, Anne L.
AS	Beard, Brian B.	BA	Brooks, Kevin

PERSONS

BB Camara, Tom
BC Capoyilla, Louie J.
BD Carlton, Alan
BE Carter, Paul and Dorothy
BF Cedar, JoAnne
BG Cena, Colleen
BH Cimino, Richard S.
BI Cook, Steven and Nancy
BJ Copenhafer, Martin
BK Copoulos, John
BL Cousins, Charlene
BM Cruz, Rhodelio
BN Cuneo, S. Peder
BO Cuneo, Suzanna S.
BP Cuneo, S. Peder and Suzanna S.
BQ Cuneo, S. Peder and Suzanna S., et al.
BR De Jager, Bill
BS Dember, Paul and Charlotte
BT Denham, W.S.
BU DeNike, Bob
BV DeRossett, Carlos
BW Despain, Joel D., et al.
BX Du Vernet, Dean H. (9/15/97)
BY Du Vernet, Dean H. (9/19/97)
BZ Du Vernet, Dean H. (9/30/97)
CA Du Vernet, Dean H. (11/22/97)
CB Dye, Richard E.
CC Eastman, Bob
CD Eastman, Walter R.
CE Emery, Paul
CF Engstrom, Cindy
CG Evans, Jim
CH Farioletti, Elizabeth V.
CI Farioletti, Marius A.
CJ Feeney, Krista B.
CK Faist, Betty
CL Gardener, Catherine M.
CM Ghiorso, John
CN Gomes, Gloria
CO Gonzaleze, Linda
CP Gould, Cathy
CQ Grainger, Martha
CR Graves, Steve and Paddy
CS Green, G.S.
CT Gregory, Sylvia M.
CU Gregory-Fisher, Mz. Deborah Lynn
CV Haines, Kyle
CW Hannelore, Barbara
CX Harmon, Shelly A.
CY Harris, David A.
CZ Harris, Noell M.
DA Hart, Ronald W.
DB Haye, Stan
DC Hennig, Anita E.
DD Henson, Pam
DE Herger, Don
DF Hickerson, Robert L.
DG Hill, Shirley
DH Holmes, Katherine
DI Holub, Ana and Richard Lucas
DJ Hutchinson, Calvin
DK Hyytinen, Roger G.
DL Jackson, Charline
DM Jackson, Jerald
DN Jackson, Marjorie
DO Jackson, Tony L.S.
DP Janson, DelMar
DQ Jim, Jessica E.
DR Johnson, Gerald
DS Johnston, Vernia
DT Jones, Carolyn D.
DU Jones, Charles B.
DV Jordan, Marilee
DW Keesee, Mike
DX Kenyon, Nancy B.
DY Kiely, Daniel

PERSONS

DZ	Kinyon, Bill and Bette
EA	Kinyon, Diane
EB	Kraft, Harry
EC	Krauel, Thomas F.
ED	Kuhn, Daniel S.
EE	Langner, Mark
EF	Larsen, Bill
EG	Leavitt, David
EH	Ledor, Kobi and Casey Kim
EI	Lettinich, Nik M.
EJ	Lewis, Laraine
EK	Linden, Kathleen
EL	Lorenz, Mitch
EM	Lorenzen, Pete and Laurel
EN	Louttit, Laura
EO	Macy, Natalie
EP	Maggiora, Maurice J., et al.
EQ	Maire, Ron
ER	Mandel, Stephanie Grace
ES	Marie, Lea
ET	Markee, Dawn
EU	Martin, Frances V.
EV	Mazzini, Shari
EW	McClain, David W.
EX	McClowd, Maria
EY	McClymonds, R.C.
EZ	McDermos, Joan
FA	McLaughlin, Bob
FB	Medley, Robert
FC	Mikec, John W.
FD	Miller, H.K. "Bud"
FE	Miller, Ray
FF	Miller, Victoria K.
FG	Misso, David Porter
FH	Mockbee, Joy
FI	Moro, Vicki
FJ	Moiher, Carolyn J.
FK	Moss, Charles F.
FL	Moss, Doris H.
FM	Mulvaney, Ana
FN	Myers, Bart and Pamela
FO	Nelson, Eric T.
FP	Nelson, Eric T. and Martha Spencer
FQ	Newcom, Joy Louise
FR	Norman, Julie
FS	Norris, Frank
FT	Olson, Claude
FU	Orr, Olga E.
FV	Padula, Anna Lee
FW	Parker, Doug and Phyllis
FX	Parker, Jacquie
FY	Perlman, S.
FZ	Petterson, Katherine
GA	Phillips, Antoinette C.
GB	Pierson, Elizabeth D.
GC	Plank, Carole
GD	Plumb, Dolores
GE	Pohlman, Sami Jo
GF	Poaler, Sarah
GG	Popplewell, D.R.
GH	Potter, Jack Jr.
GI	Potter, Myrna L.
GJ	Pratt, Melody
GK	Preston, Wallace and Mary
GL	Rand, Deirdre and Randy
GM	Reed, Ken
GN	Reed, Verna
GO	Ringer, June
GP	Rinne, Fred L.
GQ	Rivers, Walter
GR	Rohde, Marylee Patricia
GS	Rongen, Anna
GT	Savavele, John
GU	Schaeffer, Robin L.
GV	Schwartz, R.J.
GW	Schwarzenberg, Fai

PERSONS

GX Self, David
GY Server, Michael L. and Janet K.
GZ Shott, Harry and Bettie
HA Shott, James
HB Smith, David
HC Smith, Lawrence K.
HD Spencer, Amanda
HE Spencer, Daniel T. (7/29/97)
HF Spencer, Daniel T. (9/25/97)
HG Spencer, Lorin C.
HH Spencer, Lucinda
HI Spencer, Martha
HJ Spotts, Richard
HK Staunton, Marshall
HL Stearns, Howard I.
HM Stauss, Barbara
HN Sterner, Don
HO Sturgis, Victoria
HP Swanson, John R.
HQ Teague, Donald S.
HR Teberg, Annabel J.
HS Thompson, Larry H.
HT Thompson, Louise (8/30/97)
HU Thompson, Louise (9/19/97)
HV Thompson, Louise
HW Todd, Joyce T.
HX Tozier, Elizabeth R.
HY Tseng, Alice
HZ Turner, Richard
IA Turney, Susan
IB Verrill, Wayne
IC Villarruel, Sharon
ID Walters, Raquel
IE Waring, Alysa
IF Webb, A. Jonathan
IG Webb, Debbie S.
IH Weber, Jerry and Vicky
II Wells, Vivian
IJ Wheeler, Mary Jo
IK Whitaker, Howard J.
IL Whitnah, Claudia
IM Willey, Brenda
IN Williamson, Ray
IO Williamson, Sharon
IP Wilson, Joyce
IQ Woodward, Phil
IR Wright, Carol L.
IS Wynn, Carter
IT Yousie, Grant
IU Zanger, Michael
IV Adams, Shawn
IW Ano, D.
IX Carnell, Dick
IY Denham, Laurie E.
IZ Frank, Tobin E.
JA Loffmoy, Ross
JB Parkhurst, Dawn E.
JC Parkhurst, Matt
JD Piper, Robert J.
JE Sowert, Mark
JF Sowert, Stacey
JG Wallace, Ken
JH Walland, LeRoy
JI Whitmarsh, A. Clayton
JJ Wolf, Bob

2.2 List of Individuals Who Attended the Public Hearings

	PUBLIC HEARINGS	ATTENDEES
PH1	Dorris Public Hearing, Tuesday, August 5, 1997	Maria Ellis
		Jeff Cook
		Marjorie Hazelwood
		Jim Rickert
		Rick Poore
PH2	Klamath Falls Public Hearing, Wednesday, August 6, 1997	Jack Blakeney
		Marian Blakeney
		Julia Rechtin
		Dave McClain
		Leonard LeCaptain
		Faye Weckley
		Walter Smith
PH3	Yreka Public Hearing, Thursday, August 7, 1997	Bryan Kenyon
		Louie J. Capovilla
		Mark Merrithew
		Marina Phil Facchin
		Rob Painter
		Janie Painter
		Brenda Willey
		Mildred Aquila
		Don Peterson
		Emma Peterson
		Carole Plank
		James Shott
		Louise Thompson
		Jerry Turek
		John Aquila
		Rick Banum
		Robert Hickerson
		Marcia Barrow
		Philip Geist

PUBLIC HEARINGS		ATTENDEES
PH4	Mount Shasta Public Hearing, Friday, August 29, 1997	Naida Jones F.M. Heinreichse Scott Barrow Janie Painter Holly Howard Robert F. Gray Lea Marie Allan Reaves Charles F. Moss Rob Painter David Mauley Michael Haas Larry Bell John Mills
PH5	Medicine Lake Public Hearing, Saturday, August 30, 1997	No sign-in sheet was available at this hearing. Attendees were primarily affiliated with the Medicine Lake Homeowners Association.

3: RESPONSES TO COMMENTS ON THE DRAFT EIS/EIR

3: RESPONSES TO COMMENTS ON THE DRAFT EIS/EIR

Introduction

This chapter provides responses to comments on the Draft EIS/EIR raised during the public comment period. Each comment in this chapter (as well as other chapters) of this document was considered without regard to the author's location, occupation, or lifestyle. Each comment will be considered by decision-makers in determining whether to approve the project.

A total of 270 comment letters were received on the Draft EIS/EIR. Additional comments were made at the five public hearings that were held after the Draft EIS/EIR was published. Each comment letter or source has been assigned an alphabetical designation for easy reference (see Section 2.1 of this document). Each comment in each letter was assigned a number code. Thus, each comment has a unique alphanumeric code, representing the comment letter (the letter code) and the individual comment within each letter (the number code). For example, the third comment in the second letter would have the code "B.3."

Many of the comments received addressed the same topic (e.g., potential for effects on Fall River Mills water quality and quantity). The lead agencies determined that the most effective way to respond to the comment letters was to group individual comments by topic area, rather than to respond separately to each comment letter. This format is intended to provide readers with a more comprehensive and concise discussion of each topic area.

Comment letters were converted to electronic form by scanning or typing. The content of each letter was fully preserved. Individual comments in each letter were then separated and categorized by broad environmental parameter (e.g., hydrology, vegetation, etc.). The comments were then grouped by these parameters. In many cases, comments addresses several topics at once (i.e., in the same sentence). In these cases, comments were assigned to the primary environmental topic addressed. In cases where there was no primary comment (e.g., a list of topics), the comment was assigned the topic that appeared first in the sentence. Within each environmental topic, the comments were further organized into subtopics addressing specific areas of each environmental parameter (e.g., "Effects of Well Venting on Vegetation").

ORGANIZATION OF COMMENTS

The environmental parameters are presented in the same order in which they appear in the EIS/EIR. Subtopics are then organized within each environmental parameter. For each subtopic, there are two sections: comments (organized alphabetically and numerically), and their responses.

The comments addressed in Chapter 3 are those that address the content of the Draft EIS/EIR. Chapter 4, Responses to NEPA/CEQA Issues Comments, includes comments regarding the NEPA/CEQA environmental review process and responses to those issues. Chapter 5, Responses to Project Preference Comments, includes the comments regarding preference for a particular project alternative or action and responses to those issues. Chapter 6, Responses to General Comments, includes all general comments and responses.

The Comment Index in Chapter 7 of this volume provides a listing of comment letters with corresponding alphabetical designations, as well as numeric designations for each individual comment. The index can also be found in Volume IV of this Final EIS/EIR.

RESPONSES

The responses address all individual comments. The text of the responses was written to provide a thorough discussion of the issues raised by the comments, rather than segmented answers to isolated issues. Where appropriate, responses reference specific comments by alphanumeric designation (e.g., "In response to comment A.9,...") in order to address specific issues.

How to Find Your Comments

The Comment Index in Chapter 7 is organized alphanumerically. For each comment, its comment number and the name of the commentor is identified, the section of Volume III in which the comment is located is provided, and the page number on which the comment is located is identified.

1. Turn to Chapter 7, Comment Index, (the Comment Index also appears in Volume IV, which contains the original comment letters). The pages of the index are tan for easy identification.
2. Find your name or the name of your organization (alphabetized). Please note that letters IV through JJ were received after the comment period had ended, and are therefore not alphabetical with the rest of the letters.
3. Identify your letter's letter designation (e.g., Q, AL, BA, JJ, etc.).
4. Find your comment letter in Volume IV (the table of contents in Volume IV identifies the page on which the letters begin), which contains all original comments letters with individual comments identified by the letter designation and number.
5. Using the Comment Index, identify the page number on which your comments appear.
6. Turn to the pages in this volume where your comments are located. The responses will follow the comments.

An alternative method of using this document is to turn to a topic of interest, review the comments received on the topic and read the responses.

3.1 Introduction and Purpose and Need

INTRODUCTION

This section provides responses to comments on issues discussed in Chapter 1, Introduction and Purpose and Need of the Draft EIS/EIR. The comments and responses are grouped under the following headings:

- Purpose and Need for the Proposed Action
- Agency Roles and Authorizations
- Other Required Permits and Approvals
- Previous Geothermal Activities
- Geothermal Definition
- Economic Justification for and Viability of the Proposed Action

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

PURPOSE AND NEED FOR THE PROPOSED ACTION

Comments—Purpose of the Proposed Action

Y.9 The DEIS/EIR, by its very size, makes a strong statement that the relationship of purpose and need to environmental and cultural impacts is at a ratio of 1 to 800 pages!
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

BH.4 I want to call your attention to Page one (1) of the Draft EIS/EIR "Purpose and Need" which states there is no purpose to this development. This very simply states that Calpine purpose is to develop the geothermal resource. SO, SO, SO, SO, ??????

Does The Bonneville Power Admin. need to reach into California seeking electrical energy? I don't think so. Is the economy of the northwest threatened without this small project? I don't think so. This is pure foolishness.

ECONOMICALLY and ENVIRONMENTALLY this project is not necessary. Page one (1) goes on to say that in 1970 some obscure act The US Geothermal Steam Act of 1970 states a need for the project. PROVE IT . Where in the act is that stated, specifically? *(Richard S. Cimino)*

FP.3 Section 1.2 states that the purpose of this project is to "develop the geothermal resource on Calpine's Federal geothermal leases CA 21924 and CA 21926 to economically produce and deliver electrical energy to BPA and others". Paragraph 4 also states that regional growth and increasing constraints on the existing energy resource base requires BPA to pursue this project.

During the public hearing on August 30 at Medicine Lake, Calpine representatives stated that power produced would cost the consumer over two times the rate for electrical power currently marketed by BPA. Who would bare the brunt of this additional cost? Is this considered economical under the Energy Policy Act of 1992? What are the regional constraints on existing energy resource base requires this project? Please address these issues and document the "regional growth" that requires additional energy supplies in the Final EIS/EIR. *(Eric T. Nelson)*

HY.3 Furthermore, as stated on page S-11, "Population in the project area is low and includes the community of Tionesta and scattered residences. Other local communities in the vicinity of the project includes Alturas, Dorris, Dunsmuir, Etna, Fort Jones, Montague, Mount Shasta, Tuleake, Weed, and Yreka. The majority of local housing and some jobs occur in these communities. Employment in the region relates to timber, agriculture, recreation, mining, trade and service, and more recently, development and construction." It is extremely unclear to me as who would be the people benefited from this project? The discrepancy and deficiency are huge here in the purpose and need of the Fourmile Hill Geothermal Project. *(Alice Tseng)*

Response—Purpose of the Proposed Action

The purpose of the proposed action is discussed on pages 1-3 and 1-4 in Section 1.2 of the Draft EIS/EIR. In response to comment Y.9, there is no correlation or relationship

between the number of pages in the Draft EIS/EIR that discuss the purpose and need for the project, and the number of pages of environmental analysis in the Draft EIS/EIR. Both NEPA and CEQA require that an EIS and EIR (respectively) focus on the significant effects of the project on the environment. The Draft EIS/EIR has therefore been prepared to focus on the environmental effects of the project, and not the purpose and need for the project. It should be noted as a point of clarification that CEQA states that the purpose and need "statement shall briefly specify the underlying purpose and need to which the agency is responding." Thus, it is the agency's purpose and need, not the developer's, that is relevant to this discussion.

As discussed on page 1-3 of the Draft EIS/EIR, the stated purpose of the proposed action is to develop the geothermal resource on Calpine's Federal geothermal leases CA 21924 and CA 21926 to economically produce and deliver electrical energy to BPA and others. This is just one of several purposes of the proposed action. Other purposes for the proposed action discussed on pages 1-3 and 1-4 of the Draft EIS/EIR include:

- To meet the direction of the U.S. Geothermal Steam Act of 1970, the Federal Land Policy and Management Act (FLPMA) of 1976, and the Energy Policy Act of 1992 to foster and encourage private enterprise in the development of alternative energy resources, within appropriate environmental constraints
- To meet the direction of the Northwest Power Act (U.S. Congress Northwest Power Planning and Conservation Act of 1980, P.L. 96-501) to encourage development of renewable resources within the Pacific Northwest
- To meet BPA's objective to test the ability of geothermal energy in the Fourmile Hill area to provide a reliable, economical, and environmentally acceptable energy resource in the region
- To implement one element of BPA's Emphasize Conservation Alternative (which includes conservation and efficiency improvements supplemented by renewable and thermal resource developments); this alternative was adopted by the BPA on the basis of its February 1993 Resource Programs EIS (BPA 1993)
- To meet BPA's need to acquire resources that would contribute to diversification of the long-term power supply prospects in the region

Regarding the U.S. Geothermal Steam Act of 1970, this act was an important piece of legislation for geothermal exploration and development in the United States. This act and a subsequent complementary act (the Geothermal Energy Research, Development, and Demonstration Act of 1974) are both premised on the need to develop geothermal energy as an alternative to more traditional fossil-fuel energy sources. While the U.S. Geothermal Steam Act of 1970 does not explicitly state the need for geothermal projects such as the proposed project, the Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C. 1101-1164) does. This discussion of geothermal need can be found in Section 1102 of the Geothermal Energy Research, Development, and Demonstration Act of 1974. See the response to "Comments—Need for the Proposed Action" for a discussion of how information about this act has been incorporated into the EIS/EIR.

Comment BH.4 also raises several questions regarding the need for the proposed action. Please see the response to "Comments—Need for the Proposed Action" later in this section regarding this issue.

In response to comment FP.3, BPA has several purposes in pursuing the proposed project, as discussed earlier in this response. It is acknowledged that the cost for geothermal energy is currently higher than traditional fossil-fuel energy. Based on current and projected market conditions, Calpine expects to have a viable project even with these current higher costs. This expectation is based in part on expected demand for renewable energy, possible incentives to consumers for renewable energy use instead of fossil-fuel energy use, and possible future equalization of energy costs. Although impossible to predict, it can be surmised that Calpine, the future electrical distributor, and consumers would share the additional cost for geothermal energy. See the response in this section to "Comments—Economic Justification for and Viability of the Proposed Action" for more information in this topic.

As discussed on page 1-3 of the Draft EIS/EIR, another purpose of the proposed project is to meet the need identified in the Energy Policy Act of 1992 for development of alternative energy resources, within appropriate environmental constraints. This act does not require a consideration of whether the proposed project is considered economical. Title XXII of the Energy Policy Act of 1992 is one of several sections of the Act dealing with renewable energy. This section establishes several programs intended to promote: (1) increases in the production and utilization of energy from renewable energy resources; (2) advancement of renewable energy technologies; and (3) exports of U.S. renewable energy supplies and services. Technologies using high-temperature geothermal resources are among those the Act seeks to promote. Regardless of whether the Fourmile Hill geothermal project receives funding through the Energy Policy Act of 1992, this law is just one of several (the Northwest Power Act and California Assembly Bill 1890 are two other examples) that promote the development of renewable energy sources as a matter of public policy. The Energy Policy Act of 1992 does not require consideration of whether a proposed project is economical. The Act seeks to improve the commercial potential of renewable energy technologies through efforts that promote advances in technology. Similarly, the Northwest Power Act encourages BPA to promote renewable energy technologies that have potential for being cost effective.

BPA's interest in the Fourmile Hill geothermal project is not motivated by an immediate need for power, but by the need to ensure availability of renewable resources to meet future needs and to diversify BPA's resource mix. The Northwest Power Planning Council's *1991 Northwest Power Plan* examined a range of scenarios related to meeting future power needs. Changes in natural gas prices, load growth, energy conservation, and other factors could result in the need to develop large amounts of new renewable resources. The Council recommended that BPA and regional utilities take steps to ensure the future availability of these resources (Northwest Power Planning Council 1991; Northwest Conservation and Electric Power Plan, Vol. 1).

The Pacific Northwest is thought to have large geothermal resources, but they remain undeveloped. The Cascade Mountain Range, of which Glass Mountain is a part, is thought to have at least several thousand megawatts of geothermal resources. Beginning in the early 1980s, power planners in the Northwest encouraged BPA to initiate pilot power project facilities as a way to confirm the existence of geothermal resources and the ability to develop them. BPA launched the Pilot Project Program in 1990, which resulted in attempts to develop projects at Vale, Oregon and Newberry

Volcano, Oregon. Developers did not discover geothermal reservoirs at those sites, which underscores the problem of relying on unconfirmed and uncertain resource estimates. From BPA's perspective, the Fourmile Hill geothermal project is part of a long-term program based in legislative direction and public policy objectives.

References:

Northwest Power Planning Council 1991; Northwest Conservation and Electric Power Plan, Vol. 1

U.S. Bureau of the Census. 1998. *Estimates of the Population of Counties (CO-97-2) for the State of Oregon.* Population Estimates Program, Population Division, U.S. Bureau of the Census. Internet Release Date: March 17, 1998.

Comments—Need for the Proposed Action

Y.12 The project appears to be industry-driven rather than actually meeting a need for resources in the area. This is not in keeping with the National Forest Management Act and the intended uses of public lands which should benefit the public and not private interests at public expense.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AB.6 There is no demonstrated need for the project, and no economic feasibility study.
(Michelle Berditschevsky, Native Coalition for Cultural Restoration of Mount Shasta)

AE.5 There is no demonstrated need for the project, and no economic feasibility study.
(Arnold Wilkes, Pit River Tribe)

AI.8 The Four Mile Hill Geothermal Project is geographically located to provide power to both Northwest and Southwest consumers. It can take advantage of ongoing market developments in all parts of the western grid. The power is needed and will be used. The project can leverage its location to provide clean power to wherever it is demanded. *(Rachel Shimshak and Peter West, Renewable Northwest Project)*

AL.2 In all of the information I have acquired, I have not read or heard one word telling me that this project is necessary. *(Barbara Allen)*

AQ.1 Before we irreparably disturb a pristine area, I would ask -- is this new source of power really needed? Or is it motivated by someone or some group looking to make money? *(Barbara Barr)*

AZ.2 We have an over-abundance of geothermal plants throughout this country; we don't need any more. Some geothermal plants have even closed down because their power isn't needed. *(Ann Brightwell)*

BH.11 There is not pressing need for a project like this in the Modoc National Forest. *(Richard S. Cimino)*

BJ.3 3. At this time there is no urgent need for the power this development may produce. Other less environmentally damaging projects are more than capable of meeting our energy needs.
(Martin Copenhaferr)

BN.2 I have visited the Medicine Lake area for the last 20 years. I was a practicing veterinarian in Siskiyou, Shasta and Humboldt Counties before joining the faculty at the University of Arizona, and am familiar with the fragile ecosystems of these areas.

As a scientist and concerned citizen, I am appalled that any serious consideration could be given to such a project. There is no need for the limited amount of energy generated by these plants. Further, this is not a "green project"- there are energy extensive environmental costs from this project. *(S. Peder Cuneo)*

BO.3 It is also clear that the project is not necessary because there is no need for the power and the cost of the product will not be competitive given today's energy market. *(Suzanna S. Cuneo)*

CN.3 There is no demonstrated need for the project and no economic feasibility study. *(Gloria Gomes)*

DQ.3 There is no demonstrated need for the project, and no economic feasibility study. *(Jessica E. Jim)*

DW.2 In short, the project is not necessary and would sacrifice the unique qualities of the Medicine Lake area for dubious economics. First, deregulation of the electricity market makes the project unnecessary and financially risky. As an energy professional, I have followed developments in the rapidly changing electric market. Currently, the western U.S. is experiencing a glut of low cost power. The availability of this low-cost power makes any large scale energy project highly suspect. Current experience in the Geyser's, the largest and longest operating geothermal project in the USA shows that geothermal power cannot compete in a deregulated market as existing facilities are "retired" from service. *(Mike Keesee)*

DW.4 Just because Medicine Lake has the potential to produce geothermal energy doesn't mean it should be developed, especially if the market doesn't exist for the power and it will result in severe impact on the area. *(Mike Keesee)*

DY.2 Simply because the technology exists, and a profit can be made exploiting the resources around us is not a valid justification for such activities. *(Daniel Kiely)*

EJ.3 There is an overabundance of these plants now & many are being closed—once again a much touted system is failing to live up to expectations. *(Laraine Lewis)*

EM.2 You people have proven there is no need for these proposed projects. Power plants are closing because they have no market for their power. *(Pete and Laurel Lorenzen)*

FC.2 With the advent of electrical power deregulation, I question the need for additional power when many regional power companies have excess capacity now. *(John Mikec)*

FP.7 Finally, the Energy Policy Act of 1992 directs the Federal government to "foster and encourage private enterprise in the development of alternative energy resources, within appropriate environmental constraints." (Sec. 1.2, Paragraph one). What is the current definition of appropriate environmental constraints? The Draft EIS/EIR details many adverse significant impacts of this project; where is the point of no return? And who decides? Please address these issues in the Final EIS/EIR. *(Eric T. Nelson)*

FU.4 Is there any need of thermal power from this particular place? 1 understand the State of Oregon doesn't need it; in fact, doesn't want it. So why the big push for destroying a beautiful natural area, loved and prized by visitors and local people? *(Olga E. Orr)*

GC.5 Personally, as a citizen, I am appalled that any serious consideration could be given to such a project. There is no need for the limited amount of energy generated by these plants. Further, this is not a "Green Project", there are extensive environmental costs from this project. *(Carole Plank)*

HE.2 After studying the documents sent by the BLM on June 7, 1996, reading over the detailed environmental assessment plans, and talking to concerned citizens in Tulelake and members of Medicine Lake Homeowners Association, I believe the proposed Geothermal Development Projects for Medicine Lake fail on both accounts: 1. There is no demonstrated local energy need for this project; hence the ecological and economic costs far outweigh the short-term proposed benefits. *(Daniel T. Spencer)*

HF.16 Page S-10: Given these cumulative effects, the EIS rightly concludes that 'The No Action alternative would therefore be considered the environmentally preferable alternative;" yet the ES goes on to say that it would not meet "the purpose and need" for the proposed action. Once again, the alleged "need" for the project is merely asserted rather than demonstrated. A much more compelling case for the "need" for this project must be made to an informed public before it can be justified. *(Daniel T. Spencer)*

HI.5 It is also clear that the project is not necessary because there is no need for the power and the cost of the product will not be competitive given today's energy market. *(Martha Spencer)*

HL.2 We do not need any more energy development at this time. Proof of this is found, among other places, in the raising of the speed limit to 65 miles per hour, the relaxing of the fuel economy regulations, and the willingness of Congress to sell of the national oil reserves. I realize that your development is meant to generate electricity rather than oil, but since Congress in its wisdom has determined that we have plenty of oil, we can use that to generate whatever additional electricity is found to be needed. *(Barbara Stauss)*

HY.2 The inferences in this chapter doesn't clearly substantiate the "needs" for the region to initiate such project. On page 1-3 it states that "in the face of regional growth and increasing constraints on the existing energy resources base, BPA needs to acquire resources that would contribute to.....," but there is no actual growth statistics and descriptions of current and existing energy demand/sources supplied to justify BPA's conclusion.

As a taxpayer, I question the socioeconomics of this project, as many others have in the past stated on page 1-21. I did not find any explanation on the funding or on the cost analysis performed for this project. *(Alice Tseng)*

HZ.2 If there is something we really don't need in California it is another geothermal plant. The power isn't needed. It is a total waste of money. *(Richard Turner)*

IJ.3 This land belongs to We the People & we are speaking!

And so is the Land! This project is NOT necessary nor is it cost-effective The cost to the environment is too high a price to pay! *(Mary Jo Wheeler)*

PH3.30 Well, I wanted to ask you why you [BPA] want to buy geothermal. *(Yreka Public Hearing)*

PH4.5 Project is not needed. *(Mount Shasta Public Hearing)*

PH5.64 And I say that also because right now we all know that the power industry—there's no need for this project, it's just not there. We have plenty of power. So unless we can document a real need, why are we going on public lands right now? *(Medicine Lake Public Hearing)*

PH5.67 Has the need for the project been documented in light of the deregulations of the electricity in this industry? *(Medicine Lake Public Hearing)*

Response—Need for the Proposed Action

The need for the proposed action is discussed on pages 1-3 and 1-4 in Section 1.2 of the Draft EIS/EIR. The discussion of project need in this section of the Draft EIS/EIR has been prepared in compliance with 40 CFR 1502.13, which states that an EIS shall specify the need to which the lead agencies are responding. As discussed in the Draft EIS/EIR, the lead agencies are responding to the following needs:

- The need to investigate, prove, and possibly develop alternative energy resources such as geothermal. This development is essential to lessening dependence on non-renewable, fossil-fuel energy resources that, in the long-term, are expected to be depleted and may no longer be available to meet energy demands
- The need to develop alternative energy resources that result in less overall environmental effect (such as reduced air emissions and health risks) than those associated with non-renewable, fossil-fuel energy resources
- The need to respond to legislation that directs the Federal government to foster and encourage private enterprise in the development of alternative energy resources, limited by environmental constraints
- The need to meet the direction of the Northwest Power Act encouraging development of renewable resources within the Pacific Northwest
- The need to meet BPA's objective to test the ability of geothermal energy in the Fourmile Hill area in order to provide a reliable, economical, and environmentally acceptable energy resource in the region
- The need to implement one element of BPA's Emphasize Conservation Alternative (which includes conservation and efficiency improvements supplemented by renewable and thermal resource developments) adopted by the BPA on the basis of its February 1993 Resource Programs EIS (BPA 1993)
- The need to investigate the acquisition of resources that would contribute to BPA's diversification of the long-term power supply prospects in the region
- The need to allow Calpine to develop and utilize the geothermal resource (if one is proven to exist) pursuant to their Federal geothermal leases, with the provision that this development and utilization be conducted in accordance with all applicable environmental regulations

There is a demonstrated, long-term need for the investigation (and possible development) of alternative energy sources, especially geothermal energy sources. The proposed action would fulfill this need, and the demonstrated need for the project is discussed in the Draft EIS/EIR, as required by NEPA. While it is true that the project is proposed by private industry, this aspect does not affect the need for the lead agencies to consider the proposed project, and does not compromise the overriding need for the project.

As discussed in the Draft EIS/EIR, the need for alternative energy development (and geothermal energy development in particular) has been expressed by the following legislation:

- The U.S. Geothermal Steam Act of 1970
- The Federal Land Policy and Management Act (FLPMA) of 1976
- The Energy Policy Act of 1992
- The Northwest Power Act (U.S. Congress Northwest Power Planning and Conservation Act of 1980, P.L. 96-501)

In addition, the Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C. 1101-1164) has identified the need for development of geothermal energy as an alternative to more traditional fossil-fuel energy sources, as discussed in the response to "Comments—Purpose of the Proposed Action." The second sentence of the second full paragraph on page 1-3 of the Draft EIS/EIR has been revised as follows to reflect this information:

> "The need for the project was stated by the U.S. Geothermal Steam Act of 1970, the Geothermal Energy Research, Development, and Demonstration Act of 1974, the Federal Land Policy and Management Act (FLPMA) of 1976, and the Energy Policy Act of 1992."

Several comments question the immediate need for the proposed project due to deregulation of the electrical utilities and a current glut of excess, low-cost power. The actual effect of electrical deregulation on power demand is unknown at this time. Demand for power from alternative energy sources (such as geothermal, wind, and solar) may actually increase as a result of deregulation, as some consumers choose to receive their electricity from companies offering "green power," which includes energy produced from geothermal power plants. In addition, some states have recently passed legislation that supports renewable energy use through production incentives, buydowns, and consumer rebates (an example of this type of legislation is California's Assembly Bill 1890).

Geothermal is considered to be a renewable resource, and has often been labeled as "green" power. For more information on the definition of geothermal power, see the responses to "Comments—Geothermal as a Renewable Resource" and "Comments—Geothermal as Green Power" later in this section.

It is acknowledged that there is currently an adequate supply of power to meet demand, and that the cost for fossil-fuel-derived power is substantially lower than the cost of renewable energy at this time. However, the project is intended to meet the expected demand (and thus need) for power over the long term, and short-term power costs and demand are not primary factors in the need for the project. BPA believes that the existing supply eventually will not meet the demand for power. The long-term need for the project is expected to result from regional growth (see the response to "Comments—Purpose of the Proposed Action" for evidence of this growth), as well as future dwindling supplies of fossil fuels. Projected regional growth and future power demand and supply is further discussed in BPA's Resource Programs EIS (BPA 1993). The use of fossil fuels for power generation also results in greater air emissions and other environmental effects than geothermal power generation. BPA believes that utilization of geothermally generated electricity now will increase the likelihood that geothermal power will be cost competitive with fossil fuels in the future. The increased viability of geothermal energy would in turn facilitate reductions in air emissions, as well as U.S. dependency on fossil fuels.

The project is proposed at the Glass Mountain Known Geothermal Resource Area (KGRA) because a potentially viable geothermal resource has been identified at this KGRA. Very few viable geothermal resources exist within the United States. The government has identified a need to investigate the ability of the geothermal resource at

the Glass Mountain KGRA to meet the long-term need for development of alternative energy sources including geothermal energy.

Comment AZ.2 and EJ.3 state that there is an over-abundance of existing geothermal power plants, and that some geothermal power plants have closed because their power was not needed. At The Geysers, geothermal power plants have been retired due to their age (in operation for over 30 years), and because newer power plants are more efficient.

In response to comment FP.7, the term "appropriate environmental constraints" has no specific definition. This term is intended to provide a policy-level direction to the Federal agencies (in this case, the BLM, USFS, and BPA) to consider environmental aspects when encouraging alternative energy development. The environmental impacts of the project identified in the Draft EIS/EIR, the public comments, and responses to comments will be considered by the lead agency decision-makers in deciding whether to approve the project or one of the alternatives (including the No Action Alternative).

Neither NEPA nor CEQA require an economic feasibility study for the project. The CEQA Guidelines allow presentation of economic information in an EIR in whatever form a lead agency desires. For additional discussion of the economic feasibility of the proposed action, see the response to "Comments—Economic Justification for and Viability of the Proposed Action" later in this section.

Reference:

BPA. 1993. Final Environmental Impact Statement: Resource Programs. Bonneville Power Administration. DOE/BP-2075

AGENCY ROLES AND AUTHORIZATIONS

Comments—Geothermal Well Permit Requirements

A.57 According to the DEIS, most Geothermal Facilities permits fall under jurisdiction of the BLM as listed in Table 1.4-1. The FEIS should state which permits apply to production wells and which apply to injection wells, and whether there is any involvement from the state of California, the California Regional Water Quality Control Board, the EPA, and local, tribal or county agencies.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

PH4.31 What other regulations relate to geothermal production? *(Mount Shasta Public Hearing)*

Response—Geothermal Well Permit Requirements

The geothermal facility permits identified in Table 1.4-1 of the Draft EIS/EIR would be issued by the BLM and other agencies. This table focuses on key permits and approvals for the project, and is not meant to provide a comprehensive listing of all permits and approvals that may ultimately be considered or issued for the project. In addition, each section of the Draft EIS/EIR in Chapter 4 contains a regulatory framework discussion which describes the applicable regulations.

The BLM permits apply to both production wells and injection wells. The State of California Division of Oil and Gas does not have regulatory authority over geothermal wells on Federal lands, but does receive information regarding the wells. The California Regional Water Quality Control Board (RWQCB) regulates waste discharge from the geothermal wells. See also the responses to "Comments—Underground Injection Control Program" in the Hydrology Section regarding the applicability of the U.S. EPA

Underground Injection Control (UIC) regulations. Local, tribal, and county agencies do not have jurisdiction over the geothermal wells. The lead agencies are, however, consulting with these agencies and interested parties regarding the proposed project. Siskiyou and Modoc Counties will decide whether to issue road use (encroachment) permits to Calpine.

Comment—U.S. Bureau of Land Management and U.S. Forest Service Role

N.2 It is the view of the FRWTF that there is a conflict of interest associated with the approval of the proposed project by the U.S. Bureau of Land Management and the U.S. Forest Service. The federal government stands to gain 15 to 25 million dollars in royalty payments over the first 20 years of the proposed project. Consequently, this 15 to 25 million dollar windfall to the federal government gives the U.S. Bureau of Land Management and the U.S. Forest Service, the decision makers, the motivation and incentive to approve the proposed project regardless of the environmental impacts and also "unavoidable impacts" to a major high profile Native American worshipping area (Medicine Lake Highlands Area).

We reference the Draft EIS/EIR for the Fourmile Geothermal Development Project; July 1997; at page 2-59 under Economic Benefits. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

Response—U.S. Bureau of Land Management and U.S. Forest Service Role

NEPA requires that the BLM and the USFS act as the lead agencies for the project due to their pivotal role in the permitting and approval process, regardless of any economic benefit to the government. As discussed on page 1-7 of the Draft EIS/EIR, the BLM has the authority (from the Geothermal Steam Act of 1970) to make determinations on all geothermal activities proposed to be conducted on Federal lands, such as the proposed project. Additionally, the BLM has the authority to issue (or deny) the following approvals and permits:

- Approval of the Plan of Utilization (Plant and Support facilities) for the proposed project under 43 CFR 3262.4-1
- Issuance of a two-part Geothermal Utilization Permit (GUP) under 43 CFR 3264.2-1
- Approval of a Site License (SL) under 43 CFR 3250.1-1
- Individual Geothermal Drilling Permits under 43 CFR 3260

The USFS also has a primary role in project approval since the proposed project would be located on the National Forest lands (which are managed by the USFS). The proposed project would be located on the Klamath and Modoc National Forests. As discussed on pages 1-7 and 1-8 of the Draft EIS/EIR, the USFS will consider whether to issue the following authorizations to Calpine:

- Right-of-way authorization for the transmission line
- Water well use authorization
- Forest road use authorization

Part of USFS authorization of the proposed action would include amendments to the Klamath and Modoc National Forest Land and Resource Management Plans (LRMPs). The amendments are required to ensure consistency of the proposed action with these LRMPs (see the response to "Comments—U.S. Forest Service Forest Plan Amendments" for more information on proposed LRMP amendments). Other actions that would be taken by the USFS as a result of USFS authorization of the proposed action would include:

- Issuance of a Forest Order prohibiting the use of firearms in the immediate vicinity of the proposed power plant and wellfield area
- Revision of Klamath National Forest LRMP standard #24-25 to state: "Protect traditional Native American cultural and religious uses and practices consistent with Public Law 95-341 (American Indian Religious Freedom Act of 1978)."

While it is expected that there would be certain financial benefits to the Federal government if the proposed project is approved, the BLM and USFS are obligated under NEPA to consider the environmental effects of the project in making their decision whether to approve the project. Decision-makers for the project will consider all relevant factors in making their decision, including environmental and economic factors. However, this consideration does not mean that there is a conflict of interest for the BLM or USFS, or that project approval is guaranteed because of the potential financial benefits to the Federal government. It should be noted that both the BLM and the USFS do not obtain direct economic benefits from returns on projects. Funding for Federal agencies is dependent on appropriations from Congress.

Comments—U.S. Forest Service Forest Plan Amendments

N.3 6. The executive summary states that the Klamath and Modoc National Forests will also decide whether to amend the forest Land Resource Management Plans to establish and designate a utility corridor for the proposed project's transmission line and issue forest orders to prohibit the use of firearms in the immediate power plant and wellfield area. We reference Executive Summary at page S-3 of the Fourmile Hill Geothermal Project DEIS/EIR.

According to the Executive Summary, the authorization of the proposed action (project) will require that the U.S. Forest Service make certain amendments to the Klamath and Modoc National Forest Land Resources Management Plans in order to ensure consistency of the proposed action (project) with the Plans. Both Plans would be amended to establish and designate a utility corridor for the transmission line for the proposed Fourmile Hill plant site to the Bonneville Power Authority Malin-Warner transmission line.

National Forest Land Resource Management Plans throughout California took many years to be developed and approved because of public controversy. Those Plans were developed in accordance with NEPA and its requirements with full public disclosure based on scientific studies, subject to appeals. Consequently, the Klamath National Forest and the Modoc National Forest should prepare separate EIS's for the proposed amendments to their forest land resource management plans to accommodate the proposed project and future projects. The recommended EIS's should disclose, evaluate, and mitigate the following issues with full public disclosure:

(a) The potential direct, indirect, and cumulative impacts to threatened and endangered species and their habitat (all life stages) resulting from the proposed transmission corridor, including the cumulative impacts from other transmission corridors that have been approved;

(b) The potential direct, indirect, and cumulative impacts to spotted owl species and their habitat (all life stages) resulting from the proposed transmission corridor, including the cumulative impacts from other transmission corridors that have been approved;

(c) The potential direct, indirect, and cumulative impacts to other special status species and their habitat (all life stages) resulting from the proposed transmission corridor, including the cumulative impacts from other transmission corridors that have been approved;

(d) The potential direct, indirect, and cumulative impacts to Research and Natural Areas resulting from the proposed transmission corridor, including the cumulative impacts from other transmission corridors that have been approved;

(e) The potential direct, indirect, and cumulative impacts to Backcountry Management Areas, including the cumulative impacts from other transmission corridors that have been approved;

(f) The potential direct, indirect, and cumulative impacts to Special Interest Areas, including the cumulative impacts from other transmission corridors that have been approved;

(g) The potential direct, indirect, and cumulative impacts to areas used in the practice of American Indian religions, including the cumulative impacts from other transmission corridors that have been approved;

(h) The potential direct, indirect, and cumulative impacts to forest trees, riparian habitat and plants caused by fires resulting from transmission line caused fires, including the cumulative impacts from other transmission corridors that have been approved;

(i) The potential direct, indirect, and cumulative impacts to water quality resulting from land disturbance activities and erosion caused by the construction and maintenance of the project's transmission corridor, including the cumulative impacts from other transmission corridors that have been approved;

(j) The potential direct, indirect, and cumulative impacts to fishery resources and their habitat (all life stages) resulting from land disturbance and erosion caused by the construction and maintenance of the project's transmission corridor, including the cumulative impacts from other transmission corridors that have been approved;

(k) The potential direct, indirect, and cumulative impacts to the public (users) resulting from noise activities associated with the proposed project and future projects;

(l) The potential direct, indirect, and cumulative impacts to visual resources as a result of the transmission corridor, the proposed plant and associated project works, and future projects, including other the cumulative impacts from other geo and/or hydro projects;

(m) All the evaluations and studies associated with the above should be based on all new available information and data.

The DEIS/EIR for the proposed project is not an adequate NEPA document to be used by the U.S. Forest Service to amend the forest land resource management plans and approve standards and guidelines for the management of the Klamath and Modoc National Forests. This DEIS/EIR for the proposed project is for the proposed project and not for the management of the entire forests.

The DEIS/EIR for the proposed project is premature because the land resource management plans for the Klamath and Modoc National Forests must be amended prior to the U.S. Bureau of Land Management approves the proposed project; and before the U.S. Bureau of Land Management and the U.S. Forest Service's approval of the draft and final EIS/EIR for the proposed project. Consequently the DEIS/EIR is not sufficient and adequate to amend the Land Resource Management Plans for the Klamath and Modoc National Forests. We are requesting that separate EIS's are prepared by the U.S. Forest Service for the amendments to the management plans for both forests. And because the EIS for the proposed project would not be in compliance and consistent with the standards and guidelines in the land resource management plans for both forests, that the U.S. Forest Service is compelled to deny the approval of the transmission corridor and select the no project alternative.

(Robert J. Baiocci, Fall River Wild Trout Foundation)

AD.20 3. The EIS/EIR is not in keeping with the Klamath and Modoc Land and Resource Management Plans (LRMPs). The LRMPs have not been taken through the amendment and revision process and do not permit an action of the scope and nature of the Fourmile Hill and other foreseeable geothermal developments in the Medicine Lake area. The Modoc LRMP states at 1 3:

If the Forest Plan requires amending, the Forest Supervisor determines whether a proposed amendment would result in a significant change to the Plan. If the change is significant, the Forest Supervisor shall follow the same procedure required to develop and approve a Forest Plan. The Regional Forester approves significant amendments. If the change is not significant for the purposes of the planning process, the Forest Supervisor may approve and implement an amendment after the public is notified and NEPA procedures are completed.

Under the National Forest Management Act (NFMA) and NEPA, amendments and revisions to the LRMPs necessitate a NEPA process of their own, with adequate scoping, public input and decisions that are subject to review. This has not been done and at no public meeting was input taken regarding amendments to the LRMPs. To assume that amendments and revisions of this extent can be done in the same document as a major project proposal is to suit the LRMPs to a specific project, rather than having projects follow agreed upon management prescriptions. This runs counter to the Forest Planning process in NFMA.

(Floyd J. Buckskin, Pit River Tribe)

PH5.50 The EIR talked about there being a significant impact or a significant concern with the compatibility with the forest plan, and I haven't seen the forest plan for this area. I was just wondering if you could address that. Is it, you know, consistent with it or compatible with the forest plan for this area, and if so, were you going to change the forest plan? How does that, you know, work? *(Medicine Lake Public Hearing)*

Response—U.S. Forest Service Forest Plan Amendments

Proposed USFS amendments to the Land and Resource Management Plans (LRMPs) of the Klamath and Modoc National Forests are discussed on pages 1-7 and 1-8 in Section 1.4 of the Draft EIS/EIR, and the environmental effects of these proposed amendments are evaluated throughout Chapter 4 of the Draft EIS/EIR. The proposed amendment for

the Klamath National Forest was also disclosed in the Forest's Fiscal Year 1996 Monitoring and Evaluation Report and will also be included in the Fiscal Year 1997 Monitoring and Evaluation Report. These reports are made available to a mailing list of those who have expressed interest in Forest Plan amendments. These amendments would ensure consistency of the proposed action with the LRMPs of the Klamath and Modoc National Forests.

As discussed in Section 1.4 of the Draft EIS/EIR, the LRMPs of the Klamath and Modoc National Forests would both be amended to establish and designate a utility corridor from the proposed Fourmile Hill plant site to the BPA Malin-Warner transmission line. This utility corridor would accommodate the proposed transmission line for the project. The Modoc National Forest Plan already has established criteria for the utility corridor. The Klamath National Forest LRMP would be amended for the utility corridor. The specific plan amendment establishing and designating the utility corridor would provide for the avoidance of the following areas:

- Critical habitat for threatened and endangered species
- Wilderness
- Research and Natural Areas
- Backcountry Management Areas
- Special Interest Areas (SIAs)
- Areas used in the practice of American Indian religions

In addition, the USFS would amend the Klamath National Forest LRMP to include the following standards and guidelines that are already included in the Modoc National Forest LRMP:

- Cooperate with utilities representatives to develop strategies to minimize the potential for single or multiple line power outages that could result from destructive events such as wildfires
- Coordinate with Federal and private utility managers when managing Forest activities near utility corridors to ensure that Forest activities do not conflict with the intended permitted use and management of the utility corridor

As part of USFS authorization of the proposed action, the USFS would also clarify language in the Klamath National Forest LRMP regarding Forest management consistency with the American Indian Religious Freedom Act of 1978. Klamath National Forest LRMP Standard #24-25 would be revised to state:

> "Protect traditional Native American cultural and religious uses and practices consistent with Public Law 95-341 (American Indian Religious Freedom Act of 1978)."

The potential environmental effects of all of the proposed LRMP amendments are evaluated in the Draft EIS/EIR. Thus, there is no need to prepare a separate EIS for these amendments. The amendment of the LRMPs to establish and designate a utility corridor is inherently evaluated in the analyses of potential environmental effects of the proposed transmission line throughout Chapter 4 of the Draft EIS/EIR. These analyses address the following potential effects of the project (and therefore the LRMP amendment to designate a utility corridor):

- The potential effect on threatened and endangered species and their habitat (Section 4.8, Wildlife of the Draft EIS/EIR)
- The potential effect on spotted owl species and their habitat (Section 4.8, Wildlife of the Draft EIS/EIR)
- The potential effect on other special status species and their habitat (Section 4.8, Wildlife of the Draft EIS/EIR)
- The potential effect to Research and Natural Areas (Section 4.11, Land Use and Recreation of the Draft EIS/EIR)
- The potential effect to Backcountry Management Areas (Section 4.11, Land Use and Recreation of the Draft EIS/EIR)
- The potential effect to Special Interest Areas (Section 4.11, Land Use and Recreation of the Draft EIS/EIR)
- The potential effect on American Indian religious practices (Section 4.6, Traditional Cultural Values of the Draft EIS/EIR)
- The potential for the transmission line to cause fires and therefore affect to trees, riparian habitat, and plants (Sections 4.15, Human Health and Safety and 4.7, Vegetation of the Draft EIS/EIR)
- The potential for land disturbance and erosion to affect water quality (Sections 4.2, Geology and Soils and 4.3, Hydrology of the Draft EIS/EIR)
- The potential for land disturbance and erosion to affect fishery resources and their habitat (Sections 4.2, Geology and Soils and 4.8, Wildlife of the Draft EIS/EIR)
- The potential noise effects on the public (Section 4.14, Noise of the Draft EIS/EIR)
- The potential effect on visual quality (Section 4.9, Visual Quality of the Draft EIS/EIR)

The amendment of the Klamath National Forest LRMP to include the two standards and the guidelines that already exist in the Modoc National Forest LRMP would not result in any significant environmental effects. The effect of the proposed revision to Klamath National Forest LRMP Standard #24-25 is evaluated in Section 4.6, Traditional Cultural Values of the Draft EIS/EIR. The revision to Standard #24-25 is not significant, as it merely clarifies the language of the standard to more clearly reflect the intent of complying with the American Indian Religious Freedom Act. See also responses to "Comments—Effects of Amending the Klamath National Forest Land Use and Forest Resource Plan Standard 24-25" in Section 3.7, Traditional Cultural Values, of this document.

The approach to amending the LRMPs of the Klamath and Modoc National Forests through the EIS/EIR process for the project is consistent with NEPA, the National Forest Management Act (NFMA) of 1976, and the LRMPs themselves. The proposed LRMP amendments identified in the Draft EIS/EIR are considered to be non-significant amendments. As discussed in the Klamath National Forest LRMP (page 1-2 of the LRMP) and the Modoc National Forest LRMP (page 1-3 of the LRMP), the Forest Supervisor is responsible for consideration and approval of non-significant LRMP amendments. This type of amendment may be implemented after the public is notified and NEPA procedures are completed. The public has been notified of the proposed amendments through the public scoping process and the public review of the Draft EIS/EIR. Input on the proposed amendments was also solicited at the five public hearings held on the Draft EIS/EIR. Upon completion of the NEPA process for the

project, the Forest Supervisor will consider whether to approve the proposed LRMP amendments. There is no need to amend the LRMPs of the Klamath and Modoc National Forests with the proposed amendments prior to consideration or approval of the proposed Fourmile Hill project. The LRMPs specifically allow for amendments, and the Klamath National Forest LRMP explicitly states that the LRMPs are intended to be "working documents" (page 1-2 of the LRMP). In addition, the Council on Environmental Quality implementing regulations for NEPA at 1506.4 encourage the combining of NEPA documents to reduce duplication and paperwork. Forest Service handbook 1909.12, 5.4, 2 states: "In the case of a change to the Forest plan that is determined not to be significant, the Forest Supervisor documents the decision in the appropriate document and at the same time, if the activity is approved, amends the Forest plan and implements the project or activity following appropriate public notification." For all the reasons discussed, it is not necessary to prepare a separate EIS for the proposed LRMP amendments.

Comments—Siskiyou County APCD Role

V.22 This EIR is seriously flawed because it designates a legally inappropriate and functionally inadequate agency (an Air Pollution Control District) to act as the Lead Agency for CEQA purposes. This procedural error undermines CEQA's protective purpose by designating such authority to an agency with too narrow a focus and a history of total disregard for CEQA regulations. The EIR states that "The Siskiyou County APCD is acting as the lead agency under CEQA, and as such will ensure compliance with CEQA process requirements." (p. 1-8) This assurance is not worth the ink it was printed with. This Air Pollution Control District cannot effectively assume that position as a Lead Agency for many reasons:

CEQA Guidelines 15051(b)(l) expressly states that an air pollution control district is not to be a Lead Agency because it has only a limited purpose. See the footnote below for statutory regulation prohibiting such a designation. /2/

[NOTE 2: 15051. "Where one or more public agencies will be involved with a project, the determination of which agency will be the Lead Agency shall be governed by the following criteria:

"(b) If the project is to be carried out by a nongovernmental person or entity, the Lead Agency shall be the public agency with the greatest responsibility for supervising or approving the project as a whole.

"(1) The Lead Agency will normally be the agency with general governmental powers, such as a city or county, rather than an agency with a singe or limited purpose such as an air pollution control district or a district which will provide a public service or public utility to the project. " (emphasis added)

The APCD, in not having general governmental powers, can not enforce CEQA requirements.

The APCD could never be a Lead Agency on any project involving just CEQA issues; therefore it is inappropriate to expand its powers in a joint EIR/EIS preparation.

The Siskiyou County APCD has never before enforced CEQA requirements.

It has no staff members who have any experience with CEQA.

Leaving the regulation of air quality impacts from a polluting geothermal industry to this particular Siskiyou County APCD is like allowing a fox to guard the chicken coop. This Siskiyou County APCD has dismissed its two previous Air Pollution Control Officers for attempting to do their jobs properly and uphold state air pollution regulations.

This Fourmile Hill geothermal project is predicted to emit noxious H_2S odors, but the Siskiyou County APCD claims its hands are tied and it accordingly doesn't enforce any regulations against odor emissions.

The APCD's functions are too narrow to uphold the broad range of CEQA requirements as a Lead Agency does. For example, this geothermal project will also cause significant noise impacts that are inconsistent with the Siskiyou County General Plan Noise Element, but the APCD has no regulatory authority over noise impacts. /3/ The Siskiyou County APCD is only a Responsible Agency. /4/

[NOTE 3: CEQA Guidelines 15042. "A public agency may disapprove a project if necessary in order to avoid one or more significant effects on the environment that would occur if the project were approved as proposed. A Lead Agency has broader authority to disapprove a project than does a Responsible Agency. A Responsible Agency may refuse to approve a project in order to avoid direct or indirect

environmental effects of that part of the project which the Responsible Agency would be called on to carry out or approve. For example, an air quality management district acting as a Responsible Agency could not have authority to disapprove a project for water pollution effects that were unrelated to the air quality aspects of the project regulated by the district." (emphasis added)]

[NOTE 4: CEQA Guidelines 15041. "Within the limitations described in Section 15040: (a) A Lead Agency for a project has authority to require changes in any or all activities involved in the project in order to lessen or avoid significant effects on the environment. (b) When a public agency acts as a Responsible Agency for a project, the agency shall have more limited authority than a Lead Agency. The Responsible agency may require changes in a project to lessen or avoid only the effects, either direct or indirect, of that part of the project which the agency will be called on to carry out or approve.]

This APCD has a history of total disregard for CEQA, in that it fails to even notify the appropriate Siskiyou County departments when private entities apply to it for discretionary air quality permits. Moreover, it doesn't notify adjacent or nearby neighbors of such private entities when it receives applications.

This APCD is entirely incapable of handling citizen complaints about illegal permits it issues, recently having argued that only the permitted industries it regulates have the right to appeal its decisions, without extending that right to the very citizens it is supposed to protect.

The Siskiyou County APCD is the same agency which has allowed the J.F. Shea Co., Inc. asphalt batch plant to greatly pollute its surrounding rural community of Gazelle now for years with little enforcement or concern for air quality. Vast clouds of dust and toxic substances are emitted on a regular basis from that greatly underregulated industry in spite of vocal citizen complaints.

This APCD is so understaffed that it has only one Air Pollution Control Officer and a secretary for an entire county. Entrusting the APCD to enforce CEQA requirements as a Lead Agency is but a sham because, without massive funding and overhauling, it would never have the ability to carry out that responsibility with so little manpower, even if it had broader regulatory authority and a sympathy towards CEQA concerns.

In Citizens for Quality Growth v. City of Mt. Shasta (1988) 198 Cal.App. 3d 418 the court held that a lead agency may not refuse to exercise its police powers to try to mitigate significant environmental effects of a project simply because another agency may also have the power to do so. Allowing the Siskiyou County APCD to be identified as a Lead Agency when it has no intention nor power to regulate significant odor impacts, or even worse, refuses to, is contrary to this court decision.

The EIR's apparent designation of the APCD as a Lead Agency derives from a misreading of CEQA Guidelines 15051(d):

> (d) Where the provisions subsections (a), (b), and (c) leave two or more public agencies with a substantial claim to be the Lead Agency, the public agencies may by agreement designate an agency as the Lead Agency. An agreement may also provide for cooperative efforts by two or more agencies by contract, joint exercise of powers, or similar devices.

Nothing in this section allows an APCD to be elevated to the status of an agency with the general governmental powers from which a Lead Agency is to be chosen. This EIR must therefore be revised to designate the proper agency to act as a Lead Agency for CEQA purposes.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

V.26 Finally, it is strange that the Siskiyou County Air Pollution Control District is to be considered a Lead Agency when it has apparently received so little correspondence from the Bureau of Land Management or the Forest Service as apparently only two letters! The citizens group Mt. Shasta Tomorrow filed a Freedom of Information Act request dated September 3, 1997 for "copies of any correspondence in your agency's possession between the USFS or any other agencies or the company involved in this project and the Siskiyou County Air Pollution Control District." In response, the only two letters received were one letter dated September 16, 1996 from the APCD to the USFS/BLM, and one letter dated February 5, 1997 from the APCD to Calpine. One would think that a purported "Lead Agency" would have been at least sent some correspondence! The only evidence the APCD received anything is a notation about a scoping report typically provided to Responsible Agencies. Either that FOIA request was not legally responded to in full, or the APCD has been nearly totally left out of the environmental review process. Guessing that your staff has not risked violation of the stringent FOIA requirements, it is apparent that the Siskiyou County Air Pollution Control District can not be assigned the job as Lead Agency for CEQA review because it has already been excluded from much of that role, as well as the above issues.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

PH4.52 Is the Siskiyou County Air Pollution Control District the only agency responsible for air quality monitoring? *(Mount Shasta Public Hearing)*

Response—Siskiyou County APCD Role

The determination that the Siskiyou County Air Pollution Control District (APCD) would serve as the lead agency under CEQA for the proposed project was based on guidance in the CEQA Guidelines (specifically Sections 15050 to 15053 and 15367 of the CEQA Guidelines) regarding lead agency determination. The Siskiyou County APCD is the most appropriate agency to serve as the CEQA lead agency for the proposed project because it has the greatest responsibility for approving the proposed project from among state and local agencies with permit or approval authority. The involvement of other state and local agencies is, in most cases, minimal, and comparatively less than the Siskiyou County APCD. The following discussion describes the basis for identification of the Siskiyou County APCD as the lead agency under CEQA for the project.

CEQA Lead Agency Concept and Responsibilities: The concept of a lead agency for a project is established in Section 15050 of the CEQA Guidelines, which states that if a project is to be carried out or approved by two or more public agencies, one of these public agencies shall be designated as the lead agency for the project. As defined in Section 15367 of the CEQA Guidelines, the CEQA lead agency is the California state or local public agency that has the principal responsibility for carrying out or approving a project.

CEQA and the CEQA Guidelines do not prohibit a single- or limited-purpose agency from serving as the lead agency under CEQA. Comment V.22 correctly states that Section 15051(b)(1) of the CEQA Guidelines states that the lead agency will normally be the public agency with general governmental powers (such as a city or county) rather than an agency with a single or limited purpose (such as an air pollution control district). However, this guideline does not prevent a single- or limited-purpose agency from serving as the lead agency under CEQA; it merely states that a general governmental agency will "normally" be considered the lead agency over a single- or limited-purpose agency. As indicated in Sections 15051(b) and 15367 of the CEQA Guidelines, the primary criteria for determining the CEQA lead agency is the identification of the California state or local public agency that has the principal responsibility for carrying out or approving the project.

According to Section 15050 of the CEQA Guidelines, the lead agency for a project shall be responsible for preparing (or causing to prepare) the appropriate environmental document for the project that meets the requirements of CEQA. The CEQA lead agency is responsible for ensuring that the environmental document meets the requirements of CEQA. The CEQA lead agency can rely on the input from other state reviewing agencies (such as the RWQCB and the California Department of Fish and Game) to ensure that the document meets the requirements of CEQA.

Identification of the CEQA Lead Agency: Section 15051 of the CEQA Guidelines describes the criteria that should be used to identify the CEQA lead agency when two or more public agencies will be involved with a project. Section 15051(a) provides criteria for projects that are to be carried out by a public agency, while Section 15051(b) provides criteria for projects that are to be carried out by a non-governmental person or entity. Since the proposed project would be carried out by Calpine Corporation (which is a non-governmental entity), Section 15051(b) is applicable for determining lead agency responsibility for this project.

Section 15051(b) of the CEQA Guidelines states that for a project carried out by a non-governmental person or entity, the CEQA lead agency shall be the public agency with the greatest responsibility for supervising or approving the project as a whole. This criteria is consistent with the definition of the "lead agency" contained in Section 15367 of the CEQA Guidelines (see the discussion of Section 15367 above).

For the proposed project, there are four state or local public agencies involved in the approval process for the project that therefore could have potentially been designated as the CEQA lead agency:

- **Siskiyou County APCD:** Since the project would involve air emissions, the project would require an Authority to Construct and a Permit to Operate (both discretionary approval permits) from the APCD.
- **North Coast Regional Water Quality Control Board (RWQCB):** The project would involve discharge of fluids to well sumps and injection of geothermal fluids, and would therefore require a waiver or Waste Discharge Requirements (WDRs) from the RWQCB.
- **Siskiyou County:** Siskiyou County may require an encroachment or use permit for any County-maintained roads that could be used by project vehicles, or for any portion of the proposed transmission line for the project that would cross over lands under Siskiyou County jurisdiction (although all project facilities are located on Federal lands, and there are no facilities located on lands under Siskiyou County jurisdiction).
- **Modoc County:** Similar to Siskiyou County, Modoc County may require an encroachment or use permit for any County-maintained roads that could be used by project vehicles, or for any portion of the proposed transmission line that would cross over lands under Modoc County jurisdiction (although all project facilities are located on Federal lands, and there are no facilities located on lands under Modoc County jurisdiction).

Of these agencies, the Siskiyou County APCD has the greatest responsibility for approving the proposed project due to the extent of air quality permitting that is necessary for the proposed project. The role of the North Coast RWQCB in the project is somewhat less than the Siskiyou County APCD, and the North Coast RWQCB has less permitting authority. The Siskiyou County APCD must issue an Authority to Construct (prior to initiation of project construction) and a Permit to Operate. The North Coast RWQCB regulates waste discharge. The role of other Siskiyou and Modoc County agencies (such as the County planning departments) in the project is also minimal. Since the proposed project would occur on National Forest lands, the counties have limited authority over the project. Potential County involvement would be limited to encroachment or use permits for County-maintained roads. Since the roles of other Siskiyou and Modoc County agencies in the project would not involve an approval under CEQA, these agencies should not be considered as potential CEQA lead agencies for the project.

Comment V.22 incorrectly applies CEQA Guidelines Sections 15041 and 15042 to the Siskiyou County APCD. By acting as lead agency for the project, the Siskiyou County APCD will have the authority to monitor environmental effects and mitigation implementation, including potential noise effects and mitigation. The portions of CEQA Guidelines Sections 15041 and 15042 quoted in comment V.22 discuss the limits of the roles of *responsible* agencies in mitigating and disapproving a proposed project. Since the Siskiyou County APCD is a lead agency, these portions of CEQA Guidelines Sections 15041 and 15042 do not apply to the Siskiyou County APCD.

The Siskiyou County APCD has not and would not refuse to exercise its powers to try to mitigate significant environmental effects of a project simply because another agency may also have the power to do so. To the contrary, the Draft EIS/EIR identifies numerous mitigation measures for the project that would be enforced by the Siskiyou County APCD and the NEPA lead agencies for the project. The Siskiyou County APCD would be responsible for enforcing mitigation measures identified to reduce significant environmental effects under CEQA.

The Siskiyou County APCD would be the agency responsible for emissions testing at the power plant and wellfield. Other agencies, including the National Park Service at Lava Beds National Monument, conduct air quality monitoring in the region (see Section 3.13 in the EIS/EIR).

The concerns expressed in the comments regarding the ability of the Siskiyou County APCD to enforce CEQA requirements and past enforcement history are noted. See the response to "Comments—Siskiyou County APCD Enforcement History and Ability" for more information on this topic.

The Siskiyou County APCD has been actively involved in the CEQA process for the proposed project from the initiation of EIS/EIR preparation; it has:

- Participated in public scoping meetings for the project
- Helped define the scope of analysis for the EIS/EIR
- Reviewed and commented on the Preliminary Draft EIS/EIR, and ensured EIS/EIR compliance with CEQA
- Participated in public hearings for the Draft EIS/EIR
- Participated in numerous meetings and conference calls during the EIS/EIR preparation process
- Communicated frequently and consistently with the other lead agencies for the project, as well as the third-party, independent consultant for the EIS/EIR

In addition, the third-party consultant for the Draft EIS/EIR has assisted the Siskiyou County APCD in ensuring project compliance with CEQA through document preparation. The third-party consultant specializes in the preparation of objective environmental documents under NEPA and CEQA, and has more than 15 years of experience in preparing joint CEQA/NEPA documents. The Siskiyou County APCD has also retained an independent legal firm with expertise in CEQA compliance. This legal firm has reviewed the Preliminary Draft EIS/EIR and the Preliminary Final EIS/EIR, and their comments have been incorporated into the EIS/EIR. The Siskiyou County APCD has therefore been able to ensure full CEQA compliance for the EIS/EIR.

The number of letters provided in response to the Mount Shasta Tomorrow Freedom of Information Act (FOIA) request has no relationship to the level of involvement of the Siskiyou County APCD in the CEQA process. This FOIA request was filed with the USFS in August 1997. The response to the FOIA request provided all information about the project and the environmental process (including correspondence) that was determined by the USFS to be subject to disclosure under FOIA. The involvement of the Siskiyou County APCD described above has ensured that the APCD has been actively

and consistently involved in the CEQA process for the project, and has not been excluded from its role as the CEQA lead agency.

Comments—Siskiyou County APCD Enforcement History and Ability

V.23 To evaluate how effective proposed mitigations limiting air pollution impacts will be, one only need review the Siskiyou County Air Pollution Control District's recent history to see that the public can't take any such mitigations seriously. In 1995, for the J.F. Shea Co., Inc. asphalt batch plant site near Gazelle, California, a new company approached this APCD. International Surfacing, Inc. requested an Air Quality Permit for installation of rubberized asphalt equipment not listed in Shea's existing Use Permit. That equipment emitted hazardous quantities of foul smelling burnt rubber odor from crumbed rubber heated to nearly 400°F which was being added to the asphalt. The APCD however never notified the Siskiyou County Planning Department of this substantial change in the project as is required under local and state law. Nor was any environmental review pursuant to CEQA requirements ever undertaken of such project changes by the APCD or the County, nor was any Notice of Exemption from environmental review ever issued. Instead, the APCD quietly issued an Air Quality Permit without even notifying the neighboring residents. That permit contained no prohibitions to limit the foul smelling, toxic odors emitted from that rubber-melting equipment.

When neighboring residents accidentally discovered this significant change in the project, they appealed the issuance of the Air Quality Permit to the Hearing Board of the APCD according to the District's own rules. They filed in a timely way and paid the required appeal fee. However, their appeal was denied by the Air Pollution Officer. He never allowed the Hearing Board to even review his illegal actions. The Hearing Board for that matter had never been convened for the preceding 7 years so effectively there is no administrative recourse when rules are violated. Not only was the APCD unwilling to uphold CEQA regulations, but it also refused to abide by its own regulations. The only recourse for Gazelle citizens was to take the Air Pollution Control District to court where that issue is still being reviewed.

With this recent example of another polluting Siskiyou County industry being allowed carte blanche permission to harm surrounding residential areas with its excessive air pollutants, the public cannot take seriously any claim in the EIR that enforcement of mitigations by the Siskiyou County APCD will lessen the Fourmile Hill air quality impacts to less-than-significant.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

FP.20 We are also concerned that the regulatory agency, the Siskiyou County Air Pollution Control District (SCAPCD) may not have staff available that is knowledgeable in geothermal power plants. Is there a mitigation measure requiring that they hire staff with the abilities to adequately monitor this plant? How often will they be on site (please remember that Yreka, the county seat is a two hour drive to the site)? If Calpine is found to be in chronic non-compliance with air quality standards, what is the response of the regulatory agencies (SCAPCD, BLM, and USFS)? Please provide written responses in the Final EIS/EIR.

(Eric T. Nelson)

HA.7 The Siskiyou County Air Pollution Control District is the lead CEQA agency and a permitting agency. The S.C.A.P.C.D. is led by Patrick Griffen, Siskiyou County Air Pollution control officer, and the Siskiyou County Board of Supervisors. NEPA Section 1507.2 states, each agency shall be capable (in terms of personnel and other resources) of complying with the requirements below. Such compliance may use others resources, but the using agency shall itself have sufficient capability to evaluate what others do for it. It is apparent that five supervisors are not air pollution experts. *(James Shott)*

PH4.53 What if SCAPCD does not enforce standards? *(Mount Shasta Public Hearing)*

Response—Siskiyou County APCD Enforcement History and Ability

The concern expressed in the comments regarding the enforcement history of the Siskiyou County APCD is noted. The Siskiyou County APCD believes all of its past permitting and regulatory activities have been conducted in full compliance with CEQA.

The concern expressed in the comments regarding the ability of the Siskiyou County APCD to enforce CEQA requirements is noted. The Siskiyou County APCD has been (and will continue to be) involved in the CEQA process for the project from the initiation of EIS/EIR preparation. Although the Siskiyou County APCD is a single- or limited-purpose agency, this does not mean that the Siskiyou County APCD can not enforce CEQA requirements.

Staff at the Siskiyou County APCD has sufficient knowledge regarding geothermal power plants, and there is no need for the APCD to hire additional staff to adequately monitor the project. County staff have been in contact with Air Pollution Control Officers (APCOs) from other APCDs that have geothermal operations, and some County staff have worked in areas with geothermal operations. If Calpine is found to be in chronic non-compliance with air quality standards (which is not expected based on their operating record at their geothermal plant at The Geysers), the lead and permitting agencies for the project would have the authority to take a variety of actions, including revocation of performance bonds, recording with the county recorder, or, in extreme cases, issuance of a "stop work" order and civil or criminal sanctions. This authority would ensure that identified mitigation measures are enforced to minimize or avoid the environmental effects of the proposed action.

Mitigation monitoring and enforcement for the project would be a collaborative effort among the CEQA and NEPA lead agencies for the project. A detailed draft Mitigation Monitoring and Reporting Program (MMRP) is provided in Chapter 5 of the Draft EIS/EIR. This MMRP identifies the responsible lead agency, monitoring and reporting actions, and monitoring schedule for each mitigation measure discussed in the Draft EIS/EIR.

The section of NEPA (40 CFR 1507.2) cited in comment HA.7 applies to agencies of the Federal government (as discussed in 40 CFR 1507.1). This section is therefore not applicable to the Siskiyou County APCD, which is a state agency. There is no analogous requirement in CEQA for state or local agencies.

Comment—Bonneville Power Administration Role

HF.7 I am struck that on page S-I the Bonneville Power Administration is listed as a cooperating Federal agency in overseeing the EIS/EIR. Since BPA has a clearly vested interest in the energy produced by this proposed project, this role would seem to represent a clear conflict of interest. *(Daniel T. Spencer)*

Response—Bonneville Power Administration Role

As discussed on page 1-8 of the Draft EIS/EIR, BPA is a Federal agency responsible for purchasing, developing, and marketing electrical power to utility, industrial, and other customers in the Pacific Northwest. This responsibility is a result of the Bonneville Project Act of 1937 and the Pacific Northwest Electric Power Planning and Conservation Act. BPA must decide whether to purchase power from the proposed project and to transmit (wheel) project output over BPA transmission lines. BPA has agreed to consider, but has no obligation to execute, a power contract with Calpine.

NEPA defines a cooperating agency as any Federal agency other than the lead agency that has jurisdiction by law or special expertise with respect to any environmental impact of a proposed action. 40 CFR 1501.6 of NEPA discusses the identification and role of a cooperating agency. BPA is serving as a cooperating Federal agency for the project and is participating in the preparation of the EIS/EIR.

OTHER REQUIRED PERMITS AND APPROVALS

Comments—California Energy Commission Involvement

DI.4 3. Developers are trying to avoid jurisdiction of the California Energy Commission by keeping the plants just under fifty megawatts each. The public and the ecosystem need and deserve more oversight protection of the project by government agencies. *(Ana Holub and Richard Lucas)*

PH4.25 Concern that the California Energy Commission is not addressing cumulative effects. *(Mount Shasta Public Hearing)*

Response—California Energy Commission Involvement

The projected power output of the proposed project was developed on the basis of the anticipated commercial capability of the geothermal reservoir, and the proposed design of the power plant. As discussed on page 2-25 of the Draft EIS/EIR, two 24.9-megawatt (MW) turbines would be installed at the power plant, for a total electrical output of 49.9 MW. The California Energy Commission (CEC) is informed about the project and is on the project mailing list. The CEC has jurisdiction over power plants of 50 MW or larger. Both the Fourmile Hill project and the Telephone Flat project would produce less than 50 MW, and therefore would not be under the siting jurisdiction of the CEC. The CEC also has no role in addressing cumulative effects of either project.

Comments—Regional Water Quality Control Board Jurisdiction

F.1 The North Coast Regional Water Quality Control Board is, pursuant to California Environmental Quality Act (CEQA), a Responsible Agency with interest in recognizing and minimizing water quality impacts of projects. It is also, pursuant to California Water Code and Federal Clean Water Act, the primary water quality control regulatory agency with jurisdiction over activities within the North Coast Region which may affect water quality. The geothermal well sites and proposed power plant site within Sections 21, 28 and 29 of T. 44 N, R. 3 E., MDB&M (northwest of the hydrologic divide which runs between Badger Peak and Grouse Hill) in the Glass Mountain KGRA are within the North Coast Region. We expect to receive a Report of Waste Discharge from the owners and operators of the project. We are also required to utilize the CEQA document which is being prepared at this time to inform us of potential impacts and mitigations related to the project. Finally, we expect to prescribe Waste Discharge Requirements and a Monitoring and Reporting Program to ensure that waste discharges are managed and monitored to protect surface and groundwater resources. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

F.6 Executive Summary page S-3. The section headed "Approvals" should recognize the Regional Water Board's jurisdiction and duty to regulate water quality impacts of the project. It should also recognize that the EIR/EIS, when completed, will assist the Regional Water Board in assessing the environmental impacts of its regulatory actions. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

F.8 Introduction -- Responsible Agencies [pages 1-9 and 1-10 (Table 1.4-1)]. It is the North Coast (not the Central Valley) Regional Water Quality Control Board which has jurisdiction under both Clean Water Act and California Water Code at this project site. It may be helpful and correct to also recognize that the project may affect groundwater which may flow (or be affected by fallout from air currents) in a southerly direction from the project site (toward Medicine Lake and Pit River tributaries) and into the jurisdictional area of the Central Valley RWQCB. The project site and its neighborhood are not yet sufficiently explored and described to enable unambiguous declaration of which hydrologic regimes may be affected by the project. In the event of follow-on development of other ("Telephone Flat") projects, this ambiguity will become more important and in greater need of resolution. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

Response—Regional Water Quality Control Board Jurisdiction

The roles and responsibilities of the North Coast Regional Water Quality Control Board (RWQCB) for regulating water quality are acknowledged. As discussed in the first paragraph on page 4-20 of the Draft EIS/EIR, Calpine Corporation would submit a Report of Waste Discharge to the North Coast RWQCB. In order to clarify the discussion in Chapter 1 of the Draft EIS/EIR regarding the roles of the North Coast and

Central Valley RWQCBs, the third full paragraph on page 1-9 of the Draft EIS/EIR has been revised as follows:

> "Central Valley Regional Water Quality Control Boards
>
> Under the Clean Water Act and the California Water Code, the ~~Central Valley~~ Regional Water Quality Control Boards (RWQCB) in California ~~has~~ have the authority to regulate storm water runoff from construction sites and industrial facilities. The proposed power plant and wellfield would be located within the jurisdiction of the North Coast RWQCB, and ~~Therefore,~~ the proposed action would require a Storm Water Discharge Construction Permit from this RWQCB. In addition, the RWQCB also regulates discharge of waste waters from industrial facilities through the Clean Water Act. Therefore, Calpine would be required to submit a Report of Waste Discharge to the North Coast RWQCB for the proposed action.
>
> Portions of the proposed transmission line route would be located within the jurisdiction of the Central Valley RWQCB. This RWQCB is therefore being consulted to determine if any additional permits or regulatory action would be required by this agency."

As discussed in the Hydrology Section of this document, the proposed project would not significantly affect groundwater quality. In addition, groundwater in the Fourmile Hill area does not flow in a southerly direction from the project site (i.e., toward Medicine Lake and Pit River tributaries). As stated in the Draft EIS/EIR, available groundwater elevation data indicates that shallow groundwater flows radially outward from the Medicine Lake caldera. Shallow groundwater in the Fourmile Hill area flows to the northwest, not to the south. The proposed project would therefore not affect groundwater flowing into the jurisdictional area of the Central Valley RWQCB.

The portion of the Executive Summary in the Draft EIS/EIR that is referenced by comment F.6 discusses the roles and approvals of the lead agencies for the project (see the discussion under the heading *Lead Agencies Roles and Approvals* on page S-1 of the Draft EIS/EIR). It would not be appropriate to add a description of the North Coast RWQCB's approvals or approval process in this discussion because the North Coast RWQCB is not a lead agency. This information is provided in Chapter 1 of the Draft EIS/EIR. For additional information, see the response to "Comments—North Coast RWQCB Role, Requirements, and Applicable Plans" in the Hydrology Section.

Comment—Need for Identification of Required Permits in EIS/EIR

AG.31 The EIS/EIR also has deferred its environmental impact analysis by failing to ascertain whether the Project would require certain permits. For example, construction of the transmission line across intermittent stream channels may require a Stream and Lake Alteration Permit (Fish & G. Code § 1603) from the California Department of Fish and Game. (Id. at p. 4-20.) The Project may also require a section 404 permit from the U.S. Army Corps of Engineers if the transmission line passes through an area that meets the criteria for a jurisdictional wetland. (Ibid.) The EIS/EIR identifies the standards and guidelines for Riparian Reserves, but does not indicate if, or how, they are applicable to the Project. (Id. at pp. 4-20, 4-31.) Because the EIS/EIR has not yet determined whether these permits are applicable or even if these areas exist, it is impossible for the public and the decisionmakers to evaluate the Project's impacts on these areas.

In sum, the EIS/EIR provides a laundry list of applicable laws, guidelines, and regulations but does not specifically identify if, or how, they are applicable to the Project or how the Project will comply with them. Without this information, it is impossible to assess whether compliance will adequately mitigate any impacts. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

PH4.27 What permits would be required? *(Mount Shasta Public Hearing)*

PH4.28 Would any permits be issued before the Record of Decision on the EIS/EIR? *(Mount Shasta Public Hearing)*

Response—Need for Identification of Required Permits in EIS/EIR

The Draft EIS/EIR identifies a summary of applicable permits and approvals. The applicability of some permits to the project is not relevant to the analysis of the environmental impacts of the project, and does not represent a deferral of environmental impact analysis. Neither NEPA nor CEQA require that all potential permits for a project be identified in an EIS/EIR. In fact, CEQA Guidelines Section 15124(d)(1) explicitly allows an EIR to identify permitting agencies and their respective permits and approvals only to the extent that this information is known to the lead agency. The Draft EIS/EIR presents this information in compliance with CEQA Guidelines Section 15124(d)(1).

The Draft EIS/EIR does evaluate the potential effect of the project on intermittent stream channels (pages 4-30 through 4-32), wetlands (pages 4-94 through 4-96), and Riparian Reserves (pages 4-30 through 4-32). In addition, mitigation is identified to ensure that potential effects are either avoided or reduced to less-than-significant levels. Sufficient information is provided in the Draft EIS/EIR to allow the public and decision-makers to evaluate the project's impacts on these areas.

The determination of the potential for significant effect is not dependent on the possible permits from regulatory agencies. As discussed in the Draft EIS/EIR, a variety of significance criteria was used to assess the significance of potential project effects on intermittent stream channels, wetlands, and Riparian Reserves. Compliance with applicable laws, guidelines, and regulations is not identified as mitigation for these potential effects, and there is no suggestion that compliance with applicable laws, guidelines, and regulations would be required to mitigate any impacts. Instead, the mitigation for potential impacts to intermittent stream channels, wetlands, and Riparian Reserves involves avoidance and impact minimization to ensure that there would be less-than-significant effects to these areas.

In response to comment PH4.28, it is possible that the Siskiyou County APCD could issue an Authority to Construct permit prior to the USFS issuing the Record of Decision for the project; however, no activities proposed in the Plan of Utilization and addressed in this EIS/EIR would commence until after a Record of Decision is issued and all required permits are obtained.

PREVIOUS GEOTHERMAL ACTIVITIES

Comments—Previous Geothermal Exploration

A.43 According to the DEIS (pg 1-13), at least 28 geothermal exploration drill tests have been completed by various companies in the Glass Mountain KGRA since 1982. The current status of these wells along with information to their manner of closure should be discussed in the FEIS. The status of these "abandoned" wells must be evaluated prior to granting of permits for further well construction. Additional information should be provided on the cumulative impacts from these past activities. The information should include discussion of visual impacts, history of any upset conditions, a statement on any possible impairment to the local water supply or surface water quality, and results of reclamation activities, where applicable, according to BLM, Forest Service, California Division of Oil, Gas and Geothermal, or EPA regulations. Also, if any drill hole is identified within the "Area of Review" of an injection well as per 40 CFR 146.6 it shall be abandoned according to proper regulations, so that the injected waters pose no threat to potable water aquifers. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

PH5.97 How many are in place like what we're talking about, how many geothermal power plants exist? *(Medicine Lake Public Hearing)*

Response—Previous Geothermal Exploration

As discussed on page 1-13 of the Draft EIS/EIR, a total of 29 geothermal wells have been drilled at the Glass Mountain KGRA. A total of 25 temperature core hole wells have been drilled (24 wells were drilled between 1981 and 1984, and 1 well was drilled by Calpine in 1994). In addition, four deep exploration test wells were drilled between 1984 and 1989.

The existence of these previously-drilled geothermal wells is acknowledged in the Draft EIS/EIR, and these wells are considered to be part of the existing setting in the Draft EIS/EIR. The presence of these wells has been considered in the evaluation of the proposed action against the existing setting in the appropriate technical sections of the Draft EIS/EIR, particularly in Sections 4.3, Hydrology, 4.4, Geothermal Resources, and 4.9, Visual Quality. The presence of these wells has also been considered in the analysis of cumulative impacts in Section 4.17, Cumulative Impacts.

It is important to note that the Draft EIS/EIR is intended to provide an analysis of the environmental impacts of the proposed action, not of previously-drilled geothermal wells. This approach is consistent with the requirements of NEPA and CEQA. However, as requested in the comment, the Draft EIS/EIR has been revised to include information on the status of the previously-drilled geothermal wells at the Glass Mountain KGRA. Table 1.5-1 has been added to Section 1.5 of the Final EIS/EIR.

There are many geothermal reservoirs in the western U.S. and throughout the world. The proposed project would include a dual-flash geothermal power plant. There are four similar power plants producing a total of 270 MW in Inyo County, California. These plants have been operating for 10 years. Similar plants also operate in the Imperial Valley of California, Nevada, Indonesia, the Philippines, and New Zealand.

Comment—Environmental Documentation for Previous Geothermal Projects

Y.19 The DEIS/EIR is not clear on its relationship to the leases that were awarded in the 1980s to explore and test geothermal potential in the Glass Mountain KGRA. Apparently the Fourmile Hill Exploration EA of 1995 was tiered to the Supplemental EA on the Glass Mountain KGRA.

However, there is confusion because the leases appear to grant not only exploration but also a "right" to develop geothermal energy on the leased lands, yet no environmental review leading to a decision to develop commercially can be found. What little public notification there was on the leases stressed the exploratory nature of the leases which were presumably awarded to test whether there was a resource worth developing. The previous environmental assessments (EA) considered only exploration and testing, not commercial development. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

Response—Environmental Documentation for Previous Geothermal Projects

As discussed on page 1-6 of the Draft EIS/EIR, information from the 1981 EA, 1984 Supplemental EA, and 1995 EA/IS is summarized in the Draft EIS/EIR where appropriate.

Regarding the 1995 EA/IS, this document was not formally "tiered" under NEPA or CEQA to the previous EAs for geothermal leasing. NEPA and CEQA allow for tiering to only EISs and EIRs, respectively (40 CFR 1502.20 and CEQA Guidelines Section 15152). The 1995 EA/IS analyzed proposed exploration activities to be conducted for the Fourmile Hill Geothermal Exploration Project. In doing so, the 1995 EA/IS summarized information from previous geothermal leasing EAs where appropriate.

Table 1.5-1: Status of Previously Drilled Geothermal Wells at the Glass Mountain KGRA

Well Number	Type of Well	Current Status
88-28	TCH[1]	Active (capped)
45-36	TCH	Abandoned
28-32	TCH	Active (capped)
68-16	TCH	Abandoned
86-23	TCH	Abandoned
54-19	TCH	Abandoned
62-21	TCH	Abandoned
65-26	TCH	Abandoned
18-34	TCH	Abandoned
27-27	TCH	Abandoned
54-29	TCH	Abandoned
84-17	TCH	Abandoned
36-28	TCH	Abandoned
75-6	TCH	Abandoned
52-4	TCH	Abandoned
57-13	TCH	Abandoned
44-33	TCH	Active (capped)
56-3	TCH	Abandoned
71-20	TCH	Abandoned
52-30	TCH	Abandoned
17-6	TCH	Abandoned
14-23	TCH	Abandoned
56-6	TCH	Abandoned
57-11	TCH	Abandoned
37-19	TCH	Abandoned
17A-6	Exploration	Active
68-8	Exploration	Active
31-17	Exploration	Active
87-13	Exploration	Active

Notes:

[1] TCH = Temperature Core Hole

SOURCE: BLM and USFS

As a point of clarification, the 1984 Supplemental EA did evaluate commercial development and utilization of the geothermal resource at the Glass Mountain KGRA. The comment may be confusing the 1995 EA/IS (which only addressed exploration as proposed by Calpine on their leases) with the 1984 Supplemental EA (which addressed exploration, development, production, and utilization of the KGRA as a whole). As discussed on page 1-11 of the Draft EIS/EIR, the 1984 Supplemental EA analyzed:

- The potential environmental effects from expansion of the KGRA to include additional geothermal leases from those considered in the 1981 EA
- The potential environmental effects associated with the exploration, development, production, and utilization of the geothermal resource

The leases that were issued as a result of the 1984 Supplemental EA explicitly allow for the exploration, development, production, and utilization of the leases. As required by NEPA, advertisements notifying the general public of the preparation of this EA and inviting comments were placed in regional newspapers. No response was received.

Although the 1984 Supplemental EA did evaluate commercial development and utilization at the Glass Mountain KGRA, the EA acknowledges the need for project-specific environmental documentation for geothermal projects anticipated to be proposed subsequent to EA approval. As discussed on pages 9 through 12 of the 1984 Supplemental EA, all subsequent geothermal exploration, development, and utilization projects would be subject to review under NEPA, and appropriate project-specific environmental documentation must be prepared for these projects. The Draft EIS/EIR was prepared in response to this direction for project-specific environmental analyses.

Comments—Public Notification for Previous Geothermal Activities

T.4 The people who stand to be the most adversely affected by the proposed project have been shocked and dismayed by the manner in which geothermal development authorization is being handled. In several places in the DEIS/EIR, it is asserted that the Federal Government has already made decisions to allow not only exploration, but also commercial development, of the Glass Mountain Known Geothermal Resource Area (KGRA). Yet the long-time residents and property owners at Medicine Lake do not recall ever being contacted about such a major decision-making process. We believe that the DEIS/EIR misrepresents the extent to which development rights have been vested in geothermal leaseholders, with or without due public process. Furthermore, we believe that if development (as opposed to exploration) was essentially approved at the time of the leasing decisions, then BLM and USFS have failed utterly in their NEPA duties to properly scope and tier NEPA documents. If specific geothermal resource development was approved earlier, then the USFS has also failed to properly anticipate and provide for such facilities in the Modoc and Klamath National Forest Plans.

(Linda L. Blum, Medicine Lake Citizens for Quality Environment)

U.2 Calpine failed to properly inform the public of their plans for the Fourmile Hill project. On Sept. 27, 1995 Calpine had their one and only public scoping meeting at the Goosenest Ranger Station in McDoel. Effective public participation in the scoping process can not occur when the meetings are held on weekdays at remote ranger stations. The concerned people of Mt. Shasta, Alturas, Redding, Tule Lake and Klamath Falls were kept in the dark concerning this public scoping meeting. Only four people attended Calpine's public scoping meeting and two of those people were there on other business.

The public scoping meeting was supposed to address Calpine's Plan of Operation for an exploratory project at the Fourmile Hill location. This exploratory project included the drilling of temperature gradient wells and TWO deep exploratory wells. A temperature gradient well was the only well drilled.

(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

Y.18 Finally, public notification and participation, particularly for the earlier EAs during the leasing and exploratory drilling stages of the project, has been extremely misleading and inadequate. Since the Fourmile Hill DEIS/EIR is based on the leases and earlier EAs, we have a grave concern that the public was never told of the full extent of these earlier proposals .

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AD.30 6. Lack of public notification of the full extent of the project, particularly at the leasing stages. The leases were passed off as exploratory, but appear to include not only exploratory stages, but also lead to development stages. The project also involves other NEPA processes, and other aspects requiring Section 106 Process, such as amendments to the Modoc and Klamath Forest Plans, and entry into Roadless Areas. There has been no notification of these separate processes. *(Floyd J. Buckskin, Pit River Tribe)*

PH3.64 How many leases have you given all these people up there in this area? *(Yreka Public Hearing)*

PH3.75 You guys got, I don't know, between 15, 20 leases, whatever. Have you put all these on paper? *(Yreka Public Hearing)*

Response—Public Notification for Previous Geothermal Activities

These comments address the public notification that was conducted for the previously prepared environmental documents for geothermal activities at the Glass Mountain KGRA. These documents, which are identified in the Draft EIS/EIR, include the:

- 1981 Geothermal Leasing EA
- 1984 Geothermal Leasing Supplemental EA
- 1995 Glass Mountain Geothermal Exploration Project EA/IS
- 1995 Fourmile Hill Geothermal Exploration Project EA/IS

Public noticing for each of these environmental documents was provided in accordance with NEPA. In addition, the public noticing conducted for the Glass Mountain and Fourmile Hill EA/ISs and associated Negative Declarations was conducted in accordance with CEQA.

As a point of clarification, the 1981 EA and the 1995 Glass Mountain and Fourmile Hill EA/ISs only address geothermal exploration activities. The 1981 EA addressed the environmental effects of exploration as a result of geothermal leasing on a KGRA-wide basis, while the Glass Mountain and Fourmile Hill EA/ISs provided project-specific environmental analyses for the specific geothermal exploration activities to be conducted for each project.

As discussed in the response to "Comment—Environmental Documentation for Previous Geothermal Projects," the environmental effects of commercial development and utilization of the geothermal resource at the Glass Mountain KGRA were evaluated in the 1984 Supplemental EA. The public was properly noticed as required by NEPA about this EA, and the potential for commercial development and utilization of the geothermal resource at the Glass Mountain KGRA.

The BLM and USFS properly scoped the previously prepared environmental documents for geothermal activities at the Glass Mountain KGRA. The Klamath and Modoc National Forest LRMPs have been prepared by the USFS to recognize the existing geothermal exploration that has occurred at the Glass Mountain KGRA, and to acknowledge the potential for commercial development and utilization at the KGRA. For the proposed project, the public was notified of all NEPA processes, the Section 106 process, proposed amendments to the Klamath and Modoc National Forest LRMPs, and possible effects to roadless release areas through the public (see the response to "Comments—Public Scoping for the Draft EIS/EIR" in the NEPA/CEQA Issues Section of this document), as well as the public review (and associated public hearings) of the Draft EIS/EIR.

Comment U.2 raises specific concerns about the public scoping meeting that was held on September 27, 1995 for the 1995 Fourmile Hill Exploration EA/IS. Neither NEPA nor CEQA require that any public scoping meetings be held for EAs or ISs (or associated Negative Declarations). This scoping meeting was for potentially-concerned members of the public. Opportunity also was provided for the public to comment on the project during the scoping period for the EA/IS. Written notification of the project and environmental review process was distributed on September 8, 1995. This notification requested input from the public on environmental concerns about the project by October 9, 1995, and identified the date, time, and location of the September 27, 1995 scoping meeting. In addition, public notices regarding the project and preparation of an EA/IS were provided in regional newspapers.

In response to comment PH3.64 and PH3.75 Figure 1.5-1 in the Draft and Final EIS/EIR shows the location of the Glass Mountain Unit area lease holdings. There are 46 various lease holdings in the area; a majority of these leases are owned by Calpine. CalEnergy is the only other lessee in the KGRA. Geothermal leasing in the area is addressed in the response to "Comments—Public Notification for Geothermal Activities" in this section.

GEOTHERMAL DEFINITION

Comments—Geothermal as a Renewable Resource

DB.2 On Page 1-3 of the DEIS/R is the statement that "(a)s a renewable I resource, the project would implement one of BPA's Emphasize I Conservation Alternative." This statement is in error—geothermal steam is not a renewable resource. It has a finite life, in these case stated as 45 years, which is less than the life of many other mining projects. This statement should be corrected. *(Stan Haye)*

PH3.56 It is estimated that the life of the project is 45 years. And is that simply because they have run out of water or they have run out of geothermal heat? *(Yreka Public Hearing)*

PH3.57 Would the resource still be there and be able to be utilized beyond the 45 years? *(Yreka Public Hearing)*

PH5.91 So geothermal, for the process, it's considered a renewable energy, even though this project is only supposed to last fifty years, right? *(Medicine Lake Public Hearing)*

Response—Geothermal as a Renewable Resource

The statement that the geothermal resource at the Glass Mountain KGRA is a renewable resource is accurate. Geothermal resources are commonly considered renewable because the resource can be produced and managed in a sustainable manner (such as using injection to replenish the resource). The Draft EIS/EIR states that the lifespan of the geothermal project is 45 years, but this does not mean that the lifespan of the geothermal reservoir is 45 years. At the time of project decommissioning, the geothermal resource would still exist. Although there may be some depletion of the resource during the lifespan of the project, recharge of the resource both during and after project operations would renew the resource. For a more detailed discussion of the lifespan of the geothermal resource, see the response to "Comments—Effects on the Life Expectancy of the Geothermal Resource" in the Geothermal Resources Section of this document.

Comments—Geothermal as Green Power

FB.3 To label an energy source as "green" as justification to permanently alter a pristine recreational jewel is not correct or fair. *(Robert Medley)*

FP.6 This project has also been labeled a "green project" because it utilizes an alternative energy source. Section 1.2 also states that BPA completed a Resource Program EIS that recommended the inclusion of power supplies from "renewable" resources. This project has a proposed life of 45 years. During this time much environmental damage will occur in a pristine area. Does this project then qualify as a

"green" project? If so, the agencies need to reevaluate their definition of green. Also, under the Northwest Power Act, as referenced in Section 1.2, what is the definition of a renewable resource? Does a project of 45 years fit with this description? Please address these issues in the Final EIS/EIR.

(Eric T. Nelson)

Response—Geothermal as Green Power

There is currently no standard, regulatory definition for "green" power in the energy industry. The Draft EIS/EIR does not refer to the project as a "green" project. The State of California Public Utilities Commission (CPUC) has, however, defined "renewable energy." Renewable electricity is defined in California as including wind, geothermal, solar, biomass, and hydro power. Green power is considered to be power produced from cleaner energy production sources than traditional electricity sources (such as fossil fuel plants). Green energy is considered to be cleaner because it results in lower air pollution emissions and nuclear waste than electricity from traditional sources.

Since the proposed project would produce power from a geothermal resource, the project would fit this commonly used definition. The Draft EIS/EIR does not attempt to justify the project on the basis of this definition. The Draft EIS/EIR merely explains that the project would produce power from a renewable resource, and that this production would meet several identified needs (see the response to "Comments—Need for the Proposed Action").

The Northwest Power Act identifies a renewable resource as "a resource which utilizes solar, wind, hydro, geothermal, biomass, or similar sources of energy and which either is used for electric power generation or will reduce the electric power requirements" (Northwest Power Act, Section 3.16). The 45-year lifespan of the proposed project is not relevant to the definition of the geothermal resource as a renewable resource (see the response to "Comment—Geothermal as a Renewable Resource").

ECONOMIC JUSTIFICATION FOR AND VIABILITY OF THE PROPOSED ACTION

Comments—Project Economics and Viability

N.34 25. The DEIS/EIR failed to disclose and include an economic analysis of the proposed project. The economic viability of the project is very questionable considering the deregulation of the power industry. Is there a market for this project?? A significant amount of public lands and public natural resources will be adversely affected, including a significant high profile Native American religious area. Based on the adverse environmental and social impacts as a result of the proposed project it should be denied by the U.S. Forest Service and the U.S. Bureau of Land Management. The DEIS/EIR is deficient without disclosing and evaluating a detailed economic analysis of the proposed project.

(Robert J. Baiocci, Fall River Wild Trout Foundation)

Y.10 The DEIS/EIR does not establish a credible rationale nor economic viability for the project, nor that it is a viable geothermal resource. Economically, the transmission line would not be viable for a single power plant. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

Y.20 The EAs and the DEIS/EIR lack any Economic Feasibility Study to evaluate the viability of commercial development and to determine whether the environmental costs are even remotely justified.

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

Y.54 An economic feasibility study is necessary to evaluate whether the economic need for the project justifies the environmental costs. Project proponents have indicated that the cost of producing power from this project would be twice the current market rate, and the project proponent has no current buyer for the power, in spite of the DEIS/EIR's statement about the "need to economically produce and deliver electrical energy to BPA [Bonneville Power Administration] and others..." (DEIS/EIR at 1-3). Evidently BPA, in order to enhance its offering of "green energy" to customers, has offered to be a wheeler for power that has not yet been sold. Another factor is that the information necessary to evaluate the longevity of the geothermal resource has not been developed due to the lack of exploratory drilling.

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AX.3 The Fourmile Hill Project has no buyer for its proposed electricity. We are closing down plants all over the state because they are no longer profitable to PG&E and now we are going to make more mistakes in allowing the building of new ones on pristine lands :>(. I don't understand. *(Susan Bradfield)*

BJ.2 2. Geothermal projects have a poor track record for being economic developments. Why destroy a truly wilderness area for the remote possibility that this development may prove to be economic? Who benefits from this development other than a private developer? *(Martin Copenhaferr)*

BN.4 At the University of Arizona we are constantly asked to develop sustainable agricultural systems that are economically valid. This project as proposed is NOT economically justified and will come with a high environmental cost. This is not a project I would consider to be sustainable in any manner.*(S. Peder Cuneo)*

BP.3 1) There is no documented economic need for the power generated by the project and the environmental impacts will be significant and permanent.

No information has been presented which documents the economic need for the project. As stated above, the information presented showed the opposite; that there is no need for this project. At best this project is premature. At the public hearings Calpine stated that the cost of producing the geothermal power would be twice the current market rate; that Calpine does not have a buyer (BPA has made no commitments) and Calpine does not know if there is a viable geothermal resource because they have not completed exploratory drilling.

The only possible rationale for pushing this project is so Calpine is able to "beat out" Cal Energy's Telephone Flat proposed project and thereby escape a complete environmental review of the cumulative impacts to the entire Medicine Lake area as the result of the development of geothermal power. The other reason for the rush is that BPA may be trying to "clean up their negative public image" by getting into "the green power business." Of course that would be without advising the public that "green power" will be obtained by devastating a pristine and unique recreational wilderness area at taxpayer expense. The "need" for the project must be evaluated not only in terms of green power but in terms of the loss of hundreds of thousands of dollars already invested to develop recreation at Medicine Lake and the loss of future monies and enjoyment by the taxpaying public when recreation uses (hunting, camping, fishing and snowmobiling) have been permanently impaired by the negative impacts of the project. *(S. Peder and Suzanna S. Cuneo)*

BQ.4 Page S-1 of the Executive Summary of the draft EIS/EIR states: "The purpose of the Fourmile Hill Geothermal Project is to the develop the geothermal resource on Calpine's Federal geothermal leases in order to economically produce and deliver electrical energy to the Bonneville Power Administration (BPA) and others." It has been pointed out in our letter of Sept. 15th that both Calpine and BPA have admitted that the power generated by this project will cost twice as much as power currently marketed by BPA. For us to do a detailed analysis of this project we have requested the Economic Feasibility Study for this project, but this document has not been produced. Further, BPA has not officially stated that they will purchase this power. If we assume that BPA will purchase this power then we ask for a written response to these questions:

1) How can this project be justified if it fails in its stated purpose in that it does not produce economical electrical power?

2) Explain how BPA will pass on to the consumers the increased cost of electricity that results from this project? How has BPA developed the consumer market for the power generated by the Fourmile Hill Geothermal Plant? Please provide any consumer surveys developed by BPA in an attempt to market geothermal energy as "green power."

3) Because Calpine is a private company, explain how they can afford to become involved in a project that produces electricity that is twice the cost of the product on the market. How is Calpine being subsidized in order for Calpine to be profitably involved in this project?

4) If BPA is not a committed buyer of the power why does this proposal have the transmission lines connecting to the BPA Malin-Warner transmission line? If BPA does not commit to this project where will the power go?

5) The final draft EIS/EIR must address the effect of utility deregulation and corresponding decrease in utility rates and this effect on the economic feasibility of this project (see below).

In the draft EIS/EIR (page 2-58,2-59), under Economic Benefits, the statement is made: "While the total capital cost can be projected with some certainty, future cash flows are a largely a function of electricity revenues... and can fluctuate widely depending on market conditions.". Page 2-79 states "Any factor that would drive the per unit rate for geothermal power even higher than current conditions would severely affect the ability of the project to compete... and may render the project financially infeasible. If the production capacity of the power plant were reduced and Calpine could not charge a higher per unit rate, then Calpine would consider the to be infeasible from an economic standpoint and the Project would not be built." Please develop a written explanation of how Calpine could meet promised tax and 1 royalty payments if this project cannot generate economically competitive electricity, given that the draft EIS/EIR admits that revenues can fluctuate depending on market conditions and that any decrease in

revenue will render the project financially unfeasible. What will occur if there is a change in market conditions during the operation of this project and Calpine can no longer operate the plant in an economically feasible manner? Will the plant be abandoned? If the plant is abandoned how far will the $100,000 bond go toward restoring the environment (see below)? *(S. Peder and Suzanna S. Cuneo)*

DH.3 Furthermore, with the current deregulation of the electricity industry, the 100 million dollar cost for this facility is not cost effective. *(Katherine Holmes)*

DT.6 The significant underproduction of the Geysers geothermal fields also raises questions about whether it is economically sensible to pursue additional geothermal developments without additional research and technological advancement. *(Carolyn D. Jones)*

EQ.2 I have concern a geothermal power plant of only 49.9 MW can be economically feasible under the best of production well production of geothermal resources. Unical and Flour feasibility studies indicated small power generation plants where not economically feasible and a minimum of a 350 MW plant with geothermal production wells to support was required even with increased government support to justify building such a plant. (San Diego Gas and Electric shut down their small generating station which was a 50 MW plant in El Centro just because it was two expensive to operate. *(Ronald A. Maire)*

EQ.3 Unical's plants and production wells were automated to insure protection of the environment with leak detectors, telemetry, automatic well shut in valves, overpressure and temperature protection. Three years ago or so, Unical ended up selling their plants in Calipatria as well as all their world wide geothermal properties because the operation and maintenance costs precluded there making a reasonable return on there investment unless the changed their environmentally responsible construction, management and operating practices. The would have to change to the "poor boy" modis operandi as they say in the business, no leak detection at the well head or brine transmission lines, no automatic well kill valves and telemetry, skeleton operating crews, as do many of the other plants in the area. I have been in and serviced such "poor boy" plants and personally observed the results of such an operation to the environment which included massive die offs of White Pelican and fish in the adjacent Salten Sea and land sterilization do to ruptured brine lines with no containment burms to prevent massive spills. *(Ronald A. Maire)*

EQ.7 I certainly am not an expert in the area of geothermal field potential and certainly the contributing consultants listed have impressive credentials. I have no question there is geothermal resources in the Medicine Lake field but it is what they are not telling us that has me concerned. It is my perception based on a report by College of Siskiyou lecture I enjoyed on Volcanism in the Medicine Lake caldera and Mt. Shasta that there is probably more than enough geothermal brine to support many or much larger plants, unprofitable as they will be without Government support, and we will have destroyed a national treasure trying to tap a very expensive uncompetitive resource. In my thirty eight years as a process and application engineer all types of process plants and systems from major refineries all over the world, sugar refining plants, power plants of every size, to the Alaska Pipe Line the geothermal plants have the highest maintenance and operating cost of all by a factor of at least five! Now if the 50 M plant is feasible BLM is giving our resource away and the plant must be a "Poor Boy" operation if we in the business have learned anything at all. *(Ronald A. Maire)*

EQ.15 I also know first-hand Geothermal is just to expensive to produce with the necessary environmental safeguards to now be competitive and the need for government support for alternative energy support is behind the curve considering these new energy opportunities. Tax money to support these Geothermal projects will be very unpopular with the voters when the truth is known. I sight Unical, a major energy company, move to divest it's interest world wide in geothermal energy to prove my point. *(Ronald A. Maire)*

FP.4 Page 1-14 states that Calpine received approval for exploration test drills of this state but to date has not initiated the proposed exploration. Page 2-79 states that if the production capacity of the plant is reduced below the request 49.9 MW(net) and Calpine could not charge a higher rate per unit, Calpine would consider the project to be infeasible from an economic standpoint and the project would not be built. If approval for the test drills have been secured, why is Calpine pursuing a project that cannot guarantee an adequate power supply? Why have the lead agencies spent so much time, effort, and taxpayers' dollars on a project that will certainly have significant adverse effects on: Native American rights and cultural resources, endangered species, wildlife habitat, and the overall quality of the Medicine Lake Highlands when the project may not be economically feasible? *(Eric T. Nelson)*

HA.9 In summary, Mr. Sharp, I am asking that there be a full assessment of the areas I have addressed in the draft EIS/EIR. I believe there is no economic justification for this project, and I have serious questions about parts of the draft EIS/EIR. *(James Shott)*

HF.6 Beyond this philosophical objection, there are many pragmatic and ethical reasons for objecting to this plan. What follows is a page-by-page commentary on the Executive Summary, which I stress again, is the only part of the EIS/EIR to which I have had access to this point.

Page S1: For a project that will cause ecological, biological, cultural, spiritual, and recreational harm to a pristine natural environment as the ES makes clear this project will, there must be compelling economic

reasons that justify the harm. I find no such compelling reasons or economic justification anywhere in the report; rather it is simply asserted that the "need [whose need?] for the project was stated by the U.S. Geothermal Steam Act of 1970, the Federal land Policy and Management Act of 1976, and the Energy Policy Act of 1992. Rather than demonstrating what the compelling "need" for this project is, the next sentence says only that the proposed project "is consistent" with these Federal regulations. As any college instructor of writing and rhetoric can tell you, there is quite a difference between demonstrating that something is consistent with a set of regulations and demonstrating that there is a need for the project. This kind of collapsing of logic and assumptions occurs throughout the ES, consistently asserting the need for this project, rather than demonstrating and justifying this alleged need. Allowing Calpine, BPA, CalEnergy, or any other energy utility to develop this project so that they can advertise to consumers that they now produce "green energy" [a phrase that effectively hides the environmental harm the production of this energy would cause]--even though this electricity would cost twice the rate of electricity on the current market--does not demonstrate a compelling need for this project. It is difficult to see from the ES how the proposed benefits would outweigh the many harms of this project, especially since most of the economic benefits would leave the Medicine Lake area, while the damages are left behind. *(Daniel T. Spencer)*

HF.23 I believe that there has been no demonstrated economic justification for the project, and that there are numerous and serious adverse ecological! and recreational effects whose cumulative deleterious impact has been seriously underestimated or ignored. *(Daniel T. Spencer)*

IQ.18 The economic viability of the project is questionable. In light of the deregulation of the power industry in the immediate future, such a marginal project would certainly run at a deficit. The project's proponents undoubtedly plan on selling out to a larger company with a more diverse and cheaper power generation capacity. By fluffing the portfolio of the larger, more diverse company to include a "renewable" or "green" energy source, the project suddenly become attractive as a public relations gambit. Not only would this project not make economic sense on its own, but the concept of renewable energy is false. It is not uncommon for the geothermal source to cool off or for the geothermal fluids to become exhausted (i.e. the geysers in Sonoma County). Then the project dies prematurely. The information necessary for such an evaluation apparently does not even exist. *(Phil Woodward)*

PH1.3 It's also my understanding that Calpine's market for any power that was found did not happen. *(Dorris Public Hearing)*

PH3.1 On the sale of the power that Calpine generates, do they have a buyer for that power at this point? *(Yreka Public Hearing)*

PH3.2 Can the construction start on the project if the power is not sold prior to construction? *(Yreka Public Hearing)*

PH3.3 What is the price going to be per kilowatt hour? *(Yreka Public Hearing)*

PH3.4 How long would a contract period be for? Let's say for you, how long would you contract with Calpine? *(Yreka Public Hearing)*

PH3.5 If you find a customer to buy this power, how long are they expected to be your customer? Are they expected to be your customer for 30 years or are there short-term power agreements? *(Yreka Public Hearing)*

PH3.8 I am kind of aware that there are quite a few power plants in the west right now that aren't running full capacity. And we know it is a little more expensive to produce geothermal. So someone is going to pay it, basically people living in little towns across America. You are not going to absorb the cost. Calpine isn't going to absorb the cost. It would be silly because you guys wouldn't be in the business, true? *(Yreka Public Hearing)*

PH3.27 You said that you [BPA] haven't decided whether you're going to buy the power? *(Yreka Public Hearing)*

PH3.28 Either you [BPA] want the power or you don't want the power. *(Yreka Public Hearing)*

PH3.29 Why can't you guys strike a deal, it is a done deal? *(Yreka Public Hearing)*

PH3.31 According to the California Energy Commission, geothermal is second to nuclear in cost to produce. Why, when there is hydro and natural gas, would you ever consider geothermal? Cost-wise, it can't be cost efficient. *(Yreka Public Hearing)*

PH3.32 According to Calpine—I have a paper here—it says that natural gas is going to be the fuel for the 21st century and they consider geothermal an important and profitable market niche for Calpine. I don't think Medicine Lake can afford to be a niche for Calpine. I would like to know who the investors are for Calpine. Who—who are Calpine's investors? *(Yreka Public Hearing)*

PH3.33 Do you [Calpine] have foreign investors? *(Yreka Public Hearing)*

PH3.51 What would the cost be over the life of the project per kilowatt hour? *(Yreka Public Hearing)*

PH3.89 I attended a class at OIT several weeks back. One of these things they're going through what Calpine's projects were and everything. One of the issues, they had no buyer for the power before the plant was

constructed and probably that very day, they suddenly didn't have a buyer for that power. Then the gentleman next to us, telling us they can go ahead and put the plant up regardless of whether they have the power sold or not. That is not what we were told at that class. *(Yreka Public Hearing)*

PH3.90 Who would want to buy expensive geothermal-produced power when you can buy natural gas and hydro at such a cheaper rate? *(Yreka Public Hearing)*

PH3.91 Are they doing that to round out their portfolio so it looks like they have a rounded-out group of energies to sell to the public? *(Yreka Public Hearing)*

PH3.92 Is this consumer like you and I made this statement, or is it the utility company? *(Yreka Public Hearing)*

PH3.111 So will the company be willing to accept a several million dollar loss? *(Yreka Public Hearing)*

PH4.61 How much money would be borrowed from the government to construct the plant? *(Mount Shasta Public Hearing)*

PH5.36 At this time has there been a buyer for the power yet? *(Medicine Lake Public Hearing)*

PH5.40 If you hold a lease, and supposing you do have to put money out to hold that lease, is that costly to hold out all the leases around this area? *(Medicine Lake Public Hearing)*

PH5.58 How much does the Forest Service get per year from each lease from Calpine? *(Medicine Lake Public Hearing)*

PH5.59 How much does Calpine pay for the use of leases? *(Medicine Lake Public Hearing)*

PH5.60 I'd like to know what private industry is paying for the use of public lands right now. *(Medicine Lake Public Hearing)*

PH5.61 I want to know how much in ten years your profit is going to be on this project. *(Medicine Lake Public Hearing)*

PH5.62 I'm talking about Calpine; how much money are we talking about you guys making? *(Medicine Lake Public Hearing)*

PH5.63 It's my understanding that geothermal development is a real sketchy business. Sometimes it gives and sometimes it doesn't. I think a real big problem with this project is we could get all the bad things and there wouldn't be any economic viability at all. *(Medicine Lake Public Hearing)*

PH5.66 Has there been an economic feasibility study for this project? *(Medicine Lake Public Hearing)*

PH5.70 You're talking about the people are willing to pay for the greenhouse type power, green energy, okay. What is the cost difference between hydroelectricity and geothermal? What would be the cost difference to the consumer; do they know that, how much they would have to pay; is it less or is it more? *(Medicine Lake Public Hearing)*

PH5.71 We're talking about the cost difference to the consumer percentage-wise; is there an increase? *(Medicine Lake Public Hearing)*

PH5.77 What kind of tax benefit is there to the developer of this? What kind of tax credits does he get for his invested dollar to use green power? *(Medicine Lake Public Hearing)*

PH5.79 That's the way that it was explained to me; that's where you get the private money, is individuals donated it or corporations, and then get to write off double what they have donated to this project. Now that's the way that he explained it to me. So in the long run, the taxpayer is picking up—you got the money for free to do it, the taxpayer picks up the two hundred thousand off his income tax. That's the way it was explained to me. That was what was explained to me. I don't know whether it's right or not. *(Medicine Lake Public Hearing)*

PH5.96 I'm going to make a comment to surmise the economic standpoint of this, is number one, we don't have an inbuyer. Number two, data supports that there is a deregulation coming up that's going to be coming on the come line for buying power or building power, another term that you used is this is another term for selling power. Correct. BPA is not here to support any of this, but my question is, that we need to have addressed is, historically with BPA, that's the number one source customer that you're looking at, what have they done historically; have they gone ahead and bought from a 49.9 megawatt plant? Or do they go ahead and—I mean, is that historically what they do? Do they go ahead and want an up in the wattage? *(Medicine Lake Public Hearing)*

Response—Project Economics and Viability

The opinions expressed in the comments regarding the economic viability and feasibility of the proposed project are noted. In deciding whether or not to propose and pursue the proposed project, Calpine has evaluated the anticipated economic viability and feasibility of the proposed project. Based on a variety of factors (including expected regional growth, increased demand for power produced from renewable resources, and

potential rates of return), Calpine believes that the proposed project (at the proposed power generating capacity of 49.9 MW) would be viable. While the cost of power production from renewable resources is currently higher than the cost of power production from non-renewable resources, this relationship may change in the future due to deregulation and other factors. Calpine is confident that these changes will ensure the long-term economic viability of the proposed project.

The evaluation of project economic viability and feasibility is considered to be proprietary by Calpine due to the sensitive nature of this information, and the disclosure of trade secrets to competitors that would occur if this information was publicly released. CEQA provides that lead agencies may require project applicants to provide data and information necessary for determining whether an impact is significant. If trade secrets, as defined by law, are necessary to accomplish this task, they must be submitted to the lead agency, but the lead agency may not include the trade secrets in an EIR or otherwise disclose them. The lead agency may use the privileged information to determine whether a project will have a significant impact but such information is not subject to public disclosure. Calpine considers the evaluation of economic viability and feasibility to be proprietary information under this protection.

It should be noted that there is no requirement by either NEPA or CEQA for an economic viability or feasibility study for a proposed project, and the lack of this information in the Draft EIS/EIR does not make the document deficient. Environmental documents prepared under NEPA and CEQA are also not required to provide economic justification for a proposed project. This type of information was therefore not included in the Draft EIS/EIR for the project, and Calpine's evaluation of project economic viability and feasibility has not been made publicly available.

The Draft EIS/EIR does provide an evaluation of the potential economic effects of the proposed project. These effects are identified on pages 2-58 and 2-59 of the Draft EIS/EIR, and evaluated under Impact 4.16.11 on page 4-308 of the Draft EIS/EIR. The discussion of economic effects in the Draft EIS/EIR has been prepared in compliance with both NEPA and CEQA.

It is acknowledged that Calpine has not identified a specific buyer at this time for the power that would be generated by the proposed project. As discussed in the Draft EIS/EIR, BPA may decide to purchase power from the proposed project and to transmit (wheel) project output over BPA transmission lines. BPA is considering (but has no obligation to execute) a power contract with Calpine for the project. However, BPA is not formally committed to this contract, and will base its decision on the outcome of the environmental review process and other factors.

If BPA decides not to buy power from the proposed project, Calpine plans on operating the proposed power plant as a "merchant" plant. Merchant power plants are intended to sell electricity to a deregulated electrical market. Under this scenario, Calpine would still deliver the power from the proposed power plant to the BPA Malin-Warner line for transmission to other purchasers. Calpine is confident (based on its proprietary market research and evaluation) that an adequate base of consumers would purchase power from the project, and ensure an economically viable and feasible project.

If BPA decides not to allow Calpine to transmit this power over BPA transmission lines, Calpine would have to explore other avenues for transmitting power to potential customers or the proposed project would not proceed.

Although Calpine's evaluation of project economic viability and feasibility is proprietary, decision-makers for the lead and cooperating agencies will have access to this information in making their decision whether to approve the project. These decision-makers for the project will consider all relevant factors in making their decision, including environmental and economic factors.

Comment BQ.4 misinterprets one of the purposes of the proposed project. This purpose is not to produce economical electrical power, as stated by the comment. As discussed on page 1-3 of the Draft EIS/EIR, this purpose is to economically produce and deliver electrical power. In other words, the project could produce power that Calpine would view as economical to produce and deliver, but that some consumers may not view as economical to purchase. The project (as proposed), as well as any of the five other development alternatives, would allow Calpine to economically produce and deliver electrical power. The proposed action and alternatives would therefore meet this stated purpose.

Comment BQ.4 raises several questions about the cost of electricity, consumer surveys, Calpine's involvement, and utility deregulation. These questions are beyond the scope of the EIS/EIR for the proposed project, and are not relevant to the analysis of environmental impacts in the EIS/EIR.

The BLM and the USFS have discretion to require Calpine to post bonds for the project. The BLM requires that Calpine post a $50,000 state-wide performance bond and a $100,000 bond associated with the power plant Site License to ensure compliance with the lease terms of the project. The USFS would also require Calpine to post a bond for compliance with the terms of the transmission line use on USFS lands. The BLM may require Calpine to post performance bonds, to ensure compliance with the terms of the easement, right-of-way, or special use permit for development of the transmission line. In addition, the BLM may require Calpine to post reclamation bonds for any mineral, gravel, or other removal/disturbance associated with the project. The actual amounts of these bonds may be increased based on agency discretion.

In response to comment EQ.3, the proposed project would be required to have adequate equipment for environmental protection. This equipment is proposed as part of the project, and mitigation measures are identified throughout Chapter 4 of the Draft EIS/EIR to ensure that environmental effects would be avoided or minimized. The lead agencies would not allow Calpine to change their equipment or monitoring methods, as suggested in the comment, since the implementation of this equipment would be a condition of project approval. If Calpine attempted to change equipment or monitoring methods that resulted in a violation of environmental regulations, the lead agencies could shut down the project or issue criminal sanctions for this violation. The types of environmental effects described in the comment would therefore not occur for the proposed project.

Several of the comments raise other issues about the proposed project. A discussion of these issues can be found in the following sections of this document:

- For information on the phasing of exploratory well drilling for the project, see the response to "Comments—Need for Well Testing Prior to Development" in the Alternatives, Including the Proposed Action Section.
- For information on the cumulative effects of the proposed project and the Telephone Flat project, see the responses to comments in the Cumulative Effects Section.
- For information on the effects of the proposed project on recreation, see the responses to comments in the Land Use and Recreation Section.
- For information on the definition of geothermal as an alternative energy source, see the responses to "Comments—Geothermal as a Renewable Resource" and "Comments—Geothermal as Green Power" in this section.

3.2 Alternatives, Including the Proposed Action

INTRODUCTION

This section provides responses to comments on issues related to alternatives, including the proposed action. The comments and responses are grouped under the following headings:

- Project Description
- Well Testing, Design and Maintenance
- Transmission Line Design and Capacity
- Decommissioning
- Alternatives to the Proposed Action
- Alternatives Considered but Eliminated from Detailed Study

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

Some commentors expressed concern that the entire project was not disclosed (that Calpine intended to construct more than 49.9 MW), or that all reasonably foreseeable projects were not addressed. Calpine has only proposed a 49.9 MW project. CalEnergy Company, Inc. is the only other company that has proposed geothermal development in the Glass Mountain Known Geothermal Resource Area (KGRA) (the Telephone Flat Geothermal Development Project), and no other geothermal development is reasonably foreseeable at this time. See the Cumulative Effects Section for more information regarding reasonably foreseeable geothermal development.

PROJECT DESCRIPTION

Comments—General

PH4.38 How many miles of access roads would be constructed? *(Mount Shasta Public Hearing)*

PH4.46 Why will workers only drink bottled water? *(Mount Shasta Public Hearing)*

Response—General

The surface disturbance associated with the proposed project is detailed in Table 2.2-1 of the Draft EIS/EIR. The project would require 1.5 miles of road and pipeline corridors for the production and injection lines, and 0.5 miles of new access roads for a total access road construction of 2.0 miles in the power plant and wellfield area.

The workers will drink bottled water for convenience and to reduce groundwater use.

Comment—Figure Corrections

AJ.2 1.) Figure 2.3-1. The Tionesta siding is misplaced *(Larry Hearne, et al., Tionesta Residents)*

Response—Figure Corrections

Comment noted. The identification of the Tionesta Siding in Figure 2.3-1 on page 2-61 of the Draft EIS/EIR was meant as a general locator of this siding. Figure 2.3-1 (as well as all other figures in the Draft EIS/EIR that use the same base map) has been revised to more precisely identify the location of the Tionesta Siding.

Comment—U.S. EPA Rating

A.2 Although parts of the DEIS are well written and complete, we do have substantial environmental objections and concerns. Pursuant to EPA's Policy and Procedures for the Review of Federal Actions Impacting the Environment, we have rated each of the alternatives listed in the DEIS because a preferred alternative has not been identified. (See the enclosed "Summary of Rating Definitions and Follow-up Action"). Alternatives 1 through 6 are all rated E0-2 and alternative 7 is rated LO. Our rating assumes that all alternative transmission line segments include construction of the power plant and wellfield because construction of transmission lines without the power generation facilities would not serve the project's purpose and need.

The E0-2 rating, Environmental Objections - Insufficient Information, is based on the intensity of potential significant environmental impacts to water, air, and cultural resources and the degree to which the proposed action may establish a precedent for future actions with significant effects [40 CFR 1508.27(b)]. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

Response—U.S. EPA Rating

The U.S. Environmental Protection Agency (U.S. EPA) ratings of the alternatives for the proposed project have been noted. Subsequent to publication of the Draft EIS/EIR, the lead agencies for the project consulted and met with the U.S. EPA to address their concerns about the project. Various conversations with U.S. EPA staff were also held between November 1997 and May 1998. Meetings were held with U.S. EPA representatives on the following dates:

- November 19, 1997
- February 11, 1998
- May 7, 1998

These conversations and meetings were held to provide the U.S. EPA with additional background information about the project, and to clarify the potential for project effects. The Final EIS/EIR has been prepared to incorporate additional clarifying information about the project, and ensure that sufficient project information is provided to address U.S. EPA concerns.

Comments—Size of Project

T.6 It has been brought to the lead agencies' attention that project proponent Calpine has publicly announced its intention to construct an operate a 135-MW geothermal plant at Fourmile Hill, not the 49.9MW facility being considered now. *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

Y.50 CalPine's contract with the Bonneville Power Administration is for 135 megawatts (MW). The DEIS/EIR does not address the remaining contract above the 49.9 MW proposed through this project. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AG.10 An analysis of a project's environmental impacts depends on an accurate and complete description of the project. (County of Inyo v. City of Los Angeles (1977) 71 Cal.App. 3d 185, 193 [139 Cal.Rptr. 396] ("An accurate, stable and finite project description is the sine qua non of an informative and legally sufficient EIR."); City of Santee v. County of San Diego (1989) 214 Cal.App.3d 1438 [263 Cal.Rptr. 340]; Rural Land Owners Association v. Lodi City Council (1983) 143 Cal.App.3d 1013, 1024-1025 [192 Cal.Rptr. 325]; Santiago County Water District v. County of Orange (1981) 118 Cal.App.3d 818, 829-830 [173 Cal.Rptr. 602].) If the description of the project is inaccurate or incomplete, the EIR cannot be legally adequate. (14 CCR § 15063(d)(1); Christward Ministry v. Superior Court (1986) 184 Cal.App.3d 180, 197 [228 Cal.Rptr. 868]; County of Inyo, 71 Cal.App.3d at p. 193.)

A crucial component of an accurate project description is that it include the entire project. CEQA broadly defines the "project" which must be evaluated as "the whole of an action, which has a potential for resulting in a physical change in the environment, directly or ultimately... " (Citizens Ass'n For Sensible Development v. County of Inyo (1985) 172 Cal.App.3d 151, 165 [217 Cal.Rptr. 893]; 14 CCR § 15378(a).)

Early in development of CEQA law, the California Supreme Court established that it is "the mandate of CEQA that environmental considerations do not become submerged by chopping a large project into many little ones--each with a minimal potential impact on the environment--which cumulatively may have disastrous consequences." (Bozung v. Local Agency Formation Comm'n of Ventura County (1975) 13 Cal.3d 263, 283-284 [118 Cal.Rptr. 249, 263]; accord, City of Antioch v. City of Pittsburg (1986) 187

Cal.App.3d 1333 [232 Cal.Rptr. 507]; Rural Land Owners Ass'n v. Lodi City Council (1983) 143 Cal.App.3d 103 [192 Cal.Rptr. 325].)

"A public agency is not permitted to subdivide a single project into smaller individual sub-projects in order to avoid the responsibility of considering the environmental impact of the project as a whole." (Orinda Ass'n v. Board of Supervisors (1986) 182 Cal.App.3d 1145, 1171 [227 Cal.Rptr. 688]; accord San Joaquin Raptor v. County of Stanislaus (1994) 27 Cal.App.4th 713, 729-734 [32 Cal.Rptr.2d 704.) It is "[o]nly through an accurate view of the project may affected outsiders and public decision-makers balance the proposal's benefits against its environmental cost... " (County of Inyo v. City of Los Angeles (1977) 71 Cal.App.3d 185, 192 [139 Cal.Rptr. 396]; Santiago County Water District v. County of Orange 118 Cal.App.3d 818, 830 [173 Cal.Rptr. 602].)

The danger of piecemeal review of a large project is that there may never be a comprehensive consideration of the entire project's impacts. (City of Santee v. County of San Diego (1989) 214 Cal.App.3d 1438, 1452 [263 Cal.Rptr. 340, 348]; Citizens Ass'n, 172 Cal.App.3d at p. 166 [217 Cal.Rptr. at p. 902].) This is what will occur here if the lead agencies fail to consider the environmental impacts associated with expansion of geothermal production in the Glass Mountain KGRA.

Even when a project applicant seeks separate permits for different stages of a project, CEQA does not permit piecemeal review. "The term 'project' does not mean each separate governmental approval." (14 CCR § 15378(c).) "The term 'project' refers to the underlying activity and not the governmental approval process." (Orinda Ass'n, 182 Cal.App.3d at pp. 1171-1172, quoting Natural Resources Defense Council v. Arcata National Corp. (1976) 59 Cal.App.3d 959, 969 [131 Cal.Rptr. 172] (emphasis in original).)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.11 Thus, the lead agencies must assess the environmental impacts of all foreseeable geothermal development projects in the Medicine Lake area now, even if they intend to conduct additional environmental review in the future of either an expansion of the Calpine Project, or projects undertaken by others. Without an evaluation of all components of the Project, neither the public nor the lead agencies will know its true impacts.

In Laurel Heights I, the California Supreme Court held that an EIR must analyze the environmental effects of a future expansion where:

(1) it is a reasonably foreseeable consequence of the initial project; and

(2) the future expansion or action will be significant in that it will likely change the scope or nature of the initial project or its environmental effects. (47 Cal.3d at p. 433.)

In this case, there can be no doubt that future expansion of geothermal production in the Glass Mountain KGRA is reasonably foreseeable, and that this expansion will change the scope of the project and its environmental effects. Therefore, such expansion must be discussed in the EIS/EIR.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.399 The DEIS is for a 50 Mw(gross)/45 Mw (net) project, but the Bonneville Power Administration (BPA) report entitled "Calpine's Glass Mountain Geothermal Generation Integration Project Report"[1] describes a "Project" having a "Phase A" capacity of 166 MVA and a delivered capacity of 135-145 Mw. This suggests that Calpine, the Forest Service, and/or others intend or expect a larger generating project to be built than is analyzed in the DEIS. In other words, is there piecemealing going on?

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

FP.23 In a discussion with Calpine's environmental representative (Ed Merrihew) at Medicine Lake on September 3, he stated that Calpine has not even done enough test drilling to know what "size resource" they may hit at Fourmile Hill, he said, "it could be nothing, it could be 50 MW, it could be 150 MW". So, if it's a "dry hole" the lead agencies have just wasted a lot of tax dollars going through this public review process, and if it is a 150 MW "hole", will that change the size of the powerplant? Please address these issues.

(Eric T. Nelson and Martha Spencer)

GF.2 I am also unclear of how many plants are being considered? *(Sarah Poaler)*

Response—Size of Project

Chapter 2 of the Draft EIS/EIR provides a detailed description of the proposed Fourmile project. As described in the Draft EIS/EIR, Calpine Corporation has proposed the Fourmile Hill Geothermal Development Project, which includes one 49.9 MW geothermal power plant, production and injection wells, pipelines, roads, and a transmission line. The entire Calpine project is considered in the EIS/EIR and the

[1] Ravi K. Aggarwal, BPA, 3/5/96. This report is cited hereafter as the "integration report." All citations are to the executive summary. The balance of the report consists of diagrams and printouts from the load flow studies which underlie BPA's analysis.

potential cumulative impact of construction of another geothermal plant in the KGRA is discussed in the Draft EIS/EIR, on pages 4-310 to 4-328. See also the responses to comments in the Cumulative Effects Section for further discussion of the reasonably foreseeable and cumulative projects.

Comment Y.50 incorrectly states that Calpine has a contract with BPA for 135 MW. BPA is considering purchasing 30 MW of output from the project. A power purchase contract has been drafted but has not been executed, and is still subject to further negotiations between BPA and Calpine. For this reason, it is not available to the public. The EIS/EIR addresses the impacts of a 49.9 MW project, as proposed by Calpine.

In response to comment AG.399, the proposed transmission line would have a capacity of 145 MW; the "Project" would only have a net output of 45 MW. This transmission line capacity was chosen for a variety of engineering, safety, and economic factors. The entire proposed project is discussed in the Draft EIS/EIR. Additional projects would be considered under separate environmental documents when a proposal is submitted that defines the location, size, and type of additional development. The proposed CalEnergy Telephone Flat geothermal project is analyzed in a separate environmental document because it was proposed almost one year after the Fourmile Hill project was proposed, the CalEnergy project is proposed in a different National Forest, and is proposed by a separate private company. This approach to analysis is not "piecemealing," as the cumulative impacts of all reasonably foreseeable projects are addressed in the cumulative impact analysis for both projects. See the response to "Comments—Transmission Line Design and Capacity" in this section for further discussion of the rationale for the design and capacity of the transmission line. See the response to "Comments—Reasonably Foreseeable Geothermal Development" in the Cumulative Effects Section for more information on reasonably foreseeable projects.

Calpine proposes to conduct exploration drilling to confirm the presence of a commercial geothermal resource. At this time, the project is proposed to be only 49.9 MW. If a larger geothermal resource is encountered, Calpine could propose a power plant expansion or modify the size of the project; either of these options would require additional environmental analysis under NEPA and CEQA.

The cost of the environmental review by the USFS and BLM is being borne by Calpine Corporation, and not the taxpayers.

Comment—Definition of the Preferred Alternative

HD.19 It is unclear why segments Al and A2 are the "preferred alternative" Based on the EIS/EIR, these segments would cause significantly more environmental impact to vegetation and wildlife than segment A3. *(Amanda Spencer)*

Response—Definition of the Preferred Alternative

Segments A1 and A2 are a part of the proposed project, not the preferred alternative. Alternative 6, which includes segment A3 (but not segments A1 and A2) is designated the environmentally preferred alternative and the agencies' preferred alternative.

Comment—Need for Arnica Sink Well

HD.9 It is unclear why groundwater extraction from the Arnica Sink well is needed. The EIR/EIS states that a water well will be installed near the plant area during the second year of construction activities. Installing a water well near the plant prior to initiating plant and geothermal well construction activities

would alleviate the need for the water line from Arnica Sink to the plant area and the destruction of National Forest land along the 50-foot wide corridor reportedly needed for the water line.

(Amanda Spencer)

Response—Need for Arnica Sink Well

Calpine has proposed to use Arnica Sink well water for geothermal well drilling in the first year of activities. First year activities would include well pad and road construction, and well drilling and testing. These activities were analyzed in the Fourmile Hill Exploration EA (BLM et al. 1995A). Calpine has proposed to use the Arnica Sink well as it is existing, and has proven capacity. This well was used to provide drilling water to other geothermal wells drilled in the KGRA and has adequate capacity to provide the needed water. If well drilling is successful and power plant construction proceeds, a well would be drilled on the lease. If the exploration is not successful, the effects of drilling a new well would be avoided and only the effects of temporary pipeline placement and use of an existing well would occur.

Comment HD.9 incorrectly states that a 50-foot corridor would be cleared for placement of the freshwater pipeline. As stated on page 2-21 and 2-22 of the Draft EIS/EIR, the pipeline would be a temporary pipeline that would be hand-placed, primarily parallel to existing or proposed roads. On page 2-22, it is stated that the corridor for this pipeline would be 5 feet wide, not 50 feet wide. The pipeline would not require removal of vegetation and would be placed around trees, rocks, and other obstacles.

Comment—Geothermal Reservoir Management

EQ.11 On page 4-48 paragraph 5 starting on line 3, "If there are any long-term effects to the reservoir, the BLM *may* require the developer to make appropriate changes to operational procedures, including production and injection rates and location. These requirements would ensure that effect of fluid injection on the geothermal reservoir would be less than significant." In the first place "may" in the sentence must be changed to "will". "The BLM will require the developer——. The question is does the BLM have a person or persons who has vast experience in dealing with geothermal reservoir management and I don't mean an academic, but an experienced field superintendent that has been on the other side and knows all the tricks developers use to hide their problems such as arsenic finding its way into the ground water or wells running dry as a result of fractures in the supposed clay formation that sealed the ground water from the geothermal fluid because of uneven subsidence do to reduction in the reinjection levels. If you think this can't happen we can give you examples of both even though the geologist said it was not possible!

(Ronald A. Maire)

Response—Geothermal Reservoir Management

The mitigation measure uses the term "may" because slight changes would not necessarily require modification of operating procedures. The BLM has several geothermal reservoir engineers and geologists who have many years of experience overseeing and evaluating geothermal exploration and development operations.

The proposed groundwater monitoring well program would include regular reporting to the BLM, USFS, and other regulatory agencies. Geothermal fluids would be easily identified if they were to enter groundwater. Calpine would be required to report geothermal well production data to the BLM on a monthly basis. BLM would therefore have the appropriate data to evaluate the well production quantities that would indicate if a well was "running dry."

The Geothermal Resources Operational Orders (GROs) require a baseline survey to establish the elevation of well heads prior to production of geothermal fluids. Subsequent surveys would be conducted to determine if subsidence occurs.

Comment—Project Location and Unit Status

BQ.7 Draft EIS/EIR (page 2-6). The project is being developed on leases in the Glass Mountain Federal Geothermal Unit, but these leases are not committed to this unit or subject to the unit requirements. At several points in the draft EIS/EIR, Calpine claims that their proposed site is the only viable geothermal site. We would like a written response why this area was removed from the Glass Mountain Geothermal Unit and how can Calpine prove their claim as to the need for the exact location for the project if no test wells have been drilled? We believe this site has been selected to avoid coordinated environmental review under the Glass Mountain Geothermal Unit. *(S. Peder and Suzanna S. Cuneo, et al.)*

Response—Project Location and Unit Status

The proposed development site was chosen based upon optimizing geothermal energy generation given the scope of Calpine's Federal leases. Well site lithology and structure were considered by Calpine in the siting of the proposed project facilities for the project, as were geophysical and temperature gradient data. Well sites were also chosen to minimize impacts to sensitive and unique areas. Calpine selected the site in question based on comprehensive geologic and geophysical studies identifying the drilling locations on the above-mentioned leases with the greatest probability of encountering a commercially viable geothermal source. Calpine then met with the USFS to locate the power plant and wellfield facilities so as to minimize the potential environmental effects.

Even though Calpine's geothermal leases are located within the boundaries of the Glass Mountain Federal Geothermal Unit (14-08-0001-18160), they are not subject to the requirements of that Unit (BLM 1982). A discussion of why the area was taken out of the unit is beyond the scope of this EIS/EIR.

The cumulative impact analysis on pages 4-310 to 4-328 of the Draft EIS/EIR provides an environmental review of the cumulative impact of all proposed and reasonably foreseeable projects in the area. The Telephone Flat geothermal project is also being analyzed in a complete EIS/EIR; this EIS also provides an analysis of cumulative environmental effects of the two proposed geothermal projects.

WELL TESTING, DESIGN AND MAINTENANCE

Comments—Need for Well Testing Prior to Development

F.10 Neither Calpine nor CalEnergy have initiated the proposed/permitted/mitigated "exploration projects" described on pages 1-13 through 1-15. We note from the earlier (1984) Glass Mountain KGRA leasing Environmental Assessment that there was to be an "exploration phase" of the KGRA leasing project and that the exploration phase -particularly as it provides information about water resource issues -- is "...essential to answering the questions regarding impacts of development. Exploration will yield necessary information on temperatures, pressures, and fluid characteristics at depth which are currently only speculation." (Supplemented Environmental Assessment -- Geothermal leasing...., September 1984, page 40). We believe that additional details about the geothermal fluids must be provided to this RWQCB as part of the Report of Waste Discharge to be submitted by the owner/operator; we recommend that those details be provided in the EIR/EIS.
(John R. Hannum, North Coast Regional Water Quality Control Board)

T.9 It would also be premature to move forward with a final EIS/EIR and a Record of Decision at this time. Testing of deep wells for geothermal energy and chemical content is a necessary; and critical step in the information-gathering process, without which a responsible and defensible decision is impossible.
(Linda L. Blum, Medicine Lake Citizens for Quality Environment)

T.11 The EIS/EIR itself is premature, in that sufficient information is not yet available to conduct evaluations of the long-term and irretrievable commitments of public resources being contemplated in the Fourmile Hill development decision. The exploration permit obtained by the proposed Fourmile Hill developer has not been exercised through the test well stage; there has not yet been full demonstration of commercial geothermal potential. Thus the infliction of any adverse effects, however mitigated or

remote, cannot be weighed against potential benefits with any level of certainty.
(Linda L. Blum, Medicine Lake Citizens for Quality Environment)

U.3 The exploratory wells are supposed to be drilled to prove that a viable geothermal resource exists and to prove the extent of the resource. Exploratory drilling will also determine the wells chemical make-up and contents.

Calpine has NOT drilled these vital exploratory wells. Instead Calpine has jumped right into the development stage. How can Calpine develop a power plant and build a transmission line when the geothermal resource has not been proven to exist? Calpine is putting the cart before the horse.

According to the 1984 Supplemental Environmental Assessment for the KGRA (pg. 40, paragraph 5), "Deep exploratory wells will provide specific data to more accurately analyze and predict effects on subsurface hydrology, and thermal and nonthermal surface waters. The exploration phase of this project is therefore essential to answering the questions regarding impacts of development. Exploration will yield necessary information on temperatures, pressures and fluid characteristics at depths which are currently only speculation. Information on rock types, permeability and porosity will also be acquired by deep exploratory drilling, thus adding substance to current hypotheses and models."

Therefore, Calpine MUST drill deep exploration wells before the development stage is even considered. This issue must be addressed in writing.
(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

Y.28 At the September 3, 1997 Board of Supervisor's tour, an industry representative stated that Calpine had not determined if a viable geothermal power source even exists within the proposed project area because they had not completed test drilling (see draft EIS/EIR at 2-38). To date we understanding that Calpine has only drilled a temperature gradient well, no on-site exploratory wells.

According to the 1984 Supplemental EA for the Glass Mountain Known Geothermal Resource Area (the whole Medicine Lake resource area) to which the present DEIS/EIR is tiered, "Deep exploratory wells will provide specific data to more accurately analyze and predict effects on subsurface hydrology, and thermal and non-thermal surface waters. The exploration phase of this project is therefore essential to answering the questions regarding impacts of development. Exploration will yield necessary information on temperatures, pressures and fluid characteristics at depths which are currently only speculation. Information on rock types, permeability and porosity will also be acquired by deep exploratory drilling, thus adding substance to current hypotheses and models." Even though two temperature gradient holes were drilled to 2000 and 3500 feet, the results are applied to depths of over 6,000 feet.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AD.22 4. Lack of exploratory data, effects on hydrology. The EIS/EIR lacks in evidence that the exploratory drilling stage permitted in the 1984 EA was completed. Data from exploratory wells are lacking and the viability of the project has not been demonstrated. As a result, the analysis of hydrology and impacts on water quality are speculative; effects the project on the quantity, levels, and chemical make-up of springs, creeks, lakes underground aquifers and watersheds affected by the project are lacking; impacts on air quality and the effects of emissions on plants and wildlife and pure waters are only guessed at; and there is an unanswered question about the extent and viability of the geothermal resource. The project proponent has not even determined that adequate geothermal fluids are available to "suggest the presence of a geothermal system capable of commercial development" (EIS/EIR at 3-37). We also read that "No geothermal fluid samples have been obtained from the geothermal system in the Fourmile Hill area, and thus no fluid analyses from the resource believed to underlie Calpine's leases are available."
(Floyd J. Buckskin, Pit River Tribe)

AR.3 (3) A test well has not been drilled for Fourmile which is required by law and may very well be illegal, which puts the whole project under suspicion. *(Marcia Barrow)*

FP.5 Why haven't the lead agencies required the test drilling prior to project approval? What is the rush to develop this project before baseline data has been collected? Please address the accelerated timeline in the EIS/EIR with regards to project development. *(Eric T. Nelson and Martha Spencer)*

HD.2 On Page 1-14, it is reported that the exploration testing to determine whether this is an economically feasible project has not yet been done. The need for this project cannot be established without this information. Additionally, it appears that the scope and evaluation of this project has been based primarily on the information from one wen (88-28). *(Amanda Spencer)*

HT.12 Several places in the EIS notes that there is insufficient data to evaluate the effects on the environment; further drilling & reservoir testing must first be completed.

In Sec. 4.4, the capacity of the KGRA was made with very limited data and is probably an overestimate of the resource potential that can be economically developed The amount of electricity produced by the proposed project is subject to confirmation drilling and may be less than 49.9 MW. *(Louise Thompson)*

HY.5 On page 1-4, it states that "BPA has the following agency purposes or objectives: test the ability of geothermal energy in the Fourmile Hill area to provide a reliable, economical, and environmentally acceptable energy resources in the region;.....," from there, if one refers to Chapter 3: Description of the

Affected Environment, in which certain aspects of the geology, soils, hydrology and geothermal rescues are discussed, one began to realize that this is indeed, at this stage, an exploratory project, no guarantee at all as far as the proposed gross 49.9 MW geothermal power can be harnessed from the Fourmile Hill Project. This is most disturbing, especially when one thinks of all the large-scale incurred environmental damages associated with this exploration. The current scientific exploration is very deficient. I vote 200% for the "no project" alternative till more very small-scale, scientifically-based investigations, with minimal environmental damages, are conducted to ascertain the likelihood of the extraction of 49.9 MW geothermal power. And I am sure that since we live in the technology-advanced society, such small-scale investigations are technologically feasible and certainly economically feasible, before the full-scale launch of the project happens. *(Alice Tseng)*

IM.8 My understanding is that exploratory drilling which is necessary to assess impacts of drilling has not been done. This needs to be done and analyzed in the EIS/EIR. *(Brenda Willey)*

PH5.13 Several places in the EIS, notes that there's insufficient data to evaluate the effects on the environment. Further drilling and reservoir testing must first be completed. In section 4.4, the capacity of the KGRA was made with very limited data, and it's probably an overestimate of the resource potential that can be economically developed. The amount of electricity produced by the proposed project is subject to confirmation drilling and may be less than 49.9 megawatts. *(Medicine Lake Public Hearing)*

Response—Need for Well Testing Prior to Development

Many comments have stated the need to conduct exploration drilling activities prior to analyzing the potential effects of development and power production. Calpine submitted a Plan of Exploration for geothermal drilling and well testing on the proposed leases. In the Fourmile Hill Geothermal Exploration Project, Calpine set forth a series of exploration activities described in a Plan of Operations submitted to the BLM in 1995 (Draft EIS/EIR, pages 1-13 to 1-15). The exploration project includes portions of three contiguous Federal geothermal leases: CA21924, CA21925 and CA21926 (the first and third leases are included in the proposed geothermal development project). Among the proposed exploration activities are road construction, well pad construction, well drilling and testing, and reclamation of the sites. The five production well pads presently considered for the proposed action are included as part of the exploratory project. Selection of two test well pads is to be based on additional geophysical information to be obtained and collected by Calpine. Furthermore, a test temperature gradient hole is to be drilled on lease CA6111.

The exploration program was subject to environmental review under both NEPA and CEQA. The *Fourmile Hill Area Geothermal Exploration Project EA/IS* (BLM et al., 1995a) was prepared for the Calpine Plan of Exploration. The effects of well drilling and testing were analyzed in the EA/IS. Calpine has not yet commenced exploration, although the Plan of Exploration was approved by the BLM. After review and consideration of public comments on the EA/IS, the BLM and USFS made a Finding of No Significant Impact (FONSI) and a Decision Record was issued, in conjunction with a Negative Declaration prepared by the Siskiyou County APCD. Final approval for the exploratory project was obtained in April 1996.

Considerable exploratory drilling has previously been conducted in the region since 1982 (Draft EIS/EIR, page 1-11). Twenty-four temperature core hole wells were drilled in the Glass Mountain KGRA between 1981 and 1984 by UNOCAL, Phillips Petroleum, and Occidental Geothermal. Calpine completed the drilling of a temperature core hole well at well pad 88-28, the location of the proposed Fourmile Hill Geothermal Development Project, in 1994.

Although Calpine has not conducted deep geothermal drilling, a geothermal resource has been identified through geothermal well drilling and testing in the Telephone Flat

area in the Medicine Lake Highlands. Phillips Petroleum and Occidental Geothermal drilled a deep exploration test well at well pad 17A-6 (see Draft EIS/EIR, Figure 1.5-1), which was followed by UNOCAL wells 68-8, 31-17, and 87-13 (for the location of these well pads, see Figure 1.5-1, page 1-12 in the Draft EIS/EIR). A geothermal resource was encountered, and the resource chemistry data from these wells were used in the estimation of project emissions and impacts. Representative well chemistry data, such as were used to calculate project emissions and impacts, is included in the Final EIS/EIR.

In 1995, Calpine proposed a 49.9 MW power plant and transmission line by submitting a Plan of Utilization (Calpine 1995) to the BLM and USFS. The plan was submitted prior to conducting the exploration drilling to identify and test the resource. However, the Calpine proposal involves conducting the exploration drilling necessary to identify a commercial geothermal resource before beginning construction for the power plant or transmission line. No surface disturbance or environmental impacts of the proposed power plant and transmission line would occur until a commercial resource is identified.

As described in the Draft EIS/EIR, well testing and drilling are to be integrated into the development of the project (page 2-14). Steam is to be initially supplied to the power plant from nine to 11 two-phase (geothermal steam and hot geothermal water) production wells located at five proposed production well pads. The exact number of production wells to be drilled is contingent on the megawatts available from the steam flow at each site. Thus, the first three years of the project would include a steady well drilling and testing protocol (this procedure is limited to the summer and fall due to weather constraints). The project plan provides that one or two production wells would be drilled initially to confirm the viability of the geothermal source. Remaining wells would be drilled pending the outcome of this determination.

The Glass Mountain KGRA is considered an excellent site for geothermal development. These previous exploratory drilling operations have indicated large reservoirs of geothermal steam and water that are capable of maintaining a viable geothermal operation for many years. Calpine's proposal for development of this site is based on a cautious and pragmatic exploratory drilling schedule at the outset. Thus, the development of the site would proceed in accordance with the available resource. This is deemed the most effective and cost-efficient approach to developing the geothermal project.

Although Calpine has not yet conducted the Fourmile Hill Geothermal exploration program, the data gathered from wells drilled by UNOCAL, Philips, and Occidental provide representative data that can be used to asses the impacts of the proposed Fourmile Hill project. The impacts of Calpine's exploration activities have been fully analyzed (BLM et al. 1995) in an EA/IS that was distributed to the public, and the phased approach to development will ensure impacts of the power plant and transmission line do not occur prior to the identification of a resource. The impact analysis is based on actual, representative resource chemistry and conservative engineering and equipment performance assumptions.

Comments—Well Drilling/Maintenance During Operation

A.34 The DEIS does not provide sufficient information regarding the construction, operation and closure of the injection wells in the project area. These items need to be addressed in the FEIS.
(Deanna M. Wieman, U.S. Environmental Protection Agency

F.12 Alternatives pages 2-1 through 2-3. The DRAFT does not consider deferral of Development-phase activities until completion and disclosure of Exploration-phase activities and results; it seems to trivialize an essential facet of KGRA management which was established in the 1984 Environmental Assessment.
(John R. Hannum, North Coast Regional Water Quality Control Board)

BQ.8 Draft EIS/EIR (page 2-14). At several points in the draft EIS/EIR there is a clear separation made between the construction phase of this project and the operational phase. At several points the effect of the drilling rigs on noise, light pollution and ground water use are made. However the draft EIS/EIR only provides a detailed analysis of the effects of drilling during the construction phase of this project. The draft EIS/EIR on page 2-14 states that; "...one in-fill or rehabilitation well would be drilled every two years." In fact this project will have well drilling during most of the 45 year operating life of this plant and not just during the construction phase. We believe that the draft' EIS/EIR has not done a complete analysis of the effects of continued drilling. We would ask for a reassessment of the impact of continued well drilling for the duration of this project including visual, noise, ground water use and light pollution (these drilling rigs would be in operation 24 hours a day for all summer months). If this reassessment is not made please provide a written response. *(S. Peder and Suzanna S. Cuneo, et al.)*

PH3.11 There's how many wells that go to each plant? *(Yreka Public Hearing)*

PH3.13 How far apart are—is each well from the plant? Is there a grid? I have never really seen a—a design or diagram. *(Yreka Public Hearing)*

PH3.19 How are the tailings from the well drilling going to be dealt with and what kind of quantity are we talking about? *(Yreka Public Hearing)*

PH3.20 What if it [drill cuttings] does contain contaminated material? *(Yreka Public Hearing)*

PH3.21 How are the pits created and how big are those that contain the ground rock? *(Yreka Public Hearing)*

PH4.7 Drilling impacts are considered short-term, but drilling will occur over 14 years.
(Mount Shasta Public Hearing)

PH4.42 What if a pocket of magma is hit during drilling? *(Mount Shasta Public Hearing)*

PH5.27 And how many wells are projected in the future? *(Medicine Lake Public Hearing)*

PH5.88 You're not having any sumps then for the remaining water; you're only having two systems, one that's reinjected, and the other that evaporates? *(Medicine Lake Public Hearing)*

PH5.90 Did the EIR/EIS say there was going to be a certain amount allowed for leakage of the sump in there?
(Medicine Lake Public Hearing)

Response—Well Drilling/Maintenance During Operation

The drilling, maintenance, and operation protocols of the production wells are discussed in the Draft EIS/EIR on page 2-11 to 2-18. The proposed Calpine power plant would initially be supplied by 9 to 11 two-phase production wells distributed at the 5 proposed production well pads. These production wells would be drilled to a total depth ranging from approximately 4,500 to 8,500 feet. The diameter of these wells would decrease with increasing depth in a telescopic fashion. Following drilling, a series of flow tests would be conducted at the various sites to determine economic feasibility (2.9 million pounds per hour, mass flow per site).

Following initial drilling during the construction phase of the project, infill or rehabilitation wells would be drilled (during the operation phase) approximately every two years to maintain the geothermal source. This drilling would be conducted at the existing well pads, and would not require any additional surface disturbance. Thus, additional environmental impacts from the maintenance of the wells is negligible.

The project proposal includes descriptions of the geothermal fluid and runoff controls for the project. The drill pad sites would be placed within a bermed area with blowout prevention equipment (BOPE) provided. Each production well would have a 750,000-

gallon lined sump that is excavated within the pad and constructed in accordance with Federal GRO No. 4 and RWQCB requirements. Disposal of the drilling mud, protection of groundwater, and other concerns attendant with well operation are addressed in Section 2.2 of the Draft EIS/EIR. Drill fluids and cuttings would be tested to determine if they contain hazardous materials. If hazardous material are present, they would be removed and taken to an approved disposal site.

The construction, operation, and closure of proposed injection wells are described in the Draft EIS/EIR. As discussed on page 2-18 of the Draft EIS/EIR, the injection wells would be constructed and operated in a similar manner as proposed production wells, with the exception of the following:

- No well testing would occur at the injection wells
- The injection wells would be used for the injection of geothermal fluids back into the geothermal reservoir, instead of for production of fluids

A detailed description of production well construction and operation is contained on pages 2-11 through 2-18 of the Draft EIS/EIR, and reference is made in the Draft EIS/EIR to the Fourmile Hill Geothermal Exploration Project EA/IS for additional information. Additional information is also included in the Calpine Plan of Exploration (Calpine 1994) and Plan of Utilization (Calpine 1995). Closure of injection wells is described under "Well Abandonment" on page 2-17 of the Draft EIS/EIR, as well as under "Decommissioning" on pages 2-54 through 2-56 of the Draft EIS/EIR. Calpine will provide additional well construction data to BLM in a Geothermal Drilling Permit application prior to drilling the wells. The data provided in the EIS/EIR are adequate to allow for analysis of project effects. In addition, Calpine has provided the U.S. EPA with additional technical data on the construction and testing of the wells.

Injection wells would be constructed, operated, and abandoned in compliance with the GROs and the U.S. EPA Underground Injection Control (UIC) program. The GROs are designed to ensure that potential environmental effects from wells are avoided or minimized. The BLM would be responsible for enforcing compliance with the GROs during injection well construction, operation, and closure. Compliance with the GROs would ensure that no significant hydrogeology, hydrology, or water quality effects occur as a result of the injection wells. This information has been clarified in the Final EIS/EIR.

Finally, well abandonment would be in accordance with BLM and USFS requirements. A proposal for abandonment is to be submitted to the BLM and USFS for review in conformance with GRO No. 3. Generally, abandoned wells would be filled with cement, capped with a welded plate, and back-filled to USFS specifications.

The effects of well drilling and testing during the project operation phase have been evaluated in the EIS/EIR. The effects of drilling and testing during operation would be similar to that during the construction phase (see Sections 4.13 and 4.14 of the Draft EIS/EIR).

Comments—Need for Supplemental Water Injection into Geothermal Reservoir

F.13 Section 2.2 Alternative 1--Proposed Action. This section of the DRAFT elaborates on descriptions of three phases of actions: Construction, Operation and Decommissioning. There is no mention of a fourth possible phase which has become essential to operations at the Geysers--Water Import and Injection. As the steam yield of the Geysers field was developed and then began to decline (well before 45 year's of development), the operators determined that the deficit between water mass extracted and reinjected could be made up from other water sources. In this case, the first step was to tap Geysers-area streams and inject their waters into the geothermal zones. Today, the operators are constructing a system to import and inject 7.8 million gallons per day into the southeast portion of the steamfield; in the near future, they may participate in another project to import even greater quantities for injection into the western portion of the field. Even though the Glass Mountain resource is believed to be much "wetter" and up to eighty-percent reinjectible; perhaps it is appropriate to consider Import/Injection as a reasonable additional phase of Glass Mountain KGRA development which will be considered before the project is decommissioned? If so, the EIR/EIS must recognize possible sources of such water and predict the impacts of its development. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

F.21 Section 4.3.1 covers predicted effects of water use. It does not anticipate need for development of water sources for injection to the steamfield (as has occurred at the Geysers) in the event such injection might prolong the production of steam. The suggested mitigation is a hydrologic monitoring plan. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

Response—Need for Supplemental Water Injection into Geothermal Reservoir

Water importation and injection for the project is not mentioned in the Draft EIS/EIR because there is no reason to expect that water importation and injection would be required. As noted in the comment, there are significant differences between the geothermal fields at Glass Mountain and at The Geysers. The key difference is that the geothermal resource at Glass Mountain is a two-phase (water and steam) system, while The Geysers geothermal reservoir is a single-phase, dry steam resource. Unlike The Geysers resource, the geothermal resource at Glass Mountain is "water rich." Due to its high water content, the majority (approximately 84%) of the produced geothermal fluid would be injected back into the geothermal reservoir. This injection would minimize depletion of the Glass Mountain geothermal resource.

In contrast, the nature of the geothermal resource at The Geysers (i.e., steam-based) allows for very little injection of produced geothermal fluids back into the geothermal reservoir. The majority of geothermal fluids produced at The Geysers are lost to the atmosphere through evaporation in the cooling towers. As discussed in the comment, this substantial loss requires water importation and injection at The Geysers to sustain the geothermal resource. In addition, the depletion of the geothermal resource (and associated pressure declines) at The Geysers took many years to occur. Injection was minimal in the first 30 years of operations at The Geysers.

Because of the high percentage of geothermal fluid proposed to be returned to the reservoir for the proposed project, it is not anticipated that use of imported water would be necessary to recharge the geothermal reservoir. The situation that has occurred at The Geysers is not expected to occur at Glass Mountain. Analysis of water importation before there is even a power plant in place would be premature. Because water importation and injection would not be required, an evaluation of possible water sources and associated impacts is not included in the EIS/EIR.

TRANSMISSION LINE DESIGN AND CAPACITY

Comments—Transmission Line Design and Capacity

Y.51 The project requests approval for a transmission line that can serve 300 MW transmission line which could potentially serve all the leasees in the Medicine Lake area. Yet no cumulative impacts are analyzed even though six leases have been sold, and the 1984 EA mentions that the area has a potential for ten power plants! *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AB.3 We are concerned that the 300 megawatt transmission line has the potential to serve six power plants like the one being proposed as the Fourmile Geothermal Development. The combined impacts are not being addressed in the current Environmental Impact Statement/EIR.
(Michelle Berditschevsky, Native Coalition for Cultural Restoration of Mount Shasta)

AE.2 I am concerned that the 300 megawatt transmission line has the potential to serve six power plants like the one being proposed as the Fourmile Geothermal Development. The combined impacts are not being addressed in the current Environmental Impact Statement. *(Arnold Wilkes, Pit River Tribe)*

AG.13 The clearest example of this foreseeability is the proposal to build a transmission line with capacity to handle 300 MW of electricity. (EIS/EIR, p. 2-38.) The EIS/EIR claims that the Forest Service requested that the transmission line "be designed to accommodate not only the net electrical power output of 44.9 MW from the proposed project, but also reasonably foreseeable geothermal power generation that could occur at the Glass Mountain KGRA." (EIS/EIR, p. 2-37; see also p. 2-38 (230 kV line chosen over a 115 kV line because the 115 kV line "either could not transmit, or would uneconomically transmit, the proposed effective capacity [145 MW] of the line."); p. 2-77 (low-voltage lines rejected because, among other things they "may not adequately accommodate future development"); p. 2-76 (230 kV line chosen to accommodate potential future development in the KGRA); Comments of Thomas Reid Associates, Ex. B, § 2.0; Comments of David Marcus, Ex. C, Comments 2, 3, 4, 8.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.167 According to Mr. Marcus, use of a double-circuit line for the proposed Fourmile Hill-Glass Mountain Tap line could significantly reduce potential reliability problems and, consequently, environmental impacts. (Ex. C, Comment 10.) Under the proposed transmission system (single-circuit), any outage of the Tap line would cause complete shutdown of the line. Thus, Calpine, CalEnergy, and any other users of the Tap line would be forced to shut down. (Ibid.)

A double-circuit line can avoid many of these problems. With a double-circuit line, if there is an outage to one line, electricity can still flow over the other line. The EIS/EIR should evaluate the pros and cons of a double-circuit line, which could mitigate system reliability impacts as well as environmental impacts associated with geothermal plant shutdowns. (Ibid.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.184 Mr. Marcus reviewed the EIS/EIR's discussion of alternative transmission routes, as well as the BPA integration study on which the EIS/EIR relies. He concluded that the EIS/EIR failed to analyze several reasonable transmission line alternatives that have the potential to avoid or mitigate environmental impacts. (Ex. C, Comments 7, 8, 9.)

The EIS/EIR rejects the idea of using a 115 kV line because of the expense of building a transformer at the Malin-Warner interconnect. (EIS/EIR, p. 2-71.) The EIS/EIR also claims a 230 kV line was chosen over a 115 kV line because a 115 kV line "either could not transmit, or would uneconomically transmit, the proposed effective capacity [145 MW] of the line." (EIS/EIR, p. 2-38.)

However, as Mr. Marcus explains, a 115 kV line could carry the Tap line's maximum "effective capacity" of 145 MW. (Ex. C, Comment 8.) Although a 115 kV line would require the additional expense of building a transformer at the Malin-Warner interconnect, a 115 kV line would be less expensive to construct. (Ex. C, Comment 9.)

The EIS/EIR also asserts that a 115 kV line would not reduce the transmission line's environmental impacts. (EIS/EIR, p. 2-76) Mr. Marcus does not agree with this conclusion. A 115 kV line may cause fewer environmental impacts than a 230 kV line, because it requires a smaller right-of-way (less vegetation and habitat disturbance), and uses smaller poles (fewer visual impacts). (Ex. C, Comment 9.) Moreover, if the Tap line were routed to an existing 115 kV line, no transformer would be required. (Ex. C, Comment 8.) The EIS/EIR should analyze the pros and cons (economic and environmental) of using a 115 kV line versus a 230 kV line so the public and agency decisionmakers are fully informed about all reasonable project alternatives.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.186 As discussed above, the EIS/EIR also rejected the reasonable alternative of using a 115 kV line instead of a 230 kV line. One reason for rejecting this alternative was that it would require building a transformer at the Malin-Warner interconnect. (EIS/EIR, p. 2-71.) But no transformer is necessary if the Tap line is routed to an existing 115 kV line. The refusal to consider connecting with an existing 115 kV line precluded the EIS/EIR from analyzing alternative transmission line routes. (Ex. C, Comment 8.) These

routes could cause even fewer environmental impacts than the proposed route, particularly if there is an existing 115 kV connect line closer than 23 miles from the generation plant or a route that requires less disturbance of the National Forests (e.g., west-northwesterly). The EIS/EIR should analyze possible transmission line routes associated with connecting to an existing 115 kV line. (Ex. C, Comments 7, 8.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.398 I have reviewed the portions of the Fourmile Hill DEIS/DEIR ("the DEIS") dealing with transmission. In sum, it appears that the project's transmission line is sized for a much larger project.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.400 Transmission line capacity is a function of line length, conductor size, number of conductors per phase, conductor material, and voltage. Conductor size is commonly measured in units called thousands of circular mills (MCM, or kcmil). Conductors are commonly made with an aluminum conductor, steel reinforced (ACSR). The proposed transmission line is an 18 mile long 230 KV line using 1272 MCM ACSR conductors (integration report, p. 1), with a resultant line capacity of 300 Mw, more than twice the erstwhile project size of 145 Mw (DEIS; note that the DEIS says that the line would be 24 miles long, not 18; this discrepancy should be explained). Other, smaller, standard conductor sizes are 795 MCM, 954 MCM (see High Desert Power Plant AFC, 6/97, p. 6.4-2, evaluating conductor options for a 230 KV transmission line from a proposed power plant in Southern California), and 1192 MCM (see draft Sutter Power Plant AFC filing, 9/97, Chapter 6, pp. 24-29, comparing the economics of 795, 954, 1192.5 and 1272 kcmil 230 KV transmission lines). Use of a smaller conductor instead of 1272 MCM conductor would result in a smaller line capacity much more in line with the 145 Mw maximum project size. Is the choice of a 1254 MCM conductor another example of piecemealing? Note that a smaller conductor size would reduce capital costs, and, because of reduced conductor weight, might allow less massive and hence less intrusive towers to be built. The DEIS should explain why such a large conductor size is being proposed.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.401 The DEIS says that usable transmission capacity will be limited to only 145 Mw of the 300 Mw line capacity, because of system transmission constraints. The integration report makes clear that those constraints are caused by the potential loss of the Malin-Glass Mountain Tap line section which would be created by the proposed interconnection of Fourmile Hill to the existing Malin-Warner 230 KV line at a new interconnection to be called Glass Mountain Tap (integration report, pp. 4, 5). This suggests that the constraints might be relieved by the construction of a second Glass Mountain Tap-Malin 230 KV line (or by the extension of the proposed Fourmile Hill-Glass Mountain Tap line to go directly from Fourmile Hill to Malin).[2] The distance from the Glass Mountain Tap site to Malin is only 25 miles (integration report, p. 1), all in an existing 230 KV transmission corridor.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.402 The potential to increase output from the Fourmile Hill area to 300 Mw by building new transmission from Glass Mountain Tap to Malin in an existing corridor suggests, once again, that piecemealing may be going on. It looks like an eventual 300 Mw with about 50 miles of transmission line is being divided into two roughly equal projects, with 145 Mw of generation and 24 miles of transmission (Fourmile Hill-Glass Mountain Tap) being evaluated in this EIS and the next 155 Mw of generation and the remaining 25 miles of transmission (Glass Mountain Tap-Malin) to be evaluated in a future EIS, but with the current transmission line sized to accommodate the future generation and transmission requirements.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.403 The DEIS suggests that usable capacity will be limited to only 145 Mw of the 300 Mw line capacity, because system transmission constraints in some hours would require ceasing ("dropping") or reducing ("curtailing") generation at Fourmile Hill if throughput was in excess of 145 Mw. However, the integration report says that, even with Fourmile Hill generation as low as 135 Mw, let alone 145 Mw, dropping of generation at Fourmile Hill will still be necessary under certain contingencies. This raises two separate issues:

a. Dropping Will Occur at Stated Generation Capacity

If construction of generation is to occur to a level at which generation dropping will be necessary in response to certain transmission contingencies, as the integration report says will occur at the 135 Mw level and above, then the ostensible constraint on generation discussed in the DEIS does not really exist, since the proposed 145 Mw project will already exceed the level of generation which is subject to curtailment or dropping. The project could be constructed to generate up to 300 Mw, subject to interruption for transmission contingencies, without further transmission line construction. In particular, if certain contingencies (such as heavy winter south-to-north flows) occurred at forecastable times, scheduled maintenance on the geothermal project(s) could be scheduled simultaneously with those contingencies, minimizing the "lost" generation potential due to transmission contingencies. Thus, once

[2] The integration report states, however, that whether new transmission could by used "to relieve overloads or correct voltage problem[s] in lieu of generation reduction would require a detailed study" (integration report, p. 5).

again, piecemealing of a larger project may be occurring. The DEIS should explain the various scenarios resulting in generation dropping or curtailment and whether they represent true constraints on the level of generation which can be constructed and operated in the Fourmile Hill area.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.404 The integration report calls for dropping and/or reducing Fourmile Hill generation below the 135 Mw level under certain loss-of-transmission contingencies. Such contingencies are generally unanticipated (scheduled transmission line outages for maintenance or repair work do occur, but are infrequent). They are likely to occur during winter storms, summer fires, or other extreme conditions. Repairs may take hours to (in the worst case) days. Even very brief transmission line outages may trip the geothermal generation offline if the tripping scheme is fast-acting. Restoring geothermal generation and resynchronizing geothermal powerplants to the grid will also take hours. The DEIS contains no discussion of the environmental impacts of well emissions during periods of powerplant shutdown, or the expected frequency of transmission line outages which will cause powerplant shutdowns. These reasonably foreseeable impacts should be discussed.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.405 The integration report assumes a 1996 in-service date for Sierra Pacific Power's (SPP's) proposed "Alturas" project, a 164 mile long, 345 KV transmission line and 230/345 KV substation to connect BPA transmission in northeastern California to the SPP system in the Reno, Nevada area. This project will substantially change the transmission grid in the neighborhood of the proposed geothermal project.[3] However, the Alturas project has been repeatedly delayed by siting issues north of Reno, and as of August 1997 has not yet begun construction or received all necessary permits, including a California PUC permit (California Energy Markets, 8/29/97, p. 5). The integration report specifically states that its "results could change if the plan of service for the Alturas project was to change" (integration report, p. 2). Thus, the system reliability analysis which the DEIS relies upon may be seriously flawed and its conclusions unreliable. The DEIS should consider any impacts resulting from a delay of the Alturas project. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.408 The DEIS describes the proposed 230 KV transmission line as having a 300 Mw capacity, of which only 45 Mw would be directly used by the Fourmile Hill project and no more than 145 Mw would be usable in total because of regional transmission constraints. However, the DEIS does not appear to have considered the alternative of using 115 KV transmission to deliver project output to the regional grid. A single or double-circuit 115 KV line would have less than 300 Mw of capacity, but unless piecemealing is taking place, that would not matter since no more than 145 Mw of transfer capability is needed even considering the cumulative impacts of associated projects.[4]

The DEIS rejects the idea of building a 230 KV line to interconnect with existing 115 KV lines because of the associated transformer expense (DEIS, p. 2-71), but ignores the possibility of building a 115 KV line to interconnect with existing 115 KV lines. There is no discussion of the location, feasibility or cost of interconnecting with 115 KV lines to the east, south, or north of the project. There is a discussion of the location (50 miles) of 115 KV lines to the west, but no discussion of the feasibility or cost of interconnecting with those lines by means of a 115 KV line from the project.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.409 The DEIS ignores the possibility of using the proposed transmission corridor but using 115 KV transmission instead of 230 KV transmission. Use of 115 KV transmission to deliver project output would save money at the project site (by requiring only a 13.8/115 KV step-up transformer instead of the proposed 13.8/230 KV step-up transformer), and it would save money and reduce environmental impacts along the transmission right-of-way (by reducing construction costs and the width of the required right-of-way). The DEIS estimates that 500 KV transmission lines are two to five times as expensive to build as 230 KV lines (DEIS, p. 2-72). It does not state whether 230 KV transmission lines are in turn two to five times as expensive to build as 115 KV transmission lines.

The DEIS does not identify what, if any, 115 KV transmission lines are located east of the proposed powerplant(s). In the worst case, even if there is no usable existing 115 KV line at or near the transmission corridors studied in the DEIS, a 115 KV line east from Fourmile Hill could still interconnect with the existing 230 KV Malin-Warner line. Doing so would require a 115/230 KV substation at or near the Glass Mountain Tap site that would not be required for the project as proposed, but it is unclear whether the cost of that substation would outweigh the savings from reduced line and transformer costs

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[3] The Fourmile Hill transmission line is proposed to interconnect with the existing Malin-Warner 230 KV line. The Alturas project is proposed to interconnect with the same line, at a new 230/345 KV substation to be called Hilltop, to be built between the proposed Glass Mountain Tap and the existing Warner substation. See integration report, Figure 1.

[4] The Cushman Hydroelectric Project in Washington is an example of a project which uses 115 KV lines to deliver project output. There, the output of 131 Mw of installed hydro capacity is delivered over two 115 KV lines for a distance of 26.8 miles (FERC, FEIS for Cushman Hydroelectric Project, 11/96, p. xv

up to that point. Even if such an interconnection would be more expensive than the proposed interconnection, the DEIS still fails to analyze what environmental benefits might result (e.g., from reduced visual and construction impacts associated with a narrower right-of-way and reduced tower height for a lower voltage line).
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.410 The DEIS fails to identify the reliability and environmental benefits which could result from the use of a double-circuit rather than single circuit transmission line to deliver Fourmile Hill generator output. With the proposed transmission system, any outage of the 24-mile Fourmile Hill-Glass Mountain Tap line will require complete shutdown of all geothermal generation connected to that line. The outage would continue until the transmission line was back in service, since (according to the DEIS), "backfeeding" over the transmission line is the planned source of on-site power for the project. During the shutdown, project owners will suffer economic losses from lack of any market for their generation and, apparently, net emissions to the atmosphere will increase.

If a double circuit transmission system were built instead, an outage to one circuit would still allow some or all generation to flow over the remaining circuit, avoiding a complete shutdown, and the remaining circuit would provide onsite power to the project.

A double circuit transmission system would also allow phasing of the project. For example, a single 115 KV transmission circuit would be adequate to transmit the initial 50 Mw of Fourmile Hill generation, even if a second circuit would be needed later if the full 145 Mw were developed.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

CN.2 I am concerned that the 300 megawatt transmission line has the potential to serve six power plants like the one being proposed as the Fourmile Hill Geothermal Development. The combined impacts are not being addressed in the current Environmental Statement. *(Gloria Gomes)*

DB.4 Also, there should be more discussion of cumulative impacts. I note that the proposed power line has enough capacity for six 49 MW plants, Either this should be explained, or the size of the power line reduced. *(Stan Haye)*

DI.3 2. Since a three-hundred-megawatt transmission line is being planned, six power plants would be possible. The public is being received into thinking that only Telephone Flat and Fourmile Hill are under scrutiny, in actuality, the development might be substantially greater in the future.
(Ana Holub and Richard Lucas)

DQ.2 I am concerned that the 300 megawatt transmission line has the potential to serve six power plants like the one being proposed as the Fourmile Geothermal Development. The combined impacts are not being addressed in the current Environmental Impact Statement. *(Jessica E. Jim)*

FK.1 My comments will be addressing only the subjects that I consider to be related to Hazardous materials or situations and will be in parenthesis.

This project proposes to build a transmission line with the capacity to handle 6 plants of this size. I therefore feel that this EIR/EIS is remiss in not once covering the accumulative effect of more than one plant. *(Charles F. Moss)*

IE.4 But hang on folks, that's not all. The transmission lines, which could possibly go between Medicine Lake and the Glass Flow, will have the ability to carry 300 megawatts of power. Now the plant will only produce 49 megawatts and you and I both know they will want to transmit on those lines at capacity, which means - 5 more plants. *(Alysa Waring)*

PH3.62 Is the transmission line that you say you are going to put in ten plants, is the transmission line going to have sufficient capacity to carry the 500 megawatts instead of the roughly 50? *(Yreka Public Hearing)*

PH3.63 Which would imply six plants total to be carried by the transmission lines, the possibility of being six plants? *(Yreka Public Hearing)*

PH5.28 Your power line that has been designed, is it designed to carry enough megawatts for four or six plants?
(Medicine Lake Public Hearing)

PH5.29 That's six plants that this is designed for, so I—you know, I'm assuming that you wouldn't design a plant for more than you intended to use, so that infers you're looking—the Forest Service or the powers-that-be are looking to do six plants in this area and use that transmission line; is that right, or is it wrong?
(Medicine Lake Public Hearing)

Response—Transmission Line Design and Capacity

General: Please note that transmission line design and capacity is discussed in the Draft EIS/EIR on pages 2-36 through 2-54. The transmission line design for the Fourmile Hill project was developed based on several key considerations. The design considerations, set forth in more detail below, include:

- USFS desire to limit the number of transmission lines in the Glass Mountain KGRA
- Factors affecting transmission line operating efficiency
- Transmission line voltage options
- Capacity requirements
- Cost of various transmission line options
- Environmental impacts
- Need for additional transformer
- Electrical load and power outage considerations

The geothermal resource at the Glass Mountain KGRA initially was calculated to have the potential to produce an estimated 550 MW of electric power for a 30-year period according to the Glass Mountain Supplemental Environmental Assessment (BLM and USFS 1984). This estimate was developed without drilling or testing a proven resource. The actual potential in the resource could be much lower. See responses to comments in the Geothermal Resources Section of this document for more information on this topic.

At present, only the Fourmile Hill project and the Telephone Flat project are proposed for development in the area. These projects would generate an estimated total net electrical power output of approximately 95 MW, 49.9 MW from the Fourmile Hill project and 45 MW from the Telephone Flat project. Full development of the entire geothermal resource in the Glass Mountain KGRA is not considered to be reasonably foreseeable.

Although no other geothermal projects are currently proposed, there is the possibility that other projects may be proposed if the Fourmile Hill and Telephone Flat projects are approved, exploration activities are completed, and a geothermal resource with capacity to handle additional development is proved. However, due to the uncertainty about the geothermal resource capacity and the fact that no other projects are proposed at this time, consideration of further development would be too speculative at this time. However, in the interest of prudent planning, the Fourmile Hill transmission line was designed to accommodate power beyond the two projects that are proposed. Please see the responses to "Comments—Reasonably Foreseeable Geothermal Development" in the Cumulative Effects Section for further discussion of development in the region.

The following discussion provides the rationale for the size and capacity of the proposed transmission line.

Limit on Transmission Lines: In order to minimize the number of transmission lines extending from the Glass Mountain KGRA, the USFS developed a strategy of requiring proposed geothermal projects to utilize the same transmission line where possible. By limiting the number of transmission lines, the USFS intends to reduce potential disruption of Forest lands and minimize the potential for significant environmental effects from transmission line construction and maintenance. Multiple transmission lines would be expected to result in greater vegetation and wildlife habitat removal, visual effects, and potential disturbance of cultural resources. Minimization of transmission lines is a prudent, long-term planning approach for reasonably foreseeable geothermal projects, and for potential future (but speculative) geothermal development at the KGRA.

The only other reasonably foreseeable geothermal development project in the Glass Mountain KGRA is the Telephone Flat geothermal project. Even though these projects are separate, unrelated actions, it is planned that the two projects would use the same transmission line to meet the goal of transmission line minimization. The design of the Fourmile Hill project's transmission line therefore must accommodate the projected Telephone Flat electrical output, as well as the possibility of additional electrical output from future projects in the Glass Mountain KGRA.

Transmission Line Voltage Options: Given the above-mentioned transmission requirements of the project, a range of transmission line capacities was considered during project planning. Typically, transmission line capacity is measured in terms of the voltage that the line can carry (measured in kV), not the amount of electricity (i.e., MW). There are standard capacities used within the electric power industry for transmission lines that range from 50 kV to 765 kV. Common transmission line capacities are 115 kV, 230 kV, 345 kV, and 500 kV. Generally, the larger the voltage of the transmission line, the larger the electrical load that the line can carry. For example, a transmission line of 115 kV has a design rating of approximately 150 MW, while a 230-kV line has a design rating that averages 300 MW in unconstrained conditions.

Within this range of transmission line capacities, the 115-kV and 230-kV lines are logical options because they provide sufficient capacity to handle the approximately 49.9 MW requirements of the project. A 115-kV line would provide the 100 MW of capacity needed for the Fourmile Hill and Telephone Flat projects, plus an additional 50 MW of capacity for any future developments that might occur. The 230-kV line would provide 300 MW, considerably more than required for the project. However, a 115-kV transmission line was rejected from detailed evaluation in the Draft EIS/EIR for the following reasons:

- A 115-kV transmission line would result in greater electricity loss than a 230-kV transmission line due to transmission line inefficiencies and the need for a transformer to connect to the BPA Malin-Warner's 230-kV transmission line.
- A 115-kV transmission line would not provide sufficient capacity to meet the USFS goal of utilizing the same transmission line for both the Fourmile Hill and Telephone Flat geothermal projects, as well as not-yet-proposed, future geothermal projects that are considered to be speculative at this time.
- A 115-kV transmission line would not substantially reduce environmental impacts.
- A 115-kV transmission line would cost approximately 70% more than a 230-kV transmission line.
- A 115-kV transmission line would require development of a new transformer in order to connect the line to the 230-kV BPA Malin-Warner transmission line.

These reasons are discussed in the following subsections.

Factors Affecting Transmission Line Efficiency: Since the transmission line for the Fourmile Hill project is to transmit the electrical output from both the Fourmile Hill and the Telephone Flat projects, it must have a minimum capacity of 100 MW (49.9 MW from the Fourmile Hill project and 45 MW from the Telephone Flat project). In addition, additional capacity is desirable due to the USFS mandate limiting the number of transmission lines in the area.

The project proposes a transmission line with a 300-MW capacity. In addition to the expected 95-MW load, the proposed transmission line is designed with sufficient additional capacity to ensure efficient power transmission. Transmission lines inherently lose capacity as a function of the distance traveled by the electricity (i.e., length of the transmission line), and how close the line is to carrying capacity. The closer a transmission line is to capacity, the greater the reduction in transmittal efficiency. A transmission line operating close to capacity (e.g., 90%) loses substantially more electricity than a same-length transmission line operating at 50% of capacity (assuming all other factors are equal). Therefore, during operation, some electricity is lost through transmission lines. For this reason the transmission line has been designed with additional MW carrying capability to ensure efficient transmittal of electricity generated by the two proposed projects.

Capacity: A 115-kV transmission line would not provide sufficient capacity for both the Fourmile Hill and Telephone Flat geothermal projects, while allowing necessary extra capacity for power transmission efficiency. As a general rule, the efficiency of a transmission line decreases as the maximum electrical output for that line is reached. Thus, as the 150-MW capacity of a 115-kV line is approached, the efficiency of transmission decreases. A line with significantly more capacity will affect greater efficiency in electrical output. A 115-kV transmission line would have to operate at closer to capacity for the Fourmile Hill and Telephone Flat projects than a 230-kV line, and a 115-kV line would lose more electricity. More electricity would also be lost on the 115-kV line at the new transformer required to connect the line to the BPA line. Thus, a 230-kV line would be much more efficient than a 115-kV line because a 230-kV line would lose less electricity during transport.

It should also be noted that the conductor size selected for the proposed project is in conformance with the 230-kV transmission line. That is, the 1,254-MCM conductor is best suited for effective electrical transmission along the 230-kV transmission line. While other conductors could be used on this system, smaller conductors would result in a loss of transmission capacity for the system, and would be potentially incapable of managing high electrical fields generated at the conductor's surface. The 1,254-MCM conductor has a large enough diameter to avoid the problems associated with these electrical fields. Further discussion of the conductors considered for the project may be found on pages 2-41 through 2-42 of the Draft EIS/EIR.

Costs: Another benefit of a 230-kV transmission line is that it would cost substantially less than a 115-kV transmission line. The statement in comment AG.184 that a 115-kV transmission line would be less expensive to build than a 230-kV transmission line is inaccurate. Calpine estimates that a 24-mile-long 115-kV transmission line would cost $54.2 million (at a power capacity of 150 MW). This cost includes:

(1) The cost of constructing the line

(2) The cost of the electricity lost along the line during transmission over the forty-five-year life of the project

(3) The cost of a new transformer to connect the line with BPA's Malin-Warner line

In contrast, Calpine estimates that on a total cost basis (including electricity losses over the life of the project), a 230-kV line would cost $31.7 million (at a power capacity of 300

MW) and would operate at a greater level of efficiency. These cost estimates have been generated by using the net present values of costs, including the cost of resistance losses ("line losses"). Thus, the cost of the 230-kV line is 42% less than the cost of the 115-kV line over a forty-five-year lifespan due to lines losses during the lifetime of use. In addition, the 230-kV line would provide twice the power capacity supplied by the 115-kV line over the projected 45 year timespan. Furthermore, the greater price of the 115-kV transmission line reflects the additional costs associated with the second transformer that would be required to interconnect to the main BPA Malin-Warner line.

The BPA regional transmission line near Tionesta, the Malin-Warner line (previously called the Malin-Hilltop line), has a capacity of 230 kV. Connecting a 115-kV line from the Glass Mountain KGRA with the 230-kV Malin-Warner line would require the use of two transformers, i.e., a generator step-up transformer to an intermediate voltage (115 kV), and a second transformer at the interconnection point from the intermediate voltage to 230 kV. Constructing a transmission line from the Glass Mountain KGRA that is already at a capacity of 230 kV eliminates the need for a new transformer near Tionesta, since there would be no need for the step-up transformer.

The 230-kV transmission line proposed by Calpine is the most economical and effective capacity line for the project. A smaller 115-kV transmission line would be incapable of certain transmissions, and would make transmission prohibitively expensive. The 115-kV line would be similar to the 230-kV line in height, configuration, and impact with minimal difference in cost to construct. This cost differential would be more than offset by the economic losses associated with the smaller line, since there would be power losses in both the transmission line and in the second transformer of the 115-kV system.

Environmental Impacts: The benefits of the 230-kV line (i.e., no new transformer necessary, higher electrical efficiency, lower cost, greater capacity) come with essentially identical environmental impacts. The configuration and height of 115-kV and 230-kV transmission lines are very similar. As a result, the right-of-way clearance required for each line is essentially the same, and the transformer required by a 115-kV line would possibly have additional environmental impacts. Slight variations in the clearance required for the 230-kV transmission line are minimized because no additional transformer is required.

The environmental impacts associated with a 115-kV line are nearly identical to those for a 230-kV line. The right-of-way disturbance for the two lines is minimally different, as are the number of support poles required. While it is true that a transformer would not be required for a 115-kV line if it tapped directly into an existing 115-kV line, it remains that existing 115-kV lines are much more distant from the site. In addition, the clearing of additional miles of Forest needed to connect to the 115-kV lines would create a greater environmental impact that that of the proposed 230-kV line. Furthermore, a 115-kV line would reduce the output of the proposed power plant, thereby limiting its efficiency, and increasing the costs associated with its production.

Additional Transformer: Use of a 115-kV transmission line rather than the proposed 230-kV line would require installation of an additional transformer to connect to the BPA Malin-Warner line. This transformer would be necessary to "step-up" from the 115-kV line to the Malin-Warner's 230-kV line. Also, if a transformer were to be

installed at the Malin-Warner interconnection point, it would have to be replaced if additional power generation is incorporated into the Fourmile Hill transmission line (from possible future projects in the Glass Mountain KGRA). In the alternative, a large transformer with sufficient capacity to handle future inputs from possible additional projects would need to be installed.

Electrical Load and Power Outages: While the proposed project would have a design capacity of 300 MW to the tie-in with the BPA Malin-Warner line, its effective capacity would be 145 MW. BPA prepared a system integration study on behalf of Calpine Corporation to evaluate the effect of the electrical load generated by the proposed action on the regional power transmission system (BPA 1995). If the electrical load on the proposed transmission line were to be increased to over 145 MW, the combination of this load with moderate wintertime south-to-north power flow conditions would cause the PacifiCorp transmission system to become unstable. Since moderate wintertime conditions occur much more frequently than heavy wintertime conditions, system instability would occur much more frequently with electric loads greater than 145 MW. In addition, the proposed Fourmile Hill geothermal power plant (and any other future geothermal power generation projects connected to the proposed transmission line) would be required to shut down generators until such time as power flows decrease on the BPA Malin-Warner transmission line. It is estimated that these outage conditions would occur from two to four weeks annually (BPA 1995). Therefore, from both an economic and a reliability standpoint, it is desirable to limit the transmission capacity to 145 MW.

Only a maximum of approximately 100 MW of electrical output is projected to be transmitted along these lines. Therefore, there is no possibility under present design conditions that the Fourmile Hill proposed power plant would be subject to shutdowns resulting from overloading of the transmission line. The 145-MW cut-off line for stable transmission in the system would not be approached unless other significant geothermal development occurs in the area. If additional development is proposed, environmental documentation would be prepared to address the effects of the additional electrical output on the transmission system. It is therefore not within the scope of this EIS/EIR to address the potential impacts of transmitting 300 MW along the transmission line, or to address the effects of plant outages caused by transmission line loading beyond the proposed 49.9 MW or cumulative 95 MW for the two projects.

In response to comments AG.167 and AG.410, it should be noted that double circuit transmission lines would not improve the reliability of the transmission line. Power outages are expected to develop due to winter storm disturbances. An additional line would not prevent disruptions caused by these events, since a break in the system would still create power outages.

In response to comment AG.403, there is no concern of generation dropping altering the projected transmission output from the power plant. The maximum output from the proposed Fourmile Hill Geothermal plant is 49.9 MW, and that of the Telephone Flat project is 45 MW. Thus, there is a maximum potential of approximately 95 MW of electrical output to be transmitted on the line. There is no additional power plant source to generate electricity to transmit along the transmission line. Therefore, there is no potential to transmit more than 95 MW of electrical output on the transmission line,

unless additional projects are proposed. If such proposals are made, separate environmental documentation would be prepared to address their potential environmental impacts, including the effects of additional electrical output. However, such speculative and unknown contingencies are not within the scope of this EIS/EIR. For a further discussion of cumulative impacts, see Section 3.18 of this document, Cumulative Effects.

In response to comment AG.404, the Draft EIS/EIR contains a discussion of contingency measures for instances of power plant shutdowns in responses to "Comments—Upset Conditions and Mitigation" in the Air Quality Section of this document. The Fourmile Hill Draft EIS/EIR incorporated potential upset conditions into its modeling analyses in the Air Quality Section, discussed on pages 4-224 through 4-228. It is projected that an average of three or four short duration (approximately six hours) plant upsets will occur in a typical year. Approximately once every two years, Calpine expects a planned outage (plant shutdown) will occur, typically lasting two or three days. Calpine anticipates that an unplanned, long-term upset (lasting 10 to 15 days) may occur every 3 to 10 years.

Given these restrictions on capacity, Calpine is proposing a 230-kV transmission line for the proposed project. This type of line is proposed because transmission lines with lower voltages (such as 115 kV) would be either incapable of transmitting, or would transmit uneconomically, the proposed line's effective capacity.

Reference:

BPA System Integration Study for the Fourmile Hill Geothermal Power Generation Project. Bonneville Power Administration. 1995.

Comments—Transmission Line Routes

AG.185 The EIS/EIR rejected without further analysis several northerly alternate transmission line routes on the basis that these routes "could" cause other environmental impacts. (EIS/EIR, pp. 2-71.) These routes would include direct connections with the Malin or Captain Jack substations. (Ex. C, Comment 7.) However, the EIS/EIR does not provide enough information to determine whether these routes "would" cause impacts or whether these impacts could be mitigated. (Ibid.) In light of the fact that the Project's proposed transmission line route will cause significant, unavoidable impacts (e.g., Native American cultural values, visual), these EIS/EIR should have given more consideration to these alternative routes. (Ibid.) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.407 The DEIS rejects without further analysis alternative transmission paths including direct connection northward to Malin or Captain Jack substations, asserting that such lines "would need to cross through or in close proximity to the Lava Beds National Monument" and "could cross the Tule Lake and Lower Klamath Wildlife Refuges" and "could" affect views and air quality (during construction) in the Monument (DEIS, p. 2-71). These statements are disingenuous at best. A northward line would not need to cross either the National Monument or either of the Wildlife Refuges. There is no analysis in the DEIS as to how likely it is that routes northward of the proposed project would have (as opposed to "could" have) any visual or air quality impact whatsoever on the Monument. The paragraph in the DEIS (p. 71) stating that a transmission line through the wildlife refuges would have adverse impacts on wetlands, wildlife, and recreation, while arguably true, is completely irrelevant since a northward line need not cross one inch of either Wildlife Refuge (Forest Service map, Modoc National Forest). It appears these alternatives were unreasonably rejected. The DEIS should provide more information addressing northward transmission alternatives.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AJ.19 We citizens of Tionesta support geothermal power development in the vicinity of Medicine Lake, but we are opposed to the routing of a high voltage transmission line close to our residences and businesses. With so broad an area to pass through, it would not seem necessary to aim the route so close to the only full-time residential community!

We strongly encourage you to select an alternate routing. *(Larry Hearne, et al., Tionesta Residents)*

PH3.116 Why would the route by Medicine Lake have ever been proposed in the past? *(Yreka Public Hearing)*

Response—Transmission Line Routes

The selection of the transmission line route is discussed in the Draft EIS/EIR in Sections 2.2 and 2.5. Calpine began review of transmission line routes in 1994. The proposed transmission line would extend from the proposed power plant for 24 miles to connect with the BPA Malin-Warner transmission line. The routing of the line was chosen to avoid constraints in the area (a complete discussion of the limitations on siting of the transmission lines is provided in Section 2.5, pages 2-70 to 2-74).

In response to comment AG.407 which questions the range of alternative routes chosen for the proposed project, there are limitations to the number of alternatives to be considered under CEQA. CEQA requires consideration of alternatives to the proposed action "which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives" (CEQA Guidelines, Section 15126(d)). The bases for rejection of various possible project alternatives based on this section of CEQA are outlined below.

Northern transmission line routes would have greater environmental effects because they would be much longer than the proposed and alternative routes considered (and would have correspondingly greater effects due to greater surface disturbance). Western routes are limited by the excessive distances to reach existing transmission lines (greater than 50 miles), and the need to construct an expensive transformer to make such a connection (the existing transmission line's 115-kV capacity is incompatible with the proposed 230-kV line). In addition, a western route would cause much greater surface disturbance and impacts than the proposed action. A southern route is also impractical due to economic constraints. The viable transmission lines to the south are 500-kV systems, which are incompatible with the proposed 230-kV line. The construction of a 500-kV transmission line, or of 230 kV/500 kV substation are not economically viable. The former would cost two to five times more than the proposed transmission line, while the latter would cost ten times as much as the proposed transmission line. The above routes would not avoid or reduce the effects of the proposed or alternative routes.

Given these restrictions, Calpine held a series of meetings with Federal, state, and county agencies and utility company representatives to develop the most viable transmission line route running to the east of the proposed facility to connect with the BPA Malin-Warner transmission line. In conjunction with these meetings, Calpine referred to the Supplemental Environmental Assessment (EA) to determine siting constraints based on geologic features, wildlife and critical habitat uses, recreational uses, and visual resources. Furthermore, Calpine reviewed resource survey information to identify sensitive environmental areas.

The proposed and alternative transmission line routes were developed to minimize both environmental impacts and cost. The proposed and alternative routes would pose the least-significant threat to sensitive habitats, while maintaining economic feasibility. Other possible transmission line routes cannot achieve both of these goals with the same efficiency. Alternatives 2, 4, and 6 were developed to avoid the

community of Tionesta. Alternative 6 has been designated the environmentally preferred alternative and the agencies' preferred alternative.

Comments—Transmission System Reliability

AG.164 The EIS/EIR concludes that the Project will have "minimal effect" on the regional power transmission system. (EIS/EIR, p. 2-38.) Even though the Project's transmission line will have the capacity to handle 300 MW of electricity produced from geothermal plants, the EIS/EIR states that its "effective capacity" is only 145 MW. (Ibid.) This is because the Malin-Warner transmission line, into which the Project's transmission line will feed electricity, experiences heavy wintertime south-to-north power flows. Addition of more than 145 MW from the Fourmile Hill-Glass Mountain Tap line would cause this system to become unstable and possibly require plant shutdown. (Ibid.) According to the system integration report prepared by the Bonneville Power Administration ("BPA"), the system may become unstable at 135 MW. (Ex. C, Comment 4.a.)

In addition to causing economic losses for Calpine and other geothermal energy producers using the Tap line, plant shutdowns can cause a variety of environmental impacts. These include uncontrolled venting of geothermal fluids, which may cause significant air quality and human health impacts. (EIS/EIR, § 4.13.5; Ex. A, Comments 4.b., 7.d.) These impacts must be discussed in the EIS/EIR.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.165 According to the analysis of David Marcus, however, there are several unresolved issues about the Project's impacts to transmission system reliability. (Ex. C, Comments 5, 6, 10.) First, the BPA integration report, which the EIS/EIR relies on for its reliability assessment (EIS/EIR, p. 2-38), relies on the assumption that the "Alturas project" will be in service prior to Project operations. (Ex. C, Comment 5.) The Alturas project will substantially change the transmission grid in the Project area. However, siting issues have repeatedly delayed the project, which has not yet received all of its permits nor commenced construction. (Ibid.)

The BPA integration report specifically states that its reliability analysis is contingent on the Alturas project, and that results could change if the Alturas project is further delayed. (Ex. C, Comment 5, citing BPA integration report, p. 2.) Thus, according to Mr. Marcus, "the system reliability analysis which the [Fourmile Hill] DEIS relies upon may be seriously flawed and its conclusions unreliable." (Ex. C, Comment 5.) The EIS/EIR should reassess the Project's impacts on transmission system reliability under a scenario in which the Alturas project is not ready by the time Calpine commences its transmission activities. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.166 The BPA integration report also contains several caveats associated with its conclusions about the Project's reliability impacts. According to Mr. Marcus, these caveats raise several important questions about whether the Project's reliability impacts have been adequately analyzed. (Ex. C, Comment 6.) The BPA integration report calls for further study of several voltage control issues to resolve these reliability issues. The EIS/EIR does not indicate whether these reliability issues have been addressed. As discussed above, in addition to effects on other users of the transmission system, reliability problems can lead to plant shutdowns, which cause environmental impacts. This information should be included in the EIS/EIR. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.406 The integration report contains several caveats. While none of these caveats are grounds per se for not relying upon the integration report in preparation of the DEIS, they do raise substantial questions as to whether the reliability impacts of the project on the regional grid, or the effects of grid contingencies on project operations, have been adequately analyzed. The DEIS appears to neither acknowledge nor resolve the uncertainties created by the incomplete analysis in the integration report. These caveats deal with data inadequacies which should be fixed in a reanalysis of the project's impacts on transmission system reliability. Specific caveats in the integration report include:

a. Mechanically switched capacitors (MSCs) are assumed to be built at Malin as part of the Alturas project, but no final decision to actually build them has been made (integration report, p. 4). Without MSCs, certain transmission contingencies could result in voltage control problems. The integration report itself calls for further studies of voltage control issues (integration report, p. 2, recommendation 2).

b. A shunt capacitor bank was assumed built at the Warner 230 KV substation to supply voltage support for the Alturas project, but "the final reactive support plan has not been completed" (integration report, p. 2) for the Alturas project. The integration report itself calls for further studies of voltage control issues (integration report, p. 2, recommendation 2).

c. Damper winding data for the geothermal project was deleted from the model because when it was included the model found that the electrical grid was unstable under some contingencies (integration report, p. 3). It is unclear whether the problem is bad data or whether the project would indeed cause unstable system responses to some contingencies. The integration report itself calls for any further analysis to include correct damper winding data (integration report, p. 2, recommendation 3).

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Transmission System Reliability

The comments which question the reliability of the transmission line focus on the 145 MW effective capacity of the Malin-Warner line. While it is true that the Malin-Warner line is limited to 145 MW, this limitation does not imply that the combined input from the Fourmile Hill project and the Telephone Flat project would cause an overload leading to instability in the system.

Assuming that the Malin-Warner line is limited to 145 MW of input from the proposed project's transmission line (including output from the Telephone Flat project), the total added electricity would still be below 100 MW, leaving approximately 50 MW of additional capacity. It should be added that the amount of electricity to be purchased by BPA has not been established; it is possible that none of the electrical output from either the Fourmile Hill Project or the Telephone Flat Project would be purchased by BPA. In this scenario, the output from the proposed projects would flow in a north-to-south direction during the winter, rather than the south-to-north flow pattern stated in comment AG.164. Otherwise, BPA would most likely purchase a fraction of the electrical output from the two proposed sites. The remaining output would be sold to utilities in California.

Thus, the full output from the two proposed projects would not flow directly into the BPA system, but would most likely be divided between BPA and California utilities. Given this projected use, the output of the two proposed projects would not present a significant threat to the stability of the Malin-Warner line.

If there is additional geothermal development at Glass Mountain, it might be necessary to upgrade BPA's transmission line. There is a very low likelihood of a change in the Reno-Alturas plan of service. However, the Glass Mountain generation integration studies will be updated before finalizing the plan of service for the Fourmile Hill project.

DECOMMISSIONING

Comments—Decommissioning

A.60 The FEIS should include a more detailed reclamation plan and note any applicable regulations. The EPA is particularly eager to see additional assurances in the FEIS that the geothermal drill holes will be abandoned properly, surface and subsurface pipelines and other equipment removed from the site and surface restoration completed to a pre-determined degree. The UIC regulations applicable to the injection wells require that financial assurance be provided.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

B.13 Because decommissioning of the power plant and associated facilities is proposed as part of the action, the Service recommends that a detailed reclamation and revegetation plan be incorporated in a revised Draft EIS/EIR. *(Ronald A. Iverson, U.S. Fish and Wildlife Service)*

N.36 Upon decommissioning of this project, the developer, Calpine, should remove the project to pre-project conditions. That is impossible considering the U.S. Forest Service is considering clear cutting and removing vegetation and affecting wildlife habitat along 24 miles of the transmission corridor.

The U.S. Forest Service and the U.S. Bureau of Land Management should require Calpine to post a multi-million dollar bond to assure to the public that the decommissioning of the proposed project will in fact return the land and water to pre-project condition.

The DEIS/EIR should include a decommissioning analysis such as a Plan of Action with related costs which shows the specific amount of money required to return the lands and water affected by the proposed project to pre-project conditions. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

BQ.5 Under this draft EIS/EIR, Calpine is required to post a $100,000 bond to pay for mitigation of environmental damage. We would like a written response on how this amount was derived. It is difficult

to see how $100,000 could fully repair the environmental damage resulting from a serious plant disaster such as by a major well head leak, a forest fire that results from down transmission lines or a helicopter accident, damage resulting from construction activity or to restore an abandoned site.
(S. Peder and Suzanna S. Cuneo, et al.)

DB.5 However, as far as I am concerned, the heart and soul of the document is the Mitigation Monitoring and Reporting Program (MMRP). This is the only way that the nice words and promises in the DEIS/R will actually occur. The rule of thumb is that the DEIS/R is 5% of the work, the balance of 95%, which is MMRP, remains to be done. Therefore:

1. Since this project has a finite life, and all equipment is to be removed and the area reclaimed at the end of the project, a reclamation bond should be required from the proponent adequate for reclamation at any time during the life of the project. If power prices go down, if there is mismanagement of the project, or other contingencies, the project may be abandoned before the end of its life, and the taxpayers should not be stuck with cleanup and reclamation costs. The value of the equipment should not be counted as part of the reclamation bond, since the equipment may have no value because of obsolescence, wear and tear, etc. *(Stan Haye)*

EQ.10 It is disturbing that the potential reservoir thickness and rock porosity has such wide variables on page 4-46. Statements like "can be roughly estimated" on line two of the last paragraph and "simple estimation" on line two of the first paragraph on page 4-47 and statements like "The amount of electricity produced by the proposed project is subject to confirmation drilling and may be less than 49.9 MW" the last point under the title "Increase the Effect of the Project" is of further concern and raises the stakes in this gamble with this Natural Treasure of the Medicine Lake and the Medicine Lake Highlands. What will happened when the project is abandoned and who will pay to clean up and restore the area?
(Ronald A. Maire)

EQ.12 Decommissioning is of great concern. Companies are going bankrupt or being bought out and plants have been closed an wells have been shut and the plants just sit and rust and become a real hazard because no untouchable decommissioning fund has be set p. *(Ronald A. Maire)*

EV.3 When (or if) it ceases to be profitable I feel it would end up an abandoned eye sore. *(Shari Mazzini)*

FK.9 This EIS/EIR is incomplete in that it does not address how the environmental damage, once done, will ever be corrected . The EIR/EIS states that Calpine will post a bond of $100,000 for cleanup. This is equivalent to $185 per month for rent and damage. When this plant is finally abandoned, the bond will not even pay for cleanup, much less restore the environment. The USFS will be looking to the tax payer to pay the balance. I believe that for the USFS to accept such a small amount of bond is criminal and negligent. The bond should be sufficient to pay for the work required at that time of decommissioning.
(Charles F. Moss)

FP.8 The Draft EIS/EIR states that Calpine is required to post a $100,000 bond to pay for mitigation of any environmental damage and cleanup. How was this amount decided? We seriously doubt this amount could be anywhere near adequate to cover cleanup costs of sumps, deal with any accidents or spills, or to disassemble the plant and transmission lines. Please include a discussion (including estimated costs to clean up specific portions of the project) in the Final EIS on the responsibilities of Calpine and the USFS on the decommissioning of the plant. Please include a cost breakdown of decommissioning a project of this magnitude and an economic justification for requiring only a $100,000 bond. This seems an inadequate figure right now, let along 30-45 years from now. *(Eric T. Nelson and Martha Spencer)*

FP.9 It is our understanding that a similar project was constructed outside of Alturas on public land at Hayden Hill. This project was not economically feasible and has now been abandoned but not decommissioned. To what extent has this project been cleaned up and how much did it cost? If it has not yet been cleaned up, what are the estimated costs to do so? Who is paying for this? Was a bond required, and if so, how much was it for? Did it adequately cover the costs of the project cleanup? Please address these issues and questions in the Final EIS/EIR, as they are pertinent to this project.
(Eric T. Nelson and Martha Spencer)

HF.12 Project Lifespan and Decommissioning: The EIS states that "all disturbed areas would be restored to pre-project conditions as practicable and/or to conditions acceptable to the USFS and the BLM. "In addition to the loss of these disturbed areas during the estimated 48 years of construction and operation (the lifetimes of our children and grandchildren), there is no guarantee that there would be viable and significant restoration at the end of the project, since this clause makes it subject to decisions of the USFS and BLM, who are hardly perceived as neutral arbiters in this conflict, and who may have very different mandates and policies a half century from now. *(Daniel T. Spencer)*

PH3.10 Nothing has been said about what decommissioning involves. *(Yreka Public Hearing)*

PH3.25 Back to demobilization, Calpine is going to have to take it all apart, right? *(Yreka Public Hearing)*

PH3.26 You guys are going to get a deposit of a sizable amount to ensure them they are going to do this, or going to hope at the end of the period they have the money to do it? *(Yreka Public Hearing)*

PH4.34 What's going to happen during the reclamation phase? Is there a reclamation plan? *(Mount Shasta Public Hearing)*

PH5.111 What are you willing to safeguard us monetarily with? *(Medicine Lake Public Hearing)*

PH5.112 I'm suggesting a trust. *(Medicine Lake Public Hearing)*

Response—Decommissioning

The Draft EIS/EIR provides a detailed description of the decommissioning strategy for the project in Section 2.2 (pages 2-54 to 2-56). See pages 2-54 and 4-88 in the Draft EIS/EIR, and the response to "Comments—Reclamation and Revegetation Plan" in the Vegetation Section for more discussion of revegetation during the decommissioning phase of the proposed project. It is projected that after 45 years of commercial operation, the project would undergo a two-year decommissioning effort. While such plans are contingent on future developments, the Draft EIS/EIR describes the most comprehensive outline for such an effort as is possible at this time.

Accordingly, it is envisioned that the power plant site would be stripped of all structures and equipment, including equipment at the well pads. Areas disturbed by the project would be restored (including revegetation) to pre-project conditions (or conditions acceptable to the USFS and BLM). Geothermal wells would be plugged according to the terms of GRO No. 3. Recycling or reuse of materials would depend on the market and technologies available at that time. Roads created for the project would be closed and restored, pursuant to USFS direction. Solid disposal sumps would be sampled and analyzed prior to closure to confirm that no hazardous materials were present. Upon such a confirmation, the sump would be backfilled and graded to contour. In addition, the lined fluid sump would be emptied of residual fluid and closed.

The transmission line structures and equipment would be dismantled and removed. The project area would then be restored to pre-project conditions or to conditions acceptable to the USFS and BLM. The transmission line conductors would be disconnected from the power plant and the BPA Malin-Warner transmission line. The support poles and the footings would then be removed. Any roads created for accessing the transmission lines would be restored, as directed by the USFS.

The decommissioning plan for permanent closure would be developed in cooperation with the BPA, the BLM, the USFS, and the APCD. At least two years prior to the anticipated end of operations. Under this plan, specific actions and scheduling would be devised to restore the project area to acceptable conditions, and to minimize any impacts caused by the decommissioning effort. Additional environmental analysis of decommissioning would be conducted if the effects would be greater than described in this EIS/EIR.

In addition, Calpine would be responsible for posting reclamation bonds to ensure that all project activities would be reclaimed in a timely manner following cessation of operations. These bonds are to be established prior to any construction activities on the site as a condition of approval for the proposed action. Decommissioning is thus an integral part of the project plan. Comment FP.9 refers to a project at Hayden Hill. There is no geothermal project at that site so it is assumed that the commentor is referring to the gold mine at Hayden Hill. This mine has been closed because all the ore has been extracted from the site. See response to "Comments—Project Economics and Viability"

in the Introduction and Purpose and Need Section of this document for a discussion of the bonds Calpine must post.

Comment—Project Lifespan

A.41 According to the DEIS, extension of the project life span past the projected 45-year duration is not considered reasonably foreseeable, even though the Glass Mountain KGRA was initially calculated to have the potential to produce an estimated 550 MW of electric power (DEIS pg. 2-38). EPA questions this assumption, since the life of the Proposed Action could be extended based on actual conditions encountered, energy prices, and evolving technologies. We cite the history of the Geysers field, California, which started out as a 10 MW producer and currently is producing more than 1000 MW with over 250 production/injection wells in place.

At Page 4-311 the DEIS indicates that if any portion of the project were to exceed the 45-year time line, it would be subject to "additional environmental review and documentation." Nevertheless, EPA recommends that the EIS include a discussion of cumulative impacts associated with the possibility that the project's operational life could exceed 45 years, based on the original estimate of geothermal potential. This discussion should focus on cumulative impacts to surface and groundwater quality and cumulative impacts to biologic resources and human health.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

Response—Project Lifespan

As stated on page 2-10 if the Draft EIS/EIR, the 45-year lifespan of the project is based on the proposed 45-year period of commercial operation for the proposed geothermal power plant. Operation past 45 years is not proposed, contemplated, nor envisioned at this time. The 45-year lifespan of the project is not an assumption, but is instead a limitation placed on the proposed project by the expected power sales agreement. In addition, if the EIS/EIR for the project is approved and adopted by the lead agencies, this action would limit the project to a 45-year lifespan. It would therefore be remote and speculative to analyze potential environment effects past the 45-year lifespan of the proposed project. If a proposal were to come forth at a later date to extend the lifespan of commercial operation of the project, this extension would require appropriate environmental review under NEPA and CEQA.

As discussed on page 2-38 of the Draft EIS/EIR, the estimated 550-MW electrical potential of the Glass Mountain geothermal system is not certain, and this estimate should not be relied upon when discussing the ultimate capacity of the geothermal system. This estimate was an "order of magnitude" estimate with considerable uncertainty that was generated by the USFS (using USGS methodology) in 1984. The estimate was based on extremely limited geologic and geophysical data, and many assumptions went into generating the estimate. The estimate was also based on limited reservoir data.

As the Draft EIS/EIR states, the actual electrical potential of the Glass Mountain geothermal system is not known, and there is no definitive proof that the system has a 550 MW capacity. There is the potential that the actual electrical capacity of the system could be substantially less than 550 MW.

BPA's experience at the Vale and Newberry KGRAs in Oregon casts doubt on the reliability of USGS estimates of electrical potential, including the estimated 550 MW electrical potential of the Glass Mountain geothermal resource. In its Circular 790, the USGS estimated the electrical potential of the Vale KGRA as 870 MW, and the Newberry KGRA as 740 MW. However, actual attempts to locate geothermal reservoirs that could support commercial development at both KGRAs have been unsuccessful to date. At Vale, the potential resource is now considered to be fully explored, and has

been determined to be unsuitable for power production. The BPA's experience at the Vale and Newberry KGRAs are examples of the overestimation of electrical potential that can occur before the resource is actually tested and verified. This experience shows that USGS electrical potential estimates, which were based on limited data, were not accurate.

The uncertainty about actual electrical potential of the lease (and the KGRA) is the basis for Calpine's proposed phased approach to project development. Calpine proposes to drill confirmation wells during the first year of project construction and prior to the construction of any other project facilities in order to ensure that a commercially viable resource exists. Reservoir characteristics are inherently unknown until long-term flow tests are performed on production wells. The confirmation wells to be drilled by Calpine would serve to provide this information prior to initiating construction of the proposed power plant or transmission line.

Based on the limitations on the length of commercial operation and the uncertainty regarding the electrical potential of the geothermal system, it is not reasonably foreseeable to expect at this time that the project lifespan would be extended beyond that which is currently proposed. The decision to not consider environmental effects from the remote and speculative extension of the project lifespan is consistent with the requirements of NEPA and CEQA. Under CEQA, the environmental effects from future expansion or extended operation of a project must be considered when there is credible substantial evidence showing that:

(1) The future expansion or extended operation is a "reasonably foreseeable consequence" of the project, and

(2) The future expansion or extended operation "will likely change the scope or the nature of the initial project or its environmental effects."

Since a lifespan beyond 45 years is not reasonably foreseeable at this time, an evaluation of effects from such an extension of project operation is not required. As stated in the Draft EIS/EIR, if such an extension is proposed in the future, this extension would require appropriate environmental review under NEPA and CEQA. In addition, any extended operation, if it were to occur, would not be expected to change the scope or the nature of the initial project or its environmental effects. Project operation effects would be extended over a longer period of time (and would be more definitely described in an environmental document prior to an extension).

ALTERNATIVES TO THE PROPOSED ACTION

Comments—Alternatives Development

A.1 The DEIS analyzes the impacts of proposed geothermal project alternatives which include development activities, construction of a 49.9 megawatt (MW) power plant and ancillary facilities, and the construction of a 24-mile 230-kilovolt (kV) transmission line that ties into an existing power grid. Seven alternatives are provided. Alternative 1 is the proposed action and includes a power plant, wellfield and a proposed transmission line. Alternatives 2 through 6 describe various alternate routing segments for the proposed transmission line. In our review we noted that there are no true alternatives to the proposed action, except for alternative 7, which is the no-action alternative.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.11 In light of the significance of potential impacts associated with the Proposed Action, the FEIS should include a discussion of alternate well and plant sites. At Page 2-3, the DEIS cites the California Environmental Quality Act (CEQA) Guidelines, Section 1526(d)(5), to justify the exclusion of alternate

wellfield and power plant site alternatives. This section states that EIRs must include only those alternatives necessary to permit a reasoned choice. However, EPA notes that the same section states that the "key issue is whether the selection and discussion of alternatives fosters informed decision-making and informed public participation." This statement is consistent with NEPA requirements which require that an agency evaluate all reasonable alternatives [40 CFR 1502.14].

(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.12 Due to the controversial nature of the project, we suggest that alternate locations and alternate power generation scenarios be discussed. The best estimated commercial potential from other known KGRAs (Known Geothermal Resource Areas) should be discussed. Additionally, alternatives to geothermal generation, such as wind power or a combination of geothermal and an alternative energy source, should be included in the discussion. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

A.53 We also recommend that well site lithology and structure be considered in well site selection.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

H.15 The NEPA/CEQA processes both call for a full range of alternatives to be considered. Allocation alternatives call for keeping 44NO 1 and 44N64 open year around by plowing and or blowing snow from the road, which is an inadequate range of alternatives. Other possible alternatives should evaluated such as snowcat access, snowmobile access and helicopter access during winter months, all of which would not displace existing snowmobile use from designated and groomed routes and not create a potentially fatal safety hazard to snowmobilers. *(Bill Dart, American Motorcyclist Association)*

N.35 26. The above stated comments pertain to all project alternatives.

(Robert J. Baiocci, Fall River Wild Trout Foundation)

AG.182 CEQA

"The core of an EIR is the mitigation and alternatives sections." (Citizens of Goleta Valley v. Board of Supervisors ("Goleta II") (1990) 52 Cal.3d 553, 564 [276 Cal.Rptr. 410].) A major function of an EIR is to "ensure that all reasonable alternatives to proposed projects are thoroughly assessed." (Id. at p. 565-566, quoting Wildlife Alive v. Chickering (1976) 18 Cal.3d 190, 197 [132 Cal.Rptr. 377] (emphasis added by court); accord Laurel Heights I, 47 Cal.3d at p. 400.)

The burden of identifying and evaluating alternatives rests with the agency, not the public. (Laurel Heights I, 47 Cal.3d at pp. 405-406; Goleta II, 52 Cal.3d at p. 568.) What constitutes a reasonable range of alternatives depends on the circumstances. (Goleta II, 52 Cal.3d at p. 566.) However, the Supreme Court has espoused the following rule:

[A]n EIR for any project subject to CEQA review must consider a reasonable range of alternatives to the project, or to the location of the project, which: (1) offer substantial environmental advantages over the project proposal [citation]; and (2) may be "feasibly accomplished in a successful manner" considering the economic, environmental, social and technological factors involved. (Ibid., citing Cal. Pub. Res. Code §§ 21002, 21061.1, 14 CCR § 15364, and Citizens of Goleta Valley v. Board of Supervisors ("Goleta I") (1988) 197 Cal.App.3d 1167 [243 Cal.Rptr. 339].)

Reasonable project alternatives include those that could feasibly accomplish most of the Project's basic objectives, and could avoid or lessen one or more of its significant impacts. (14 CCR § 15126(d)(2).)

If certain alternatives are considered and deemed infeasible, the agency must explain its conclusion in the EIR with enough factual detail to allow the public to understand, evaluate, and respond to the conclusion. (Laurel Heights I, 47 Cal.3d at pp. 403-404; San Joaquin Raptor, 27 Cal.App.4th at pp. 736-737.)

An EIR must discuss alternatives in sufficient detail to meet the EIR's information purposes. (Laurel Heights I, 47 Cal.3d at p. 406.) This is also governed by a rule of reason: "Absolute perfection is not required; what is required is the production of information sufficient to permit a reasonable choice of alternatives so far as environmental aspects are concerned... (Id. at p. 407, quoting Residents Ad Hoc Stadium Committee v. Board of Trustees (1979) 89 Cal.App.3d 274, 287-288 [253 Cal.Rptr. 426].)

In this case, the EIS/EIR fails to consider a reasonable range of alternatives, fails to analyze feasible alternative transmission line routes, and rejects feasible alternatives from further consideration without sufficient basis.

NEPA

As with CEQA, the alternatives analysis is the "heart" of NEPA. (42 U.S.C. § 4332(2)(C)(iii); 40 C.F.R. § 1502.14.) The alternatives analysis is one area in which NEPA's requirements are more stringent than CEQA's. (Remy et al., Guide to the California Environmental Quality Act (CEQA), p. 19 (9th ed. 1996).) Lead agencies must "[r]igorously explore and objectively evaluate all reasonable alternatives..." (40 C.F.R. § 1502.14(a).) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.183 Where a project involves unresolved conflicts about alternative uses of available resources, the lead agency must "study, develop and describe appropriate alternatives to recommended courses of action..." (42 U.S.C. § 4332(2)(E); City of New York v. U.S. Dept. of Transportation (2d. Cir. 1983) 715 F.2d 732.) This Project is a clear case of unresolved conflicts about uses of available resources. For example, the

> Project will cause an unavoidable significant impact to traditional cultural values by interfering substantially with traditional Native American uses and values. (EIS/EIR, § 4.6.) Thus, the EIS/EIR should study and develop any alternatives that might help resolve these conflicts.
>
> *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

Response—Alternatives Development

Both NEPA and CEQA require the lead agency to consider a reasonable range of alternatives to the proposed project that could feasibly attain the objectives of the project (the objectives of the project are defined in the Introduction and Purpose and Need Section of the Draft EIS/EIR). In general, true alternatives to a proposed geothermal project are limited by the site-specific nature of the geothermal resource and leases. The CEQA guidelines reference geothermal power plants as an example of a project for which there may be no feasible alternative location (CEQA Guidelines Section 15126(d)(5)(B)(2)).

As described in Section 2.5 of the Draft EIS/EIR, many alternatives to the proposed project and project elements were considered by the project applicant (Calpine Corporation), Calpine contractors, the USFS, the BLM, and the interdisciplinary EIS/EIR team. Alternatives that were considered during either initial project design or during the environmental review process included:

- Alternate power plant and wellfield facility locations
- Smaller power plant and wellfield
- Buried wellfield pipelines
- Alternative geothermal power technologies
- Alternate transmission line routes
- Buried transmission line
- Smaller capacity transmission line

These alternatives are addressed and described in Section 2.5, Alternatives Considered but Rejected from Detailed Study. These alternatives either did not meet the purpose and need of the proposed action or did not reduce environmental effects. In many cases, such as power plant siting, Calpine had considered many alternatives and proposed the location for the facility that resulted in the fewest environmental effects.

The seven alternatives evaluated in detail in the Draft EIS/EIR present the entire range of feasible alternatives that both (1) meet the purpose and need for the project, and (2) would reduce environmental effects when compared to the proposed action. The alternatives evaluated in the EIS/EIR would reduce the effects of the proposed transmission line. For example, Alternatives 2, 4, and 6 (of the action alternatives) would result in less noise, air quality, and visual effects on the community of Tionesta than would the proposed action

During the initial planning phases of the proposed project, alternate power plant and well locations were considered by the lead agencies and project proponent. Alternative sites were considered within the Calpine leases, as well as at other locations at the KGRA. The alternatives development process is fully explained in Section 2.1, and the rationale for rejecting alternate power plant and well locations is fully described in Section 2.5 of the Draft EIS/EIR.

There were many reasons why alternate power plant and well locations were not included in the Draft EIS/EIR, the primary reason being that alternate power plant and well locations would not reduce environmental effects. The proposed power plant and well locations were sited by Calpine (in consultation with the USFS and BLM) to minimize environmental effects, while still allowing access to potentially commercially viable portions of the geothermal reservoir.

As discussed under "Alternate Power Plant and Wellfield Locations" on page 2-77 of the Draft EIS/EIR, there are no alternate power plant or well locations that would meet the purpose and need for the proposed project and reduce environmental effects. Three of the purposes of the proposed project central to this analysis are:

- To undertake a geothermal project that allows Calpine to utilize the geothermal resource of its Federal geothermal leases CA21924 and 21926 at the Glass Mountain KGRA.
- To confirm the commercial viability of the geothermal resource of the Calpine geothermal leases at the Glass Mountain KGRA.
- To investigate the feasibility of including geothermal power in the BPA's power capability in order to diversify BPA power sources and decrease dependence on non-renewable power sources.

In addition, geothermal power plants and wells must be located in proximity to a geothermal reservoir in order to allow access to the reservoir. Calpine has identified portions of the reservoir that have a relatively high likelihood of commercial viability, and it is necessary for Calpine to locate the well pads and power plant in areas with access to these portions in order to have a viable project. The proposed location of the Fourmile Hill geothermal power plant and wellfield is the only location that would allow Calpine to access the geothermal reservoir of their leases and meet the purpose and need for the proposed project. Within this constraint, Calpine (under the direction of the USFS) has sited the geothermal power plants and well pads to avoid sensitive resources (such as the northern goshawk nest located in Section 2.8) and minimize environmental effects.

Calpine does not hold (and is not expected to be able to reasonably acquire) developable geothermal leases with potential commercial viability at other KGRAs; a discussion of the commercial potential of other KGRAs is therefore not relevant and is beyond the scope of this EIS/EIR. In addition, consideration of geothermal development at other KGRAs would not fulfill one of the basic purposes of the proposed action, which is to confirm the commercial viability of the geothermal resource on Calpine leases at the Glass Mountain KGRA.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

Comments—Alternatives Considered but Eliminated from Detailed Study

AI.4 We ask you to consider other northern routes near alternatives 5 and 6 that can minimize impacts even further, create more of a buffer from the MT Hoffman RRA, continue to take advantage of the extensive network of existing roads, and as much as possible avoid areas with late seral reserves.
(Rachel Shimshak and Peter West, Renewable Northwest Project)

AJ.17 A transmission line running south of Timber Mountain was proposed as an option, but the option was discarded in part because it ran through the Damon Butte "roadless release area" (page 2-74). This reasoning seems totally inconsistent with the conclusions drawn for the proposed routing. The proposed route passes through the Mount Hoffman roadless release area. The EIR concludes that the transmission

line would not substantially alter the character of the roadless release area. If the roadless release area issue is essentially a non-issue for the proposed routing (which we consider to be through a more sensitive area), how can this issue be used to justify dropping the route south of Timber Mountain from consideration? We believe the south routing should receive a thorough investigation!
(Larry Hearne, et al., Tionesta Residents)

AJ.18 The possibility of a tie-in to a 500 kv transmission line was also discarded. In this case, increased cost was the justification. However, no quantitative estimate of overall cost impact was provided; instead, it was simply stated that a 500 kv line would be 2 to 5 times as expensive as a 230 kv line and that a 230/500kv Substation would be 10 times as costly as a 230 kv station. These statements raise a number of questions What are these costs relative to the overall project cost? How much would be saved by shortening transmission line length? How might any additional construction costs be offset by the increased efficiency (lower transmission power losses) of a shorter transmission line or of a higher voltage line? The environmental advantages of a shorter line are numerous. We believe they are sufficient to at least thoroughly analyze this possibility! *(Larry Hearne, et al., Tionesta Residents)*

DK.4 If it becomes the approved route to allow the power lines to come down through the basin, then it should be a requirement that the lines are placed underground so that no power lines are visible either on the summit or in the basin. The developer has already shown that he is willing to spend more money by placing the longer alternates 1 and 2 ahead of 5 and 6. Since this is the case, then it should be no problem for him to expend the additional funds to keep the power lines underground within the basin.
(Roger G. Hyytinen, Hyytinen Engineering)

HK.4 It saddens me that neither prospective geothermal company has tried to design a total project development on one quadrant of their leaseholdings on the east side of the caldera with one medium sized facility [instead of the potential for several small facilities surrounding the caldera] and one transmission line directed away from Medicine Lake and Lava Beds National Monument.
(Marshall Staunton)

PH4.9 EIS/EIR should consider an energy conservation alternative since that would meet the purpose and need. *(Mount Shasta Public Hearing)*

PH5.39 Has your company explored other potential sites other than the one that you're trying to develop?
(Medicine Lake Public Hearing)

Response—Alternatives Considered but Eliminated from Detailed Study

During the initial planning phases of the proposed project, in-depth consideration of a wide range of alternatives, including alternative transmission line routes, undergrounding of transmission lines, and alternative locations for the facility, were conducted by the lead agencies for the project. The lead agencies considered and evaluated a wide range of alternatives for the project, including alternate power transmission line routes and designs were considered. The alternatives development process is explained in Section 2.1, and the rationale for rejecting alternate power plant and well locations is described in Section 2.5 of the Draft EIS/EIR.

The segments used by Alternatives 5 and 6 were sited to avoid environmental effects, and they maximize the buffer from the Mount Hoffman released roadless area. These alternatives take advantage of the extensive network of existing roads, and as much as possible avoid areas with late seral reserves. The avoidance of the released roadless area was only one of many factors in selecting alternative transmission line routes.

Comments—Preference for Alternative Site

CY.2 Why would anyone want to put this type of project at Medicine Lake when there are so many other places that would be more suitable? *(Dave Harris)*

DG.2 There are other areas available for geothermal development. Why must the Medicine Lake area be destroyed? *(Shirley Hill)*

EF.2 I am sure that there are quite a few geothermal areas in Siskiyou County that would not have a negative effect on the environment. *(Bill Larsen)*

ER.5 There must be other sites for power plants. Please find them. *(Stephanie Grace Mandel)*

HO.3 I'm sure if you really combed other areas you would find one with the same or more geothermal power—one that would not destroy this beautiful pristine area of Medicine Lake. *(Victoria Sturgis)*

IB.7 I believe that alternatives for siting the power plants and other facilities could have made a minimally acceptable project. These alternatives were dismissed in your Draft EIR/EIS in arguments without merit. I would suggest, for example, that the power plants could have been sited outside or below the 5000-foot contour, with either horizontally drilled wells or extended pipelines. In response to the argument that cost would be prohibitive, I would say that if Calpine cannot accept the cost of the environmental impacts of their proposed projects, then they should not be in the geothermal business. *(Wayne Verrill)*

Response—Preference for Alternative Site

As described above, and in Chapter 2 of the Draft EIS/EIR, many factors went into the selection of the proposed project site. The project is proposed on leases held by Calpine Corporation, with the greatest probability of identifying a commercial geothermal resource.

The preference for siting the geothermal project at another location is noted.

Comments—Preference for Wind, Solar, or Other Technology

Y.58 The DEIS/EIR contains very little discussion of alternatives to meeting electric energy needs through other means, such as solar energy, wind generation, or, most importantly through developing an energy conservation strategy. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

Y.60 A feasibility study should also evaluate alternative power sources, and an energy conservation strategy, as viable economic alternatives to the proposed geothermal development, particularly given the environmental sensitivity of the Medicine Lake Highlands. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AQ.2 If more power is required, I suggest two alternatives: (1) assessment of conservation methods, how to cut waste already existing, and (2) solar development. The sun gives its power freely and abundantly, without the need for destroying the quality of air, water, peace and integrity of the Medicine Lake area. A lot of time, money and human energy has been put into researching this project and complying with the laws governing the process. If this much energy was channeled into solar technology and into making it easily accessible and affordable, there would be more than enough energy available to all. *(Barbara Barr)*

CL.1 Alternative plans would be solar or wind power some other place than our pristine Medicine Lake Highlands. *(Catherine Gardner)*

DI.7 Money should be spent on building solar and wind generation plants, which don't pollute the environment. *(Ana Holub and Richard Lucas)*

DV.7 Let us work together to find ways to encourage less use of electricity in homes and businesses. So much is wasted and not enough is done to conserve and find alternative sources of energy. Changing our over-consuming life styles would be the first place to start I'M WILLING -- ARE YOU? *(Marilee Jordan)*

EQ.14 In the view of the major players in the geothermal business without Federal price supports, which seem to be phasing out, there is more energy and cheaper energy in new natural gas and untapped coal reserves. New clean burning high sulfur coal technology is now coming to market, (Pyropower in San Diego is the leader in the US) The US has huge known reserves in coal and gas which are a much more attractive and productive investment. Before retirement I was involved in projects involving Pyropower clean burning coal projects as well as pipeline projects from new gas fields so I know first hand of what I write. *(Ronald A. Maire)*

IT.1 I would like to make a few comments about the Fourmile project.

First, I do NOT think there is any reason to commence with this project. There is absolutely no reason to develop geothermal, especially in the light of fact that we have at our disposal numerous alternative energy sources that are far more environmentally friendly than the proposed project. Solar energy is of age, as is Hydrogen fuel cells or Biomass or wind power. *(Grant Yousie)*

Response—Preference for Wind, Solar, or Other Technology

Alternatives to geothermal development (such as wind power or a combination of alternative energy sources) would not allow Calpine to utilize its geothermal leases at the Glass Mountain KGRA, or to confirm the commercial viability of this resource. These alternatives would also not fulfill the need to investigate the feasibility of including geothermal power in the BPA's power capability. The BPA has evaluated environmental effects of other renewable power sources in its Resource Programs EIS

(BPA 1993). These alternatives have therefore not been evaluated in detail in the Draft EIS/EIR.

A project was not sited on the east side of the Caldera because the initial exploration data indicated greater probability of locating a commercial geothermal resource on the leases proposed for development.

3.3 Geology and Soils

INTRODUCTION

This section provides responses to comments on issues related to geology and soils. The comments and responses are grouped under the following headings:

- General
- Potential Effects to Caves
- Geologic Hazards
- Potential Effects to Soils

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

GENERAL

Comment—Geology of Region

A.38 We consider the Regional Geologic Map, Figure 3.2-1 lacking sufficient detail. At the level of detail provided the northeast trending fault, as depicted, could affect the project area. Is this a fault zone, and what is the nature of this structure? With regard to the geologic characterization, the DEIS' description of a long exploration history would suggest that additional geologic and geophysical data may be available. For instance, a thick and clay-rich "impermeable" zone separating the hot and cold water is noted but poorly documented. Could the clayey character be only a local feature, and could this formation contain areas with a non-clayey and fractured character, capable of transmitting water? A detailed resistivity survey over the well field site could identify fault zones within the confining unit that should be avoided. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

Response—Geology of Region

The Draft EIS/EIR presents a summary of the geology of the project area. The comment includes a request for more information on the nature of the northeast-trending fault near the project site. This information is provided below.

The surface geology in and near the caldera consists of numerous very young lava flows and pyroclastic deposits of cinders and pumice. These deposits typically have very limited lateral extent or are difficult to correlate due to the very high number of volcanic vents in and around the caldera. The young age of these volcanic rocks tends to obscure fault scarps. Even the dominant fault structure in the area, the caldera ring fracture system, is impossible to locate precisely; instead, its location must be approximated on the basis of topography (Donnelly-Nolan 1988). (Note that even in non-volcanic areas fault scarps are often obscured by recent deposition and erosion.)

Because of the difficulties in identifying and mapping scarps in the Glass Mountain area, mapped faults are drawn to correspond to the alignments of volcanic vents. The northeast-trending faults shown in Figure 3.2-1 of the Draft EIS/EIR are based on the alignment of eruptive vents (from southwest to northeast) at Paint Pot Crater, Little Glass Mountain, and the Crater Glass Flows.

Some of the geologic data for the Medicine Lake Highlands were collected in conjunction with geothermal exploration that has taken place in the area. Much of these data are proprietary for competitive reasons and can not be released to the public. CEQA allows the withholding of information considered to be a "trade secret" from public environmental documents such as EIRs (CEQA Section 21160). The data have

been reviewed by the lead agencies and the third-party consultants who prepared the EIS/EIR.

As discussed on pages 3-40 and 3-41 of the Draft EIS/EIR, all of the available data from temperature gradient wells drilled in and around the Medicine Lake caldera indicate that there is a layer of impermeable rock underlying the shallow groundwater table. This layer separates the geothermal system from the shallow groundwater system. Drill cuttings taken during exploration activities show that a prominent portion of the impermeable layer in the project area is made up of a clay-rich lithic tuff. This lithic tuff unit is believed to extend through much of the area (based on well data). However, in some places the impermeable layer may include other rock formations. Nearly 9,000 feet of core hole drilling has been done in the Fourmile Hill area. With this type of data, once can reliably characterize the subsurface conditions (e.g., core hole data are far more reliable than data on subsurface resistivity). Data collected in the Medicine Lake region document a thick layer of impermeable rock between shallow groundwater and the geothermal reservoir.

See response to "Comment—Separation of Local Groundwater and the Geothermal Reservoir" in the Hydrology Section for a detailed discussion of the geologic and other evidence that supports the existence of an impermeable layer.

There is no evidence that any active surface faults occur in the power plant and wellfield area. Calpine has considered potential subsurface fault zones in siting its wells, and a detailed resistivity study would not be warranted. See also response to "Comment—Potential Groundwater Contamination due to Geothermal Fluid Use" in the Hydrology Section.

Reference:

Donnelly-Nolan, J. M. 1988. A magmatic model of Medicine Lake volcano, California. *Journal of Geophysical Research* **93**:4412-4420.

Comments—Corrections

C.1 Thanks for letting me have a look at the EIS/EIR for Calpine's proposed development at Medicine Lake volcano. I did not receive a copy. I scanned through the document and looked fairly carefully at pages related to the geology. On page 3-4, I am credited with saying that the caldera "was created during a catastrophic eruption approximately 10,000 to 12,000 years ago (Donnelly-Nolan 1990)." I didn't say that and it isn't true. *(Julie Donnelly-Nolan, U.S. Geological Survey)*

C.2 Same goes for p. 3-7 where I am credited with saying that "Some of the most recent lava flows in the Medicine Lake area may be only 500 years old (Donnelly-Nolan et al. 1989)." Not true unless Lassen is considered to be in the Medicine Lake area. *(Julie Donnelly-Nolan, U.S. Geological Survey)*

C.3 Otherwise there are lots of small errors (naming, spelling, locations, etc.) in addition to failure to discuss the Dzurisin et al. paper in the context of seismicity and ground subsidence. The geology reference list is remarkably short. (p. 7-2). *(Julie Donnelly-Nolan, U.S. Geological Survey)*

Response—Corrections

Comments noted. The sentence referenced in comment C.1 (which was the second sentence of the first full paragraph on page 3-4 of the Draft EIS/EIR) has been deleted. The sentence referenced in comment C.2 (which was the first sentence of the second paragraph under the heading "Volcanic Activity" on page 3-7 of the Draft EIS/EIR) has also been deleted.

Comment C.3 does not provide specific direction on the referenced errors, so no corrections can be made to the EIS/EIR. The Dzurisin et al. paper that is referenced in comment C.3 has been obtained. See the responses to "Comments—Effects on Seismic Activity from Geothermal Fluid Use" and "Comments—Potential for Ground Subsidence" for a discussion that incorporates the information in this paper.

POTENTIAL EFFECTS TO CAVES

Comment—Effects of Project Construction on Caves

CV.1 Upon inspection of the power plant site, I found an underground crack-fault cave system approximately 175 paces from the wellhead near transmission line section A3. This crack-fault cave system is 8-10' deep and at least 50' long as evidenced by nearby surface depressions. The crack/cave system has good airflow, and is home to at least 1 frog, and other ground-dwelling mammals. There are also other surface depressions for at least one mile from the proposed power plant site along transmission Route A3.

Construction of the power plant site, and road building along section A-3 would adversely effect these crack/cave systems. Cave-ins due to road building or drilling at the power plant site are possible.

(Kyle Haines)

Response—Effects of Project Construction on Caves

USFS staff and field personnel familiar with the power plant and wellfield area are not aware of a "crack-fault cave system" near a wellhead (it is unclear from the comment exactly where the alleged cave is located). Project facilities, including well pads, roads, and transmission lines, were carefully located to avoid any potential geologic hazards such as caves. As a result, project facilities would not cause cave-ins due to road building or drilling.

As described in Section 3.8 of the EIS/EIR, Wildlife, surveys have been performed for special-status wildlife species within the power plant and wellfield area. No special-status species were found to inhabit caves within this area. Mitigation Measure 4.8.3i on page 4-124 of the Draft EIS/EIR proposes pre-construction surveys for the Townsend's big-eared bat. This bat species inhabits caves and may be present along the transmission line corridor that is ultimately selected (including segment A3). If these pre-construction surveys detect caves with bats in them within the selected transmission line corridor, the final route of the transmission line would be moved to provide a buffer zone of at least 250 feet between the cave and the transmission line.

GEOLOGIC HAZARDS

Comments—Effects on Seismic Activity from Geothermal Fluid Use

Y.56 The DEIS/EIR fails to provide information evaluating effects of the project on potential seismic activity. In a volcanic area this is a large omission. The DEIS/EIR 4-8 states that 'Withdrawal or injection of large amounts of fluid from the geothermal reservoir could cause increased seismic activity in the project area...' At 4-9 we read that such impacts would be 'adverse, but not significant." No data is given to back this up. We understand that USGS information has been developed on the area but was not used in the draft EIS/EIR. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

DC.2 I feel strongly that the location of these projects is in an area that poses serious geophysical risks. *(Anita Henning)*

FD.2 Another factor is the seismic activity generated by such geothermal power plants. *(H. K. "Bud" Miller)*

PH3.72 I would like to go back to square one. My dates aren't exactly right. Start drilling these test wells in 1989, et cetera. They had a whole bunch of seismographic readings of the area, one four point five or five two or something. Shook the whole lake. Is there a correlation to these 10,000 foot holes and seismographic readings? Drill these holes, like letting air out of a tire, going to go flat here. It is a caldera, volcanic reaction. What are we doing down there if we start putting all these wells down there? Going to create something—any test on this or am I barking up a tree here or anybody know anything about this?

(Yreka Public Hearing)

Response—Effects on Seismic Activity from Geothermal Fluid Use

As described on page 4-9 of the Draft EIS/EIR, the proposed project is not expected to increase the magnitude of seismic events that already occur naturally in the area. However, the frequency of these low-level seismic events may increase as a result of project activities. This conclusion is based on data collected at other geothermal fields in California (e.g., Stark 1991). For example at The Geysers, geothermal operations have increased the frequency of small earthquakes (called "microearthquakes") that measure up to 3.0 on the Richter scale. Earthquakes of this magnitude typically are not felt by humans and do not pose any safety risk from damage to structures on the surface.

At The Geysers, microearthquakes that occur during the operation of the geothermal facilities are coincident in space and time with the injection wells (Stark 1991). These data strongly suggest that the injection of cold geothermal fluids back into the reservoir are the cause of the microearthquakes. It is likely that water already in the geothermal reservoir at the point of injection experiences an increase in pressure, which leads to microearthquakes (Stark 1991; Kirkpatrick et al. 1996). The hot rocks surrounding the outflow of the injection well contract when they come in contact with the cold geothermal waters. Because the contracting rocks would actually relieve pressure, the injection of cold water somewhat ameliorates the effects of the increase in the amount of water in the reservoir.

At The Geysers, it is well established that active geothermal wells increase the frequency of microearthquakes. However, in some geothermal fields there is not a clear link between geothermal operations and the frequency of microearthquakes (Fabriol and Glowacka 1997). Thus, active geothermal wells may not cause microearthquakes at all geothermal fields.

Even at The Geysers, where the correlation between microearthquakes and geothermal wells is clear, it is not known how much geothermal wells actually increase microearthquakes. By their nature, geothermal power plants are located in areas that are volcanically active. These areas are often in areas that experience substantial numbers of earthquakes naturally. For example, at The Geysers, several thousand microearthquakes occur every year. Because the frequency of these earthquakes were not measured before the installation of the geothermal facilities, it is difficult to know how many are now caused by the geothermal activities. However, scientists speculate that a majority (i.e. more than half) of the microearthquakes are caused by the geothermal activities. These data were considered in the analysis in the Draft EIS/EIR.

While microearthquakes do occur in the Medicine Lake region, they do not appear to be as common as they are at The Geysers. Between 1980 and 1988, only three earthquakes occurred in or near the Medicine Lake caldera (Dzurisin et al. 1991). Indeed, there were very few measurable earthquakes within 25 km of the caldera during this period (by comparison, Mount Shasta is much more seismically active). The largest known recent earthquake in the caldera occurred on August 1, 1978, when a quake measuring 4.6 on the Richter scale preceded a swarm of several lesser quakes and hundreds of microearthquakes of < 2.0 on the Richter scale. This swarm lasted for approximately 24 hours. Two similar events occurred in 1980 and 1988, which included quakes of up to 4.1 on the Richter scale.

References:

Dzurisin, D., J. M. Donnelly-Nolan, J. R. Evans, S. R. Walter. 1991. Crustal subsidence, seismicity, and structure near Medicine Lake Volcano, California. *Journal of Geophysical Research* **96**:16,319-16,333.

Fabriol, H., and E. Glowacka. 1997. Seismicity and fluid reinjection at Cerro Prieto geothermal field: Preliminary results. Pp. 11-17 of Proceedings of the 22nd workshop on geothermal reservoir engineering, Stanford University, Stanford, CA. January 27-29, 1997.

Kirkpatrick, A., J. E. Peterson, Jr., and E. L. Majer. 1996. Source mechanisms of microearthquakes at the southeast geysers geothermal field, California. Proceedings of the 21st workshop on geothermal reservoir engineering, Stanford University, Stanford, CA. January 22-24, 1996.

Stark, M. A. 1991. Microearthquakes—a tool to track injected water in The Geysers reservoir. Pp. 111-117 *In:* Monograph on The Geysers Geothermal Field, Special Report No. 17. Geothermal Resources Council, Davis, CA.

Comments—Effects on Volcanic Activity from Geothermal Fluid Use

AB.4 The developers do not know the results of disturbing an active volcanic area. *(Michelle Berditschevsky, Native Coalition for Cultural Restoration of Mount Shasta)*

AE.3 The developers do not know the results of disturbing an active volcanic area. *(Arnold Wilkes, Pit River Tribe)*

CS.3 The Medicine Lake Highlands is an active volcanic area. Such development would be completely inappropriate in such a setting. *(G.S. Green)*

EJ.2 Not only will you be building in a caldera (and the danger of triggering volcanic reactions) but no project has ever been built where there's snow—and this area gets a lot of snow. You are treading on dangerous ground when you butt heads with Mother Nature. *(Laraine Lewis)*

Response—Effects on Volcanic Activity from Geothermal Fluid Use

As described in the Draft EIS/EIR on page 4-10, it is unlikely that drilling, development, and production of the geothermal wells would induce either volcanic or hydrothermal explosions. Most geothermal development throughout the world has occurred in active or formerly-active volcanic areas. As a result, the effects of geothermal development on volcanic activity is well known.

The movement of magma is controlled by tectonic forces which are orders of magnitude greater than the slight changes in fluid pressure which may result from geothermal development. Thus, the chance of magmatic activity (eruptions) would not be influenced by the proposed project. Phreatic explosions are volcanic eruptions that occur when magma (molten rock) comes in contact with groundwater. While such events have probably occurred in the Glass Mountain area in the geologic past, they are quite rare in the span of a human lifetime.

Comment EJ.2 states that the proposed project involves building in a caldera. As a point of clarification, the proposed geothermal power plant and wellfield would be located on the flanks of the Medicine Lake volcano, and would not be located actually within the caldera. Portions of transmission line segments A1 and A2 (and associated access roads) would be the only facilities constructed within the Medicine Lake caldera under the proposed action (Alternative 1). This information is discussed on page 3-4 of the Draft EIS/EIR. Alternatives 2 through 4 would also include construction of portions of one or both of these segments within the caldera. If Alternative 5 or 6 is implemented, no project construction would occur within the caldera.

The potential for the proposed project to induce volcanic activity is discussed under Impact 4.2.6 Volcanic Activity on pages 4-9 and 4-10 of the Draft EIS/EIR. As discussed under Impact 4.2.6, any fluid pressure changes from proposed geothermal activities would be orders of magnitude less than the forces required to induce volcanic activity. In addition, production of geothermal fluids has not been known to induce volcanic activity at other geothermal developments. The proposed project is therefore not expected to induce volcanic activity in the Medicine Lake area, and this potential effect would not be considered to be significant.

Proposed operation activities during winter months (when snow would be present) are described under "Winter Operating Conditions" on pages 2-35 and 2-36 of the Draft EIS/EIR, and potential effects associated with the presence of snow are discussed under Impact 4.2.9, "Snow Avalanches," on pages 4-12 and 4-13 of the Draft EIS/EIR. As discussed on pages 2-35 and 2-36, the proposed power plant and wellfield facilities would be built to withstand the severe weather conditions in the project area. There have been many structures built in areas with similar weather conditions, and the knowledge gained in building these structures would be applied to the design of the project facilities. As discussed under Impact 4.2.9, the power plant and wellfield would be located in a relatively flat area that would not be at risk for snow avalanches.

Details of the transmission line design are described under "Transmission Line Design" on pages 2-39 through 2-42 of the Draft EIS/EIR. Similar to the power plant and wellfield facilities, the proposed transmission line would be built to withstand the severe weather conditions in the project area. As discussed on page 2-39, the transmission line would be designed to meet or exceed standards of the National Electric Safety Code and to conform with California Heavy Loading criteria, which complies with the requirements set forth in California General Order No. 95 for transmission lines in elevations above 3,000 feet. As discussed on page 2-41, single steel pole support structures may be used instead of wood poles in areas that could experience extreme snow-loading during the winter.

Many transmission lines have been built in areas with similar weather conditions, and the design specifications required to withstand these conditions are well known and documented. These design specifications would ensure that the proposed transmission line would be able to withstand the expected snow conditions. In addition, as discussed under Impact 4.2.9, potential effects of snow avalanches along the transmission line corridor would not be significant due to the low probability of one occurring and the limited risk posed to people and structures.

Comment—Effects on Slope Stability

AG.17 Construction of the proposed transmission line and associated access roads could cause slope instability, especially where it traverses steep slopes (50-100%). (EIS/EIR, p. 4-11.) This slope instability could trigger transmission line problems during Project operation, including "line breakage, pole movement, and structural collapse. (EIS/EIR, p. 4-12.) Nevertheless, the EIS/EIR concludes that these impacts are not significant because of "the low potential for slope [in]stability", construction techniques, and limited risk to people and structures. However, this slope instability could increase the risk of fire and, thus, cause significant impacts to human health and safety. (See Comments under Human Health & Safety, Increased Fire Risk, below.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Effects on Slope Stability

On page 4-11 and 4-12, the Draft EIS/EIR concludes that the impacts of project construction and operation on slope stability is not significant. The EIS/EIR draws this conclusion based on the low potential for the sudden movement of rock or soil downslope from the project facilities. There is a low potential for slope instability because the majority of project facilities (e.g., the power plant, all wells and pipelines, and most of the proposed and alternative transmission line segments) would be located on gentle to moderate slopes (less than 30 percent slope).

The only project facility that could occur on steep slopes is segment A2 of the proposed transmission line. The southeastern end of segment A2 would traverse relatively steep slopes (greater than 30 percent) on the south flank of Mt. Hoffman. The northeastern end of segment A2 would traverse the northern flank of Glass Mountain, which also has relatively steep slopes.

Construction of segment A2 of the transmission line along the south flank of Mt. Hoffman would not require the construction of new roads because a road already exists that parallels the proposed transmission line route in that area. The existing road could be used for access to the transmission line (for maintenance). In the southeastern end of segment A2, no slope instability would occur because no new roads would be constructed (and no new grading would occur).

However, in the northeast end of segment A2, the construction of new roads along the transmission line route might result in slope instability due to the grading that would be required to build such roads. A mitigation measure has been added to the Final EIS/EIR that limits the construction of new roads in this area of segment A2 and mandates that maximum use of existing roads in that area:

> "4.2.8a If a transmission line alignment is chosen that includes segment A2, roads will not be constructed on the steep north slopes of Glass Mountain. The distance between transmission poles in this area will be maximized in order to accomplish this goal. Existing roads will be used in this area to maximum extent possible."

See also responses to comments in the Human Health and Safety Section for a discussion of the potential for significant impacts to human health and safety.

Comment—Potential for Landslides from Induced Seismic Activity

O.6 The EIS concedes that the potential exists for earthquake-induced landslides in the project area (3-8) and that there are several active fault lines surrounding the proposed plant. The Likely and Surprise faults located 50 and 75 miles east of the site, have the ability to generate a magnitude 5 earthquake, but are downplayed in the EIS report. Clearly the threat of seismic activity is real in this area, since there have been several earthquakes ranging within miles of the proposed site during the past nine years, including a ground rupture that was more than a mile long (EIS, 3-7). For the safety of the public, we urge you to avoid a future potential catastrophe by adopting the No-Action alternative.

(Katherine Kowatch, Friends of the River)

Response—Potential for Landslides from Induced Seismic Activity

As discussed in the response to "Comment—Effects on Seismic Activity from Geothermal Fluid Use," increases in seismic activity due to the proposed project would be of low magnitude only (1 to 3 on the Richter scale); this range of magnitude would be similar to naturally-occurring seismic events. Earthquakes of this magnitude would not increase the likelihood of landslides in the project. Therefore, the proposed project

would not increase the likelihood of earthquake-induced landslides above the natural frequency of this event.

The comment may also express concern about the potential for earthquakes to damage project facilities. As described on page 2-54 of the Draft EIS/EIR, project facilities would be built to meet state and local requirement for seismic stability. Thus, project facilities are expected to withstand earthquakes of a magnitude typical for the region. The comment also expresses concern about the potential for a "future catastrophe." A response to this comment can not be provided because the "catastrophe" to which the comment refers is unclear.

Comments—Potential for Ground Subsidence

AG.16 The EIS/EIR concludes that water withdrawals from Arnica Sink would not cause ground subsidence. (EIS/EIR, pp. 4-6-7.) This conclusion is based on "the relatively small amount of groundwater that would be withdrawn and the short time required to recharge the groundwater resource." (EIS/EIR, p.. 4-7.) However, according to Dr. Fox's calculations, the Project would lower the water table in Arnica Sink by withdrawing groundwater and eliminating local recharge. (Ex. A, Comment 8.b.) Thus, the basis for the EIS/EIR's conclusion that there would be no significant impact is flawed. This impact should be reassessed, along with appropriate mitigation strategies, and included in a recirculated EIS/EIR. (See Ex. A, Comment 8.b., for mitigation options.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

EQ.8 Some technical concerns I have based on the limited information in the report. First on page 4-44 paragraph 4 states the estimated fluids available for rejection is 83.6%. It is my recollection reinjection in the Calipatria Field had to be increased to the 90% plus level to stop subsidence. BLM better check this out very carefully.

(Ronald A. Maire)

Response—Potential for Ground Subsidence

The conclusion in the EIS/EIR that water withdrawals from Arnica Sink would not cause ground subsidence are based on two sets of calculations:

- Estimates of groundwater withdrawals from Arnica Sink and
- Estimates of recharge rates of Arnica Sink from the surrounding recharge zone

These calculations were performed by the hydrogeologist for the third-party consultants on this project. Based on these calculations, the EIS/EIR concludes that the input to the recharge zone of Arnica Sink is sufficient to replenish the groundwater quickly (see response to "Comment—Potential Groundwater Depletion at Arnica Sink from Groundwater Use" in the Hydrology Section for the justification for this conclusion). Because the groundwater level at Arnica Sink would be replenished quickly, ground subsidence would not occur. Moreover, the subsurface rocks in the project area are primarily volcanic andesite that erupted in the Pleistocene period (over 10,000 years ago) (see Figure 3.2-1 on page 3-3 of the Draft EIS/EIR). These rocks are structurally sound and are not prone to subsidence due to groundwater withdrawal.

Comment AG.16 also questions the accuracy of the calculations on which this conclusion is based. See response to "Comment—Calculation of Groundwater Recharge" in the Hydrology Section for a discussion of the accuracy of the groundwater calculations in the Draft EIS/EIR.

Comment EQ.8 expresses concern about the potential need to increase the amount of injection to stop subsidence. The estimate given in the Draft EIS/EIR on page 4-44 of the amount of fluid that would be injected into the geothermal reservoir was based on data

collected at the project site (from previous exploratory wells) and from Calpine's experience with operating geothermal power plants in other areas.

The comment refers to the Calipatria field, where there has been only limited exploration and no development. It is assumed that the commentor meant to refer to either the Salton Sea or Heber geothermal field. At the Heber field, there has been about 6 to 8 inches of subsidence in areas of production, and 6 to 8 inches of uplift in areas of injection (Timothy Boardman, California Division of Oil and Gas and Geothermal Resources (CDOGGR), *personal communication*, 1998). The CDOGGR requires an injection rate of 80 percent of the total fluids withdrawn from the reservoir, in part to help mitigate subsidence. The Heber reservoir consists of loosely consolidated sands that readily compact and expand in response to changing pore pressure.

There has been very little subsidence at the Salton Sea field because the reservoir consists of much more competent formations which are not affected by pore pressure. What little subsidence that has occurred at the Salton Sea field is not attributable to geothermal development, but to local tectonic activity. The CDOGGR requires an injection rate of 70 percent to 75 percent of the total fluid withdrawn from the Salton Sea reservoir, primarily as a means to extend the life of the reservoir. The current injection rate is over 90 percent due to the high flash pressures currently used. The high rate of injection was not designed to mitigate for subsidence.

The Calipatria, Heber, and Salton Sea geothermal reservoirs consist primarily of hot water zones within stratified sedimentary rocks. As a result, the distribution of the reservoir fluids is subhorizontal, which allows for some minor subsidence due to long-term fluid withdrawal (as demonstrated by the values cited above). At the proposed project site, reservoir fluids would be produced from fracture systems that are primarily subvertical and therefore not prone to ground movement. Thus, the volcanic rock formations in the project area are very competent and would not be significantly affected by changes in pore pressure. As discussed in the Draft EIS/EIR on pages 4-6 through 4-8, the project would not result in substantial ground subsidence. Thus, there would be no need to increase fluid injection levels to offset subsidence.

The USGS has taken measurements since 1954 of the natural subsidence that has occurred in the Medicine Lake Highlands. They took measurements at points within caldera and at locations up to 30 km to the west, southwest, and south of the caldera. Between 1954 and 1989, the maximum measured subsidence of all of the measurement points was approximately 11 mm per year (Dzurisin et al. 1991). Even during the period that included the earthquake of 1988 (the strongest of which measured 4.1 on the Richter scale), the estimated subsidence rate in the Medicine Lake caldera was 15 mm per year. These data indicate that subsidence does occur naturally within the Medicine Lake Highlands, but at a very slow rate.

Reference:

Dzurisin, D., J. M. Donnelly-Nolan, J. R. Evans, S. R. Walter. 1991. Crustal subsidence, seismicity, and structure near Medicine Lake Volcano, California. *Journal of Geophysical Research* **96**:16,319-16,333.

POTENTIAL EFFECTS TO SOILS

Comments—Potential Effects on Soils from Erosion

O.7 The EIS notes that there will be a total of 2 miles of new road construction and roughly 1.25 miles of road improvements on existing roadways (2-20). However, the Modoc LRMP restricts the use of or the obliteration of roads and trails when necessary to protect the soil resource and maintain water quality (4-212). In the Revised Draft Environmental Impact Statement of the California Spotted Owl, roads are said to negatively impact watersheds by the routing of sedimentation and water throughout the watershed. "Greater road densities are more likely to intersect streams and disrupt the routing of water, sediment, and nutrients through the system" (3-147). Increased road densities are a concern because "Current thresholds of concern values used by Sierra Nevada Forests range on average between 11 and 13 percent though recent research shows a significant decline in aquatic macroinvertebrate (3 diversity in Sierra Nevada watersheds with ERA (equivalent roaded acres) above 5 percent (Cal Owl Revised EIS, 3- 147)." *(Katherine Kowatch, Friends of the River)*

O.19 The Modoc LRMP states specific guideline's for soil management within the project area. Management for Soils includes conducting an SRI Order 2 on sensitive soil areas identified in the Modoc SRI Order 3 and to develop site-specific management practices for soil-disturbing activities during: the project planning phase (4-212). The EIS makes no mention of the required surveys for the site-specific management practices and the SRI Order 2 study, and should be done before further planning occurs. *(Katherine Kowatch, Friends of the River)*

U.24 (pg. 2-21 EIS/EIR) The Draft fails to address the possibility of erosion caused by leaks in the fresh water pipeline between Arnica Sink and the Calpine project. This pipeline will transverse sharp volcanic rocks, uneven terrain, downed trees and branches. Leaks in the pipeline would cause erosion, which in turn could damage roadways, groundcover vegetation and nearby cultural resources along the pipeline route. Please address these issues in writing. *(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)*

X.11 In addition, it is a well studied fact that logging roads cause tremendous environmental damage by increasing sedimentation and erosion, increasing the risk of landslides, degrading water quality, and fragmenting wildlife habitat. *(Michael Hauptman, Mount Shasta Area Audubon Society Board of Directors)*

Response—Potential Effects on Soils from Erosion

The potential for proposed project to cause soil erosion and increase surface runoff is discussed on pages 4-11 through 4-15 and pages 4-27 through 4-32, respectively, of the Draft EIS/EIR. As discussed in these sections, the project is not expected to have significant adverse impacts on slope stability, soil erosion, surface runoff, flooding, or stream channel erosion. There are several reasons for these conclusions, each of which is described in detail below:

- Soils in the project area have moderate to high infiltration rates, which results in slow to very slow runoff potential
- As a result of the high infiltration and slow runoff, soils in the project area have low to moderate erosion hazard ratings
- Topography is relatively flat in the area, which substantially reduces the chance of erosion
- There is little to no surface water in the project area into which sediments could accumulate and damage aquatic ecosystems

As described in Table 3.2-1 of the EIS/EIR, soils in the project area have water infiltration rates that range from moderate to very rapid. This is due to the high porosity and permeability of the soil. Soils that have high infiltration rates can absorb more water than soils with low infiltration rates.

All else being equal, soils with high infiltration rates also experience much less erosion than soils with low infiltration rates, because surface water runoff is greatly reduced. The runoff potential of the soils in the project area is also relatively low (see Table 3.2-1). Exceptions to this include soils on segment A1 and A2 of the proposed and alternative

transmission line. Segment A1 contains rocky outcrops, which experience rapid runoff. However, because there is no soil on rocky outcrops, this runoff would not result in any erosion. Segment A2 crosses areas in which soils have moderate to high runoff potential, primarily due to steeper slopes. See response to "Comment—Effects on Slope Stability" above for a discussion of soil erosion on segment A2 and the mitigation measure that is proposed to reduce the potential for erosion. For the remainder of the project area, slopes are moderately-steep or gentle (less than 30 percent slope). This gentle topography greatly reduces the chance of rapid surface runoff and thus decreases the likelihood of erosion.

Finally, the project would not result in damage to aquatic ecosystems and watersheds (e.g., streams, lakes, ponds) because there is little to no surface water in the project area. As described on page 3-20 of the Draft EIS/EIR, there are no perennial streams near the project site. As described in response to "Comment—Effects of Water Quality on Fish" in the Wildlife Section, the proposed transmission line would cross up to only two intermittent and small streams. The transmission line (and its associated access roads) would not cause substantial erosion into these streams because of the properties of the soil and topography that are outlined above.

Despite the low level of soil erosion that is expected to occur as a result of this project, mitigation measures are proposed that would reduce soil erosion even further (e.g., Mitigation Measures 4.2.10a, 4.3.3, 4.3.5, and 4.7.1a). For example, Mitigation Measure 4.2.10a proposes the development of a comprehensive Soil Conservation and Erosion Control Plan that would identify specific techniques to minimize soil erosion.

Comment U.24 expresses concern that a leak in the freshwater pipeline between Arnica Sink and the wellfield may cause erosion; this is acknowledged on page 4-14 of the Draft EIS/EIR. Mitigation Measure 4.2.10a includes a provision that specifically addresses this concern: "The water supply pipeline shall be monitored for leaks throughout the first construction season and removed at the end of this period." Other provisions of Mitigation Measure 4.2.10a would further reduce the likelihood that the freshwater pipeline would cause soil erosion.

For a discussion of other issues raised in these comments, see the following responses to comments (relevant comments are listed in parentheses):

- Surface Water Impacts from Road Construction and Maintenance, in the Hydrology Section (O.7, U.24, X.11)
- Effects of Water Quality on Fish, in the Wildlife Section (O.7)
- Effects of Hunting and Habitat Fragmentation on Wildlife, in the Wildlife Section (X.11)

Comment O.19 cites the Modoc LRMP, which states that an Soil Resources Inventory (SRI) Order 2 should be done on sensitive soil areas that are identified in SRI Order 3 surveys. Calpine is currently conducting a detailed field survey of all soils on the Modoc National Forest within the study corridor of the lead agencies' preferred alternative alignment of the transmission line (Alternative 6). The results of this survey were not available at the time of publication of the Final EIS/EIR. The survey report

will be available to the public at the USFS Modoc National Forest office in Alturas, California.

Comment—Potential Effects on Soils from Deposition

AG.18 Section 4.2.11 of the EIS/EIR concludes that there will be no significant impact from the deposit of air emissions on soils. (EIS/EIR, p. 4-16.) According to Dr. Fox, however, deposition rates will be much higher than calculated in the EIS/EIR. (See Ex. A, Comments 8 and 12.) This section also failed to evaluate the impacts of Project-induced acid rain, which can acidify soils. (Ex. A, Comment 8.d.) Section 4.2.11 should be revised in light of Dr. Fox's comments and recirculated for public review and comment.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Potential Effects on Soils from Deposition

The comment expresses disagreement with the conclusion reached in the Draft EIS/EIR on page 4-16 that the potential effects to soils from project emissions would not be significant. As stated on page 4-16 of the Draft EIS/EIR, soils in the project area would be expected to have a similar mineral makeup as the solids in the air emissions because both are derived from similar volcanic rocks. Because of this similarity, deposition of project air emissions would not be expected to substantially change the composition of soils in the project area.

During the operational phase of the proposed action, air emissions would be released from the cooling tower and plant silencers. The emissions would have a similar makeup as those released during the construction phase. Well venting emissions would also occur in this phase. For the same reasons described above, the impact of the deposition of air emissions on project area soils during this phase would be adverse, but not significant.

Comment AG.18 references comments made by Dr. Phyllis Fox. Responses to comments by Dr. Fox are presented in the Vegetation Section under the heading "Effects of Emissions on Vegetation." In particular, see response to "Comment—Effects of Boron Emissions on Vegetation;" this response addresses the potential for boron to accumulate in the soil near the proposed power plant.

3.4 Hydrology

INTRODUCTION

This section addresses topics related to hydrology. The comments and responses are grouped under the following headings:

- General
- Regulatory Information
- Local Groundwater and Effects from Groundwater Use
- Local Groundwater and Effects from Geothermal Fluid Use
- Regional Groundwater
- Surface Waters and Effects from Construction Activities
- Surface Waters and Effects from Groundwater Use
- Surface Waters and Effects from Geothermal Fluid Use
- Surface Waters and Effects from Deposition
- Hydrology Mitigation
- Hydrology Monitoring Plan

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

For the purposes of these responses to comments, "local groundwater" refers to the shallow groundwater resources in the immediate vicinity of the Medicine Lake caldera. The term "regional groundwater" is used to refer to groundwater (and associated surface manifestations such as springs) at locations dispersed throughout the region, including Fall River, Butte Valley, Tule Lake, and Mt. Dome/Klamath Lake.

GENERAL

Comments—Adequacy of Hydrology Analysis

F.17 Section 3.3 Hydrology. This section of the DRAFT EIR/EIS summarizes what is known about surface and groundwaters near the project -- very little pre-project "background" work (which can be revealed to the public) has been done. At page 3-27 a proposal from USGS is mentioned and we have been provided with letters mentioning work done proposed by other parties. Perhaps because the Exploration-phase work has not been done (thus no results of monitoring it are available) nor has there been a concerted effort to describe conditions at the proposed powerplant/well sites, this DRAFT cannot adequately describe the to-be-affected environments. If that is the case, it also cannot describe nor dismiss-to-insignificance the impacts of the proposed development.

(John R. Hannum, North Coast Regional Water Quality Control Board)

N.4 The hydrology information and data in the DEIS/EIR is grossly deficient and failed to provide scientific evidence as a result of documented supporting studies that the proposed project will not directly, indirectly, and cumulatively affect groundwater, surface flows, and subsurface flows, and numerous spring water sources.

To show that the hydrology analysis in the DEIS/EIR is grossly deficient, Mr. Phil Woodward, a professional expert, stated the following to the U.S. Forest Service:

"Current knowledge of the hydrology in the area, both groundwater and surface water is limited. The extent of the limited knowledge is apparent in any discussion in the text where a description of the hydrology is found. For example, page 3-21, paragraph 4 reads in part, "Data suggest that regional groundwater flow...". "...Shallow groundwater within the caldera appears to flow towards the center at a very shallow gradient, and probably discharges at...". It is assumed that through the surface flow..." (emphasis added) And the fourth paragraph on page 3-41 summarizing the relationship of surface water, groundwater, and geothermal system has similar qualifiers in every sentence. Figure 3.4 2, a Schematic

Cross Section of Medicine Lake Area has numerous question marks indicating unknown areas which are critical to understanding fluid movement in and around the geothermal source and the relationship with shallow groundwater and surface water. In short, no one knows what is happening with the hydrology in the area." (Our Emphasis)

It is clear that the hydrology information in the DEIS/EIR is grossly deficient, without merit, and is not supported by any qualified studies.

Mr. Woodward further stated that:

"Groundwater and surface water flow in the Medicine Lake Highlands is indeed controlled by the highly fractured basaltic formations as described in the EIS/EIR. However, cavernous flow is also a controlling factor and one not discussed in the document. Lava tubes are common in the Medicine Lake Highlands, including one known tube system over 20 miles in length. Groundwater flow through such conduits results in surface effects similar to those found at Big Springs below McCloud, and the springs which supply the Fall River, Big Lake and Horr Pond in the Fall River Valley. The effects of the geothermal operation on subsurface flows and their interaction with surface waters are unknown." (Emphasis Added)

We reference letter of September 12, 1997 to Randall Sharp, USFS/BLM; Fourmile Hill Geothermal Development Project; EIS/EIR Coordinator; from Phil Woodward, Registered Geologist; Certified Engineering Geologist; Certified Hydrogeologist.

As stated beforehand, it is very clear the hydrology analysis in the DEIS/EIR is grossly deficient and totally incomplete for the U.S. Bureau of Land Management and the U.S. Forest Service to consider making any decision on approving the proposed project. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

U.4 (pg. 3-14) The hydrology data in the Draft EIS/EIR is provided by the Calpine staff. The information supplied by Calpine is full of suppositions such as, "appears, probably, it is assumed, data suggests, interpreted", (pgs. 3-14, 3-15 & 3-21). According to the North Coast and Central Valley Water Quality Control Boards, knowledge concerning ground water and surface water flows within the area is limited. Calpine's suppositions support the limited knowledge theory.
(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

Y.25 The DEIS/EIR lacks independent hydrologic and air quality reports. It also lacks in information which should have been developed in the exploratory drilling stages permitted by the earlier EAs (see water and air quality below). *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

Y.26 Calpine, the geothermal developer for this project, did its own hydrologic report for the DEIS/EIR. We believe that a project of this level of controversy and impact merits an independent hydrologic report. The DEIS/EIR contains extremely limited and mostly speculative knowledge about the area. It does not adequately address issues such as: where surface water goes, potential contamination by deeper, hotter waters; potential contamination of Medicine Lake and other water sources, including Little Medicine Lake, Bullseye Lake, Blanche Lake, Paynes Springs, Crystal Springs, Schonchin Springs, as well as the entire Fall River watershed. Related fluctuations of quantity, chemical composition and temperature of these waters are not evaluated with any scientific method or data. The result has been that the effects to air, water, wildlife etc. have been minimized and passed off as insignificant in the DEIS/EIR, or inadequately mitigated. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AD.23 Other issues regarding hydrology are that there is no independent hydrological data. The only data in the EIS appears to be that supplied by the project developer, Calpine. In an area as important as water, the EIS/EIR should contain independent scientific information on the effects to the hydrology of the project area. Because of the lack of exploratory data, the impact of sulfur laden steam on the environment is underestimated and not supported by data. *(Floyd J. Buckskin, Pit River Tribe)*

AG.19 The EIS/EIR does not contain sufficient information and analysis that would enable the public and decisionmaker to assess the Project's impact on hydrologic resources. (Adler, 675 F.2d at p. 1096; Robertson 490 U.S. at p. 349; Sierra Club v. United States Army Corps of Engineers (2nd. Cir. 1983) 701 F.2d 1011, 1029; Cal. Pub. Res. Code § 21061; 14 CCR § 15151.) The EIS/EIR's conclusion that the Project's impact would be insignificant is not based on scientific and factual data. Additionally, because the EIS/EIR's analysis is flawed in several respects, it substantially underestimates the Project's effects on water quality and groundwater recharge. Hence, the EIS/EIR is deficient as an informational document.

Further, significant impacts have been overlooked in the EIS/EIR. The EIS/EIR must be revised to address these significant effects and recirculated for public review and comment. (Cal. Pub. Res. Code § 21092.1; 14 CCR § 15088.5; Laurel Heights Improvement Association of San Francisco v. Regents of the University of California (1993) 6 Cal.4th 1112, 1130.) The significant effects are summarized below.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AY.4 As you know, forests are natural water purifiers. This forest provides water year round too the people of this region. It provides much of their water. *(Theresa Brady)*

HY.6 It is clear in my mind that the BPA is too uncertain about the impact on the environment, for instance, as it describes the regional groundwater flow directions from Medicine Lake/Medicine Lake Caldera to

vicinity. In the various descriptions of the affected environment, there are too numerous assumptions allowed and statements including "probably" and "likely." On page 3-26 and 3-27, it was stated that "It is likely that a portion of the groundwater recharge area for the Fall River springs includes much of the south flank of the Medicine Lake volcano. An uninterrupted downhill slope, almost entirely underlain by young, permeable lava flows,....." and "It is probable that groundwater feeding the Fall River springs has moved only in the very shallow subsurface with probably relatively short residence times.....", this particularly instill a lack of confidence in me on BPA's work and it only further accentuates the need, in my mind, for BPA to employ more small-scale investigations to ascertain the probability of the region providing the proposed power, in an environmentally-sound manner. This deficiency desperately needs to be addressed! Scientifically! *(Alice Tseng)*

IQ.6 As a Registered Geologist, Certified Engineering Geologist, and Certified Hydrogeologist, I find the conclusion that the project will have no significant impacts to groundwater resources or the geothermal resources insupportable.

Current knowledge of the hydrology in the area, both groundwater and surface water is limited. The extent of the limited knowledge is apparent in any discussion in the text where a description of the hydrology is found. For example, page 3-21, paragraph 4 reads in part, "Data suggest that regional groundwater flow...". "...Shallow groundwater within the caldera appears to flow toward the center at a very shallow gradient, and probably discharges at...". "It is assumed that through the surface flow...." (emphasis added). And the fourth paragraph on page 3-41 summarizing the relationship of surface water, groundwater, and geothermal system has similar qualifiers in every sentence. Figure 3.4-2, a Schematic Cross Section of Medicine Lake Area has numerous question marks indicating unknown areas which are critical to understanding fluid movement in and around the geothermal source and the relationship with shallow groundwater and surface water. In short, no one knows what is happening with the hydrology in the area. *(Phil Woodward)*

PH1.28 My concern, listening to this conversation, is whoever the powers-that-be are, who will make the recommendation to either go along with the project or scrap the project or go with which alternatives, are they also only going to be given this proprietary data, which we have, which is nothing, I would argue, to—upon which to base their decisions? There's nothing existing there to me that says there's no connection; it's smoke and mirrors. So if that's all they get, I would say that that's—this is an inadequate document. *(Dorris Public Hearing)*

PH3.44 And just in glancing at the report, it shows like under "Water Quality Studies," that these studies have been done in 1980, '81, '82. You are talking about 14, 15 years ago. And could the Medicine Lake area be more fragile now than it was 15 years ago? I mean, we are not—it doesn't sound like we are making all these studies. This is old information gathered years ago. *(Yreka Public Hearing)*

PH4.13 The analysis of hydrology in the Draft EIS/EIR is difficult to follow. *(Mount Shasta Public Hearing)*

Response—Adequacy of Hydrology Analysis

The EIS/EIR summarizes the available hydrologic information for the project area in Sections 3.3 and 4.3 and in the responses to comments presented in this section below. This information provides sufficient basis for drawing the conclusions presented in the EIS/EIR about existing hydrology and potential hydrologic impacts. As summarized in Table S-5, the EIS/EIR concludes that the proposed project or its Alternatives would have either no effect or a less-than-significant effect on hydrologic resources. These conclusions apply to the following potential impacts:

- Effect of water use
- Effects of geothermal fluid production and injection on water quantity
- Effects of increased surface runoff
- Effects of flooding
- Effects on stream channels
- Effects of geothermal drilling, production, and injection on water quality
- Effects of air emissions on water quality
- Effects of sanitary waste on water quality
- Effects of chemical and hazardous material spills on water quality

The discussion of potential impacts in Section 4.3 of the EIS/EIR is based on numerous studies that were conducted for this project or conducted by others within the Medicine Lake Highlands. All of these studies were conducted by qualified hydrogeologists and experts in the evaluation of geothermal systems and groundwater hydrogeology. The hydrologic analyses in the EIS/EIR were conducted by a qualified hydrogeologist with the third-party independent consultant. The analysis in the EIS/EIR was also based on the hydrogeologists' experience with effects of geothermal development at other KGRAs. There is sufficient information and analysis in this document to enable the public and decision-makers to assess the potential impact of the project on water resources.

Subsequent to release of the Draft EIS/EIR, additional data relevant to hydrology has become available. The following hydrogeology reports were made available after release of the Draft EIS/EIR, and have been incorporated into these responses to comments and into the EIS/EIR, where appropriate:

- Bredehoeft, J. 1997a. *Potential Impacts of Fourmile Hill Geothermal Development on Springs of the Fall River*. Report prepared by the Hydrodynamics Group for Peter Stent. August.
- Bredehoeft, J. 1997b. *Potential Impacts of Fourmile Hill Geothermal Development on Springs of the Fall River Revisited*. Report prepared by the Hydrodynamics Group for Peter Stent. November.
- Davisson, M. L., and T. P. Rose. 1997. *Comparative Isotope Hydrology Study of Groundwater Sources and Transport in Three Cascade Volcanoes of Northern California*. Lawrence Livermore National Laboratory Report UCRL-ID-128423, Livermore, CA. September.
- Mariner, R. H., W. C. Evans, and M. Huebner. 1998. *Preliminary Chemical and Isotopic Data for Waters from Springs and Wells on and near Medicine Lake Volcano, Cascade Range, Northern California*. U.S. Geological Survey Open-File Report 98-2, Menlo Park, CA. January.
- Weiss Associates. 1997. *Baseline Hydrology Evaluation Report for Telephone Flat Geothermal Project, Medicine Lake, California*. Prepared for CalEnergy Company, Omaha, NE. August.

The information from these reports substantiates the conclusions drawn in the Draft EIS/EIR regarding existing geologic, hydrogeologic, and thermal information and the potential for impacts from the proposed project.

The proposed phased approach to implementing the project (i.e., confirmation drilling and testing before development) would allow for the collection of additional geothermal and groundwater data prior to development. This approach allows for the comparison of actual and expected conditions. If any of the assumptions upon which conclusions in the EIS/EIR are based are proven to be invalid and could result in the potential for significant effects to water resources, contingency measures would be enacted to either correct the problem or provide mitigation. These measures are spelled out in the mitigation measures contained in the EIS/EIR.

Comments F.17, Y.25, Y.26, and AD.23 question whether data on the geothermal resource are adequate to evaluate the environmental impacts of the proposed project. Data from temperature gradient wells that was previously proprietary has been

released and made available in the EIS/EIR. A summary of these data is presented in responses to "Comments—Local Groundwater Flow" and "Comments—Separation of Local Groundwater and the Geothermal Reservoir."

There is some uncertainty about the actual chemistry of the geothermal fluid at the project site. However, this uncertainty does not affect the validity of the hydrology analysis contained in the EIS/EIR or the conclusions drawn from this analysis. The chemistry of geothermal fluids from existing geothermal wells in the project vicinity provide a good indication of the concentrations of the most important chemicals in the geothermal fluids. These data are sufficient to estimate the chemistry of geothermal fluids in the proposed wellfield area. Specific data on geothermal fluid chemistry at the project site cannot be obtained until the long-term confirmation flow tests are performed on production wells during the first year of project construction (and prior to the construction of any other project facilities).

Comment AG.19 states that the Draft EIS/EIR underestimated the project's effects on water quality and groundwater recharge. The responses to comments provide further support for the Draft EIS/EIR's conclusion that the project would not have a significant adverse effect on water quality or groundwater recharge.

Some comments express concern that data were collected by Calpine, the project proponent. It is true that some geologic, hydrogeologic, and thermal information used in the analysis of the project was gathered and prepared by Calpine, as well as other geothermal operators at the Glass Mountain KGRA. All of this information has been objectively reviewed for adequacy and correctness by the lead agencies for the project (including the BLM). This information was also objectively reviewed for adequacy and correctness by the third-party, independent contractor who was hired to prepare the EIS/EIR for this project (based on experience analyzing the effects of geothermal exploration, development, and production and other geothermal fields).

The comments raise many issues which are discussed in more detail in the responses to comments in this section and in other sections. See the following responses regarding issues raised in the comments above (the relevant comments are noted in parentheses):

Responses in this Section:

- "Local Groundwater Flow" (N.4 and U.4)
- "Calculation of Groundwater Recharge" (A.19)
- "Potential Groundwater Depletion at the Project Site from Groundwater Use" (N.4, U.4, and AG.19)
- "Potential Effect of Groundwater use on Nearby Groundwater Wells" (N.4)
- "Separation of Local Groundwater and the Geothermal Reservoir" (N.4, Y.26, AG.19, HY.6, and IQ.6)
- "Potential Groundwater Depletion due to Geothermal Fluid Use" (N.4 and AG.19)
- "Well Casing Program and Potential for Casing Rupture" (Y.26)
- "Potential Effect to Fall River Springs"(N.4 and Y.26)
- "Existing Springs in the Project Vicinity" (N.4 and Y.26)
- "Effects to Surface Waters from Accidental Geothermal Brine Spills" (N.4 and Y.26)
- "General Deposition Effects on Surface Waters" (N.4, Y.26 and AG.19)

- "Effect of Acid Deposition on Surface Waters" (N.4 and AD.23)
- "Hydrologic Monitoring Plan" (PH3.44)

Responses in other Sections:

- "Well Testing Prior to Development" in the Alternatives, Including the Proposed Action Section (F.17, Y.25, Y.26, and AD.23)
- Responses to comments in the Air Quality Section (Y.26 and AD.23)
- Responses to comments in the Wildlife Section (Y.26)
- "Effects of Hydrogen Sulfide Emissions on Vegetation" in the Vegetation Section (AD.23)
- "Proprietary Temperature Gradient Data" in the Geothermal Resources Section (PH1.28)

Comments—Baseline Hydrology Information

A.24 The FEIS should provide and/or assure that sufficient baseline information regarding water resources is collected prior to initiation of commercial geothermal operations so that the proposed and recommended monitoring and mitigation measures are effective. We recommend a complete baseline study of potentially affected surface and groundwater resources. This should include geochemical sampling and collections of various parameters, including isotope analysis and gasses.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.26 EPA commends the USFS and BLM on the inclusion of the section "Effects of Air Emissions on Water Quality." However, EPA believes that a complete geochemical analysis of water is required to make this section credible. In keeping with 40 CFR 1502.22 we recommend that this information be provided in the FEIS *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

A.36 Under 40 CFR 1502.24, "agencies shall insure ... scientific integrity ... in environmental impact statements" and provide accurate scientific analysis [40 CFR 1500.1(b)]. Additional detail should be provided in the FEIS on geochemical analysis from springs and lakes, and more detail is required in the form of a geologic and structural map of the specific project area to assess potential shallow groundwater contamination/depletion or creation of thermally related surface geologic hazards.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.37 Page 3-15 of the DEIS states that no detailed analysis of lake water chemistries that include concentrations of metals and organic compounds are available. The EPA feels that specific water quality analysis of constituents potentially related to thermal waters should be collected and discussed in the FEIS. We cite 40 CFR at 1502.22 that provides guidance to agencies regarding incomplete or unavailable information. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

N.15 The collection of baseline water level and water quality information and data should have been included in the DEIS/EIR. The DEIS/EIR is deficient without this information and data. As stated beforehand, the hydrology information and data in the DEIS/EIR is deficient, including the lack of water quality information that renders the DEIS/EIR for water quality significantly deficient.
(Robert J. Baiocci, Fall River Wild Trout Foundation)

Response—Baseline Hydrology Information

The comments request the inclusion in the EIS/EIR of baseline water quality data from groundwater in the project area and from surface water in the region.

A groundwater monitoring program is proposed in the Final EIS/EIR to provide data on groundwater quality and quantity. An extensive summary of this groundwater monitoring program is provided in response to "Comments—Hydrologic Monitoring Plan" at the end of this section. As discussed in this response, three groundwater monitoring wells would be installed in the wellfield prior to the operation of the power plant. Groundwater samples would be collected prior to the operation of the power plant to provide baseline data with which to compare measurements taken after the production wells begin operation. The groundwater monitoring wells would

detect any unexpected changes in groundwater chemistry in the project area. Based on the analysis conducted for the EIS/EIR, such changes are considered unlikely.

As suggested in all of the comments above, additional baseline surface water quality sampling was conducted to evaluate and allow for verification of the effects of the proposed project. The protocol for this sampling and analysis was developed in conjunction with the North Coast RWQCB. Water samples were collected and analyzed in November 1997. Samples were collected at various depths and locations from the following surface waters:

- Medicine Lake
- Little Medicine Lake
- Bullseye Lake

These samples were analyzed for total dissolved solids (TDS), pH, conductivity, chloride, sulfate, nitrate, ammonia and total organic carbon. These samples were also analyzed for a variety of chemical and geochemical constituents, including arsenic, boron, cadmium, lithium, and mercury. The results of this analysis are presented in the Final EIS/EIR. In addition, appropriate water quality information from the Telephone Flat Draft EIS/EIR (which was released in April, 1998), is presented in the Final EIS/EIR. See response to "Comments—Hydrologic Monitoring Plan" at the end of this section for further details on the methodology of the baseline surface water quality sampling. The data from the additional sampling and analysis has not changed any of the conclusions in the Draft EIS/EIR regarding the project's effect on groundwater or surface water availability or quality.

Comment A.36 also requests a geologic and structural map of the specific project area. See response to "Comments—Geology of Region" in the Geology and Soils Section for a discussion of this issue. The assessment of potential shallow groundwater contamination is discussed in response to "Comments—Potential Groundwater Contamination due to Geothermal Fluid Use" below. The assessment of potential shallow groundwater depletion is discussed in response to "Comments—Potential Groundwater Depletion at the Project Site from Groundwater Use" below. A discussion of the potential for the project to create thermally-related surface geologic hazards is found in response to "Comments—Effects on Seismic Activity from Geothermal Fluid Use" and response to "Comments—Effects on Volcanic Activity from Geothermal Fluid Use," both of which are in the Geology and Soils Section.

Comment—Hydrology Summary Information in Table 2.4-1

F.16 Section 2.4 and Table 2.4.1 -- Comparison of Alternatives and Key Issues. Between Section 1--Introduction, identifying Key Issues (including questions about water quality impacts) which emerged during "scoping", and this section of the DRAFT, the matter of "Effects to regional water quality or quantity" for the Selected Alternative project have been sufficiently diminished to be deemed to be "N", that is of "No Effect". Perhaps the rationale for- and merits of the DRAFT's dismissal of a key issue will be provided in a subsequent section of the DRAFT? If not, the text and Table should be revised.

(John R. Hannum, North Coast Regional Water Quality Control Board)

Response—Hydrology Summary Information in Table 2.4-1

Table 2.4-1 of the Draft EIS/EIR is intended to provide a brief summary comparison of key issues (identified in Table 1.6-2 of the Draft EIS/EIR) for each of the alternatives evaluated in the Draft EIS/EIR. This comparison is a summary of the detailed analysis of environmental consequences for each of the alternatives presented in Chapter 4 and is not intended as a substitute for reading the text of the EIS/EIR. For a full discussion of the rationale for concluding that no effects to regional water quality and quantity would occur, please refer to the following sections of Chapter 4:

- 4.3.1: Effects of Water Use, pages 4-21 through 4-26
- 4.3.2: Effects of Geothermal Fluid Production and Injection on Water Quantity, pages 4-26 and 4-27
- 4.3.6: Effects of Geothermal Fluid Drilling, Production, and Injection on Water Quality, pages 4-32 through 4-34

In order to clarify the intent of Table 2.4-1, the text on page 2-66 that accompanies Table 2.4-1 has been revised to indicate that the evaluation of the level of impact for the key issues can be found in Chapter 4. Additional information regarding the conclusion that there would be no significant adverse effects to regional water quality has been included in the Final EIS/EIR.

Comment—U.S. Geological Survey Hydrology Information

M.10 The USGS hydrogeologists have undertaken a study to determine the chemical and other similarities of the Fall River Springs to the Medicine Lake Highland source area. The data that this study produces should also be considered in the Final EIS/EIR document.
(Rick Poore, et al., Fall River Resource Conservation District)

PH1.17 Number eight: USGS hydrogeologists have undertaken a study to determine the chemical and other similarities of the Fall River Springs and Medicine Lake Highland source area. The data that this study produces should also be considered in the final EIS/EIR document. *(Dorris Public Hearing)*

Response—U.S. Geological Survey Hydrology Information

The study referenced in the comment was released as an open file report by the U.S. Geological Survey (USGS) in January 1998 (Mariner et al. 1998). Information from this report has been incorporated into this Final EIS/EIR. The USGS report concludes that the large-discharge cold springs at Fall River differ in chemical and isotopic composition from geothermal waters at Medicine Lake. No chemical connection has been established between the known chloride-rich geothermal reservoir in the Medicine Lake Highlands and the large-discharge cold springs at Fall River. While isotope values of the cold springs and wells (i.e., groundwater) in the Medicine Lake Highlands are compatible with isotope values of the large-discharge cold springs at Fall River, the report emphasizes that this similarity is not proof of a connection between Medicine Lake Highlands groundwater and springs at Fall Rivers. The results of this report are discussed further in response to "Comments—Potential Effect to Fall River Springs."

Reference:

Mariner, R. H., W. C. Evans, and M. Huebner. 1998. *Preliminary Chemical and Isotopic Data for Waters from Springs and Wells on and near Medicine Lake Volcano, Cascade Range, Northern California*. U.S. Geological Survey Open-File Report 98-2, Menlo Park, CA. January.

Comments—General Corrections and Questions

HD.10 Page 4-22: 21.3 million gallons is 65 acre-feet not 6.6. *(Amanda Spencer)*

HD.20 What is meant by "standard drinking water quality constituents" (p.4-26)? *(Amanda Spencer)*

PH4.36 What would be stored in the sumps? *(Mount Shasta Public Hearing)*

PH4.37 Who would monitor the sumps for leaks? *(Mount Shasta Public Hearing)*

Response—General Corrections and Questions

The value referenced in comment HD.10 on page 4-22 of the Draft EIS/EIR has been corrected.

In response to comment HD.20, "standard drinking water quality constituents" (referenced in Mitigation Measure 4.3.1a on page 4-26 of the Draft EIS/EIR) are measures of water quality such as the criteria established by the EPA for Maximum Contaminant Levels (MCLs). For constituents for which no MCLs have been established, criteria such as the Suggested No-Adverse-Response Levels (SNARLs) (EPA 1996) would be used. These standards are discussed more fully on page 4-37 of the Draft EIS/EIR, where they are applied to the analysis of potential effects of air emission on the water quality of Medicine Lake (see responses to comments under "Surface Waters and Effects from Deposition" in this section for more discussion of this analysis).

In response to comments PH4.36 and PH4.37, as described on page 2-15 of the Draft EIS/EIR, the sumps would hold all fluid wastes produced during the drilling and testing operations. The sumps would also hold water used during drilling. It is expected that the composition of the fluids contained within the sumps would be similar to that described in Table 3.4-1 on page 3-39 of the Draft EIR/EIR. The sumps would be lined with clay or another impervious material to prevent leaks, in accordance with state and Federal standards. Because the sumps would be constructed in accordance with these standards, there would be no need to monitor the sumps for leaks.

Reference:

EPA (Environmental Protection Agency). 1996. Drinking water regulations and health advisories. EPA 822-B-96-002. Office of Water, Washington, DC.

REGULATORY INFORMATION

Comment—Required Permits and Authorizations

AG.29 The EIS/EIR fails to adequately identify and discuss the Project's compliance with applicable laws, regulations, and guidelines. The EIS/EIR states that the Project would require a water well use permit, waste discharge report, and storm water discharge construction permit. (EIS/EIR, pp. 1-10, 4-20.) However, the EIS/EIR fails to provide any information about these permits such as a citation to the statutory authority, a schedule for obtaining the permits, the permits' scope, or discharge quantities and constituents governed by these permits. This information would be helpful in assessing the Project's impact on water quality. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

Response—Required Permits and Authorizations

The comment requests more information on the permits that would be required for project water use or discharge. Specifically, the comment requests for each permit:

- The statutory authority
- A schedule for obtaining the permits
- Permit scope, including discharge quantities and constituents governed by these permits

It is typically beyond the scope of an EIS or an EIR to provide all of the information requested in the comment. General information on the required permits and authorizations for water issues is presented on page 4-20 of the Draft EIS/EIR. More details are provided below of the water use and water discharge permits that would be required for this project.

Statutory Authority: Statutory authority for the water use and water discharge permits comes from Federal law such as the Federal Clean Water Act and the Code of Federal Regulations, Part 40. Statutory authority is provided directly to the permitting agencies listed in Table 1.4-1 on page 1-10 of the Draft EIS/EIR. The permitting agency for water-well usage permits is the State Water Resources Control Board. Because the proposed water well for the project would be located on Federal National Forest lands, the USFS would be responsible for authorizing the water well use for the proposed project.

Waste water discharge in California is also regulated under the California Water Code. The North Coast RWQCB has jurisdiction over permitting both the storm water and waste water discharges of the proposed project. The permitting structure for wastewater and storm water discharges is outlined in the National Pollution Discharge Elimination Systems (NPDES) and Waste Discharge Requirements (WDR) provisions in the Federal Clean Water Act.

Permit Schedules: Schedules for obtaining permits would begin upon submittal of applications to the appropriate regulatory agencies. The project proponent would obtain each of the required permits and approvals in the time frame required by the issuing agency. Calpine must file an application for permit with the North Coast RWQCB at least 180 days before beginning the activity. The North Coast RWQCB would review the application and may request additional information. After a determination of completeness, the North Coast RWQCB would forward the information to the EPA. The EPA has a 30- to 60-day comment period; after this comment period, the North Coast RWQCB would prepare a "Notice of Public Hearing." The general public would then have 30 days to comment on the conditions in the permit.

This schedule would be modified somewhat in the event that a WDR permit were issued instead of a NPDES-type permit. Neither the North Coast RWQCB nor the State Water Resources Control Board will approve the permits unless the project is in complete compliance with all applicable rules and requirements. The permits could not be issued until after the EIR for the project is certified by the state lead agency, the Siskiyou County Air Pollution Control District.

Scope of Permits: Other information requested in the comment, such as permit scope, discharge quantities, and the discharge constituents allowed under these permits, would be determined at the time of the application submittal for each permit. For example, the water well use permit will be based upon a water budget that limits the number of gallons of withdrawal. The water budget in each permit would be developed by the USFS and North Coast RWQCB as part of a larger water balance system for the ground water resources in the region.

As described on page 4-20 of the Draft EIS/EIR, the North Coast RWQCB would evaluate the Calpine Report of Waste Discharge for discharge of washed solids to the sump at each well pad. None of the fluids flowing through the wells would be discharged to the sump during drilling (All of the circulating fluids are contained in sumpless drilling). Typical fluid discharges at the power plant are described in the Draft EIS/EIR in Section 2.2, Description of the Proposed Action (under the heading "Well Drilling and Testing"), and on page 4-45 in Section 4.4, Geothermal Resources.

As part of the water-quality permitting process and once the power plant is operational, Calpine would take samples of the water discharge, both from storm water and from injection fluids. Samples would then be submitted to a certified laboratory for analysis using EPA Standard Methods. The laboratory analyses would be submitted, in turn, to the North Coast RWQCB to support the permit application. The wastewater sampling would consist of a series of grab samples and composite samples designed to identify concentrations of typical contaminants in the waste discharge.

Storm water sampling would be conducted in two phases. First, as part of the State of California Permit for the Discharge of Storm Water Associated with Construction Activities (Permit #CAS000002), grab samples would be taken during significant storm events. Then, as part of the General Industrial Permit, grab samples would be taken to capture the first large storm event of the wet season and then again during a storm event that has been preceded by at least three days of dry weather. The Construction Permit and the General Industrial Permit have been developed by the State Water Resources Control Board to standardize compliance for all construction projects that will disturb five or more acres of land and operating facilities that do not fall under other EPA-approved standard permits.

As part of the permitting process, Calpine would also propose a set of wastewater treatment controls and a set of Best Management Practices (BMPs) for the handling of storm water. The waste discharge permit would include several components such as a Spill Prevention and Control Program and designs for the discharge system. For storm water, the development would follow the controls guidance under the Construction Permit during the construction phase and, most likely, the General Industrial Permit during operations phase.

The North Coast RWQCB would not grant a permit to Calpine unless proper erosion control measures are effectively implemented. As part of the storm water management requirements, Calpine would be required to develop and maintain a Storm Water Pollution Prevention Plan (SWPPP) during both the construction and operation phases of the project. Appropriate water quality control measures and BMPs would be

proposed and negotiated between Calpine and the North Coast RWQCB as a part of the permitting process.

See also responses to "Comments—Regulatory Compliance" below and "Comments—Hydrologic Monitoring Plan" at the end of this section for more information on the proposed groundwater and surface water monitoring programs.

Comments—Regulatory Compliance

AG.30 Also, the EIS/EIR asserts that the Project would be conducted in accordance with applicable regulations, guidelines, and best management practices, including those in the North Coast and Central Valley Water Quality Control Plans, but it does not provide any information to support this conclusory statement. (*Id.* at pp. 4-20, 4-33.) The EIS/EIR does not say what the Project will do to comply. Without this information, it is impossible to determine whether the Project will comply.

Further, the EIS/EIR does not identify how laws, guidelines, and regulations would mitigate any impacts to the environment. Hence, it is impossible to evaluate whether compliance with these permits will adequately mitigate the Project's impacts.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

FK.2 Starting on page 4-20. [When reading this section, they proceed to tell you of all the possibilities that could go wrong. They then tell you not to worry, there are laws that prohibit them from happening. Many of these same laws were in existence when accidents occurred at other geothermal plants, but it didn't prevent them from happening.] *(Charles F. Moss)*

Response—Regulatory Compliance

Section 2.2 of the EIS/EIR, Alternatives, Including the Proposed Action, describes the procedures that would be followed to comply with regulatory requirements. The impacts of the project are fully described in Chapter 4 of the EIS/EIR. Project compliance would be dictated by the permit conditions and requirements identified as part of the permitting process. The lead and permitting agencies would be responsible for ensuring compliance with all permit requirements. If the project did not comply with permit requirements, regulatory agencies could take a number of actions, including halting the project or imposing fines. Water use and water discharge permit schedules and scopes are described above in response to "Comments—Required Permits and Authorizations."

Once the North Coast RWQCB receives the application for a permit, a regulatory negotiation process would occur. Calpine would submit Form 200 to the State Water Resources Control Board to initially file a Report of Waste Discharge or obtain a National Pollution Discharge Elimination System permit. This standard process of "submittal and modification" could result in an approved permit. If the permit were approved, it would include a set of conditions that Calpine would fulfill in order to operate its facility. The conditions of this permit would be based on maintaining the assigned Beneficial Uses of all potentially affected water bodies identified in the North Coast RWQCB's Basin Plan. The conditions would also be in accordance with Federal law, particularly the Clean Water Act, as promulgated through the California Water Code. Storm water provisions are listed in 40 Code of Federal Regulations Section 122.26 (b)(14). The exact conditions of the permit would be determined before project construction, in consultations with the appropriate regulatory agencies.

These mitigation, or water-quality-control measures (defined in the permitting process), would include many of the measures discussed in the EIR/EIS. They would also include new Best Management Practices that would be proposed by the regulatory agency. The RWQCB would be responsible for ensuring that the permit conditions for

the proposed project would enable the State to meet the standards in the Regional Water Quality Control Plan (i.e., the Basin Plan). Calpine would not be allowed to operate without an approved permit in place. Therefore, compliance with North Coast RWQCB permitting requirements would adequately mitigate the project's impacts.

In response to the concerns raised in comment FK.2, emergencies do occasionally arise at geothermal facilities. However, for the proposed project, Calpine would have all of the necessary emergency response plans and equipment in place in order to respond quickly and efficiently in case of an emergency. The laws, guidelines, and regulations governing the geothermal industry (e.g., the GROs) were developed through legislative processes outlined to respond to historical incidents and potential future problems. While compliance with these requirements does not guarantee that there will be no accidents at the proposed project, it does greatly reduce the possibility of accidents and provides clear guidelines for a response in case of an emergency. See also response to "Comments—Well Casing Program and Potential for Casing Rupture" and responses to comments in the Human Health and Safety Section.

Comments—Underground Injection Control Program

A.25 Please note that when looking at the proposed project from the Underground Injection Control Program (UIC) regulatory point of view, this DEIS is insufficient in noting (even in general terminology) that the proper measures will be considered and implemented.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.35 The FEIS should also mention compliance with the applicable regulations pertaining to the Underground Injection Control Program of the Safe Drinking Water Act.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.59 Legal requirements governing construction, operation and closure of injection wells are documented in detail in UIC regulations at 40 CFR §§ 144, 146. The injection wells for the Proposed Action would be classified as Class V Geothermal injection wells. EPA has ultimate responsibility to ensure that the UIC regulations are being properly implemented, and would like to work with that lead agency. The FEIS should properly state the applicability of federal UIC regulations at a minimum.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

Response—Underground Injection Control Program

The Draft EIS/EIR does address the EPA Underground Injection Control (UIC) program. As stated on page 4-20 of the Draft EIS/EIR, the BLM GROs overlap somewhat with the EPA UIC program for permitting, monitoring, and ensuring proper construction and maintenance of geothermal injection wells under this program. As stated on page 4-32 of the Draft EIS/EIR, the proposed project would comply with applicable guidelines. This statement is intended to include the UIC program.

In order to address EPA comments about the UIC program, the EPA was contacted during preparation of the Final EIS/EIR to discuss the requirements of the UIC program and EPA implementation for the proposed project. Information about the UIC program was provided to the lead agencies by the EPA. The following discussion describes and clarifies information about the UIC program, and is intended to provide sufficient information in the EIS/EIR to address EPA concerns. Appropriate clarifying UIC information has also been provided in the text of the Final EIS/EIR. In addition to the UIC program, GRO #2 through #4 identify requirements for geothermal well construction, operation, monitoring, and reporting. For more information on the GROs, see the response to "Comments—Well Casing Program and Potential for Casing Rupture."

UIC Regulations: The Safe Drinking Water Act (SDWA) of 1974, as amended, requires the EPA to establish a comprehensive program that provides for the safety of our nation's drinking water. One part of this comprehensive program, the UIC program, was established to prevent contamination of underground sources of drinking water due to improper design, construction, and operation of injection wells. Through the UIC program, the EPA is charged with protecting underground sources of drinking water (USDWs) by regulating injection practices.

There are five classes of injection wells that are regulated by the UIC program. A specific well classification is made by determining the type of fluid to be injected and the geologic area into which the fluid is to be injected. Class I through IV wells are wells that inject specific types of waste materials and fluids. Class V wells are wells which do not meet the criteria listed for Classes I through IV. Generally, wells covered under the Class V classification inject non-hazardous fluids into, below, or above formations that contain underground sources of drinking water

UIC Requirements: Legal requirements governing construction, operation, and closure of injection wells are documented in detail in UIC Regulations at 40 CFR 144 and 40 CFR 146. The major areas of UIC injection well requirements for protection of water sources include:

- Mechanical integrity
- Area of review
- Confining zone and related geology
- Injection pressure limitations
- Financial responsibility

These terms and associated water protection procedures and concepts are described and discussed below.

Mechanical Integrity: Mechanical integrity is required of all injection wells before injection is allowed. Injection wells must maintain mechanical integrity throughout their time of use. An injection well must be constructed to stringent standards in order to pass the required mechanical integrity test demonstrations that are periodically performed throughout the life of the well. If a well fails mechanical integrity testing, it must either be repaired or plugged and abandoned properly. Examples of methods for demonstrating that a well has mechanical integrity include pressuring the well to the maximum permitted pressure for a length of time (with no leaks), cement bond logging (to assure that the casing has been properly cemented in the hole), and other types of logs to determine that there is no contamination of the USDWs through leaks in the casing or channels in the well bore. Mechanical integrity is the best assurance that an injection well is operating properly.

Area of Review: The area of review is used to describe the area within a prescribed radius of the proposed injection well that is scrutinized for any potential problems. Records of existing or abandoned wells are examined for their potential to serve as possible conduits between the deep injection zone to shallow, fresh water (i.e., USDWs). If these conditions exist, they must be remedied or repaired before injection can be permitted.

Confining Zone and Related Geology: The confining zone and related geology are important factors that must be considered for proposed injection wells. The confining zone is the geologic layer of earth that must be impermeable and be of sufficient thickness and strength to contain the injection zone from the USDWs. This zone must be present throughout the project area, and be located above the injection zone, but below the bottom of the USDWs. The zone must be devoid of fractures that could act as conduits to allow the injection fluid to migrate upward to contaminate USDWs.

Injection Pressure Limitations: Injection pressure limitations are initially set for every injection well permit or project area to assure that migration of injected fluids into USDWs through pressure-induced, vertical fractures does not occur. This prevents the injection pressure from overcoming the strength of the confining zones or layers that separate the injection zone from the USDWs .

Financial Responsibility: Through the UIC program, the financial responsibility is determined regarding the amount of money that the EPA would need to properly plug and abandon an injection well if the operator is unable (through bankruptcy or other event) to do so. An operator is required to establish and provide the proper funds to the EPA before injection well construction is allowed.

UIC Applicability to the Proposed Project: As discussed in comment A.59, the injection wells for the proposed Fourmile Hill project would be classified as Class V geothermal injection wells under the UIC program. Implementation of the UIC program for the proposed project would focus on the items discussed above under the heading "UIC Requirements." The UIC program would be used to verify and document that the proposed injection wells would not endanger USDWs in the area.

The BLM would provide the day-to-day regulation of geothermal development activities, including injection well drilling and completion. BLM regulation of these activities would be conducted to meet the requirements of the EPA UIC program. The BLM would be responsible for injection well monitoring and for injection well permitting. The following representative procedures would be incorporated into the BLM injection well permits for the proposed project. The exact content may be modified and adapted for the permits based on actual well and reservoir conditions, new technology, and recommendations from other agencies such as the EPA and the California Department of Conservation, Division of Oil and Gas.

Well Design Requirements: All injection wells would be required to be designed to protect fresh water. This design protection would primarily be accomplished by ensuring that the casing and cement are adequate to contain injection pressure and to contain the maximum anticipated reservoir pressure. All casing strings would be analyzed to ensure that tensile, burst, collapse, and joint strength are adequate. Metal properties would be temperature-rated in performing the design analysis. All cement that would be used must be API grade with additives (e.g., silica flour) to prevent thermal degradation. Blowout prevention equipment and procedures would be required to contain any pressures that may be encountered during drilling.

Prior to well drilling, the area of review for each injection well would be identified by the BLM, and this area would be scrutinized for any potential problems. Records of existing operating and abandoned wells would be examined to determine their

potential to serve as possible conduits between the deep injection zone and shallow, fresh water. If this possibility exists, these existing wells would be remedied or repaired before injection would be permitted. In addition, Calpine would establish and provide the proper funds to the EPA before injection well construction. This funding would ensure Calpine assumption of financial responsibility in case the EPA needs to properly plug and abandon an injection well because Calpine is unable to do so.

Since the confining zone between the injection zone (i.e., the geothermal reservoir) and the overlying groundwater aquifer has been well established, no contamination of USDW from upward migration of the injection fluid would occur. For more information about this impermeable layer that separates the geothermal reservoir from the overlying groundwater aquifer, see the response to "Comments—Separation of the Local Groundwater and the Geothermal Reservoir."

Well Drilling Requirements: A standard stipulation in all drilling permits (injection or production) for the project would be to perform a casing shoe integrity test for all casing strings run. This test would be conducted by drilling 5 to 10 feet out of the casing shoe, then applying surface pressure to obtain a pressure at the bottom of the well equivalent to 0.6 to 1.0 pounds per square inch (psi) per foot of depth. A test where the pressure is held for a period of at least 30 minutes would be considered a successful test. This testing would confirm the strength of the casing, the cement around the casing, and the formation.

Prior to drilling out of the casing shoe, the well would be pressured up to a higher pressure (usually 1,000 psi at the surface). This pressuring would be conducted in order to test the strength of the casing, and to ensure that the blowout prevention equipment is working properly.

Injection Requirements and Limitations: A maximum allowable injection pressure for the injection wells would be calculated by multiplying the surface pressure used in the casing shoe integrity test by 0.70. The injection pressure would be continuously monitored, and a violation would be issued if the pressure exceeds the maximum allowable pressure.

Periodic Inspection Requirements: Every two years, Calpine would be required to perform a mechanical integrity test. The test must be one of the following:

- **Pressure test:** Under this test, a cement plug would be placed at the casing shoe. The well would then be pressured up to check for leaks.
- **Ultrasonic logs:** This test would involve running ultrasonic logs to determine casing thickness and cement integrity.
- **Radioactive tracers:** Under this test, a radioactive dye would be placed in the injection stream. A radioactive log would then be run to detect the presence of radioactive elements that may have migrated up the hole.
- **Temperature logs:** This test would involve running temperature logs to determine where the injection fluid has been going. These logs can be very effective in geothermal operations because of the large difference in temperature between the injectate and the geothermal reservoir.

Based on actual reservoir conditions, certain methods may be better suited than others. However, all of these methods are valid and viable methods for performing mechanical integrity tests. Calpine would be allowed to select which method (or methods) to use for the mechanical integrity test. The BLM would confirm that the mechanical integrity testing method selected by Calpine provides sufficient information to evaluate the mechanical integrity of the injection wells.

Comments—North Coast RWQCB Role, Requirements, and Applicable Plans

F.11 Introduction pages 1-17 through 1-21. The summary of key issues and concerns includes mention of water quality and quantity concerns and promises that they will be addressed in Chapters 3 and 4 of the EIR/EIS. This section of the document recognizes the relevance of the North Coast RWQCB's Basin Plan. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

F.20 Section 4.3 Hydrology. This section begins with a discussion of the regulatory framework and adequately describes the role of the RWQCB. It summarizes recognition of potential significant impacts of the project and declares that mitigation measures are available to minimize or eliminate all of the potential impacts. Those mitigation measures and a program to monitor and disclose their performance will be included in the Regional Board's Waste Discharge Requirements. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

Response—North Coast RWQCB Role, Requirements, and Applicable Plans

Comments are noted. A detailed discussion of the role of the North Coast RWQCB in the permitting process, North Coast RWQCB permitting requirements, and the applicable plans of the North Coast RWQCB is contained in the response to "Comments—Required Permits and Authorizations" above.

LOCAL GROUNDWATER AND EFFECTS FROM GROUNDWATER USE

Comments—Local Groundwater Flow

A.30 This figure and Figure 3.3-4 show that the shallow groundwater table is "mounded" (i.e. has a higher elevation) in the general project area, and the regional groundwater flow direction is radially outward from this mounded region in all directions. The implications of this configuration is not explained in the DEIS, but should be addressed in the FEIS. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

HD.3 Figure 3.3-3 presents a potentiometric map of the project area and vicinity. There appears to be no basis supporting this map. The map apparently assumes that all wells in the project vicinity are screened across the same water bearing zone (this seems unlikely); boring logs and/or well construction information for these wells were not provided. *(Amanda Spencer)*

IQ.7 Groundwater and surface water flow in the Medicine Lake Highlands is indeed controlled by the highly fractured basaltic formations as described in the EIS/EIR. However, cavernous flow is also a controlling factor and one not discussed in the document. Lava tubes are common in the Medicine Lake Highlands, including one known tube system over 20 miles in length. Groundwater flow through such conduits results in surface effects similar to those found at Big Springs below McCloud, and the springs which supply the Fall River, Big Lake and Horr Pond in the Fall River Valley. The effects of the geothermal operation on subsurface flows and their interaction with surface waters are unknown. *(Phil Woodward)*

PH1.21 That's the first statement, "No data or little data exists on the ground water flow in the Medicine Lake Highland area." Sometime later it says, "Data," it says, sort of vague term, nonspecified, "supports the ground water flow goes the same direction as surface flow." And then, "Surface flow is north, so Fall River is not a problem." And in my years of schooling that's not how the scientific method goes. You collect data in the field and then you analyze it. *(Dorris Public Hearing)*

Response—Local Groundwater Flow

As stated in comment A.30, groundwater elevations around the Medicine Lake Caldera indicate that the water table is "mounded." The topography of the shallow groundwater table generally reflects the surface topography. As stated in the Draft EIS/EIR (in Table 3.3-5 and in Figure 3.3-3) and in the comment, the available groundwater elevation data indicates that groundwater flows radially outward from

the caldera. Thus, groundwater in the Fourmile Hill area flows to the northwest. No other implications can be drawn from the configuration of the groundwater.

Figures 3.4-4a through 3.4-4c provide further evidence that the flow of groundwater away from the project area would be to the north, away from the Medicine Lake caldera. Figures 3.4-4a through 3.4-4c illustrate the distribution of temperature with depth throughout the Medicine Lake Highlands. Data from temperature gradient wells were used to create these illustrations (well locations are indicated by vertical lines and identified by well number). Figure 3.4-4b shows a cross-section of water temperature with depth across the area in Figure 3.4-4a from point "A" to point "B." Figure 3.4-4c shows a similar temperature pattern for a cross-section from point "E" to point "F."

These cross-sections span a distance of 10 to 11 miles, and each section begins and ends outside of the margins of the caldera. In these figures, the surface topography is taken from USGS maps and contain no vertical exaggeration (i.e., the horizontal and vertical scales are identical). The contour lines indicate the elevation of temperature isotherms (isotherms are lines connecting points of equal temperature) below the surface to a maximum of 250°F (data for higher temperatures are proprietary).

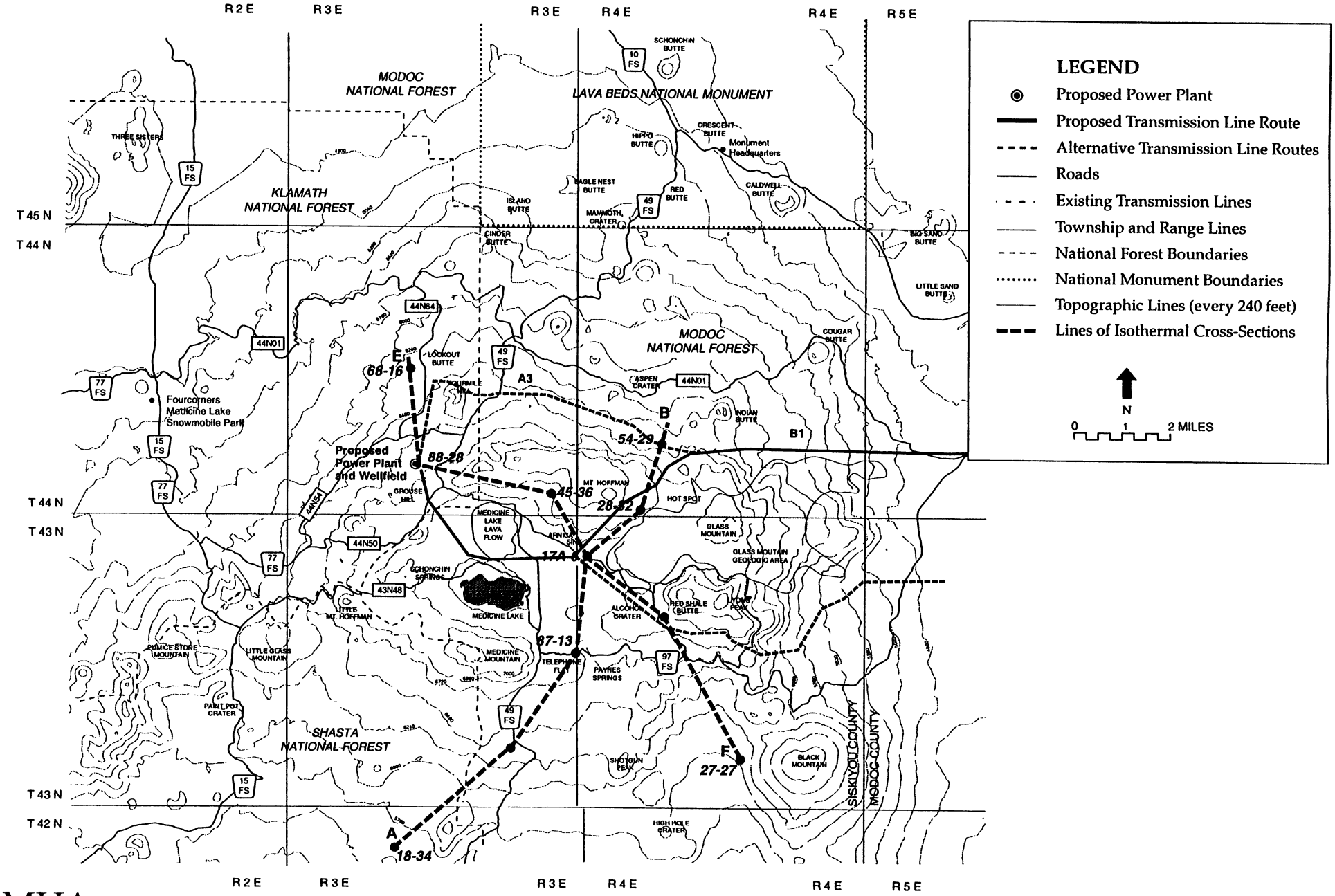
These cross sections show that elevated temperatures are found at the highest elevations and shallowest depths along the ring fracture zone, which bounds the caldera. These data further substantiate the conclusion that groundwater flows radially outward, away from the caldera. Measurements of the depth to the water table, as illustrated in Figure 3.3-3, show that the shallow water table also slopes radially outward, away from the caldera. Both sets of data indicate that the groundwater under the power plant and wellfield area flows away from the site to the north, down the topographic gradient. Thus, the groundwater flows away from the caldera.

These data also indicate that, just as the upper surface of the zone of saturated ground water slopes away from the caldera, so does the base of the zone. The high temperature gradient shown in Figures 3.4-4a through 3.4-4c demonstrates that the ground water saturated zone slopes away from the ring fracture system. See response to "Comments—Separation of Local Groundwater and the Geothermal Reservoir" below for more discussion of this issue.

To clarify the nature of the groundwater in the Medicine Lake Highlands, the second paragraph on page 3-21 of the Draft EIS/EIR has been revised as follows:

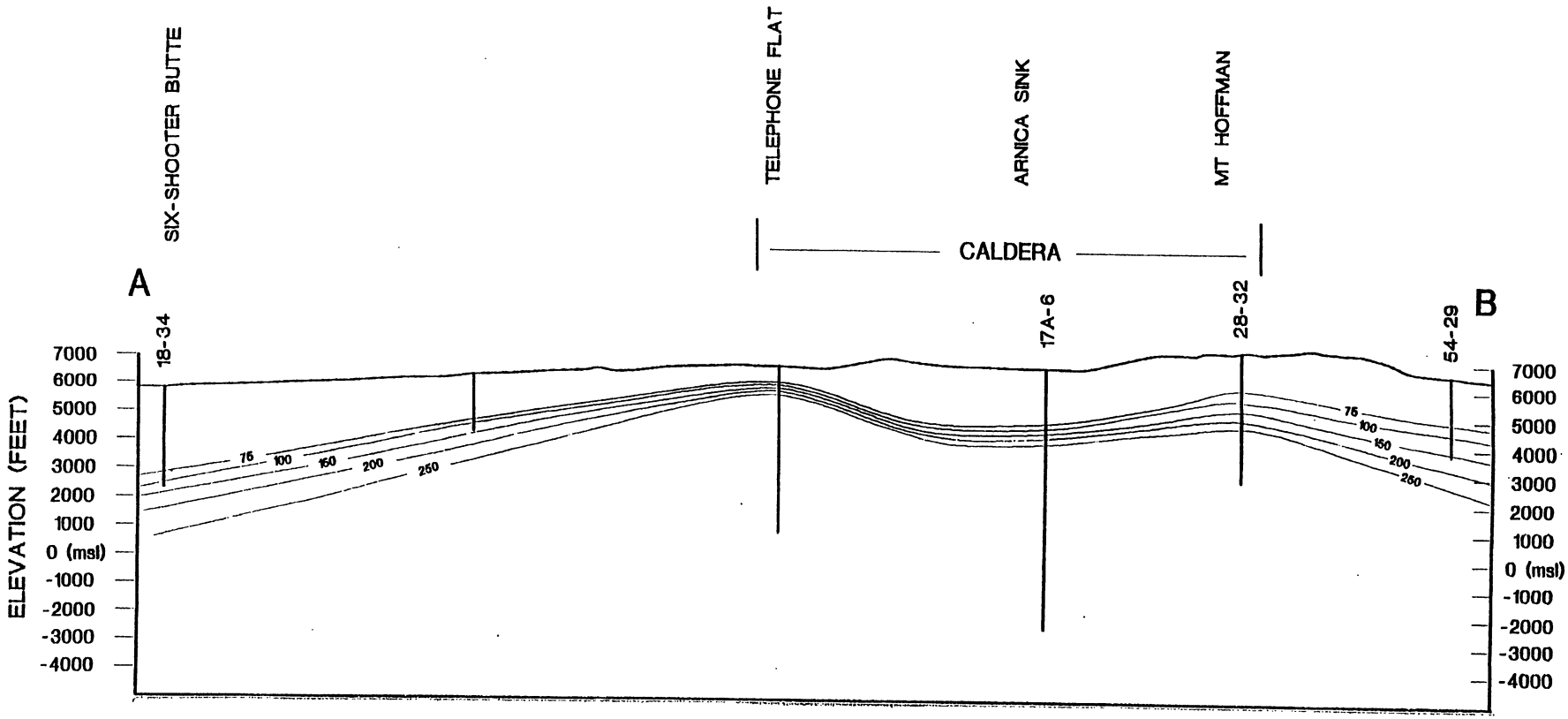
> "The base of the shallow groundwater aquifer in the Medicine Lake Highlands coincides with a thick section of impermeable rocks which underlie the lavas and cinders which comprise the aquifer. These impermeable rocks (a prominent member of which in the Fourmile Hill area is a clay-rich, ash-flow tuff) ~~is interpreted to be confined by a relatively impermeable layer of clay-rich ash flow tuffs which underlie the lavas. This layer of tuff~~ isolates the shallow groundwater system from the geothermal system (see Section 3.4, Geothermal Resources, for a more detailed discussion of this separation). Within the caldera, the lithologic sequence consists of collapsed layers of volcanic deposits and glacial deposits, bounded by a ring fracture system (Ciancanelli 1983). Shallow groundwater within the caldera is probably separated for the most part from the shallow groundwater outside the caldera by the ring fracture system."

Figure 3.4-4a: Locations of Isothermal Cross Sections



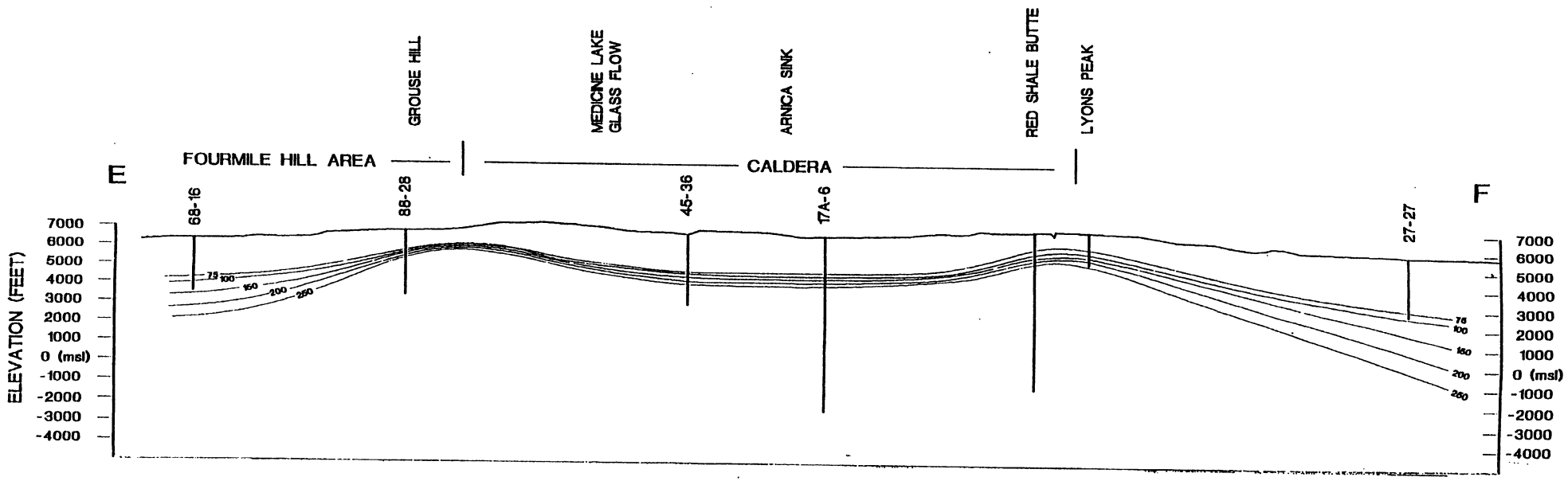
MHA *Environmental Consulting, Inc.*

Figure 3.4-4b: Distribution of Temperature with Depth through the Medicine Lake Highlands



Distribution of temperature (deg.F) with depth along Cross Section A-B, extending from northeast of Mt. Hoffman, southwest through the caldera. Names written vertically, above the section are geographic features near the line of the section.

Figure 3.4-4c: Distribution of Temperature with Depth through the Medicine Lake Highlands



Distribution of temperature (deg.F) with depth along Cross Section E-F, extending from Fourmile Hill southeast through the caldera. Names written vertically, above the section are geographic features near the line of the section.

Comment HD.3 questions the basis for Figure 3.3-3 that shows the shallow groundwater levels and estimated flow directions. The basis for this map is the data in Table 3.3-5, as revised below, which provide elevations and depths of the top of the water table in each well. Although the potential exists for separate zones to have been screened (i.e., sections of the well open to groundwater), the majority of the wells were perforated throughout the entire saturated depth. The consistency of the groundwater elevation contours as compared with topography suggests that each data point used for constructing the contour map is valid for regional groundwater elevation. Using those data from 19 temperature gradient wells, 7 water supply wells, and 6 surface springs (where groundwater contacts the surface), the hydrologist for the third-party consulting firm inferred the regional pattern of groundwater flow. Figure 3.3-3 has also been slightly modified in the Final EIS/EIR to reflect the edits to the data in Table 3.3-5.

See also response to "Comments—Effects to Fall River Springs" below for more discussion on the potential effects to the springs at Fall River.

Comment IQ.7 states that surface water and groundwater flow through lava tubes was not discussed in the Draft EIS/EIR. It is recognized that lava tubes exist in the Medicine Lake area. These features represent old lava flows where the upper portion (roof) of the flow cooled sufficiently for it to become solid. When the lava stopped flowing, the roof remained intact, leaving a tunnel or open tube within the lava. These lava tubes occur in a number of areas in the vicinity of Medicine Lake associated with very recent basaltic lava flows such as those within the Lava Beds National Monument and the flow exiting High Hole Crater.

In general, these lava tubes are very shallow features, developing only within 100 feet below the surface. At greater depths and with time, tubes will often collapse due to the overlying lithostatic pressure. For these reasons, these lava tubes generally do not play an important role in groundwater flow. In many areas around Medicine Lake the tubes only occur above the water table. Where collapsed tubes do exist below the water table they permit shallow groundwater to flow at increased rates, acting much like the characteristic rubble zones between lava flow units. While these features may affect shallow groundwater flow rates locally, their limited depth and extent will not have any effect on development of the geothermal resource. Within the Medicine Lake area, lava tubes cover only a limited area and do not substantially alter the shallow groundwater flow pattern; lava tubes only increase groundwater flow velocities.

Table 3.3-5: Shallow Groundwater Data

Well	Depth to Water (ft)	Elevation of Water (ft msl) [1]	Groundwater Interval[4] Depth (ft)	Elevation (ft msl)	Date Measured
Water Supply Wells					
45N/4E-28aaa	658	3912	709-758	3861-3812	9/17/92
43N/2E-14acd	3	6336	0-4.7	6339-6334	9/16/92
43N/3E-10bda	12	6776	no data	no data	9/15/92
43N/3E-11ddd	7	6693	0-13.8	6700-6686	9/16/92
43N/3E-11dcd	137	6623	no data	?-6588	9/16/92
43N/3E-12bbc	179	6621	180-220	6620-6580	9/15/92
43N/4E-6ccbc	98	6619	?-535?	?-6182	9/16/92
Active Temperature Gradient Well					
88-28	800	6110	800-1060	6110-5850	9/94-10/94
Abandoned Temperature Gradient Wells					
68-16 [2]	740	5620	740-2170	5620-4190	7/84-12/84
36-28 [2]	765	5915	765-1440	5915-5240	7/84-12/84
75-6	810	5870	810-1560	5870-5120	7/84-12/84
86-23	1180	4852	1180-2700	4852-3332	7/84-12/84
52-4	1363	4197	1363-2840	4197-2720	7/84-12/84
54-19	1020	5180	1020-2025	5180-4175	7/84-12/84
65-26	1570	4830	1570-1750~~2240~~	4830?-4670~~4160~~	7/84-12/84
57-13	710	5440	710-2020	5440-4130	7/84-12/84
44-33	900	6040	900-970~~990~~	6040-5970~~6040~~	7/84-12/84
45-36	800[3]	6155	800-1665	6155-5290	10/83
28-32	953[3]	6272	953-1453	6272-5790	7/84
56-3	725[3]	5995	725-1845	5995-4875	9/82
17-6	789[3]	6081	789-1845	6081-4660	11/82
84-17	613[3]	6337	613-1000	6337-5950	10/82
87-13	347[3]	6508	347-675	6508-6180	9/82
62-21	920-1160	5440-5680	920-1220	5680-5380	7/84-12/84
52-30	813[3]	5507	no data	no data	7/83
18-34	1010-1340	4460-4790	1010-2800	4790-3000	7/84-12/84
27-27	1300-1840	3975-4515	1300-2470	4515-3975	7/84-12/84

Notes:

1 Groundwater elevation data were obtained from selected temperature gradient wells prior to well abandonment. The lower section of the geothermal wells were sealed using cement and then the upper portion perforated in the upper shallow groundwater zone. (Beall 1996, pers. com.). Groundwater elevations were calculated from fluid pressure surveys run in each well. In most cases the pressure survey profiles were sufficiently consistent to allow projection of zero pressure conditions (i.e. top of groundwater in well). In some wells, estimation of zero pressure was less reliable due to non-linear pressure survey profiles. These less certain groundwater elevations are shown as ranges.

2 Located within Calpine's Fourmile Hill leases.

3 Estimated from driller's reports. Below this level, water was always encountered when lowering drilling equipment into wellbore (Beall 1997).

4 Lower limit of shallow water table assumed to coincide with a measured temperature of 90° F.

SOURCES: Schneider and McFarland 1996; Calpine 1985; Beall 1997

Comments—Calculation of Groundwater Recharge

AG.24 A project may be deemed to have a significant effect on the environment if it will substantially degrade or deplete groundwater resources or interfere with groundwater recharge. (CEQA Guidelines, App. G(h)-(i).) The EIS/EIR understates the Project's impact on groundwater supplies and overlooks significant impacts, as discussed in the attached comments of Dr. Fox. (Ex. A, comment 9.)

The Project could significantly affect the groundwater supply by totally eliminating local recharge, by reducing recharge in the Arnica Sink and by reducing recharge at the project site. (*Ibid.*) According to the standard of significance in the EIS/EIR, these are significant impacts that must be mitigated. (EIS/EIR, p. 4-21.) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.237 Water Use Would Significantly Reduce Recharge. The Project would use 21.3 million gallons ("MG") of groundwater during the three year construction period (DEIR, p. 4-22 and Table 4.3-1) and a maximum of about 1.45 million gallons of groundwater per year ("MG/yr") during operation. (DEIR, p. 4-25.) The water would be pumped from an existing well at Arnica Sink during the first year of construction (DEIR, p. 4-22) and thereafter from a well drilled into the shallow aquifer on Calpine's Fourmile Hill leases and supplemented as needed by water from Arnica Sink or other sources. (DEIR, p. 4-24.)

The DEIR evaluates the impact of this proposed water use by estimating the reduction in groundwater recharge. (DEIR, pp. 4-22 to 4-26.) Impacts were judged to be significant if pumping substantially depleted groundwater resources or interfered with groundwater recharge. (DEIR, p. 4-21.) These analyses are flawed because the DEIR uses the wrong methodology and the wrong value for the annual evaporation rate.

The Recharge Analyses Are Flawed

The DEIR estimated recharge by assuming that 50 percent of all precipitation is recharged and that the balance of the precipitation is evaporated. No reference is provided for this assumption. (DEIR, p. 4-22.) This is not the correct method for calculating recharge. Recharge is calculated from a water balance as follows:

$$G = P - R - ET$$

where G is groundwater recharge, P is precipitation, R is runoff, and ET is evapotranspiration.[1] Failure to use the proper methodology understates the significance of the impact.

First, the DEIR's calculation assumes that runoff is zero. While the volcanic soils in the area are porous, runoff would not be zero. The DEIR identified several intermittent streams in the area from maps. (DEIR, pp. 3-28, 3-29.) Although no flow data are available, these and potentially other unidentified intermittent steams carry substantial amounts of runoff water during snowmelt and intense summer storms.[2]

Second, the DEIR assumes that evaporation in the Project area was 50 percent of annual precipitation, or about 15 inches per year ("in/yr"), because this is allegedly "a typical evaporation rate for areas with similar climate and vegetation." No support is provided for this assumption. (DEIR, p. 4-22 *et seq.*) However, potential evaporation in the area is actually about 50 in/yr, or over three times higher. Evapotranspiration from the types of vegetation in the Project area is much higher than 15 in/yr. Finally, the type of vegetation currently present is irrelevant because this vegetation will be removed during the first year of site development. (DEIR, pp. 2-34, 4-85.)

The Central Valley Regional Water Quality Control Board ("CVRWQCB"), which has issued waste discharge requirements for exploration and testing in the Glass Mountain KGRA where the Project is located, states that the evaporation rate in the Project area is 50 in/yr.[3] In addition, the California Department of Water Resources ("DWR") has measured evaporation at six stations in the general area for up to 16 years, including one station at Alturas, two stations on Davis Creek, one station at Clear Lake Dam, and two stations at Tule Lake. The evaporation rate at these stations ranges from 36.5 to 67.6 in/yr and averages 50.1 in/yr.[4]

Although all of the precipitation that falls in the area could potentially be evaporated because the evaporation rate (50 in/yr) is higher than precipitation (30 in/yr), some precipitation could escape evaporation because it would infiltrate beneath the root zone before it is evaporated or transpired by

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[1] D.R. Maidment, Handbook of Hydrology, McGraw-Hill, Inc., 1993, p. 15-5; V.T. Chow, Handbook of Applied Hydrology, McGraw-Hill Book Co., 1964, p. 11-1.

[2] U.S. Forest Service, Land and Resource Management Plan, Modoc National Forest, 1991, p. 4-211.

[3] CVRWQCB, Waste Discharge Requirements for California Energy General Corporation and U.S. Department of Agriculture, Forest Service, Glass Mountain Geothermal Unit, Siskiyou County, Order No. 95-199, August 17, 1995, p. 2, Finding #6.

[4] California Department of Water Resources, Evaporation from Water Surfaces in California, Bulletin 73-79, November 1979, pp. 32, 33, 76.

plants. This could occur during the winter and spring, when evapotranspiration and evaporation are low because some of the snowmelt infiltrates into the ground beneath the snowpack and during snowmelt. However, a study in an adjacent groundwater basin found that "[m]uch of the water from rain and melted snow that is absorbed by the soil is later returned to the atmosphere by evaporation or is consumed by vegetation."[5] There is no evidence to the contrary for the study area.

Finally, evapotranspiration rates for the types of the vegetation in the study area are higher than the evaporation rate assumed in the DEIR. The predominant vegetation communities in the Project area are lodgepole pine forest, mixed conifer forest, and red fir forest. (DEIR, p. 4-85.) A water balance study in mixed conifer forest with permeable soils[6] indicates that 76 percent of the total annual precipitation is evapotranspired, with the balance lost to surface runoff and recharge. In the Project area, this would be about 28 in/yr. Measurements of evapotranspiration for pine forests indicate that the evapotranspiration rate is 31.2 for an average stand of lodgepole pine[7] and ranges from 12.3 to 39.2 in/yr for Scotch pines (*Pinus sylvestris*).[8] The average evapotranspiration rate for these two studies is 29 in/yr.[9] If precipitation is 30 in/yr, then about 97 percent of the annual precipitation could be evapotranspired by local vegetation, not the 50 percent assumed by the DEIR. This is consistent with a water balance study on a lodgepole pine forest in Medicine Bow Mountains in Wyoming which found that up to 95 percent of the precipitation was evapotranspired.[10] In another study, it was found that evapotranspiration in stands of Douglas fir was 80 percent of the evaporation rate from a free water surface.[11]

In sum, the DEIR overestimates the amount of recharge that would occur in the Project area by underestimating evaporation and omitting surface runoff. Because the Project impact is estimated as the percent of the total recharge that is pumped, the DEIR underestimates the impact of groundwater pumping on recharge. As discussed below, these impacts are significant.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Calculation of Groundwater Recharge

The comments claim that the potential effects of the proposed project on groundwater recharge have been underestimated and as a result, the project could significantly affect groundwater resources. This claim is based on the conclusions in comment AG.237 that the Draft EIS/EIR:

- Incorrectly assumes that runoff is zero, and
- Underestimates evapotranspiration

Estimating groundwater recharge rates for any area requires a complex calculation using a large number of site-specific parameters. In its very simplest, conceptual form, groundwater recharge can be expressed as:

$$G = P - R - ET$$

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[5] P.R. Wood, Geology and Groundwater Features of the Butte Valley Region, Siskiyou County, California, USGS Water-Supply Paper 1491, 1960, p. 58.

[6] P. Greminger, Physical and Ecological Studies on the Water Flow Pattern in a Fairly Permeable Soil on a Slope Under Vegetation, Eidgenoessische Anstalt Fuer das Forstliche Versuchswesen Mitteilungen, v. 60, no. 2, 1984, pp. 151-301.

[7] D.H. Knight, T.J. Fahey, S.W. Running, A.T. Harrison, and L.L. Wallace, Transpiration from 100-yr-old Lodgepole Pine Forests Estimated with Whole-Tree Potometers, Ecology, v. 62, no. 3, 1981, pp. 717-726. This paper reports an average daily evaporation rate of 0.33 cm/day for an average stand. Assuming an 8 month growing season from March to October, the total annual evapotranspiration rate would be (0.33 in/day)(240 days)/(2.54 cm/in) = 31.2 in/yr.

[8] M.R. Petersen and R.W. Hill, Evapotranspiration of Small Conifers, Journal of Irrigation and Drainage Engineering, v. 111, no. 4, 1985, pp. 341-351. The evapotranspiration rate measured in three separate lysimeters was 39.2, 32.4, and 12.3 in/yr.

[9] The average measured evapotranspiration rate for pines is (31.2 + 39.2 + 32.4 + 12.3)/4 = 28.8 in/yr.

[10] D.H. Knight, T.J. Fahey, and S.W. Running, Water and Nutrient Outflow from Contrasting Lodgepole Pine Forests in Wyoming, Ecological Monographs, v. 55, no. 1, 1985, pp. 29-48.

[11] T.A. Black, Evapotranspiration of Douglas Fir Stands Exposed to Soil Water Deficit, Water Resources Research, v. 15, no. 1, 1979, pp. 164-171.

where G = groundwater recharge, P = precipitation, R = runoff, and ET = evapotranspiration.

In most areas, P is the only parameter known to any degree of confidence. The remaining two parameters, R and ET, can usually only be approximated. At Medicine Lake, R is assumed to be very small compared to ET because of the nature of the soils. As discussed in Section 3.2, Geology and Soils, the soils in the project area are very porous. As a result, there are almost no creeks or streams in the area. Almost all precipitation that falls in the Medicine Lake Highlands enters the ground as groundwater rather than as runoff into streams and lakes. Thus it is reasonable to assume in the Draft EIS/EIR that surface runoff equals zero.

When no site specific data are available, it is common to estimate a combined value for ET and R using other areas with similar hydrologic conditions. When this is done recharge values for groundwater basins can be expressed simply as a proportion or percentage of precipitation. This approach recognizes that precipitation values have a significantly higher level of confidence than other parameters in the calculation. In particular, the ET value is extremely site-specific and dependent on a large number of parameters, few of which are known.

Comment AG.237 questions the source and accuracy of the estimate of evapotranspiration that is presented in the Draft EIS/EIR. The Draft EIS/EIR estimated values for evapotranspiration/surface runoff at 50 percent of precipitation, or 15 inches per year. This was based on data from several sources. The primary data source was Sammel and Craig (1983) who calculated the water budget for the Newberry Crater in Oregon. Newberry Crater has a very similar geologic and volcanic setting to Medicine Lake:

- Precipitation is 35 inches at Newberry, compared to 30 inches at Medicine Lake
- Surface soils are at both sites are composed of recent, highly permeable volcanic material of almost identical composition
- Both areas have calderas with caldera lakes at approximately the same elevation

Evapotranspiration at Newberry was estimated by Sammel and Craig to be 13.1 inches per year using calculations made by J.E. Vaughn of the USFS. The calculation was made using the potential evaporation equation of Hamon (1961). The Sammel and Craig estimate of ET was 37 percent of total precipitation in the Newberry area. The Fourmile Hill Draft EIS/EIR estimate provided a margin of error for surface runoff and used an ET value of 50 percent of total precipitation for the Medicine Lake area. The same ET estimate (13.1 inches per year) was used by Sammel and Benson (1987) for the eastern flank of Crater Lake, Oregon as part of an analysis to evaluate the possible impact of geothermal drilling on hydrology and water quality of the lake.

Independent confirmation of the estimate of ET in the Draft EIS/EIR has been provided by Bredehoeft (1997) and Weiss Associates (1997). Bredehoeft estimated that only 40 percent of precipitation is evapotranspired in the area between Medicine Lake and the Fall River springs. This lower estimate was required because of the high spring flow rates at the Fall River springs. However, Bredehoeft did recognize that the ET value was lower than normal because of the high permeability of the volcanic rocks. Weiss

Associates (1997), using proprietary data from CalEnergy, estimated an ET rate for the Medicine Lake caldera of 14 inches per year.

A USGS specialist in ET measurement and processes further supported the estimates of ET presented in the Draft EIS/EIR (David Stanard, USGS, personal communication). Without benefit of knowledge of the site, Stanard suggested that ET rates between 33 percent and 67 percent of precipitation would be expected from areas with a low water table and highly permeable soils, even in areas that were Forested.

Comment AG.237 presents an estimate of ET of 29 inches per year for the Medicine Lake area. This estimate is almost twice the estimate of 15 inches per year that is presented in the Draft EIS/EIR. The estimate of ET presented in comment AG.237 was derived by averaging ranges of ET rates that were reported for lodgepole and Scotch pine Forest types. The method used in comment AG.237 to derive this estimate of ET is inappropriate because:

- It fails to use any specific data from the Medicine Lake area or similar areas where many of the parameters effecting ET are non-standard, such as high soil permeability due to recent volcanism. Most of the values used in the Comment estimation come from lodgepole pine forests in Wyoming.
- Using lower and upper values of ranges is not a statistically sound technique for calculating an average.
- The actual numbers used are erroneous.

The following example illustrates why the numbers used in comment AG.237 are erroneous. A value of 31.2 inches per year was calculated in comment AG.237 using a daily estimate of transpiration from Knight et al. (1981). This calculated value was then used, with others, to estimate a value of 29 inches per year for evapotranspiration in the Medicine Lake area. However the daily rate cited in that particular paper is 0.33 cm/day for a clear day maximum in June or early July in Wyoming. It is inappropriate to then use this maximum daily rate in mid summer for a complete eight-month growing season, as was done in comment AG.237. Furthermore Knight et al. (1981, p. 724) states:

> "Partly because of late summer stomatal closure we have not attempted to extrapolate to seasonal and annual transpiration estimates. Too many assumptions would be required. We know that nighttime frost inhibits transpiration and that transpiration is reduced to nearly zero in rainstorms and by 40 percent on overcast days, but other required information is still insufficient...."

Thus, the value of 29 inches per year suggested by comment AG.237 is unreasonable because it was calculated using erroneous data and has been extrapolated to seasonal levels against the recommendation of the referenced authors.

Comment AG.24 includes the assertion that the project could totally eliminate local recharge by reducing recharge in the Arnica Sink. As discussed in response to "Comments—Potential Groundwater Depletion at Arnica Sink from Groundwater Use" below, the project would not significantly affect local recharge by reducing recharge at Arnica Sink.

References:

Bredehoeft, J. 1997. *Potential Impacts of Fourmile Hill Geothermal Development on Springs of the Fall River*. Report prepared by the Hydrodynamics Group for Peter Stent. August.

Hamon, W. 1961. Estimating potential evapotranspiration. *Journal of Hydraulics* 87:107-120.

Knight, D. H., T. J. Fahey, S. W. Running, A. T. Harrison, and L. L. Wallace. 1981. Transpiration from 100-yr-old lodgepole pine forests estimated with whole-tree potometers. *Ecology* 62:717-726.

Sammel, E. A., and R. W. Craig. 1983. Hydrology of the Newberry Volcano Caldera, Oregon. U. S. Geological Survey Water Resources Investigation, Report 83-4091.

Sammel, E., and S. Benson. 1987. An analysis of the hydrologic effects of proposed test drilling in the Winema National Forest, near Crater Lake, OR. Geothermal Resources Council Annual Meeting, Sparks, NV. October, 1987.

Weiss Associates. 1997. *Baseline Hydrology Evaluation Report for Telephone Flat Geothermal Project, Medicine Lake, California*. Prepared for CalEnergy Company, Omaha, NE.

Comments—Potential Groundwater Depletion at Arnica Sink from Groundwater Use

AG.238 The Project Would Significantly Reduce Recharge In Arnica Sink. The Project would pump 6.9 MG[12] of water from an existing well in Arnica Sink during the first year of construction. According to the Forest Service, this well is actually south of Arnica Sink, in a lodgepole pine forest.[13] The DEIR estimates that recharge in the Arnica Sink area is 80 MG/yr, assuming that 50 percent of the annual precipitation of 30 in/yr falling on the 200-acre Sink is evaporated.[14] Because the Project would use only about 8.5 percent of the estimated recharge, the DEIR concludes that the impact is not significant. (DEIR, p. 4-22.)

The DEIR's calculations overestimate recharge by assuming that only one-half of the precipitation is evaporated. In fact, as demonstrated above, the potential evaporation rate in the area is greater than precipitation. Therefore, essentially all of the precipitation falling in the Arnica Sink could potentially be evaporated, depending upon its timing, ground cover, and climate. Thus, unless there are substantial subsurface flows into the area, for which there is no evidence, Project pumping would not be replenished and the groundwater table would decline.

The presence of vegetation would reduce potential evaporation through canopy shading and other physical modifications of the ground surface. According to the DEIR, the vegetation in the Arnica Sink area is lodgepole pine forest and herbaceous cover. (DEIR, Fig. 3.7-2, p. 3-84.) The Forest Service indicates that the Sink itself is a large barren pumice flat that is about 40 acres in size and barren except for scattered forbes, grasses, and other herbaceous vegetation. The surrounding area, where the well is located, is lodgepole pine forest. (Reed 9/23/97.) The average evapotranspiration rate for lodgepole pine forest, as discussed above, is 29 in/yr. Conservatively assuming that there is no runoff, the recharge would be 5.4 MG.[15] Therefore, groundwater pumping during the first year of construction would remove essentially all of the local recharge and draw down the water table.

Either of these scenarios would more than offset local recharge. This is a significant impact based on the significance criteria in the DEIR. (DEIR, p. 4-21.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.240 In sum, the impact of first year pumping from the Arnica Sink well is significant and must be mitigated. A possible mitigation measure would be to require that the first year construction water supply be obtained from an on-site well that is hydraulically isolated from the Medicine Lake area. Although the local water table would still decline, other water supply wells would be at greater distances and drawdown impacts would probably be less severe. Further, other local mitigation measures, as discussed below, could be implemented.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

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[12] The DEIR states that the amount pumped is 6.6 MG in the second paragraph on page 4-22, 6.9 MG in the third paragraph on page 4-22, and 6.9 MG in Table 4.3-1. I have assumed that 6.9 MG is the correct value.

[13] Personal communication, Brad Reed, District Resource Officer, Doublehead Ranger District, Tulelake, CA (916-667-2246), September 22, 1997.

[14] DEIR Recharge = (200 ac)(30 in/yr)(ft/12 in)(3.259×10^5 gal/ac-ft) = 81.5 MG/yr.

[15] Revised Recharge in Arnica Sink = (200 ac)(30-29) in/yr)(ft/12 in)(3.259×10^5 gal/ac-ft) = 5.4 MG/yr.

FP.12 Section 2 of the Draft EIS/ER states that 10,000 gpd of water would be needed for dust suppression, 90,000 gpd of water would be needed for the cooling tower, 20,000 gpd of water would be needed for well drilling (a 30-45 day process) and over 1,000,000 gallons of water would be needed in the cooling tower to start the process (over 6.9 million gallons of water per year during construction). Approximately 8.5 million gallons would be required during the peak of construction in the third year. This is an incredible amount of water! The majority of water will be taken from the well drilled at Arnica Sink; however, some water is proposed to be "trucked in".

Table S-5 states that the project will have a "less than significant effect" on water quantity ("effects of water use"). This just seems hard to believe that removing this much water per day will not have any effect on an area in the Semi Arid west! California recently recovered from a five-year drought. The Medicine Lake water table was greatly affected by this drought along with many domestic water systems going completely dry. Will there be any safeguards for water users (cabin owners and recreation) if another drought occurs? Please include a discussion in the Final EIS/EIR for water usage during a drought period and any proposed mitigation for water users of the area. Also, please provide further information to Section 2-31 regarding the source of the water that will be "trucked in".

(Eric T. Nelson and Amanda Spencer)

GP.7 It will consume over 1 million gallons of water from a publicly owned well at Arnica Seep - for a private entity. *(Fred L. Rinne)*

PH3.100 And where are they going to get this water for their construction and for road, for dust and for just all facets of this construction period? *(Yreka Public Hearing)*

PH3.101 I am just interested in the water that is coming out of the well. *(Yreka Public Hearing)*

PH3.102 The Arnica sink well that could go up on the Medicine Lake aquifer, and how much water is going to be required for all of your road maintenance and your building? *(Yreka Public Hearing)*

Response—Potential Groundwater Depletion at Arnica Sink from Groundwater Use

The calculation of recharge volumes to the immediate area of Arnica Sink was presented to provide the reader of the Draft EIS/EIR with a conceptual approximation of the amount of groundwater usage as a proportion of total groundwater recharge over an easily recognizable topographic feature (Arnica Sink). However, Arnica Sink is not a separate groundwater basin. Arnica Sink is a part of the shallow groundwater system that underlies the complete Medicine Lake caldera. Any pumping from the Arnica Sink well would therefore extract groundwater from this shallow groundwater system and not from an area confined to beneath Arnica Sink itself. Any discussion of groundwater depletion must include recharge from the complete Medicine Lake caldera.

The area of the caldera is approximately 7 miles by 4 miles, with a total size of 17,920 acres. Using an annual recharge rate of 15 inches per year, total recharge to the caldera would be 7.13 billion gallons per year. This recharge would be from precipitation alone, without considering any seepage from the lake. The estimated water usage from the Arnica Sink well during the first year of the proposed project is approximately 6.9 million gallons. This represent only 0.096 percent of the total recharge to the groundwater system from precipitation. This reduction in groundwater would not represent a significant impact.

During the pumping of any well, water levels will be lowered in the immediate vicinity of the well. This area is known as the "cone of depression" and its extent is dependent on the properties of the individual aquifer. Following a period of pumping, groundwater levels in any individual well will normally return to their approximate levels before pumping. This return in water level is a result of lateral flow from the aquifer and vertical infiltration, assuming that pumping rates have not exceeded natural recharge. Given the permeable nature of the volcanic rocks in the caldera, it is probable that groundwater levels would re-equilibrate rapidly following the cessation of pumping. Wells in similar geologic environments have equilibrated in just a few days.

The water well at Arnica Sink has been used in the past to support geothermal drilling within the caldera. Although detailed extraction volumes are not available, no significant impacts resulting from the use of this well have been recorded.

Comments AG.238 and AG.240 claim that the Draft EIS/EIR overestimated the rates of groundwater recharge and that groundwater depletion would be significant in the Arnica Sink area. See response to "Comments—Calculation of Groundwater Recharge" above for a discussion of this issue. As stated above, groundwater depletion would not be significant because recharge would not be limited to the Arnica Sink area.

Comment AG.238 also claims that all of the precipitation falling in the Arnica Sink could potentially be evaporated. This claim is inaccurate because most of the precipitation in the Medicine Lake Highlands falls as snow in the winter. As a result, the snow accumulates over the winter. Much of the snow melts during the spring (some of it does evaporate) and either percolates into the soil as groundwater or enter the few creeks and streams in the area as surface runoff. Because of the climatic conditions in the area, 50 percent is a reasonable value for the evaporation rate; 100 percent is not.

In response to comments PH3.100 through PH3.103, the amount of water from Arnica Sink that would be used by the project is summarized in Table 4.3-1 on page 4-23 of the Draft EIS/EIR.

Comment—Potential Groundwater Depletion at Project Site from Groundwater Use

AG.241 The Project Would Significantly Reduce Recharge At The Project Site. The Project would pump 5.9 MG of water during the second year of construction and 8.5 MG of water during the third year of construction. Thereafter, the Project would pump 650,000 gal/yr for domestic purposes and 800,000 gal/yr every second year for drilling of one infill production well. All of this water would be pumped from an unlocated well on the Calpine lease. (DEIR, p. 4-24, 4-25.) Over the 45 year life of the Project, a total of 58 MG of water would be extracted from the shallow groundwater basin in the Mt. Dome/Klamath Lake basin where the Project is located.[16]

The DEIR concludes that this is not a significant impact because it represents a small percent of the total recharge in the Mt. Dome/Klamath Lake groundwater basin. However, the DEIR fails to quantify the total basin recharge. Therefore, it is not possible to determine the actual percentage of the total recharge that would be withdrawn and to evaluate its significance.

The DEIR argues instead that at most, the recharge from only 21 acres would be required to supply 8.5 MG of water, assuming that 50 percent of all precipitation is recharged and the balance is evaporated. This is wrong because it uses the wrong evaporation rate and it assumes that the Project site is forested. The location of the proposed well is unknown. However, assuming the area that supplies the recharge is forested with pine, the evapotranspiration rate for pine forest is 29 in/yr, not 15 in/yr as assumed in the DEIR analysis. Repeating the DEIR's analysis using 29 in/yr yields 313 acres,[17] or about 15 times more area than calculated in the DEIR. This is a large area and represents a significant impact.

However, the Project site itself where the well would probably be located, would not be forested at all. Construction of the Project would eliminate vegetation on the Project site during the first year of construction. (DEIR, p. 2-34.) The DEIR indicates that 177.3 acres at the power plant and well site would be altered by the removal of vegetation and soils, compaction of earth material, paving, and construction of buildings. (DEIR, p. 4-28.) This would increase rates and/or quantities of surface runoff. (DEIR, p. 4-27.) The surface runoff from these alterations would be stored in well pad sumps or injected into the geothermal system. Snow would be placed directly into the cooling tower basin, be allowed to melt, and piped with the injection fluids into the geothermal reservoir. (DEIR, p. 2-35.) Therefore, much of the precipitation that may have recharged the groundwater at the site prior to development, if any, would be

[16] Total groundwater pumped from Calpine well = (650,000 gal/yr)(42 yr) + (800,000 gal/yr)(21 yrs) + 5,900,000 gal + 8,500,000 gal = 58.5 MG.

[17] Recharge area required to supply 8.5 MG of water annually = $(8.5 \times 10^6$ gal/yr)/[$(3.259 \times 10^5$ gal/ac-ft)(30-29 in/yr)(ft/12 in)] = 313 ac.

captured and removed from the system by injection into the geothermal system or by evaporation from the cooling tower and sumps. Thus, the 62 MG of water pumped from the Calpine well would not be replenished by local recharge and would result in lowering the water table. This is a significant impact.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

PH3.99 And I am concerned about the amount of water that these power plants are going to use.
(Yreka Public Hearing)

PH4.10 The project would use too much water. *(Mount Shasta Public Hearing)*

Response—Potential Groundwater Depletion at Project Site from Groundwater Use

The Draft EIS/EIR concludes on pages 4-24 and 4-25 that water withdrawals from well(s) on Calpine's lease area would not significantly deplete groundwater in the project area. This conclusion is based on the comparison between the total land area within the groundwater recharge basin with the land area required to recharge the amount of water projected to be used by the proposed project. As stated in the Final EIS/EIR, during construction, the proposed project is expected to withdraw up to 10 million gallons of water per year (maximum water withdrawal from Calpine's wells would occur during the third year of construction).

Given the assumptions stated in the Draft EIS/EIR, approximately 25 acres is required to recharge this amount of water. The Mt. Dome/Klamath hydrologic basin is over 50,000 acres in size. However, it is approximately one mile up-gradient to the edge of this basin. Thus, the portion of the basin that provides recharge to the project site can be estimated conservatively as approximately 0.5 square mile (1.0 mile X 0.5 miles), or 320 acres. Project "use" of 25 acres of this recharge area, or approximately 8 percent of the recharge area up-gradient of the site, would not be a significant impact.

The comment questions the assumption in the Draft EIS/EIR that evaporation is 50 percent of precipitation and suggests 29 inches per year (97 percent) instead. The response to "Comments—Calculation of Groundwater Recharge" explains why the values of groundwater recharge rates stated in the Draft EIS/EIR are accurate. The value of 29 inches per year cited in the comment is incorrect. Recharge comes not only from the project site but from an area up-gradient of the project site.

The value of 313 acres required for recharge appears to be a miscalculation. According to the equation provided in the comment (footnote 17), the correct value is 11 acres (assuming evaporation of 29 inches/yr). Even if an area of 11 acres (or even 313 acres) were required for recharge, as suggested in the comment, there would still be sufficient recharge available up-gradient of the project site to supply the project site.

The total recharge to the Mt. Dome/Klamath Lake Hydrologic subarea was not calculated because its aerial extent is significantly greater than that required to supply a source of water for the project The subarea extends from Medicine Lake to the Oregon border, a distance of at least 20 miles.

The comment also questions whether the recharge zone up-gradient of the project site would be forested. The calculation of the recharge zone available to the aquifer at the project site was based on the distance from the southern edge of the project site to the boundary of the hydrologic basin. This distance is approximately one mile. Thus, the value of 320 acres does not include the "recharge area" of the project site, which would be cleared of vegetation. If Calpine locates its groundwater wells on the project site or to

the north of the project site, the groundwater recharge area to those wells would be greater than 320 acres and impacts from the proposed project would be reduced.

Comments—Potential Effect of Groundwater Use on Nearby Groundwater Wells

AG.239 In addition, Project pumping could potentially lower water levels in nearby wells. According to the Forest Service, there is a second water supply well about 300 ft from the Calpine well which is used by geothermal companies for exploratory drilling and by the Forest Service and others for road watering. (Reed 9/23/97.) Further, there are four other nearby wells within about 1 mi of the Sink. (DEIR, Fig. 3.3-3, Wells 11-14.) Therefore, pumping during the first year of construction could adversely affect the yield of nearby wells and/or increase pumping costs. This is also a significant impact that is not discussed in the DEIR. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

EZ.1 The unknown factor of exactly where the underground waters go. How far away might someone lose their well water.

The U.S. geological survey determined with the use of blue dye. In the water of Crater Lake, Oregon. The dyed water came out in springs of Fall River Valley. Crater Lake Oregon is a long way from here. But Medicine Lake is very near. *(Joan McDermos)*

FZ.3 And when the wells run dry (as is happening here) what will happen to this once pristine environment. *(Katherine Petterson)*

Response—Potential Effect of Groundwater Use on Nearby Groundwater Wells

As stated in the response to "Comments—Potential Groundwater Depletion at the Project Site from Groundwater Use" above, the Draft EIS/EIR concludes on pages 4-24 and 4-25 that water withdrawals from wells on Calpine's lease area would not significantly deplete groundwater in the project area. This conclusion is based on the comparison between the total land area within the groundwater recharge basin and the land area required to recharge the amount of water that would be used by the proposed project. See response to "Comments—Potential Groundwater Depletion at the Project Site from Groundwater Use" above for details of this comparison.

As stated in the Draft EIS/EIR on page 4-24, water withdrawals from the Calpine well, especially during peak pumping periods, could lower local groundwater levels, but not to a significant degree. Moreover, this effect would be temporary and not significant because the water levels would be expected to rebound after pumping is stopped. Maximum water use would occur during the third construction season. Based on the calculations presented in the response to "Comments—Potential Groundwater Depletion at the Project Site from Groundwater Use" above, the project would not significantly affect groundwater resources in the Mt. Dome/Klamath Lake groundwater basin, including groundwater wells in or near the project area (as referenced in comment AG.239).

As described in the EIS/EIR, annual water use during the operation phase would be substantially less than during the construction phase. The amount of water used by the proposed project during operation would be a tiny fraction of the annual precipitation falling directly on Calpine's Fourmile Hill leases that provides recharge to local groundwater. Therefore, effects of projected water usage on the supply of local groundwater to local groundwater wells may be adverse, but not significant during the operational phase of the proposed project.

Comment EZ.1 references research done by the USGS in Crater Lake, Oregon. No research has shown that a hydrologic connection exists between Crater Lake and the Fall River springs. See response to "Comments—Potential Effect to Fall River Springs" for more information on this subject.

See also responses to the following comments for more information on the effects of project groundwater use on groundwater availability (listed in the order in which they occur in this section):

- Local Groundwater Flow (comment EZ.1)
- Potential Groundwater Depletion at Arnica Sink from Groundwater Use (comment AG.239)
- Potential Groundwater Depletion at the Project Site from Groundwater Use (all comments)

Comment—Potential Effect of Groundwater Use on Lava Beds Groundwater Wells

AG.242 The water supply well for Lava Beds National Monument is located about 6 miles northeast of Calpine's Fourmile Hill leases. The DEIR concedes that shallow groundwater from the eastern portion of these leases may partially recharge this well (DEIR, p. 4-25), which is downgradient from the Project site. (DEIR, Fig. 3.3-3.) Thus, the removal of 62 MG of water from this aquifer, which would not be recharged as explained above, could adversely affect this well by lowering the water table, increasing pumping costs and perhaps degrading water quality. The DEIR did not evaluate this important impact, which may be significant.

In sum, the Project would significantly reduce recharge in the Project area and may reduce the water supply available to the Lava Beds National Monument. The DEIR should be revised to require that local recharge impacts be mitigated. One possibility is to require that the local aquifer be artificially recharged with captured surface runoff, rather than injecting it into the geothermal system or evaporating it in the cooling tower. Depending upon the quality of the captured water, it could be treated prior to recharge, as appropriate. The DEIR should also be revised to include specific calculations on the effect of Project pumping on the water supply of Lava Beds National Monument. If this impact is significant, it must also be mitigated. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Potential Effect of Groundwater Use on Lava Beds Groundwater Wells

The vast majority of groundwater that recharges water-supply wells in Lava Beds National Monument comes from the northeast flank of the Medicine Lake Highlands and from within the Tule Lake hydrologic subarea. This is because the ground water surface normally mimics the surface topography. Five out of six of Calpine's geothermal leases are not within the boundary of the Tule Lake hydrologic subarea (see Figures 1.5-1 and 3.3-1 in the EIS/EIR). A portion of one of Calpine's leases (the eastern portion of the most eastern of Calpine's leases) crosses the boundary of the Tule Lake hydrologic subarea. All the other leases are within the Mt. Dome hydrologic subarea. Development of groundwater resources at the project site would not impact the water supply to the Lava Beds National Monument wells because the wells are not directly down-gradient of the proposed project site nor are they in the same hydrologic subarea.

The comment suggests that development of groundwater at the project site may affect the water supply to the wells at the Lava Beds National Monument. The basis for this comment is the statement on page 4-25 of the Draft EIS/EIR that: "Groundwater from the eastern portion of Calpine's leases may partially contribute to the recharge of these wells." However, no development is anticipated in the eastern portion of the lease block. The project site is located in the western portion of the lease block, approximately three miles west of this hydrologic boundary.

LOCAL GROUNDWATER AND EFFECTS FROM GEOTHERMAL FLUID USE

Comments—Separation of Local Groundwater and the Geothermal Reservoir

A.9 The proposed action would be located just outside of the Medicine Lake Caldera, whereas the Telephone Flat project would be within the Caldera Complex. Based on the schematic cross section of the Medicine Lake Highlands (Figure 3.4-2), we contend that both projects are part of a large, regional geothermal system. While shallow groundwater may flow northward from Fourmile Hill, the geothermal reservoir for both projects appears to be connected. The DEIS gives insufficient information to provide reasonable assurance that there would not be fracture communication between the deep and shallow systems. EPA is concerned regarding possible recharge of the geothermal system by depletion of the shallow system, and the possibility of fresh water contamination by thermal waters.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.20 The DEIS presents very general geologic, hydrogeologic, and thermal information and vaguely documented statements that suggest a low probability for the occurrence of the previously described events. Provided information suggests that a thick unfractured and impermeable geologic formation separates the cold water system from the fresh water system. Aside from one documented surface hot spot, all other included information in the DEIS indicates that the shallow groundwater and springs/lakes are presently unaffected by the underlying geothermal activity.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

M.5 The supposed volcano-wide clay-rich ash-flow tuff that is presumed to act as a caprock to the geothermal system is an interpretation without substantiation, unless all the proprietary well data support it. But the reader has no way of checking it. (See Fig. 3.4-2 and Fig. 3.4-3). Basaltic shield volcanoes are not known for such layers anywhere, at least of the magnitude assumed for this prospect.
(Rick Poore, et al., Fall River Resource Conservation District)

M.6 It is assumed that a deep hot water zone is neatly isolated from a shallow cold water zone, by this assumed widespread insulating thick layer. Geologic and geophysical evidence, i.e., modern faulting, seismicity, etc., of the volcano behavior says otherwise. Again, the subject is not discussed; it should be.
(Rick Poore, et al., Fall River Resource Conservation District)

O.5 In addition, it is probable that there is an interconnection between the "deep thermal waters" and "shallow surface waters" in the Medicine Lake Highlands due to active fault zones in the area. These faults would maintain and recreate permeability for the exchange of deep and shallow waters, and any high pressure induced fracturing would stimulate further mixing. *(Katherine Kowatch, Friends of the River)*

AG.26 The EIS/EIR asserts that the Project will not have a significant impact on water resources because there are no known connections between the geothermal sources and the groundwater aquifer. (EIS/EIR, pp. 4-33, 4-49.) However, this conclusion is based upon speculation and is contradicted by scientific evidence, as is discussed in the attached comments of Dr. Fox. (Ex. A, comment 11.) The lead agency should investigate this impact and develop adequate data to support its position. (*Ibid.*)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

PH1.12 Number three: The supposed volcano-wide, clay-rich, ash-flow tuff that is presumed to act as a caprock to the geothermal system is an interpretation without substantiation, unless all the proprietary well data support it. But the reader has no way of checking it. And it references Figure 3.4-2 and Figure 3.4-3. Basaltic shield volcanoes are not known for such layers anywhere, at least of the magnitude assumed for this prospect.
(Dorris Public Hearing)

PH1.13 Number four: It is assumed that a deep hot water zone is neatly isolated from a shallow cold water zone by this assumed widespread insulating thick layer. Geologic and geophysical evidence, i.e., modern faulting, seismicity, et cetera, of the volcanic behavior says otherwise. Again, the subject is not discussed, and it should be.
(Dorris Public Hearing)

PH5.110 Probably a silly question but one that's haunted me, so I'd like to have it answered. I don't know how geothermal is actually—the process is done, how it's drilled down and so forth, but possibly one of the fears that I have is that it taps some volcanic tube and drains our lake. What are the safeguards? This is pointed towards the Calpine people; what safeguards, or even monetary safeguards are you willing to do for the property owners that are sitting in front of you in case something like this happens? Do you have—you have nothing to lose; we have everything to lose; this is irreplaceable.
(Medicine Lake Public Hearing)

Response—Separation of Local Groundwater and the Geothermal Reservoir

The geologic, hydrogeologic, and thermal information contained in the Draft EIS/EIR reflects the best information concerning these issues that was available at the time of Draft EIS/EIR publication. This information (along with experience with effects of geothermal development at other KGRAs) provided sufficient basis for drawing the

conclusions regarding existing hydrology and potential impacts that were presented in the Draft EIS/EIR. Subsequent to release of the Draft EIS/EIR, additional geologic, hydrogeologic, and thermal information has become available through various hydrogeology reports, as discussed in response to "Comments—Adequacy of Hydrology Analysis." Information from these reports has been incorporated into these responses to comments and the EIS/EIR text where appropriate.

As noted in the comments, the Draft EIS/EIR presented current knowledge about the hydrogeologic system in the region, including at the project site and in the Medicine Lake caldera. The hydrogeologic discussion is based primarily on proprietary and non-proprietary data gathered during field operations by geothermal operators at the Glass Mountain KGRA. The analysis also reflects the expert opinions of various hydrogeologists with experience at the Glass Mountain KGRA and other KGRAs. All hydrogeology information was independently verified by the third-party hydrogeologist who prepared the geology, hydrology, and geothermal resources sections of the Draft EIS/EIR.

As discussed in the Draft EIS/EIR, available evidence and data show that the deep geothermal system does not receive recharge from the overlying, shallow, fresh-water aquifer (i.e., groundwater) system. As discussed on pages 3-39 and 3-40 of the Draft EIS/EIR, an impermeable layer of rock separates the geothermal zone from the overlying groundwater reservoir. The additional hydrogeologic reports discussed above that address this issue concur with this conclusion. Evidence of the impermeable layer includes:

- Lithologic data (from wells) showing the composition of the rock layer between the groundwater and the geothermal reservoir
- The existence of a well-defined, high-temperature gradient zone, that defines the location of the impermeable rock layer
- The absence of any surface manifestations of the geothermal reservoir (except for the Hot Spot)
- Groundwater chemistry data that show no evidence of mixing with geothermal fluids

Presented below is an explanation of the data that support the existence of an impermeable layer between the groundwater and the geothermal reservoir.

Lithologic data: The geothermal reservoir that is present at the Glass Mountain KGRA contains fluids that have unusually high temperatures. In order for a high-temperature geothermal reservoir to form and be maintained, it must be isolated from the cold groundwater above. If the heat and steam within the reservoir was not isolated from the cold groundwater, natural processes would result in the mixing of geothermal reservoir fluids. This mixing would dissipate the heat of the geothermal reservoir. Alternatively, a lack of isolation could result in the escape of geothermal heat and steam to the surface, where it would release much of its energy. Neither of these situations occur at the Glass Mountain KGRA, which substantiates the EIS/EIR's conclusion that the geothermal reservoir is isolated from the cold groundwater.

What might be responsible for the isolation of the geothermal reservoir? The most common cause of isolation of geothermal reservoirs is the presence of an impermeable

cap-rock (Armstead 1978). This cap-rock prevents the release of energy in the geothermal reservoir into an overlying cold freshwater aquifer. The cap-rock also prevents the release of the energy and fluids in the geothermal reservoir to the surface in the form of geysers, hot springs, and fumaroles.

Drill cuttings and core samples from wells drilled at the project site and at other locations throughout the Glass Mountain KGRA confirm the existence of an impermeable layer between the geothermal reservoir and the groundwater. These samples show that there is a sequence of tuffaceous rocks[18] located within the top of the impermeable zone. This tuffaceous rock has a matrix which is generally rich in clay and highly impermeable. Data collected by Calpine indicate that this sequence is approximately 800 feet thick in the project area (the tuffaceous rock was encountered from approximately 800 feet to 1,600 feet below the surface). Based on data collected at other core holes in the KGRA, the impermeable layer in the Medicine Lake Highlands varies in thickness from 500 feet to about 3,000 feet.

Tuffaceous rocks in the subsurface in the Glass Mountain area (particularly the "lithic tuffs") contain abundant volcanic ash as a matrix to the lithic fragments. Ash is erupted as dust-sized particles of volcanic glass. This ash material is easily altered by heat and fluids to clay, giving these tuffaceous units very low permeability. With or without overlying tuff units, geothermal reservoirs become isolated from overlying cool groundwater by the process of "self sealing" (Facca and Tonani 1967; Ellis and Mahon 1977). Deposition of silica (SiO_2) or calcite ($CaCO_3$; predominantly in systems rich in CO_2) in fracture and pore spaces or alteration of rock minerals to clay minerals are the primary agents of this process. Waters heated to geothermal reservoir temperatures (400° and up) dissolve silica from the surrounding rock. Because high-temperature waters have a lower density than cooler waters, these fluids rise. As these high-temperature waters rise and mix with the cooler waters, they cool and the dissolved silica becomes supersaturated and is deposited in the pore spaces and fractures of the rock. Gases accompanying geothermal fluids are reactive with rock minerals and promote the formation of clay minerals through the process of alteration.

Additional evidence for the existence of this self-sealing layer is provided in Weiss Associates (1997). Weiss Associates summarize data collected by the USGS on the resistivity of the subsurface rocks. Using a method called "Schlumberger sounding," USGS geologists were able to create computer models of the resistivity of the subsurface rocks based on an electrical survey of the Medicine Lake Highlands (Zohdy and Bisdorf 1990).

Electrical resistivity indicates the properties of rock, including their fluid content. The level at which exploratory drilling wells encounter tuffaceous rock in the Medicine Lake Highlands correlates extremely well with the depth at which the rocks begin to have low resistivity. According to the regional models provided by the surveys, this region of low resistivity appears to be unbroken at a depth of at least 2,000 feet. These electrical resistivity data therefore provide independent support of a regional layer of impermeable material separating the groundwater and geothermal reservoir.

[18] Tuffs are rocks which contain a large fraction of volcanic ash.

Temperature Gradient Data: Although the impermeable layer of tuffaceous rock can prevent the loss of heat resulting from geothermal fluids rising to the surface, this layer cannot prevent heat from escaping from the geothermal reservoir through conductive heat flow. Therefore, a layer of thick, impermeable rock is still a formidable barrier to heat. The impermeable zone of rock functions as an insulating cover over the geothermal reservoir. Temperatures above the insulating cover are typically controlled by the movement of cool groundwater. Temperatures below the insulating cover are controlled by the connective flow of geothermal fluids. Consequently, the temperature gradient, the rate at which temperature increases with depth, is high within the impermeable zone because of low-temperature water circulating above it and high-temperature water circulating below it.

In other geothermal areas in the western United States, such as the Long Valley caldera in California and the Newberry crater in Oregon, a high temperature gradient beneath the surface occur within the layer of cap-rock that separates the geothermal reservoir from the groundwater (Benoit 1984; Swanberg and Combs 1986). As described below, the pattern of sub-surface heat distribution in the Medicine Lake Highlands is similar to the one seen at the Long Valley caldera and Newberry crater.

Well temperature log data has been collected from numerous temperature gradient wells in the Medicine Lake Highlands. These data share two important thermal characteristics:

- A cold, nearly isothermal (constant temperature) section extending from the ground surface to the bottom of the groundwater aquifer
- A rapidly increasing temperature in the impermeable layer beneath the groundwater

Both of these characteristics document the existence of a high-temperature gradient zone, which supports the conclusion that the rocks underlying the shallow groundwater aquifer are impermeable. Vertical continuity of permeability, between overlying cold water and underlying hot water (> 400° F) is not a stable situation that can persist in nature. The density of cold water is much greater than the density of water at 400° F. Consequently, mixing of the cold and hot water (i.e., spontaneous annihilation of the high-temperature geothermal system), driven by gravity is the inevitable consequence of such a situation. A high-temperature gradient, therefore, establishes the existence of a low-permeability zone.

Figures 3.4-4a through 3.4-4c (see pages 2 through 4 of this section) illustrate the temperature gradient throughout the Medicine Lake Highlands. Data from temperature gradient wells from throughout the region were used to create these illustrations (well locations are indicated by vertical lines and identified by well number). Figure 3.4-4b shows a cross-section of subsurface temperature distribution across the area in Figure 3.4-4a from point "A" to point "B." Figure 3.4-4c shows a similar temperature pattern for a cross-section from point "E" to point "F." These cross-sections span a distance of 10 to 11 miles, and each section begins and ends well outside of the margins of the caldera. In these figures, the surface topography is taken from USGS maps and contain no vertical exaggeration (i.e., the horizontal and vertical scales are identical). The contour lines indicate the elevation of temperature isotherms (isotherms are lines

connecting points of identical temperature) below the surface to a maximum of 250°F (data are proprietary at higher temperatures at deeper depths).

Cross sections A-B and E-F in Figures 3.4-4b and 3.4-4c also demonstrate that the zone of low permeability (i.e., high-temperature gradient indicated by "bunching up" of temperature isotherms) underlying the groundwater zone is a feature that is found throughout the caldera and adjacent areas. The hydrogeology in the project area is therefore not unique to the project area. The cross sections also show that elevated temperatures are found at the highest elevations and shallowest depths along the ring fracture zone, which bounds the caldera. These data further substantiate the conclusion that the base of the groundwater saturated zone slopes radially outward, away from the caldera.

Absence of Surface Manifestations: The third line of evidence for the existence of an impermeable barrier between the geothermal reservoir and the groundwater system is the absence of any surface manifestations of the geothermal reservoir. There are no thermal springs or other surface manifestations of the geothermal system found in the Medicine Lake area, except for the Hot Spot. The Hot Spot (located near the northwest flank of the Glass Mountain lava flow) is a fumarole that emits a small amount of water vapor and gas. The gases consist largely of air (nitrogen and oxygen) and are lacking in hydrogen sulfide, an important indicator of geothermal fluids. It therefore appears that the emanations at the Hot Spot represent heated groundwater and not a surface leakage of geothermal fluids.

As stated above, the impermeable rock layer serves as a partial barrier to heat flow resulting from "mass transfer" by the escape of hot fluids; it does not completely block conductive heat flow. Thus, the presence of the Hot Spot does not contradict the existence of an impermeable layer separating the groundwater and geothermal fluids. However, the absence of hydrothermal features (i.e., heated fluids or gases with geothermal chemical "signatures") at the surface does support the presence of an impermeable layer overlying the geothermal reservoir, and the lack of a permeability connection between the geothermal reservoir and the near-surface groundwater.

Groundwater Chemistry Data: A comparison between the chemical composition of the shallow groundwater and the geothermal fluids provides another line of evidence to support the existence of an impermeable layer that separates the two systems. Geothermal fluids have characteristic chemical signatures (see Section 3.4, Geothermal Resources, for more information) that include high levels of silica, sodium, and chloride. This chemical signature is distinct from fresh water, which in the Glass Mountain and surrounding area has extremely low concentrations of silica, sodium, and chloride (in fact, fresh water is defined by its low concentration of salts like sodium chloride). By analyzing the chemical composition of a sample of water, one can determine if that water may have mixed with geothermal fluids.

As discussed above, if there were no separation between the shallow groundwater and the geothermal reservoir in the Glass Mountain KGRA, cold groundwater would gradually sink (due to gravity) and hot geothermal fluids would rise (due to high temperature and pressure). As a result, geothermal fluids and cold groundwater would mix, and their chemical signatures would blend together. However, if there were no

mixing of these waters, the chemical signatures of these two "water types" would remain distinct.

Table 3.3-7 presents water chemistry data from groundwater wells and groundwater-fed springs in the Medicine Lake Highlands. These wells and springs were chosen because of their proximity to the project site and because their was sufficient data collected at these sites. Table 3.3-7 also presents geothermal fluid chemistry data from the Telephone Flat well 87-13. A portion of these data are found in the EIS/EIR in Table 3.4-1. Table 3.3-7 shows that the chemical composition of the groundwater in the Medicine Lake Highlands, regardless of their source (i.e., wells or springs) is substantially different from the chemical composition of the geothermal fluid. Many constituents in the geothermal fluids, such as total dissolved solids, silica, sodium, and chloride, are two to three orders of magnitude more abundant than in the shallow groundwater. Other constituents in the geothermal fluids, such as potassium, boron, and iron, are several times more abundant than in the shallow groundwater.

Thus, it has been determined by experts in geothermal reservoir assessment (e.g., Weiss Associates 1997; Mariner et al. 1998) that groundwater and geothermal fluids do not appear to have mixed; the shallow groundwater has retained the chemical signature of fresh water. These chemistry data support the conclusion that there is an impermeable layer that separates the geothermal reservoir from the shallow groundwater aquifer.

Conclusions: All available data support the conclusion that an impermeable layer exists between the geothermal resource and the overlying shallow groundwater system.

Because of the presence of this impermeable layer, it is reasonable to conclude that there would be:

- Little or no recharge of the geothermal system by the overlying shallow groundwater system, and
- Little or no recharge of the groundwater system by the geothermal system

Further discussion of these conclusions and their implications for project impacts is provided in the responses to comments immediately below.

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Table 3.3-7: Chemical Analyses for Groundwater Wells, Groundwater Springs, and Geothermal Well near the Project Area

Constituent (ppm)	Groundwater Wells		Groundwater from Springs[a]			Geothermal Fluid	
	Pumice Stone[b,c]	Crescent Butte[d]	Schon-chin Spr.[c]	Crystal Spring[c]	Payne Spr. (N)[c]	87-13 11/6/89[e]	87-13[e] 10/13/91
pH	6.3	7.8	6.7	6.6	6.4	8.6	8.5
Total Dissolved Solids	36	150	88	57	59	NR	2,337
Silica	16	49	32	28	29	582.3	442.0
Sodium	1.3	26	3.1	2.3	2.6	632.0	442.0
Chloride	< 1.8	11.0	< 1.8	< 1.8	< 1.8	1,012.2	1,085.0
Bicarbonate	13.9	89.0	41.6	20.8	20.8	49.0	28.0
Potassium	1.2	1.8	1.0	0.8	1.3	107.7	77.0
Sulfate	< 5.0	3.0	< 5.0	< 5.0	< 5.0	46.9	46.0
Boron	< 0.01	0.3	< 0.01	0.03	< 0.01	NR	10
Calcium	3.1	3.0	8.6	3.9	3.8	7.9	4.3
Iron	< 0.05	0	< 0.05	< 0.05	< 0.05	NR	0.36
Magnesium	0.6	0.9	2.0	1.1	1.1	0.1	ND
Manganese	< 0.01	NR	< 0.01	< 0.01	< 0.01	NR	ND
Nitrate	< 0.4	0.6	< 0.4	< 0.4	< 0.4	NR	ND

Notes:

[a] Locations of springs shown in Figure 3.3-2 in the EIS/EIR

[b] Pumice Stone Well located approximately 1 mile west of Little Glass Mountain

[c] Data from Cosens-Gallinatti (1984) cited in Weiss Associates (1997)

[d] National Park Service well in Lava Beds National Monument; data from Leivas et al. (1981) cited in Weiss Associates (1997)

[e] Data collected on two different dates from well 87-13 at Telephone Flat; Source: USFS et al. (1998) (also cited in part in Table 3.4-1 of the Draft EIS/EIR); data are flash-corrected

ND = Not detected and detection limit not given

NR = Not reported

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Comments—Potential Groundwater Depletion due to Geothermal Fluid Use

A.19 Due to insufficient information, the EPA is left with questions about the potential for depletion or contamination of the shallow aquifer by geothermal fluids during the life of commercial production of geothermal power, and the possibility of creating surface geothermal hazards. A combination of such events could jeopardize public health or safety, recreation opportunities, or possibly prohibit access to Indian sacred sites (Executive Order 13007). *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

A.31 EPA is concerned with possible lowering of the shallow water table and effects on springs and lakes, including the Fall River springs, if some recharge occurs to the geothermal system via fractures in vicinity of the Medicine Lake Caldera. The DEIS implies that the Medicine Lake Highlands is an area of groundwater recharge. The mounded character of the water table supports this position. However, the DEIS has strong statements that imply no recharge to the geothermal system from the overlying, shallow, fresh water aquifer system. This is poorly substantiated by the data provided. The FEIS should include additional scientific support for the proposed conceptual geothermal/hydrogeologic model.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

L.5 I should also point out that geothermal drilling and exploitation is well known for drawing down water tables by depleting the water supply where they are installed. These types of facilities can also pollute aquifers by allowing migration of toxic hot water from one place to another and from the subsurface to the surface. It would be a great tragedy if this happened in this outstanding natural area.
(Steve Tabor, Desert Survivors)

AG.247 Power Production May Adversely Affect Water Resources. The production of 49.9 MW of power would require the removal of 2.9 million pounds per hour ("Mlb/hr") of fluid from the geothermal reservoir and the reinjection of 2.425 Mlb/hr. (DEIR, Table 4.4-1.) Therefore, 501 MG[19] of water would be removed from the geothermal reservoir every year and 23,000 MG would be removed over the 45 year life of the Project. This is a substantial amount of water. The DEIR argues that this would have no impact on local water resources because there are no known connections between the geothermal reservoir and local thermal sources (DEIR, pp. 3-36, 4-49) and the overlying groundwater aquifer. (DEIR, p. 4-33.)

However, this conclusion is pure speculation. There are no data whatsoever to support it. For example, the DEIR states that "[s]hallow groundwater within the caldera is probably separated from the shallow groundwater outside the caldera...the geothermal system is probably recharged from deep groundwater recharge...it is probable that if there is significant recharge..." (DEIR, p. 3-41, underlining added.) "[T]here appears to be no connection between the shallow groundwater and the geothermal system." (DEIR, p. 4-33.) "The geothermal reservoir is not believed to be connected to regional groundwater systems." (DEIR, p. 4-316.) No boring logs or published field investigations are cited to support any of these claims.

Three letters from the Fall River Resource Conservation District in RWQCB files present evidence that contradict this speculation. These letters, citing work by the USGS, Lawrence Livermore National Laboratory, and the Colorado School of Mines, claim that there are active high-angle fault zones between the geothermal reservoirs and shallow groundwaters and springs. High-pressure production activities could stimulate fluid movement along these fractions and open new fractures.[20] Further, the presence of

[19] Amount of water removed from geothermal reservoir = (0.475 Mlb/hr)(24 hr/day)(365 day/yr)/(8.3 lbs/hr) = 501.3 MG/yr.

[20] Letter from Rick Poore, Fall River Resource Conservation District, to Randy Sharp, USFWS, February 18, 1997; Letter from Rick Poore, Fall River Conservation District, Thomas Grose, Colorado School of Mines, and Maria Ellis, University of Michigan, to Randy

two fumaroles in the Medicine Lake area that emit steam and gases along fracture intersections (DEIR, p. 3-35) clearly demonstrate that there are connections between the geothermal resource and the upper aquifers in the Medicine Lake area.

Connections among these sources could degrade the quality of springs if high salinity reservoir fluids seeped into freshwater springs. Further, to the extent that the geothermal reservoir recharges local thermal springs, such as those in the Butte Valley and Fall River areas (DEIR, p. 3-36), the discharge from these springs could be substantially reduced. These impacts could be aggravated by other projects in the area, such as the recently proposed CalEnergy Telephone Flat 48 MW geothermal power plant.

The DEIR must provide data to support its position that fluid extraction and injection would not impact the quality and quantity of local shallow groundwaters and springs. Otherwise, the impact should be qualitatively assessed and found to be tentatively significant based on the information cited in the Fall River correspondence. An investigation should be required to develop the data to quantitatively evaluate the impacts and to propose suitable mitigation, as appropriate.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

FW.2 We do not want to see the area destroyed with pipelines running throughout from geothermal plants that are draining waters from the lake and the surrounding caldera. The only waters running into Medicine Lake are from the melting winter snows since no streams run by to replenish its supply.

The endless water supply needed for geothermal operation could easily diminish the waters in and around the lake and caldera. Just consider the geysers operation in Lake County here in California that are already non-operative because of no water supply. *(Doug and Phyllis Parker)*

Response—Potential Groundwater Depletion due to Geothermal Fluid Use

The comments express concern about the potential for depletion of the shallow aquifer by geothermal fluids during the commercial production of power. Comments A.31, AG.247, and FW.2 also express concern that any potential depletion of groundwater would affect the surface water bodies that are supplied by the groundwater aquifer (e.g., springs and lakes). See response to "Comments—Effect on Surface Water from Groundwater Use" in this section for further discussion of this issue.

As described in Section 4.3.1 on pages 4-21 through 4-26 of the Draft EIS/EIR, the water needs of the proposed power plant would be supplied by the geothermal fluids. The water needs of the drilling and construction activities would be supplied by groundwater. As described in this section, the available evidence indicates that an impermeable layer separates the groundwater from the geothermal reservoir. This separation serves to prevent any communication between the geothermal fluids in the reservoir and the groundwater in the near-surface aquifer.

As described in the response to "Comments—Separation of Local Groundwater and the Geothermal Reservoir," data that support the existence of an impermeable layer include:

- Temperature gradients from deep wells show the existence of a distinct, high-temperature gradient zone that corresponds to the boundary between the geothermal fluids and the near-surface groundwater.
- Rock samples taken from deep wells show the presence of a sequence of tuffaceous rocks that is coincident with the boundary between the cold, shallow groundwater and the deeper, hot geothermal fluids.
- The absence of any natural surface penetration of deep geothermal fluids (e.g., hot springs or geysers) strongly suggests that there are no regional connections between the geothermal reservoir and the groundwater. The Hot Spot, the only thermal surface manifestation in the Medicine Lake Highlands, releases gas that

Sharp, USFWS, June 4, 1997; Letter from Rick Poore, Fall River Conservation District, Thomas Grose, Colorado School of Mines, and Maria Ellis, University of Michigan, to Randy Sharp, USFWS, August 4, 1994.

> lack the characteristic signature of geothermal fluids. This suggests that in the vicinity of the Hot Spot, the groundwater is being heated by the geothermal reservoir indirectly, and no geothermal fluids come in contact with groundwater directly.

Comment AG.247 cites work performed by the USGS, Lawrence Livermore National Laboratory, and the Colorado School of Mines that claim the presence of "active high-angle fault zones between the geothermal reservoirs and shallow groundwaters and springs." The presence of such zones is inconsistent with the data presented above (i.e., temperature gradient data, geologic composition data, and surface manifestation data).

As described in the previous response, the well log data support the conclusion that there is an effective barrier between the geothermal reservoir and the overlying groundwater. Comment AG.247 refers to letters from the Fall River Resource Conservation District which claims that "high pressure production activities could stimulate fluid movement in all these [high-angle fault] fractures and open new fractures." It is not clear what is meant by "high pressure production activities." Production wells, in high-temperature, liquid-dominated reservoirs spontaneously flow hot water to the surface. Over time, production tends to gradually reduce pressure in the geothermal reservoir. It is standard practice to inject separated geothermal brine (i.e., the water fraction not flashed to steam) and steam condensate back into the reservoir. Injection is used for the purposes of maintaining reservoir pressure and disposing of this water in an environmentally acceptable manner. Injection is achieved either by the gravitational force exerted by the weight of the column of water in the well bore or, if necessary, by gravitational force plus pumping.

Pumping, when necessary, is powered by electricity which is deducted from the output of the plant (this deduction is part of what is known as "parasitic load," the power needed to run the plant's machinery). Consequently, it is necessary to inject geothermal fluids into relatively permeable zones of the geothermal reservoir so that high pressures are avoided and pumping costs are minimized. Therefore, the proposed project is not expected to conduct any "high pressure production activities" which could materially affect the natural segregation of cold groundwater from hot geothermal fluids.

As described in several responses, there are no surface manifestations of the geothermal resource in the region. The Hot Spot does not demonstrate a connection between the geothermal resource and the upper aquifers in the Medicine Lake area; the Hot Spot fluids show no signature of the geothermal reservoir and the gases emitted do not include hydrogen sulfide, which would be present if the Hot Spot was connected to the geothermal resource.

Based on the evidence presented above, it is expected that the impermeable layer would generally prevent recharge of the geothermal system by the shallow groundwater system. As a result, this impermeable layer would prevent groundwater depletion due to the consumption of geothermal fluids.

Comment A.19 also expresses concern that the consumption of geothermal fluids may affect public health or safety or recreation opportunities, or that it may prohibit access to American Indian Sacred Sites (as defined in Executive Order 13007). Surface geothermal hazards are not expected to be created due to the:

- Competent volcanic rocks overlying the geothermal resource
- Expected depth of 5,000 feet or greater to the geothermal resource
- Injection under no or low pressure
- Proposed use of proper drilling and engineering practices
- Lack of communication between the geothermal reservoir and shallow groundwater

Since depletion and contamination are not expected, no effects to public health and safety, recreation opportunities, or access to American Indian Sacred Sites are expected. If a hazardous geothermal event were to occur (such as a new surface manifestation), it would likely be small and localized due to the precautionary measures taken by Calpine and because of the lack of hazardous seismic activity in the area already. If such an event occurred, Calpine would implement protective measures under the direction of the BLM and USFS. In addition, access to American Indian Sacred Sites (as defined in Executive Order 13007) would not be prohibited by the proposed project or its effects.

The geothermal fluids would be produced at depths of approximately 5,000 feet or greater. This production would not drain Medicine Lake or affect the springs located in the Medicine Lake caldera (see response to "Comments—Effect on Surface Water from Groundwater Use" for more discussion). The water supply for the power plant would be the produced geothermal fluids. Of the fluids produced, approximately 80 percent would be returned to the geothermal reservoir. The geothermal resource at Fourmile Hill is liquid-dominated and therefore expected to be significantly different from the vapor-dominated geothermal resource at The Geysers. At The Geysers, only steam is produced; most of the steam is lost to the atmosphere and not returned to the reservoir. The injection program is expected to help maintain pressure and fluids in the Fourmile Hill reservoir.

In summary, the proposed project would not result in the depletion of the shallow aquifer through the consumption of geothermal fluids. The comments also raise other issues that are not directly related to the potential groundwater depletion due to geothermal fluid use. For a discussion of the other issues raised in these comments, see the following responses in this section (listed in the order in which they appear; relevant comments are listed in parentheses):

- Comments—Separation of Local Groundwater and the Geothermal Reservoir (A.31, L.5, AG.247)
- Comments—Potential Groundwater Contamination due to Geothermal Fluid Use (L.5)
- Comments—Effects to Groundwater from Accidental Geothermal Brine Spills (L.5)
- Comments—Potential Effect to Fall River Springs (A.31, AG.247)
- Comments—Effects to Surface Waters from Accidental Geothermal Brine Spills (L.5)

Comments—Potential Groundwater Contamination due to Geothermal Fluid Use

A.23 EPA is concerned about the potential for contamination of the shallow aquifer by geothermal fluids during the life of commercial production of geothermal power.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.32 The information provided suggests that groundwater upwelling is quite possible. The DEIS states that Medicine Lake is fed in part by springs. Upwelling could include the hot water system, even if thermal or chemical signatures are very subtle at the surface. We note evidence of thermal/freshwater connections based on collected data by Rose and Davisson (1996) at the Fall River springs. Section 3.4-2 indicates that the deep water system flows in toward the Medicine Lake Caldera. What assurances are there that the project and/or projects would not perturb the hydrogeologic system? Are there additional "ring fracture" faults in the area of the proposed well field that could cause freshwater contamination as a result of operations? These questions should be addressed in the FEIS.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

FM.2 The project will change the Medicine Lake area forever The Lake and its aquifer will become polluted with geothermal wastes such as hydrogen sulfide and other heavy metals. *(Ana Mulvaney)*

Response—Potential Groundwater Contamination due to Geothermal Fluid Use

The potential for contamination of the shallow aquifer (i.e., groundwater) by geothermal fluids is discussed on pages 4-32 through 4-34 of the Draft EIS/EIR. With standard operating procedures, compliance with GROs, and with identified mitigation measures, the proposed project would not result in contamination of groundwater by geothermal fluids. As discussed in the Draft EIS/EIR, three possible scenarios have been identified by commentors as having the potential to result in groundwater contamination from the geothermal fluids:

(1) Upwelling of geothermal fluids into groundwater

(2) Intermingling of geothermal fluids with groundwater through drilling or inadequate sealing of the groundwater interval within the geothermal well

(3) Surface release of geothermal fluids and subsequent percolation into the shallow groundwater

Geothermal Fluid Upwelling: As discussed in response to "Comments—Separation of Local Groundwater and the Geothermal Reservoir" above, there is currently no evidence of geothermal fluids in the shallow groundwater system. Since no communication between the two systems occurs (or is expected to occur), no upwelling of geothermal fluids into groundwater would occur.

Geothermal Well Drilling and Casing: Drilling and design of the geothermal wells would be regulated by the BLM and would be in compliance with the GROs. The GROs were designed to provide guidance for geothermal drilling and operation. The GROs define measures to protect groundwater that include :

- Drilling practices
- Drill hole casing and cementing requirements
- Sump permeability
- Well abandonment
- Monitoring of wells and the geothermal reservoir

For example, GRO #2 provides detailed guidelines regarding the drilling, completion, and spacing of geothermal wells. The drilling would not create a connection to groundwater because all groundwater intervals would be sealed from the wells (and the geothermal reservoir through the cementing and steel casing). As discussed on page

2-16 of the Draft EIS/EIR, geothermal wells drilled as part of the proposed project would be constructed with cemented casings (in accordance with GRO #2) to seal off the groundwater from geothermal fluids within the well. The drilling and casing program would ensure that geothermal fluids would not contaminate the shallow groundwater through seepage out of the well. See response to "Comments—Well Casing Program and Potential for Casing Rupture" below for more details on GRO #2.

Mitigation Measure 4.3.6b would provide additional assurance that geothermal fluids would not contaminate the shallow groundwater interval. This mitigation measure calls for periodic inspection of the well casing to verify its structural integrity. In the event of a failure of one of the well casings, operating procedures would quickly detect any leakage of geothermal or injection fluids. The pressure in the geothermal wells would be continuously monitored by plant operators. A failure of a well casing would lead to a drop in pressure at the wellhead which would be quickly detected by plant operators. Based on BLM regulations, Calpine would be required to immediately address this problem.

Mitigation Measures 4.3.1a and 4.3.2a would require Calpine to conduct regular groundwater quality monitoring in the project area and make appropriate operation changes if project activities are affecting the surrounding groundwater. See response to comment A.33 for additional information on the water quality monitoring program.

Surface Release of Geothermal Fluids: The proposed project includes several mechanisms to ensure that the shallow groundwater would not be contaminated through a surface release of geothermal fluids. GRO #2 requires the installation of Blowout Prevention Equipment on every well. Each well pad would also include a sump lined with an impermeable layer that would protect the shallow groundwater layer from contamination. Each sump would maintain approximately 225,000 gallons of unused capacity, which could be used to contain geothermal fluids in the event of an emergency. In addition to the lined sump, each well pad would be surrounded by a berm to further contain accidental release of geothermal fluids in an emergency.

In addition to the emergency control measures outlined above, Mitigation Measure 4.3.6c would require Calpine to develop a plan detailing runoff control and restoration measures to be implemented in the event of a sump overflow. The water quality monitoring program described in response to "Comments—Hydrologic Monitoring Plan" would ensure that:

- Any contamination of groundwater from geothermal fluids would be detected, and
- If contamination is detected, corrective action would be taken immediately to minimize the extent of the contamination.

Operation of the proposed project would not significantly affect upwelling from the geothermal reservoir to the shallow groundwater, if it occurs. As discussed on pages 4-8 and 4-9 of the Draft EIS/EIR, the project could induce low-level seismic activity (less than magnitude 3.0 on the Richter scale). This activity would be similar to the magnitude of naturally occurring seismic activity in the region. Induced seismic activity would not be strong enough to affect the competency of rocks in the geothermal system or create new connections between the geothermal reservoir and shallow groundwater systems.

Therefore, induced seismic activity would not be expected to alter existing patterns of geothermal fluid upwelling, if it occurs (see also the response to comment A.21).

Available water quality data do not show any chemical or thermal indication of a connection (upwelling or otherwise) between the shallow groundwater in the Medicine Lake Highlands and the underlying geothermal reservoir. Ring fractures such as those found around the rim of the caldera are not known to exist under the Fourmile Hill project area. Project activities would not alter any existing hydrologic connection between the shallow groundwater and the geothermal system.

As discussed on page 4-45 of the Draft EIS/EIR, evaporative losses from the cooling tower would result in the consumptive loss of approximately 16.4 percent of the geothermal fluids produced. It is uncertain to what extent the geothermal reservoir is recharged. If the geothermal fluids lost to evaporation are not replaced by recharge, there could be a gradual drop in pressure within the geothermal system (see page 4-48 of the Draft EIS/EIR for additional information on pressure changes as a result of project operation).

Extensive geothermal and groundwater monitoring would be conducted for the proposed project. The project would include monitoring of geothermal reservoir and pressures. The monitoring data would be reviewed by the BLM, which could require Calpine to modify operating procedures if necessary. Local groundwater would also be monitored for evidence of contamination of shallow groundwater from ring fracture faults.

Comment A.32 also cites data from Rose and Davisson (1996) that suggests a connection between the geothermal reservoir and the freshwater in the aquifer. Rose and Davisson note that waters sampled from the Fall River springs have an elevated concentration of volcanic carbon dioxide (CO_2). The same authors note that this "does not in itself indicate a direct physical contact between the geothermal system and the Fall River Springs recharge system" (Davisson and Rose 1997). These authors state a belief that the data do not imply leakage of CO_2 (which is far more volatile than water) from a geothermal reservoir into groundwater. Volcanic CO_2, however, is generated by magmatic activity, not a geothermal reservoir. Although both can contribute CO_2 to the shallow groundwater, the many eruptive vents of basaltic lava flows, which occur far to the south of Medicine Lake caldera (in the direction of the Fall River springs), provide for adequate channels of volcanic CO_2 leakage to groundwater to explain the concentrations of volcanic CO_2 observed at the Fall River springs.

See also response to "Comments—Effects to Groundwater from Accidental Brine Spill" and response to "Comments—Well Casing Program and Potential for Casing Rupture."

References:

Davisson, M. L., and T. P. Rose. 1997. *Comparative Isotope Hydrology Study of Groundwater Sources and Transport in Three Cascade Volcanoes of Northern California.* Lawrence Livermore National Laboratory Report UCRL-ID-128423, Livermore, CA.

Rose, T. P., and M. L. Davisson. 1996. Radiocarbon in hydrologic systems containing dissolved magmatic carbon dioxide. *Science* **273**:1367-1370.

Comment—Groundwater Impacts from Geothermal Fluid Injection

A.22 According to the DEIS the proposed project will inject spent geothermal fluids back into the formation. The project proponent would be responsible for geothermal reservoir pressure and chemical characteristic monitoring. While groundwater injection is a recognized standard procedure, it involves the potential for creation of geologic hazards, alteration of flow regimes, etc. The FEIS should discuss the potential for the proposed action to create such problems--and provide assurances that potential structures that could accommodate fluid flow into the overlying fresh water aquifer will be avoided and/or mitigated. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

Response—Groundwater Impacts from Geothermal Fluid Injection

As discussed on pages 4-47 through 4-48 of the Draft EIS/EIR, the injection of spent geothermal fluids into the geothermal reservoir could result in minor localized changes in temperature, pressure, and chemistry within the geothermal system. Injection of spent fluids into the geothermal reservoir would not affect the shallow groundwater system for the following reasons:

- As discussed in the Draft EIS/EIR, drilling data show that in the project area there is a well-defined impermeable zone between the shallow groundwater and the geothermal system. Due to this impermeable layer, injection of fluids into the geothermal zone (at 5,000 feet or deeper) would not affect the conditions in the shallow groundwater system (at approximately 800 feet) at the project area
- Geothermal wells would be constructed and operated to ensure no intermingling of geothermal fluids with the shallow groundwater. See response to "Comment—Potential Groundwater Contamination due to Geothermal Fluid Use" for additional information on this issue.

Based on hydrogeologic information, there is no evidence of a permeable connection between the shallow groundwater in the Medicine Lake Highlands and the underlying geothermal system that would allow geothermal fluids to flow into the shallow groundwater system. The effects on the geothermal reservoir from injection of spent fluids would be localized and would not impact regional hydrogeologic conditions. The fluids would be injected at depths of 5,000 feet or deeper. These fluids would be injected under gravity flow or low pressure. This injection procedure would minimize the potential for surface geologic hazards. Surface flow regimes would not be expected to be altered by injection at the proposed depth.

As discussed on pages 4-8 and 4-9 of the Draft EIS/EIR, the project could induce low-level seismic activity. This activity would be similar to the magnitude of seismic activity that occurs naturally in the region. See response to comments in the Geology and Soils Section for more discussion of this issue.

Comment—Potential for Groundwater Flow Alterations due to Geothermal Fluid Use

A.21 The FEIS should address, in more detail, the potential for geothermal operations to modify the existing groundwater flow regime, especially in light of induced seismicity. Furthermore, the geothermal system relies on fracture permeability. The potential for fracture permeability to accommodate communication between the thermal reservoir and overlying fresh water system, and possible resulting contamination and/or fresh water depletion, should be further discussed in the FEIS, and supported by field data. Plans to obtain and evaluate this information, if not presently available, should be provided. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

Response—Potential for Groundwater Flow Alterations due to Geothermal Fluid Use

As discussed on pages 4-8 and 4-9 of the Draft EIS/EIR, seismic activity (if induced by project activities) would be of low magnitude, and would be similar to the naturally occurring seismic activity in the project area. This conclusion is based on experience at

other operating geothermal fields such as those at the Coso and The Geysers KGRAs. Seismic activity induced by the proposed project would not be sufficiently strong to alter the hydrogeologic conditions in the project area. Further discussion of this issue is not included due to the lack of potential impact.

See response to "Comments—Separation of Local Groundwater and the Geothermal Reservoir" regarding fracture communication and the potential for effects on and the protection of the shallow groundwater system from project activities. See response to "Comments—Potential Groundwater Depletion due to Geothermal Fluid Use" regarding potential depletion of groundwater resources from the production of geothermal fluids. The proposed monitoring program described in response to "Comments—Hydrologic Monitoring Program" would protect the shallow groundwater system from depletion and contamination. See response to "Comments—Baseline Hydrology Information" for details on Calpine's baseline data collection program for groundwater.

Comments—Well Casing Program and Potential for Casing Rupture

A.52 The FEIS should indicate if on-site inspection will be provided (as required in state, federal and local regulations) during drilling and construction operations to ensure that proper cementation techniques are used. In particular, the potential for casing rupture should be addressed in the FEIS. We cite an example of casing failure and contamination of shallow aquifers in the East Mesa geothermal field, located near El Centro, California (Estabrook, 1997).

(Deanna M. Wieman, U.S. Environmental Protection Agency)

U.10 According to the 1984 Supplemental Environmental Assessment (pg. 44) "Accidental puncturing of an aquifer during drilling or fracturing of bedrock during active seismic testing could cause ground water movement or mixing. While unlikely, such accidents could potentially cause fluctuations in quantity, chemical content or temperature of spring or stream flows." Isn't this the same scenario that the Fall River Resource Conservation District was referring to in their letters of concern and comment about the Fourmile Hill project? These issues must be addressed in the Final EIS/EIR.

(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

FK.8 SECTION 4.15.3 WELL BLOWOUT HAZARDS page 4-282 During the construction and operation of well drilling, well blowouts could potentially occur with resulting uncontrolled discharge of well fluids and / or gases that could affect human health and safety. page 4.283 Fluids could percolate into the subsurface, but because of the depth of the shallow ground water, it would be absorbed by soils and bedrock before it could mix with ground water. [The ground water depth of most of the wells near Medicine Lake are approximately 100 feet. This does not sound safe to me. The EIR/EIS states that this is not likely to occur because they have plans to avoid this and they will use experienced well drillers. Does this mean that all of the recorded blowouts at other plant didn't have plans or experienced well drillers? To reach the conclusion that this project will have no significant impact to the ground water resources is absurd. The author of this EIR is quite clear that a study of the ground water is lacking. On page 3-21 he uses words like "appears to", "data suggests", "probably" and "it is assumed". This is very misleading to the reader. Somehow I loose confidence in this type of reporting. *(Charles F. Moss)*

Response—Well Casing Program and Potential for Casing Rupture

Effects of geothermal drilling, production, and injection on water quality are discussed on pages 4-32 through 4-34 of the Draft EIS/EIR. These comments present concerns about the potential for effects to groundwater from the potential for:

(1) Intermingling of geothermal fluids with groundwater through inadequate sealing of the groundwater interval within the geothermal well, and

(2) Release of geothermal fluids near the surface and subsequent percolation of these fluids into the shallow groundwater

Drilling and design of the geothermal wells is regulated by the BLM and would be in compliance with the GROs. The BLM would be responsible for inspections during

well drilling and construction to ensure compliance with the GROs, which includes inspection for the use of proper cementation techniques.

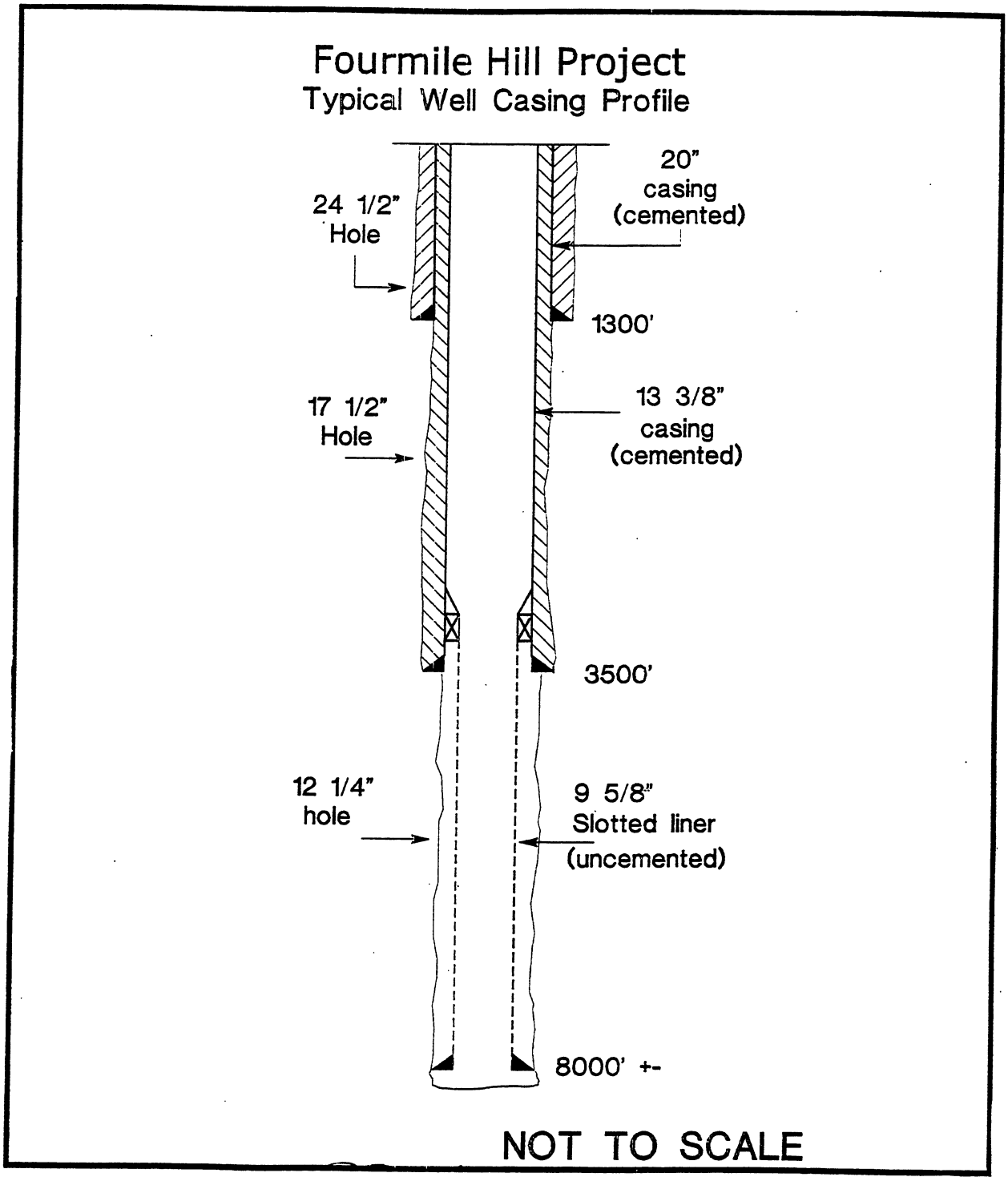
The proposed project includes several mechanisms to ensure that the shallow groundwater would not be contaminated through a surface release of geothermal fluids. For example, GRO #2 requires the installation of Blowout Prevention Equipment on every well (see further discussion below). Each well pad would also include a sump lined with an impermeable layer that would protect the shallow groundwater layer from contamination. Each sump would maintain approximately 225,000 gallons of unused capacity, which could be used to contain geothermal fluids in the event of an emergency. In addition to the lined sump, each well pad would be surrounded by a berm to further contain accidental release of geothermal fluids in an emergency.

GRO #2 also provides detailed requirements for the drilling, completion, and spacing of geothermal wells. As discussed on page 2-16 of the Draft EIS/EIR, geothermal wells drilled as part of the proposed project would be constructed with cemented casings (see further discussion below) to seal off the groundwater from geothermal fluids within the well. The wells would "telescope" from larger to smaller diameter holes with depth (see Figure 2.2-4a). The casing program would ensure that geothermal fluids would not contaminate the shallow groundwater through seepage out of the well.

GRO #2 also requires specific and detailed designs and procedures to be used in the construction and operation of wells. These designs and procedures would ensure that the likelihood of a well casing failure is minimized to the maximum extent possible. GRO #2 requires designs and procedures that include:

- **Cementing of Well Casing:** Production well casing would be cemented with a high-temperature-resistant admix that would exclude overlying formation fluids from the geothermal resources zone to prevent the movement of fluids into possible fresh water zones [GRO #2, 1(E)].
- **Well Pressure Testing:** Prior to drilling out the casing shoe after cementing, all casing strings set to a depth of 500 feet or greater (except for conductor casing), shall be pressure tested to a minimum pressure of 1,000 psi or 0.2 psi/foot, whichever is greater. All casing strings set at a depth less than 500 feet (except for conductor casing), shall be pressure tested to a minimum pressure of 500 psi. Casing test results shall be recorded on the driller's log and reported to the BLM Supervisor within 30 days after completion of the test [GRO #2, 1F].
- **Blowout Prevention Equipment:** Blowout preventers and related well control equipment shall be installed, tested immediately thereafter, and maintained ready for use until drilling operations are completed. Blowout prevention equipment shall include:
    1. On the conductor casing, at least one remotely-controlled, hydraulically-operated, expansion-type preventer that includes a drilling spool with side outlets and a kill line and blowdown line connected to the drilling spool [GRO #2, 2A]
    2. On the surface, intermediate, and production casings, one expansion-type preventer and accumulator or a rotating head [GRO #2, 2B (1)]
    3. On the surface, intermediate, and production casings, a manual and remotely-controlled, hydraulically-operated double ram blowout preventer (or equivalent equipment) [GRO #2, 2B (2)]

Figure 2.2-4a: Typical Well Casting Profile



4. On the surface, intermediate, and production casings, A drilling spool with side outlets, a fillup line, a kill line equipped with at least one valve, and a blowdown line equipped with at least two valves and securely anchored at all bends and at the end [GRO #2, 2B (3-6)]

- **Blowout Prevention Procedures:** A Blowout Prevention Program and a Blowout Contingency Plan shall be submitted with the Application for Permit to Drill that includes the following elements:
  1. The ram-type blowout preventers and auxiliary equipment shall be tested to a minimum of 1,000 psi or to the working pressure of the casing or assembly, whichever is the lesser. The expansion-type blowout preventers shall be tested to 70 percent above pressure testing requirements [GRO #2, 2C].
  2. The blowout prevention equipment shall be tested (a) when installed, (b) prior to drilling out plugs and/or casing shoes, (c) not less than once per week, alternating the control stations, and (d) following repairs that require disconnecting a pressure seal in the assembly [GRO #2, 2C].
  3. During drilling operations, blowout prevention equipment shall be actuated to test proper function (a) once each trip for blind and pipe rams (but not less than once each day for pipe rams), and (b) at least once each week on the drill pipe for expansion-type preventers [GRO #2, 2C].
  4. Inspections of other equipment shall occur on a regular basis, for example (a) all flange bolts shall be inspected at least weekly and re-tightened as necessary during drilling operations, and (b) the auxiliary control systems shall be inspected daily [GRO #2, 2C]
  5. Blowout prevention controls shall be plainly labeled and all crew members shall be instructed on the function and operation of such equipment [GRO #2, 2C]
  6. A blowout prevention drill shall be conducted weekly for each drilling crew and all blowout prevention tests and crew drills shall be recorded in the driller's log [GRO #2, 2C]

Geothermal well blowouts are extremely rare; of the hundreds of wells drilled at the Coso KGRA, there have been no blowouts after 18 years of exploration and 10 years of operation. Mitigation Measure 4.3.6b would provide additional assurance that geothermal fluids would not contaminate the shallow groundwater interval. This mitigation measure calls for periodic inspection of the well casing to verify its structural integrity.

In the event of a failure of one of the well casings, operating procedures would quickly detect any leakage of geothermal or injection fluids. The pressure in the geothermal wells would be continuously monitored by plant operators. A failure of the well casing would lead to a drop in pressure at the wellhead which would be quickly detected. Based on BLM regulations, Calpine would be required to immediately address this problem.

In addition to the emergency control measures outlined above, Mitigation Measure 4.3.6c would require Calpine to develop a plan detailing runoff control and restoration measures to be implemented in the event of a sump overflow. Mitigation Measures 4.3.1a and 4.3.2a would also require Calpine to conduct regular groundwater quality monitoring in the project area and make appropriate operation changes if project

activities are affecting the surrounding groundwater. See response to "Comments—Hydrologic Monitoring Plan" for additional information on the water quality monitoring program.

Comments—Effects to Groundwater from Accidental Geothermal Brine Spills

F.4 The Geysers has unstable ground and high rainfall conditions which are not similar to the case at Glass Mountain; nevertheless, corrosive conditions and isolation are likely to contribute to leaks and spills of geothermal fluids. This issue is best resolved by close monitoring and well-conceived contingency plans.
(John R. Hannum, North Coast Regional Water Quality Control Board)

U.7 The porous volcanic ground in the Medicine Lake Highlands is conducive to the ground water being contaminated by accidental spills. The contaminated ground water could thus contaminate the entire aquifer. Will the pristine cold water aquifer become contaminated and undrinkable? Please address this issue and the fact that Calpine employees will be drinking bottled water. (pg. 2-33 EIS/EIR)
(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

AG.27 The EIS/EIR fails to discuss significant impacts to groundwater quality that result from geothermal brine spills, as discussed in the attached comments of Dr. Fox. (Ex. A, comment 12.) Geothermal brine, which contains high concentrations of toxic and hazardous substances, could significantly affect groundwater quality. The EIS/EIR should evaluate this impact and propose mitigation measures.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.248 Brine Spills Would Result In Significant Impacts. The DEIR discusses the impacts from chemical and hazardous material spills on water quality. (DEIR, p. 4-39.) However, it fails to comprehensively discuss the impact of the largest single hazardous material at the site, the brine itself. The Human Health and Safety section considers well blowouts, which are one type of accident that could result in a brine spill, but concludes they are not significant because the Project includes blowout prevention equipment on each production well and a 750,000 gallon sump to contain any losses. (DEIR, pp. 2-15, 4-282, 4-283.)

However, brine spills at other locations, including piping between wells and the power plant and at the power plant itself are possible because of the highly corrosive nature of the brines, which can cause pipeline and other failure, and the high pressures in the pipelines.[21] Because geothermal brines contain high concentrations of toxic and hazardous substances, including hydrogen sulfide and metals, they can adversely affect local soils, groundwaters, and exposed workers if not properly contained.[22]

According to the DEIR, the Project would process 2.9 million pounds of geothermal water per hour. (DEIR, p. 4-44.) Assuming the fluid weighs 8.3 lbs/gal, the density of water, and that the entire fluid flow of the plant discharged, about 350,000 gallons of brine could be discharged to the ground in 1 hour.[23] This is comparable to other estimates of the size of a typical spill. (Layton and Morris, 1981, p. 64.) According to the published literature, this would result in the dissolution of large amounts of chloride, lead, boron, copper, and zinc from local soils, which could contaminate underlying aquifers. (Shinn and Ireland 1981.)[24] Further, it could take 3 to 10 years to reclaim the soils by leaching.[25]

This is a significant impact that is not revealed in the DEIR. The DEIR should be revised to quantitatively evaluate the impact of a brine spill on groundwater quality and to recommend mitigation. Mitigation would include constructing containment berms along pipeline corridors and at the power plant. Pressure activated alarms could also be used to alert plant operators so that remedial actions could be promptly taken.[26] *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

FK.6 SECTION 4.3.9 page 4.39 EFFECTS OF CHEMICAL AND HAZARDOUS MATERIALS SPILLS ON WATER QUALITY. The proposed project would involve the use of several chemical and hazardous materials. Accidental spills of these materials would not be expected to result in adverse impacts to water quality in the project vicinity, due to planed control practices. [What they are telling us is that they

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[21] J.H. Shinn and R.R. Ireland, Ecology Problems Associated with Geothermal Development in California, Symposium on Energy and Ecology in the West, Lawrence Livermore Laboratory Report UCRL-83941, Revision 1, August 4, 1980.

[22] D.W. Layton and W.F. Morris, Geothermal Power: Accidental Fluid Releases and Waste Disposal, CEP, April 1981, pp. 62-67.

[23] Amount of brine discharged = $(2.9 \times 10^6$ lbs/hr)(1 hr)/(8.3 lbs/gal) = 349,398 gal.

[24] G. Sposito, A.L. Page, and S.V. Mattigod, Trace Metal Speciation in Saline Waters Affected by Geothermal Brines, Lawrence Livermore National Laboratory Report UCRL-15072, 1979.

[25] W.A. Jury and L.V. Weeks, Solute Travel Time Estimates for Tile Drained Fields, III. Removal of a Geothermal Brine Spill from Soil by Leaching, Lawrence Livermore National Laboratory Report UCRL-13792.

[26] R. Sung, Surface Containment for Geothermal Brines, TRW, Inc. Report, Redondo Beach, Calif., 1979.

are not planning any accidental spills. That is why they call them accidents. Due to the extreme winter weather conditions in this area, one can expect to have accidents with trucks carrying hazardous materials. I am sure that all of the recorded spills of hazardous materials at the other existing plants were not planned either.] *(Charles F. Moss)*

Response—Effects to Groundwater from Accidental Geothermal Brine Spills

These comments present concerns about the potential for effects to groundwater from the following sources:

(1) Intermingling of geothermal fluids with groundwater after failure of the well casing, or

(2) Release of geothermal fluids at the surface and subsequent percolation of these fluids into the shallow groundwater

The potential for contamination of groundwater through a rupture of wells near the surface is discussed above in responses to "Comments—Potential Groundwater Contamination due to Geothermal Fluid Use" and "Comments—Well Casing Program and Potential for Casing Rupture."

The proposed project includes several mechanisms to ensure that the shallow groundwater would not be contaminated through a surface release of geothermal fluids. GRO #2 requires the installation of Blowout Prevention Equipment on every well. Each well pad would also include a sump lined with an impermeable layer that would protect the shallow groundwater layer from contamination. Each sump would maintain approximately 750,000 gallons of capacity, which could be used to contain geothermal fluids in the event of an emergency. A minimum of 225,000 gallons of capacity would be maintained at all times to prevent sump overflow. In addition to the lined sump, each well pad would be surrounded by a berm to further contain accidental release of geothermal fluids in an emergency. See response to "Comments—Well Casing Program and Potential for Casing Rupture" above for more discussion of GRO #2.

In addition to the emergency control measures outlined above, Mitigation Measure 4.3.6c would require Calpine to develop a plan detailing runoff control and restoration measures to be implemented in the event of a sump overflow.

Comments F.2 and AG.248 present concerns about the potential for geothermal brine spills from the proposed pipelines (including between the well pads and the power plant). The production and hot-injection pipelines would be designed with the highest level of structural integrity and safety in order to comply with GRO #6, which governs the design, operation, and testing of geothermal surface pipelines. GRO #6 dictates specific design features that must be included in geothermal surface pipelines, including provisions for extreme levels of thermal expansion, extreme levels of water pressure due to the two-phase flow, and safety devices. Depending on the facility that is proposed, the safety devices that are mandated by GRO #6 include pressure sensors, pressure-relief valves, check valves, rupture discs or venting systems. The specific design and safety features of the proposed facility would be submitted to the USGS with the Application for Permit to Drill and the Plan of Operation and Utilization for their approval.

As described on page 2-19 and 2-20 of the Draft EIS/EIR, the proposed production and injection pipelines would be constructed of insulated carbon steel. All production

pipelines would be designed, fabricated, and inspected in accordance with the latest version of American National Standards Institute (ANSI) code B311 for power piping. The carbon steel piping would be able to accommodate extreme levels of temperature (up to 400°F) and the associated expansion and contraction that might occur (up to 14 feet of expansion in every mile of pipeline). Because of their design features, leakage from the pipelines is not expected to occur.

Prior to placing pipelines in service, GRO #6 mandates pipeline integrity tests that are witnessed by a representative of the BLM (who took over this authority from the USGS). As discussed in the Draft EIS/EIR, during operation, Calpine would closely monitor the proposed geothermal pipelines for corrosion and leaks as part of routine monitoring efforts for the project. In addition, pressure levels of the pipelines would be monitored by safety devices installed on the pipeline and monitoring equipment at the proposed power plant. This monitoring would ensure that any leaks or breaks of the pipelines are immediately detected; Calpine would immediately repair any leak or break.

The contingency plan for the project, which would be submitted to the BLM for approval under GRO #2, would spell out specific measures that would be enacted to immediately and fully repair any pipeline leaks or breaks, if they occur. The North Coast RWQCB would participate in the development of this plan to ensure that contingency measures for pipeline leaks or breaks meet with their approval.

Comment AG.248 also claims that about 350,000 gallons of brine could be discharged into the groundwater. This calculation is based on a spill that would occur for one hour. A spill of this magnitude and duration would be nearly impossible. The comment assumes that the entire fluid flow of the plant would be discharged. This assumption is unrealistic because it would require a simultaneous failure of all production wells or main surface pipelines. The comment also assumes that the full discharge would occur for one hour. As described in the EIS/EIR and in response to "Comments—Well Casing Program and Potential for Casing Rupture" above, each production and injection well would be monitored constantly for any changes in well pressure. A well casing rupture would result in an instant drop in well pressure, which would then be immediately detected. Upon detection, the ruptured well would be shut down. Thus, it would be impossible for a leak of the magnitude described in the comment to go undetected for one hour.

Comment AG.248 also states that a spill of this magnitude would result in dissolution of large amounts of chloride, lead, boron, copper, and zinc from local soils, which could contaminate underlying aquifers. There are no data to support the assumption that local soils contain large amounts of these elements. (The soils in the project area are typical of young volcanic terrain which do not contain elevated concentrations of these elements, particularly in a soluble compound.) Furthermore, if such concentrations of these elements were present in local soils, the existing groundwater would dissolve the elements; the addition of more fluid (i.e., geothermal waters) would not change the rate of dissolution of constituents in local soils.

Comment FK.6 references trucks carrying hazardous material that are associated with the proposed project. See response to "Comments—Hazardous Materials Transport" in the Human Health and Safety Section for a discussion of this issue.

REGIONAL GROUNDWATER

Comments—Potential Effect to Fall River Springs

B.3 There is a conspicuous lack of scientific data in the draft document to describe the regional groundwater flow direction, either of the shallow cold groundwater aquifer or the underlying geothermal flow. Indeed, Figure 3.3-4 represents the estimated regional groundwater flow direction as a series of question marks. In addition, the draft document cites (page 3-26) a letter to your office from the Director of the Fall River Resource Conservation District, a geologist from the Colorado School of Mines, and a University of Michigan doctoral student, suggesting that there is a direct geohydrologic connection between the Medicine Lake Highlands, where this project and others are being proposed, and the headwater springs of the Fall River. We recommend that the draft EIS/EIR be revised to include a comprehensive description of existing scientific information and proposed scientific research regarding regional groundwater flow interconnections and the potential effects that removal or disturbance of such groundwater would have on federally listed aquatic species that inhabit the waters of the surrounding Mt. Dome/Klamath Lake, Tule Lake, and Fall River groundwater basins.

(Ronald A. Iverson, U.S. Fish and Wildlife Service)

D.3 However, some issues that we identified in our June 17, 1997, letter were not adequately addressed in the draft EIR/EIS. This includes the lack of hydrologic data to verify that the proposed project would not impact surface or ground water recharge of Fall River Springs. Figure 3.3-4 of the draft EIR/EIS demonstrates the uncertainty in information on regional ground water flow directions.

(Richard L. Elliott, California Department of Fish and Game)

M.2 Our comments were based on many hours of consultation with some of the leading geologists in the nation. These experts are well versed in geothermal development, and the concerns raised during these discussions are based on sound scientific evidence of a potential connection of the Medicine Lake Highlands to the source spring areas for the Fall River. Our primary concern remains that not enough is known about this inter-connection to safely proceed with geothermal development. The failure of the EIS/EIR to address that concern is apparent.

Of further concern has been the resistance of the USFS, BLM, Weiss and Associates, Bonneville Power and other to aggressively pursue existing proposals by Lawrence Livermore Laboratories to research this inter-connection through isotopic testing, helping us to better assess the risks. Do the guardians of our public resources feel that this study would pose unacceptable delays to this project? Does the value of the pristine spring systems feeding Fall River or the value of the threatened and endangered species in those springs warrant such a study? *(Rick Poore, et al., Fall River Resource Conservation District)*

M.3 The critical subject of regional hydrogeologic setting of the Four-mile Hill prospect area is simply not discussed. Mention is made of the Fall River Springs, but dismissed on basis of perceived, but not substantiated, groundwater flow directions being away from the springs, etc. Powerful evidence indicates that basically the regional gradient is southward. There is no discussion at all of this probability. *(Rick Poore, et al., Fall River Resource Conservation District)*

M.4 Drainage basins as supposed in the EIS are simply based on weak topography. The deeper systems at least would be forced to flow (in significant part) southward along the base of the ML volcano, and to escape at the low point or subsurface spill point along the south margin of the volcano edifice, and from there to the Fall River Springs. (I site these interpretations as examples of what is likely to be true; the EIS ignores or doesn't understand these likely hydrogeologic conditions. Field data are required to resolve these problems.) *(Rick Poore, et al., Fall River Resource Conservation District)*

M.8 Most serious, the basic question of how geothermal activities anywhere on the Medicine Lake volcano may affect the Fall River Springs system is not addressed. What is the level of risk to the Springs? And why? If we do not know, what do we do to find out? Known geologic evidence firmly supports some risk. Risk must be evaluated, not dismissed on the basis of one or two suppositions as the EIS does.

(Rick Poore, et al., Fall River Resource Conservation District)

N.7 The Fall River Resource Conservation District (FRRCD) advised the USFS/USBLM EIS/EIR Coordinator for the proposed Telephone Flat Geothermal Project that during the past several months, Dr. Thomas Grose, Geologist with the Colorado School of Mines, had collected data and produced the basic geologic mapping of the Fall River Valley and surrounding area for use by the FRRCD in planning efforts and water development. After consultation with Dr. Grose, the FRRCD has been advised of the probable link from the Medicine Lake Highlands to the headwaters springs of Fall River.

The FRRCD further advised the USFS/USBLM Coordinator that given the unique and invaluable nature of this spring system and the community it supports, the likelihood of geologic connection to the project

area, and the danger of potential impacts from disturbance by geothermal development, the FRRCD provided site specific comments such as it is probable that most of the water issuing from the headwater springs of the Fall River is water from the Medicine Lake Highlands. And that this conclusion is supported by work done by the Lawrence Livermore Lab, the U.S. Geological Survey, and Dr. Thomas Grose.

The FRRCD went on to advise the Coordinator that the risk of perturbation or contamination of the source area constitutes a threat to the integrity of Fall River and its spring system and to aquatic species dependent upon the constant flow, clarity, water chemistry, and temperature of the spring environment.

We reference letter of June 4, 1997 to Randy Sharp, USFS, Coordinator, from Fall River Resource Conservation District. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

N.10 11. Without a proper and justifiable detailed hydrology analysis in the DEIS/EIR, based on the information and data in the DEIS/EIR, it is impossible for the public, U.S. Forest Service, and the BLM to determine whether or not the proposed project will affect the surface flows and the subsurface (underflow) flows of Fall River Springs and other surface and subsurface and spring sources. At least one professional source states that it will affect Fall River Springs [Thomas L.T. Grose, Geologist].

In the event it is determine by study or other means, that the proposed project will affect the surface and/or subsurface (underflow) flows of Fall River Springs and/or any other surface and subsurface flows, state law (California Water Code) requires Calpine, the applicant, to obtain a conditioned water right permit from the California State Water Resources Control Board to divert and use the state's surface and subsurface (underflow) flows for the proposed project.

Consequently, the U.S. Forest Service must conduct a detailed hydrology analysis to determine whether or not the proposed project will have any affect to the Fall River Springs and other surface and subsurface flow sources. That detailed hydrology analysis must be included in any supplemental DEIS/EIR prepared by the U.S. Forest Service for the proposed project.

12. In the event the proposed project affects the surface and/or subsurface (underflow) flows of Fall River Springs or any other surface and subsurface flow sources, that effect has the potential to injury legal water right holders who may divert, store, and use the state's water for beneficial uses.

Consequently, all legal water right holders should be advised by the U.S. Forest Service that a potential exist that may affect their water rights and water supplies.

(Robert J. Baiocci, Fall River Wild Trout Foundation)

O.4 Furthermore, we are concerned with the scientific validity of the EIS in regards to protecting the water quality of Medicine Lake. Thomas Grose, a leading geologist with the Colorado School of Mines, has expressed concern over the risk of connectivity between the project area and the headwater springs of the Fall River. If these areas are connected, disturbance to the Medicine Lake Highlands will be significant. According to Lawrence Livermore Laboratories, the U.S.G.S. and Dr. Thomas Grose, it is highly probable that most of the water from the headwaters of the Fall River drainage seeps from the Medicine Lake Highlands. Due to the volume and purity of this spring water, any risk of perturbation or contamination of the source area constitutes a threat to the integrity of the Fall River and the aquatic species dependent on the constant flow, clarity, chemistry and temperature of the spring water.

Investigations should be required to assess the interconnection between both the waters of the Medicine Lake Highlands summit and the springs in the Fall River drainage to determine the potential for contamination of the springs. It is known that the spring sources for the Fall River are capable of remarkably consistent flow volume, even after the long drought periods experienced in recent years. This suggests that there is a connection to vast underground aquifers. Though this phenomena is not fully understood, disturbance to this aquifer without full knowledge of the complex geologic interrelationships would pose an unacceptable risk to the Fall River ecosystem.

(Katherine Kowatch, Friends of the River)

S.1 This letter is in regard to the Draft Fourmile Hill Geothermal Development Project EIS/EIR of July, 1997. We have reviewed the hydrology section and offer a newly published report in response. In particular, we would like to point out that, based on our stable isotope data, groundwater recharge and flow beneath the Medicine Lake region must be a significant component feeding the Fall River Springs. Our carbon isotope data also shows that a large magmatic carbon dioxide component occurs in the Fall River Springs, and is of such a large magnitude that it can only be derived from a large and active geothermal system like that found beneath Medicine Lake Volcano. This latter evidence disproves the opposite claim made in the second paragraph on page 3-27 of the Draft EIR/EIS. In addition, a unprecedented amount of heterogeneity in fracture permeability must exist throughout the subsurface in this region in order to direct such a large groundwater flow to the Fall River Springs. Therefore, in our opinion and experience, designation of groundwater divides in this area based on surface topography as made in figure 3.3-1 are overly simplistic and unsubstantiated.

(M. Lee Davisson and Timothy P. Rose, Lawrence Livermore National Laboratory)

Y.27 As indicated in the December 4, 1996 and subsequent letters by the Fall River Resource Conservation District, the project has the potential to affect more distant water sources because of the porosity of the

volcanic soils and the prevalence of lava tubes which supply the Fall River, Big Lake and Horr Lake. Impacts on these water sources have also not been adequately addressed in the DEIS/EIR.

Many of these water resources no doubt qualify as high quality waters under EPA standards because of their purity and the general pristineness of the area. As such, they would fall under stricter EPA regulations than those applied in the DEIS/EIR.

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AF.1 PG&E has reviewed the Draft Environmental Impact Statement Report (DEIS/EIR) for the proposed Fourmile Hill Geothermal Development Project. PG&E has concerns about the potential hydrologic impacts of the Fourmile Hill Geothermal Development Project and other geothermal developments being proposed near Medicine Lake, California. PG&E has expressed similar concerns about the Telephone Flat Geothermal Development Project.

PG&E owns and operates several hydroelectric projects in the Sacramento River Basin that are dependent on flows into the Fall and Pit Rivers. The Fall River, the largest tributary to the Pit River, drains a 612-square-mile watershed located in the volcanic terrain of the Modoc Plateau. The Fall River originates from Bear Creek and numerous large springs and spring-fed tributaries, including Spring Creek, Lava Creek, and the Tule River, Horr Pond, and Big Lake. With its tributary streams, the Fall River system comprises roughly 40 miles of streams flowing over flat terrain to its confluence with the Pit River at Fall River Mills.

PG&E believes that there is a probable hydrological link between Medicine Lake area and the headwater springs of the Fall River. This conclusion is based on the fact that flows from the headwater springs into the Fall River are at consistent levels even during prolonged drought periods. On page 3-27 of the DEIS/EIR, it states that "recharge solely from precipitation over the surface area of the lava flow northwest of Fall River would be insufficient to support the flow volumes from the springs". Where the additional flow comes from is unknown. Changes in surface flows, aquifer linkages and aquifer recharge due to the development of geothermal projects may have a direct and severe effect on PG&E's hydroelectric generation capabilities. A study should be conducted to confirm or deny the connection between the waters of the Medicine Lake area and the headwater springs in the Fall River drainage. The study should either refute or support the conclusion on page 3-26 that states:, "It is unlikely, therefore, that groundwater in the Fourmile Hill area communicates with groundwater on the south flank of the Medicine Lake volcano."

(John Sandhofner, PG&E)

CM.1 For all geothermal projects that might have a defect on any of our water in the intermountain area. The people on the study should be held responsible for all damages. I will, my two attorneys will file a lawsuit that they caused any damages in the Fall River Water area. Those people that made the study an have caused the damages will pay for everything.

(John Ghiorso)

CM.2 I was born in Santa Clara Valley and saw a complete destruction of the water in that valley. I hope we don't let it happened in Fall River Valley. Protect it.

(John Ghiorso)

PH1.6 I read the draft document here, and it seems quite uncertain about the relationship between this project and the springs at Fall River. There's a question there that doesn't seem to be addressed at this point.

We have a concern whether it might be either a water quality problem that might develop out there, a volume problem that might develop out of this, and it doesn't seem to be addressed. They say the water goes out that way, we're not sure how much.

On page 4-24 it says there's some uncertainty about the geohydrologic connection between the Medicine Lake area and Fall River Springs, but that's as far as it seems to go. There's no discussion about what really is going on there. We think it's an important resource and ought to at least be addressed. Thank you.

(Dorris Public Hearing)

PH1.7 First, I'd like to support what Jim Rickert said. We do not believe that the EIR/EIS addresses our concerns. We don't believe that it has addressed anything related to potential impacts to Fall River. And what I'd like to do is read to you a letter that is from the Fall River Resource Conservation District and Tom Grose of the Colorado School of Mines and myself.

(Dorris Public Hearing)

PH1.9 Our comments were based on many hours of consultation with some of the leading geologists in the nation. These experts are well versed in geothermal development, and the concerns raised during these discussions are based on sound scientific evidence of a potential connection of the Medicine Lake Highlands to the source spring areas for the Fall River.

Our primary concern remains that not enough is known about this interconnection to safely proceed with geothermal development. The failure of the EIS/EIR to address that concern is apparent. Of further concern has been the resistance of the U.S. Forest Service, Bureau of Land Management, Weiss and Associates, Bonneville Power and others to aggressively pursue existing proposals by Lawrence Livermore Laboratories to research this interconnection through isotopic testing, helping us to better assess the risks.

Do the guardians of our public resources feel that this study would pose unacceptable delays to this project? Does the value of the pristine spring systems feeding Fall River or the value of the threatened and endangered species in those springs warrant such a study? *(Dorris Public Hearing)*

PH1.10 Number one: The critical subject of the regional hydrogeologic setting of the Fourmile Hill prospect area is simply not discussed. Mention is made of the Fall River Springs, but dismissed on the basis of perceived, but not substantiated, groundwater flow directions being away the springs, et cetera. Powerful evidence indicates that basically the regional gradient is southward. There's no discussion at all of this probability. *(Dorris Public Hearing)*

PH1.11 Number two: Drainage basis supposed in the EIS—drainage basins as supposed in the EIS are simply based on weak topography. The deeper systems at least will be forced to flow in significant part southward along the base of the Medicine Lake volcano, and to escape at the low point or subsurface spill point along the south margin of the volcano edifice, and from there to the Fall River Springs. I cite these interpretations as an example of what is likely to be true. The EIS ignores or doesn't understand these likely hydrogeologic conditions. Field data are required to resolve these problems. *(Dorris Public Hearing)*

PH1.15 Number six: Most serious, the basic question of how geothermal activities anywhere on the Medicine Lake volcano may affect the Fall River Springs system is not addressed. What is the level of risk to the Springs and why? If we do not know, what do we—what do we do to find out? Known geologic evidence firmly supports some risk. Risk must be evaluated, not dismissed on the basis of one or two suppositions as the EIS does. *(Dorris Public Hearing)*

PH1.20 I would also like to include the comments that we are intensely interested in the potential links between this project and Fall River Springs system, and follow closely any developments. We'd like to see any information available which would substantiate what was stated in the EIS. *(Dorris Public Hearing)*

PH1.24 Our concern is very little consideration was given to the potential impasse or the potential interconnection between the Fall River Springs source area and the Medicine Lake Highlands, which is the recharge area for the springs. Very little attention was given that in the EIS, making us naturally feel that it was being brushed under the rug, so to speak, as a potential hindrance to the project. That's where our concern lies, and it was not treated in a very in-depth fashion in your documentation. *(Dorris Public Hearing)*

PH1.25 In other words, you were too busy dealing with the focus, you were not going to deal with the issue of Fall River. *(Dorris Public Hearing)*

PH1.27 So then, you're asking us to simply trust the geologist that this has no effect on Fall River, and allow you to move forward with a project without further comment, without review today, doesn't that—wouldn't that be difficult for you to do if you were in our position? *(Dorris Public Hearing)*

PH1.29 Until Friday, when USGS came to Thousand Springs, to my knowledge they didn't collect any data from Fall River. So with just data from the wells and Medicine Lake, how can they say there's no connection to Fall River? Even if this data, you know, exists, it's incomplete, it's only half a picture. So how can they talk about whether there is or is not a connection? *(Dorris Public Hearing)*

PH4.12 The Fall River Resource Conservation District requested a study of the project effects on Fall River springs be done. Request that this study be completed before the Record of Decision is finalized. *(Mount Shasta Public Hearing)*

Response—Potential Effect to Fall River Springs

All of the comments express concern that the proposed project at Fourmile Hill could affect the water quantity or quality at the Fall River springs, 35 miles to the south. Some of the comments state that the potential for effects to the Fall River springs was not addressed in the Draft EIS/EIR. The springs at Fall River were discussed in the Draft EIS/EIR on page 3-26 and 3-27; the potential for effects to the Fall River springs were addressed in the Draft EIS/EIR in the following locations:

- Section 4.3.1, page 4-24 and 4-25
- Section 4.3.6, page 4-34

The analysis of the potential for effects to the Fall River springs, local groundwater, and regional groundwater, was conducted by the hydrologist on the third-party, interdisciplinary team contracted by the USFS and BLM to prepare the EIS/EIR. (Note the definitions of "local groundwater" and "regional groundwater" at the beginning of this

section.) The team members who conducted the hydrologic analysis each have over 15 years of experience in studying geothermal systems and the effects of fluid production and injection. The analysis was conducted through review of hydrologic and geologic data for the project region. These data included proprietary well data for the many wells that have been drilled in the Medicine Lake Highlands and the surrounding region. The analysis was based on consultations with other knowledgeable hydrologists and geologists. Persons consulted include:

- USFS resource staff
- The senior scientist at the Calpine Corporation
- Hydrologists and geothermal reservoir specialists at the USGS
- An expert on the modeling of contamination fate at The Hydrodynamics Group, a hydrology consulting firm
- Scientists from the Colorado School of Mines and the Lawrence Livermore Laboratory

Subsequent to the original analysis, additional data and reports have been prepared that discuss the hydrology of the Medicine Lake Highlands. Some of these reports also address the potential for effects to the Fall River springs from proposed geothermal activities in the Medicine Lake Highlands. These recent reports, which support the conclusions of the Draft EIS/EIR, are cited below where appropriate. A complete list of these recent reports is found in response to "Comments—Adequacy of Hydrology Analysis" at the beginning of this section.

Some of the comments reference a specific pathway by which the proposed project would affect the Fall River springs. Other comments state that the scientific evidence presented in the Draft EIS/EIR is not sufficient to determine whether the proposed project would affect the Fall River springs. All of the comments, however, question the conclusion of the Draft EIS/EIR: The proposed project would not adversely affect either water quality or water quantity at the Fall River springs. Presented below is an elaboration of the analysis presented in the Draft EIS/EIR. The analysis below provides further support for the conclusion that the proposed project would not adversely affect the Fall River springs.

For there to be an effect of the proposed project on the water quantity or quality (or both) of the Fall River springs, there must be some type of hydrologic connection between the project site and the Fall River springs. There are only two such hydrologic connections that are possible:

- A connection between the shallow groundwater at the project site and the outflow at the Fall River springs, or
- A connection between the geothermal reservoir beneath the project site and the outflow at the Fall River springs.

The Potential for a Connection between the Groundwater under the Project Site and the Fall River Springs: The Draft EIS/EIR and others (e.g., Bredehoeft 1997a, 1997b) have concluded that the Fall River springs are not supplied by shallow groundwater recharge from the proposed project area. This conclusion is supported primarily by the likely directions that shallow groundwater flows from the project site. As shown in

Figures 3.3-3 and 3.3-4 of the EIS/EIR, the project area is located on the north flank of the Medicine Lake caldera and is separated from the Fall River springs by the caldera. This caldera serves as a barrier to shallow groundwater communication between the north and south side of the Medicine Lake Highlands. Because groundwater tends to flow from areas of high elevation to areas of low elevation, groundwater movement generally follows the surface topography. Within the Fourmile Hill area, the topographic gradient is to the northwest, not to the south towards the Fall River springs. In addition, water levels from wells in the project area confirm a hydrologic gradient to the northwest. Thus, groundwater within the proposed project area probably does not recharge the Fall River springs.

Figures 3.4-4a through 3.4-4c in the EIS/EIR (and shown in response to "Comments—Local Groundwater Flow" at the beginning of this section and in the Final EIS/EIR) provide further evidence that the flow of groundwater away from the project area would be to the north, away from the Medicine Lake caldera. Figures 3.4-4a through 3.4-4c illustrate the distribution of temperature with depth throughout the Medicine Lake Highlands. Data from temperature gradient wells were used to create these illustrations (well locations are indicated by vertical lines and identified by well number). Figure 3.4-4b shows a cross-section of water temperature with depth across the area in Figure 3.4-4a from point "A" to point "B." Figure 3.3-4c shows a similar temperature pattern for a cross-section from point "E" to point "F."

These cross-sections span a distance of 10 to 11 miles, and each section begins and ends outside of the margins of the caldera. In these figures, the surface topography is taken from USGS maps and contain no vertical exaggeration (i.e., the horizontal and vertical scales are identical). The contour lines indicate the elevation of temperature isotherms (isotherms are lines connecting points of equal temperature) below the surface to a maximum of 250°F (data for higher temperatures are proprietary).

These cross sections show that elevated temperatures are found at the highest elevations and shallowest depths along the ring fracture zone, which bounds the caldera. These data further substantiate the conclusion that the base of the groundwater saturated zone slopes radially outward, away from the caldera. Measurements of the depth to the water table, as illustrated in Figure 3.3-3 in the EIS/EIR, show that the upper surface of the groundwater saturated zone also slopes radially outward, away from the caldera. Both sets of data indicate that the groundwater under the power plant and wellfield area flows away from the site to the north, down the gravitational gradient. Thus, the groundwater flows away from the caldera and away from the springs at Fall River which are located on the south side of the Medicine Lake caldera.

Recent analyses indicate that the Fall River springs may be supplied, at least in part, from groundwater recharge in the Medicine Lake region (but not necessarily the project site). Water samples were taken from wells in the Medicine Lake Highlands, the Fall River springs, and other locations to the south and west of the Fall River springs. These samples were analyzed for their isotopic signatures. The isotopic signature of water varies as a function of elevation and distance from the ocean (Dansgaard 1964; Smith et al. 1979; Davisson and Rose 1997). By comparing isotopic signatures of water samples from many locations, one can infer the path of groundwater movement. In some cases, if the data are adequate, one can even estimate the origin of the groundwater.

In these recent studies, the isotopic signatures of water samples from the Fall River springs were found to be most similar to the signatures of groundwater from the Medicine Lake Highlands (Grose 1996; Davisson and Rose 1997; Weiss Associates 1997; Mariner et al. 1998). The authors of these recent studies concluded that these limited data support, but do not prove, that there is a connection between the groundwater in Medicine Lake Highlands and the Fall River springs.

However, the isotopic data are not inconsistent with the hydrologic model presented in the EIS/EIR. Only one water sample has been collected on the north side of the Medicine Lake caldera (where the proposed project is located) and analyzed for its isotopic signature (Davisson and Rose 1997). Thus, the conclusions drawn from these data only apply to the south side of the caldera, but not necessarily to the project site.

It is acknowledged that Medicine Lake Highlands may provide some recharge to the Fall River springs. However, it has been shown that precipitation within the Medicine Lake Highlands cannot be responsible for all of the extremely high flows seen at the Fall River springs. Davisson and Rose (1997) estimate that half of the outflow at the Fall River springs originates in the Medicine Lake Highlands. However, they do not present any calculations used to derive this value or references to support their estimate.

Weiss and Associates (1997) estimated the amount of recharge to the Fall River springs that could reasonably originate in the Medicine Lake Highlands using extensive calculations and all of the available data. They determined that about five percent of the flows at the Fall River springs could originate in the Medicine Lake Highlands (which they define as an area of about 66 square miles). The question remains of where the vast majority (95 percent) of the water at the Fall River springs comes from. Weiss Associates (1997) describe six potential sources of the remaining water:

- Tule Lake-Klamath Lake area (Macdonald 1966; Hotchkiss 1968)
- Southeast extension of the Fall River Graben (Weiss Associates 1997)
- Northwest extension of the Fall River Graben (Weiss Associates 1997)
- Pit River (Norris and Webb 1990)
- Vulcan Lineament-Caribou Wilderness Area (Weiss Associates 1997)
- Hat Creek Graben (Rose et al. 1996; Rose and Davisson 1996)

All of the regions listed above, with the exception of the Tule Lake-Klamath Lake area, are south or west of the Fall River springs. Thus, the hydrologic reservoir under the proposed project could intersect only the potential source of Tule Lake and Klamath Lake, which is approximately 15 miles northeast of the project site. As stated in Weiss Associates (1997), it is speculation that Tule Lake and Klamath Lake may be a water source for the Fall River springs:

> "Macdonald (1966) suggested the possibility that ground waters from the Tule Lake - Klamath Lake Area, located some 92 km (55 mi) to the north of [the Fall River springs], may be the source area for these springs. This inference was based on ground water gradients in the area reported in an oral communication by the USGS in 1965. The authors of this report [i.e., Weiss Associates] have contacted the USGS in Redding, California in order to locate the data on which that oral communication was based. No record of this 1965 data remains. However, Hotchkiss (1968) reported that ground water gradients in the Lava Beds National

> Monument area from about Tule Lake to Timber Mountain due east of Tionesta, indicate that ground water flows south from Tule Lake to at least the Tionesta area. The current authors were also not able to identify any oxygen-18 and deuterium isotopic values for these waters flowing south from Tule Lake."

Some comments have suggested that a connection exists between Tule Lake and the Fall River springs via a deep groundwater reservoir that is at a depth that is below the geothermal reservoir (but not necessarily beneath it). However, analysis of water samples collected at the Fall River springs indicates clearly that the water originates from a shallow source and does not undergo any deep (>1,000 feet) transport. Furthermore, the low temperatures and high flow rates imply a relatively short residence time that is inconsistent with the deep transport model (Davisson and Rose 1997).

Taken together, these data strongly support the hypothesis that groundwater beneath the proposed project site does not flow into the Fall River springs or if it does, it contributes only a tiny fraction of the flows.

The Potential for a Connection between the Geothermal Reservoir under the Project Site and the Fall River Springs: The other potential hydrologic connection between the project site and the Fall River springs is via the geothermal reservoir. As described below, the available data strongly refute the hypothesis that the geothermal reservoir supplies some of the outflow at the Fall River springs.

Geothermal waters have unique chemical signatures. The most distinctive and easily-measured signature of geothermal waters is their high level of chloride. Because natural freshwater has an extremely low concentration of chloride, freshwater that mixed with geothermal waters would show a clear and dramatic increase in chloride concentrations. Water samples taken at the Fall River springs show no sign of elevated chloride concentrations or any other chemical that would indicate mixing with geothermal waters (BLM et al. 1995; Weiss Associates 1997; Mariner et al. 1998). These data indicate that there is no direct connection between the geothermal reservoir under the Medicine Lake caldera and the Fall River springs.

Potential for Impacts to the Fall River Springs if a Connection Exists between the Groundwater at the Project Site and the Fall River Springs: Based on the evidence presented above, there is only one possible hydrologic connection between the proposed project and the Fall River springs: The shallow freshwater aquifer in the Medicine Lake Highlands. As discussed above, this connection has not been proven; some data are consistent with such a connection while other data are inconsistent with such a connection. However, for the purpose of the impact analysis, the Draft EIS/EIR presented a worst-case scenario in which there was a direct hydrologic connection between these two systems. The analysis below further explores this scenario.

If groundwater from the project site contributes some of the outflow at the Fall River springs, there are three potential pathways by which impacts could occur to the Fall River springs from the proposed project. The first two of the pathways involve impacts on water quantity; the other pathway considers the potential for impacts to water quality:

(1) Groundwater consumption at the project site
(2) Groundwater depletion due to geothermal fluid use
(3) Groundwater contamination from geothermal fluid use

None of these impacts are expected to occur and none would result in a significant adverse effect to the Fall River springs. A discussion of each potential impact and its likelihood of occurrence is presented below.

1. Potential Effects of Groundwater Consumption at the Project Site: As discussed on pages 4-21 through 4-26 in the Draft EIS/EIR, as revised in the Final EIS/EIR, the Fourmile Hill project is expected to use groundwater primarily during construction and, to a lesser extent, during operation of the project. Maximum water withdrawals from the well on Calpine's lease area would occur during the third year of construction. During this year, water withdrawal would total approximately 10 million gallons.

Assuming that all groundwater from the project site fed into the Fall River springs, groundwater withdrawals from the project site would still not have a significant effect on the flow of these springs. This conclusion is based on the following calculations.

As stated on page 4-24 of the Draft EIS/EIR, the flow from the Fall River springs is approximately 1,200 cubic feet per second, or 283 billion gallons per year. Therefore, the maximum water withdrawal from the Calpine well would be less than 0.004 percent of the annual discharge from the Fall River springs. Use of this amount of water would not measurably affect water availability in the springs.

The effect of groundwater withdrawals from the Arnica Sink wells is addressed on page 4-24 of the Draft EIS/EIR. Groundwater withdrawals from Arnica Sink during the first year of construction are estimated to be less than 0.003 percent of the annual flow from the Fall River springs. Use of this amount of water would also not measurably affect water quantity or quality at the Fall River springs.

2. Potential Effects of Groundwater Depletion due to Geothermal Fluid Use: Some comments express concern that depletion of the geothermal reservoir may reduce flows to the Fall River springs. This concern is based on the assumption that waters in the geothermal reservoir have a direct connection with the Fall River springs. The evidence to date does not support that assumption.

As discussed on pages 3-39 and 3-40 of the Draft EIS/EIR, available data support the interpretation of an impermeable layer of rock overlying the geothermal zone that would strongly limit the recharge of the deeper geothermal reservoir from shallow groundwater (BLM et al. 1995, 1997; Mariner 1997; Weiss Associates 1997). For further discussion of the evidence that underlies this conclusion, see response to "Comments—Separation of Local Groundwater and the Geothermal Reservoir." It is therefore

expected that the impermeable layer would serve to generally prevent recharge of the geothermal system by the shallow groundwater system.

There is some evidence that gases from the geothermal reservoir enter the groundwater aquifer from below and are transported south to the Fall River springs through the groundwater aquifer. Radiocarbon measurements taken at the Fall River springs indicate that 27 percent of the carbon in the water originates from the geothermal reservoir (Rose et al. 1996; Davisson and Rose 1997). This pattern is consistent with the pattern of the geothermal system observed near Mt. Lassen (Rose and Davisson 1996). However, these data suggest a connection between the gases of the geothermal system and the groundwater system. There is no evidence to support a connection between the geothermal waters and the groundwater (indeed, the lack of chloride in spring water at Fall River refutes this hypothesis). Moreover, the carbon isotope data present a picture of communication that occurs somewhere in or near the Medicine Lake Caldera (under which the geothermal reservoir is found). These data do not suggest communication under the project site.

Even if a connection existed between the shallow groundwater and the geothermal reservoir, the consumptive use of geothermal fluids would not significantly affect water flows at the Fall River springs. As discussed on pages 4-44 and 4-45 of the Draft EIS/EIR, the proposed project would produce approximately 2.9 million pounds of steam per hour from the power plant. Of this total, approximately 2.4 million pounds would be injected back into the geothermal reservoir. The remainder, or approximately 0.475 million pounds, would be emitted from the cooling towers. Thus, approximately 0.475 million pounds of steam per hour would be lost from the geothermal reservoir. This amount is equivalent to a loss of approximately 60,000 gallons per hour, or 0.5 billion gallons per year.

The flow from the Fall River springs is approximately 1,200 cubic feet per second, or 283 billion gallons per year. Assuming that all of the geothermal fluid would be recharged by groundwater above it, and assuming that all of the groundwater at the project site flow directly to the Fall River springs, the maximum effect on water discharge at the Fall River springs would be less than 0.18 percent of the annual discharge from the Fall River springs.. Use of this amount of water would not measurably affect water availability in the springs.

3. Potential Effects of Groundwater Contamination due to Geothermal Fluid Use: Some comments express concern that the proposed project could affect the Fall River springs through contamination of the groundwater at the project site. These comments suggest that this contaminated groundwater could then flow to the Fall River springs and adversely affect the water quality of the springs. This concern is based on the assumption that a hydrologic connection exists between groundwater at the project site and the Fall River springs. As discussed above, such a connection is unlikely.

If a connection existed between groundwater at the project site and the Fall River springs, the project could affect water quality at the springs in three possible ways:

- Pumping of geothermal fluids could cause upwelling of geothermal fluids into the groundwater aquifer above and contaminate the groundwater

- A rupture of the geothermal well casing near the surface could cause leakage of geothermal materials into the shallow groundwater
- An accidental spill of geothermal brine at the surface could percolate through the soil and contaminate the groundwater

First, as discussed above, the available data from wells drilled in the Medicine Lake Highlands indicate the presence of an impermeable zone that separates the geothermal reservoir from the groundwater aquifer. This impermeable layer would prevent the upwelling of geothermal fluids into the groundwater. For an extensive discussion of this issue, see response to "Comments—Separation of Local Groundwater and the Geothermal Reservoir."

Second, the potential for a well casing failure during project operation is extremely low due to the integrity of the well casings. Drilling and design of the geothermal wells would be regulated by the BLM and would be in compliance with the Federal GROs and the EPA UIC regulations for injection wells. The BLM would be responsible for inspections during well drilling and construction to ensure compliance with the GROs, which includes inspection for the use of proper casing and cementation techniques. The EPA would be responsible for ensuring appropriate construction, operation, and monitoring of injection wells.

Mitigation Measure 4.3.6b would provide additional assurance that geothermal fluids would not contaminate the shallow groundwater interval. This mitigation measure calls for periodic inspection of the well casing to verify its structural integrity. In the event of a failure of one of the well casings, operating procedures would quickly detect any leakage of geothermal or injection fluids. A failure of the well casing would lead to a drop in pressure at the wellhead which would be quickly detected. Based on BLM and EPA UIC regulations, Calpine would be required to immediately address this problem. See response to "Comments—Well Casing Program and Potential for Casing Rupture" for more discussion of this issue.

Finally, the comments express concern about the potential for contamination of the groundwater through a release of geothermal fluids on the surface. The proposed project includes several mechanisms to ensure that the shallow groundwater would not be contaminated through a surface release of geothermal fluids.

GRO #2 requires the installation of Blowout Prevention Equipment on every well. This equipment is designed to prevent accidental release of geothermal fluids during drilling. Each well pad would also include a sump lined with an impermeable layer that would protect the shallow groundwater layer from contamination. Each sump would maintain approximately 225,000 gallons of unused capacity, which could be used to contain geothermal fluids in the event of an emergency. In addition to the lined sump, each well pad would be surrounded by a berm to further contain accidental release of geothermal fluids in an emergency.

In addition to the emergency control measures outlined above, Mitigation Measure 4.3.6c would require Calpine to develop a plan detailing runoff control and restoration measures to be implemented in the event of a sump overflow. See also response to "Comments—Effects to Groundwater from Accidental Geothermal Brine Spills."

Despite the extremely low likelihood of groundwater contamination from the surface release of geothermal fluids (by any of the mechanisms described above), it is important to consider the impact that the release of such fluids might have on the Fall River springs. A recent report prepared by a hydrologist for a landowner in the Fall River springs area provides estimates of the magnitude of effect that a release of geothermal fluids might have at the Fall River springs (Bredehoeft 1997b).

In this report, Bredehoeft developed a transport model of a chemical plume through the groundwater aquifer between an area south of Medicine Lake and the Fall River springs. This model assumes a very large mass of contaminated water is emplaced within the freshwater aquifer at "time zero." The model presumably uses this large mass of high-salinity water as the starting condition in order to have a signal at the end point that is detectable, not because it is reasonable (J. Bredehoeft, *personal communication*, 1998).

Bredehoeft made various other assumptions in the model, including values of rock permeability, rock porosity, aquifer thickness, and the size of the chemical spill. Assuming that the area on the south side of Medicine Lake becomes contaminated with a chemical and the aquifer reaches a concentration of 1,000 parts per million (ppm) of this chemical, the chemical plume would take approximately 4 years to reach the Fall River springs. Once it reached the Fall River springs, however, the concentration of the chemical pollutant would be reduced to 34 ppm. Thus, due to the dilution effects of precipitation during those four years, and the dispersion of the chemical that occurs as it spreads out away from the source, the chemical concentration would be reduced approximately 30 times.

As stated before, Bredehoeft's model relies on several assumptions, several of which are unrealistic. For example, the chemical concentration used in Bredehoeft's model assumes that the groundwater is composed of almost pure geothermal fluids. As stated in Table 3.4-1 of the EIS/EIR, the maximum concentration that is reached by any chemical constituent within the geothermal waters is approximately 1,000 ppm (for chloride), which is the concentration used in Bredehoeft's model. For this condition to occur, geothermal fluids would need to leak into the groundwater continuously for three years at a rate of 1,900 gallons per minute (Beall 1998). Without being diluted by the pre-existing groundwater, and given the safety precautions taken to prevent and detect well casing failures, such an event would be impossible.

The second assumption that Bredehoeft makes that is unrealistic is that the thickness of the groundwater aquifer is 100 feet. Data in Table 3.3-5 of the EIS/EIR show that the thickness of the groundwater aquifer ranges between approximately 750 and 1,500 feet. Thus, the capacity of the aquifer (and thus its ability to dilute any contaminants) is about an order of magnitude larger than was assumed in the Bredehoeft model.

Even under conservative (and unrealistic) assumptions, the model estimated that a plume composed 100 percent of geothermal waters would be substantially diluted by the time it reached the Fall River springs. According to this model, chloride concentrations in geothermal waters would be reduced from 1,000 ppm to 34 ppm. For comparison, sea water has a chloride concentration of 32,000 ppm. Thus, the water that reached the Fall River springs would be considered fresh water.

Potential Effects to Other Regional Water Bodies: Comment B.3 and Y.27 express concern about potential effects of the proposed project on the hydrology of other regional water bodies, including Mt. Dome/Klamath Lake, Tule Lake, Big Lake, and Horr Lake. Potential impacts to each of these water bodies are discussed below.

Mt. Dome/Klamath Lake and Tule Lake: The proposed project would not significantly affect the Mt. Dome/Klamath Lake or Tule Lake from:

- Project water withdrawals from Arnica Sink
- Project water withdrawals from the project area
- An accidental discharge of geothermal fluid

As discussed on page 4-23 of the Draft EIS/EIR, project water withdrawals from Arnica Sink wells would not affect groundwater resources in the Mt. Dome/Klamath Lake or Tule Lake areas. Arnica Sink is located within the Medicine Lake caldera in the Central Valley drainage basin. The Mt. Dome/Klamath Lake and Tule Lake groundwater basins are all located within the North Coast drainage basin. Therefore, it can be reasonably concluded that there is no hydrologic connection between the Arnica Sink and Mt. Dome/Klamath lake or Tule Lake groundwater aquifers.

Similarly, withdrawals of groundwater from the project area would not significantly affect Mt. Dome/Klamath Lake or Tule Lake. As discussed on page 4-24 of the Draft EIS/EIR, as revised in the Final EIS/EIR, maximum water use would occur during the third construction season. Proposed pumping would reduce the recharge to the Mt. Dome/Klamath Lake basin but the amount of water used by the project would be small in relation to total recharge to the basin. Using a 50 percent evaporation rate and 30 inches of precipitation annually, the recharge area required to supply 10 million gallons of water annually would be approximately 25 acres. This amount of water would be extracted from a groundwater basin that extends at least 20 miles to the north. Impacts to the Mt. Dome/Klamath Lake groundwater basin from withdrawal of this amount of water would be adverse, but not significant.

As discussed on page 4-33 of the Draft EIS/EIR, no impacts to the Mt. Dome/Klamath Lake or Tule Lake would occur as a result of accidental discharge of geothermal fluids. Lower Klamath Lake Sump, located about 16 miles north of the proposed power plant, is the nearest perennial water body downstream from the power plant and wellfield area. Tule Lake is approximately 20 miles from the proposed power plant. Because of the moderate to very rapid infiltration rate of the soils in the wellfield and power plant area (see Table 3.2-1 in the EIS/EIR), it is extremely unlikely that geothermal fluids would be generated in sufficient quantities to flow 16 miles to the Lower Klamath Lake Sump. Accidental discharges would percolate into the subsurface, but because of the depth to the shallow groundwater they would probably be absorbed by soils and bedrock prior to mixing with groundwater. Therefore, accidental discharge of geothermal fluids would not be expected to significantly affect surface water or groundwater quality at the Mt. Dome/Klamath Lake or at Tule Lake.

Big Lake and Horr Lake: It is assumed that comment Y.27 refers to Big Lake in Ahjumawi Lava Springs State Park, located approximately 35 miles south of the proposed power plant and wellfield. It is also assumed that comment Y.27 refers to Horr Pond, not "Horr

Lake." Horr Pond is adjacent to Big Lake, near Fall River. The proposed project would not significantly affect the water quantity or quality of Big Lake or Horr Pond for the same reasons as stated in the discussion above for the Fall River springs:

- Project water withdrawals, either from Arnica Sink or from the project area, would not significantly reduce flows to Big Lake because of (1) the lack of groundwater connection between Big Lake and the project site and (2) the small amount of water that would be withdrawn relative to the recharge to Big Lake.
- Accidental discharge of geothermal fluids would not contaminate Big Lake because of (1) the lack of groundwater connection between Big Lake and the project site, and (2) the substantial dilution that would occur to any contaminant before it reached Big Lake, if there is a connection.

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Comment—Potential Effect on Lava Beds National Monument Ice Caves

GB.8 Hydrology/Geothermal Resources. My most serious concern regarding this project involves an issue that is nowhere addressed in the DEIS/EIR -- and this is the potential impact of this project on the ice caves in Lava Beds National Monument. In early September 1997, a radiotracking study (funded by USGS under their Species At Risk program) was conducted to examine the foraging and roosting behavior of *Corynorhirzus townsendii* (Townsend's big-eared bat) at Lava Beds National Monument. This site was selected because the cave system at Lava Beds supports the most significant concentration of *C. townsendii* known in California. In the course of this study it was determined that this species, and a number of other species (including pallid bats and special-status Myotis species) relied on the ice caves as a source of water. These sites appeared to be sufficiently important for *C. townsendii*, that it is unlikely the population would persist without this available source of water during the summer. The ice cave receiving the most significant use was Heppe, the cave closest to the project area. It is evident from reviewing the DEIS/EIR that relatively little information is available on the hydrology of this area. While the entire project design is based on an assumption that the groundwater system is isolated from the geothermal system, data to document this assumption are not presented. It is my understanding that geothermal resources are dominated by meteoric water. Thus even if the geothermal reservoir is deep, the ultimate source of much of that water is likely to be meteoric. With a projected net loss of 475,000 pounds per hour from the geothermal reservoir, any contribution from groundwater to the recharge process raises the possibility of drawdown and perhaps persistent impacts to the ice caves.

The document acknowledges that during the construction phase water withdrawals for construction purposes may be sufficient to lower local groundwater levels. Whether these reductions would affect the ice caves also needs to be addressed.

The paths of groundwater circulation in this lava terrain are poorly understood and likely complex. With lava tubes acting as long-distance conduits, it is very possible that drilling activities could make connections between independent aquifers, and change the underground patterns of water flow over a large area in ways that would likely be irreversible. A change in discharge patterns could result in the draining and destruction of ice caves.

Another concern would be potential accidents associated with drilling, production and reinjection processes that might result in the direct mixing of geothermal fluids with the groundwater supply. If such a mixing resulted in alterations to groundwater chemistry or changes in groundwater temperature, there could be adverse, and potentially irreversible, impacts to local ice caves. Geothermal operations in the Long Valley Caldera have lead to lowered discharge in hot springs at distances out to 5 km to the east and increased steam discharge to the west. Ice caves are demonstrably quite sensitive to micrometeorological change (e.g., changes in air circulation) and presumably to local thermal gradients. Ice caves are also potentially sensitive to induced seismicity which could well follow from geothermal reservoir drawdown. *(Elizabeth D. Pierson)*

Response—Potential Effect on Lava Beds National Monument Ice Caves

The commentor is concerned that development at Fourmile Hill may affect the source of water of the ice caves in Lava Beds National Monument, particularly Heppe Cave. Because the ice in these caves provides a critical source of water to wildlife (including several special-status bat species) in the summer, the commentor is concerned that development at Fourmile Hill may adversely affect wildlife in Lava Beds National Monument through effects on their summer water supply. This concern is based on the assumption that all or part of the water source for the ice caves is regional groundwater. Because there have been no studies tracing the source of water in the ice caves in Lava Beds National Monument, there are no data to support (or refute) this assumption.

The source of the water for the ice in the caves may be entirely from surface runoff. This runoff may enter the cave either directly through cave openings or from percolation through the porous basaltic rocks directly above the caves. If the source of the water that forms ice in the caves is from local surface runoff, then development at Fourmile Hill would not affect the ice in the cave.

It is possible that some of the water that forms ice in the caves comes from groundwater within the region. However, even if this assumption were true, the proposed development at Fourmile Hill would not affect the amount of ice in the caves in Lava

Beds National Monument because of the probable lack of groundwater connection between the two regions.

Groundwater flows down gravitational gradients, from areas of high elevation to areas of lower elevation. Moreover, groundwater flow tends to follow the surface topography. Heppe Cave is located approximately 7 miles northeast of the project site, at approximately 5,240 feet above sea level. The lowest elevation within the proposed power plant and wellfield is approximately 6,400 feet above sea level. Although the topographic gradient between the proposed project and Heppe Cave is almost 1,200 feet, the topographic connection is not necessarily direct.

As stated on page 4-25 of the Draft EIS/EIR, shallow groundwater from the eastern portion of Calpine's Fourmile Hill leases may partially contribute to recharge of the well near monument headquarters. However, a strong northwest-southeast-trending fault pattern that exists between the Mt. Dome and Tule Lake basins probably restricts groundwater flow between the two basins (see Figure 3.2-1 in the EIS/EIR). Primary recharge to the Tule Lake basin comes from the northeast portion of the Medicine Lake Highlands within the Tule Lake hydrologic subarea. Due to the relative size of the recharge area and limited groundwater connection to the project area, there would not be a significant effect on the Lava Beds water supply or Tule Lake groundwater basin as a result of water withdrawals from the project area during construction. Thus, the potential for impacts to the ice caves in Lava Beds National Monument would be minimal and not significant.

Groundwater within the Medicine Lake Highlands drains from the area radially (see Figures 3.3-3 and 3.3-4 in the Draft EIS/EIR). Because of the topography near the project site, the gravitational gradient is greatest to the northwest. Thus, according to this hydrologic model, groundwater in the proposed project area flows to the northwest, not to the northeast towards Heppe Cave. Because it is extremely unlikely that there is hydrologic connection between the project site and Heppe Cave, the proposed project would not affect the source of water for the ice caves in Lava Beds National Monument. See also response to "Comments—Potential Effect of Groundwater Use on Lava Beds Groundwater Wells."

See also response to "Comments—Potential Groundwater Depletion due to Geothermal Fluid Use" regarding potential depletion of groundwater resources around Fourmile Hill and Arnica Sink from the production of geothermal fluids. See also responses to "Comments—Separation of Local Groundwater and the Geothermal Reservoir" and "Comments—Potential Groundwater Flow Alterations due to Geothermal Fluid Use" regarding fracture communication and potential effects to and protection of the shallow groundwater system around Fourmile Hill from project activities.

SURFACE WATERS AND EFFECTS FROM CONSTRUCTION ACTIVITIES

Comment—Existing Springs in the Project Vicinity

A.29 The DEIS describes the affected environment's hydrology. Clearly, the hydrogeologic environment is complex. Medicine lake is reported to be fed by "emergent springs" (pg. 3-20). Five other springs are located within five miles of the proposed power plant site. These springs should be cross-referenced with spring locations shown on Figure 3.3-3. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

Response—Existing Springs in the Project Vicinity

Figure 3.3-3 of the Draft EIS/EIR has been revised to indicate the location of Schonchin Springs, Crystal Springs, Paynes Springs, and the unnamed spring on the west shore of Medicine Lake. Tamarack Springs is not located within the area shown in Figure 3.3-3 and thus has not been added.

Comment—Surface Water Impacts from Road Construction and Maintenance

N.24 Road construction has had adverse impacts to water quality on lands managed by the U.S. Forest Service. Forest management practices simply do not protect water quality. We reference major sediment problems on the North Fork Feather River [Plumas National Forest]. The DEIS/EIR failed to disclose and evaluate the potential direct, indirect, and cumulative impacts to water quality resulting from the construction and maintenance of roads associated with the transmission corridor, including other roads in the forest.

The DEIS/EIR failed to disclose the frequency of all maintenance activities.

(Robert J. Baiocci, Fall River Wild Trout Foundation)

Response—Surface Water Impacts from Road Construction and Maintenance

As discussed in Section 3.4 of the EIS/EIR, Hydrology, there is only one perennial stream within five miles of the project area and very few intermittent streams. The effects on these streams from road construction associated with the proposed project are analyzed on page 4-30 of the Draft EIS/EIR (see below for revisions to this analysis). As discussed in this analysis, road construction would not result in significant effects to the water quality of streams, as long as Mitigation Measures 4.3.5a and 4.3.5b are implemented (see revisions to Mitigation Measure 4.3.5a below).

The impact analysis on page 4-31 of the Draft EIS/EIR has been revised:

> "**Construction:** Construction of the power plant and wellfield would not affect any perennial or intermittent streams. ~~Segment A2 of the transmission line would cross three identified intermittent streams.~~ Construction of the transmission line would not affect any perennial or intermittent streams marked on USGS maps. However, this transmission line may cross small, intermittent creeks that are not large enough to be included on USGS maps. Construction of the proposed project could cause increased scour and erosion within stream or creek channels if transmission line structures or access roads are constructed within streambeds. In addition, transmission line structures and access roads could be damaged by erosion if these facilities are constructed within streambeds. Construction activities which require vehicles to cross streambeds would also cause erosion within the streambed and on the bank.
>
> Construction of the proposed project could conflict with management policies for Riparian Reserves if project facilities or activities are located within Riparian Reserves (see Section 3.10, Plans and Policies for details of these policies). The power plant and wellfield would not be located within a Riparian Reserve. Segment A1 of the transmission line would traverse a wet meadow that is potentially a Riparian Reserve~~, and segment A2 would cross three intermittent streams and associated Riparian Reserves~~."

In addition, the impact analysis on page 4-41 of the Draft EIS/EIR has been revised:

> "With Alternative 5, ~~the potential impacts of segment A2 crossing three intermittent streams would be avoided; however,~~ the alternate transmission line route would cross up to two ~~four~~ intermittent streams located along segment A3. For the reasons discussed under the proposed action, construction of the transmission line would have an adverse, but not significant effect on these streams."

In addition, Mitigation Measure 4.3.5a has been revised:

> "4.3.5a Calpine shall not site transmission line structures and access roads ~~(except road crossings)~~ within Riparian Reserves~~, areas~~ as delineated by the USFS. For streams located outside of Riparian Reserve areas, Calpine shall not site transmission line structures and access roads (except road crossings) within 100 feet of intermittent stream channels. (C)"

The comment also states that Draft EIS/EIR failed to disclose the frequency of all maintenance activities. Maintenance activities are described in Section 2.2 of the EIS/EIR, Alternative 1—Proposed Action. The frequency of road maintenance is not known at this stage of the project. In general, road inspection would occur immediately after major rain storms. Maintenance would occur on an as-needed basis. As described on page 2-21 of the Draft EIS/EIR, some road would remain open during the winter. On these roads, road inspections would occur periodically to assess the need to plow the roads. However, it is not expected that any road maintenance would occur during the winter.

See also response to "Comments—Effects of Water Quality on Fish and other Aquatic Organisms" in the Wildlife Section for a discussion of the effects of road construction on aquatic communities. See also response to "Comments—Effects on Soils from Erosion" in the Geology and Soils Section for a discussion of the potential for soil erosion in the project area.

SURFACE WATERS AND EFFECTS FROM GROUNDWATER USE

Comments—Calculation of Surface Water Recharge

AG.25 The EIS/EIR understates the Project's impact on local surface water supplies and overlooks significant impacts, as discussed in the attached comments of Dr. Fox. (Ex. A, comment 10.) The Project could significantly affect local surface water supplies by reducing recharge to Little Medicine Lake and other lakes and by reducing recharge to local springs. According to the standard of significance in the EIS/EIR, these are significant impacts that must be mitigated. (EIS/EIR, p. 4-21.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.243 The lakes in the area are primarily fed through groundwater seepage and a small contribution from springs in the area. (Leydecker 1972, p. 1.)[27] Because the local groundwaters and springs may be hydraulically connected with Arnica Sink (DEIR, pp. 4-22, 4-23), pumping from the Arnica Sink well may reduce the groundwater discharge to lakes in the area.

The DEIR evaluates the impact of the proposed water use discussed above by estimating the reduction in the amount of water in Medicine Lake. (DEIR, pp. 4-22 to 4-26.) Impacts are judged to be significant if pumping substantially changes the amount of water. (DEIR, p. 4-21.) These analyses are flawed because the DEIR uses the wrong methodology and the wrong value for the annual evaporation rate. The DEIR also fails to evaluate the impact of pumping on other smaller lakes and springs in the area.

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[27] The DEIR incorrectly claims that Medicine Lake is fed primarily by emergent springs, citing USFS 1972. (DEIR, p. 3-20.) However, this reference states Medicine Lake is primarily fed through ground water. (Leydecker 1973, p. 1.)

The DEIR evaluates the impact of pumping from the well in Arnica Sink on Medicine Lake recharge by estimating the percent of the total net precipitation falling on the 425-ac lake that would be exported to the Project site. The DEIR estimates that the annual recharge to the lake is 258 MG[28] and that the Project would potentially remove 6.9 MG or 2.5 percent of this, which the DEIR concludes would not significantly affect lake levels. (DEIR, p. 4-22.)

Recharge to the lake is actually greater than estimated in the DEIR.[29] Recharge to a lake is normally estimated from a water balance around the lake as follows:[30]

$R = O + E - P$

where R is recharge or inflow to the lake from surface runoff, springs, and groundwater seepage; P is precipitation falling on the lake; E is evaporation from the lake surface; and O is outflow from the lake due to seepage and surface water flows. The DEIR ignores the outflow component, which is about 5 ft/yr of seepage through the bottom of Medicine Lake (693 MG) (Schneider and McFarland 1996, p. 12), and uses the wrong value for evaporation.

As discussed in Comment 9.a, the DEIR erroneously assumes that evaporation from a lake surface is only 15 in/yr. Evaporation is measured using Class A pans. Evaporation from a lake surface can be assumed to be about 70 percent of the pan evaporation (Chow 1964, p. 11-7), which is 50 in/yr in the Medicine Lake area as discussed in Comment 9. Therefore, lake evaporation would be 35 in/yr. Alternatively, the Forest Service estimates that in the Project area, annual evaporation from a Class A pan is between 60 and 65 inches and that lakes lose 73 to 74 percent as much as a Class A pan, making annual evaporation from lakes around 45 inches.[31] Because average annual precipitation is only 30 in/yr, more water is evaporated from lakes in this area than falls on them as precipitation.

The DEIR's procedure, modified as described above, is used to evaluate impacts of pumping on small lakes and springs in the Medicine Lake area. For each water body, it is assumed that the entire amount of pumpage would come from groundwater that would otherwise recharge that water body, following the DEIR's procedure. This overestimates actual impacts, which would be spread out among all lakes and springs simultaneously. However, this procedure ignores the impacts of cumulative pumping from the Project and other nearby projects, underestimating impacts. CalEnergy has proposed to build a 48 MW geothermal plant at Telephone Flat, and exploration occurs in the area. Cumulative impacts would also be significant and should be evaluated by the EIR.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Calculation of Surface Water Recharge

The comments include claims that the Draft EIS/EIR understated the impact of the proposed project on local surface water supplies by underestimating the amount of recharge to Medicine Lake. Comment AG.243 claims that the amount of recharge to Medicine Lake was underestimated in the Draft EIS/EIR because it underestimated evaporation from the lake.

The analysis in the Draft EIS/EIR assumes a constant rate for evapotranspiration and runoff for the entire caldera. Comment AG.243 correctly states that the actual evaporation from Medicine Lake may be greater than the 15 inches per year estimated by the Draft EIS/EIR. However, the area of the lake is small compared to the area of the caldera (425 acres compared to 17,920 acres for the caldera), and the reduction in

[28] Annual recharge to Medicine Lake = (425 ac)(15 in/yr)(ft/12 in)(3.259 x 10^5 gal/ac-ft)/10^6 gal/MG = 173.1 MG. The DEIR reports that the recharge is 258 MG (DEIR, p. 4-22). However, there is apparently an error in the DEIR calculations.

[29] The DEIR estimates that pumping would reduce recharge to Medicine Lake by 2.5 percent (DEIR, p. 4-22), which is an overestimate. Recharge to Medicine Lake = E + O - P = (425 ac)(3.259x10^5 gal/ac-ft)(5 ft/yr) = 692.5 MG. (The USGS observed in 1992 that the lake level dropped 5 ft between June and September, which would be approximately equal to E + O - P for this period. Comparable declines, amounting to about 1 ft/mo, were also reported by the USFS in 1982 and 1983 (Jones 1983, Fig. 8).) Therefore, recharge to the lake is 693 MG/yr and the Project could reduce recharge to the Lake by 6.9 MG or up to about 1 percent. Spring discharge to Medicine Lake would also be reduced Cumulative impacts from this and other projects may be significant.

[30] L.L. Hubbard, Water Budget of Upper Klamath Lake, Southwestern Oregon, USGS Hydrologic Investigations Atlas HA-351, 1970.

[31] U.S. Department of Agriculture, Forest Service and Soil Conservation Service, Soil Survey of Modoc National Forest Area, California, 1983, p. 5.

groundwater recharge due to this increased evaporation rate from the lake surface would be insignificant.

A better estimate of the evaporation rate from Medicine Lake is provided by Sammel and Craig (1983), who estimated lake evaporation for two lakes in the Newberry Crater, Oregon (East Lake and Paulina Lake, in Deschutes County) at 28 and 19 inches per year, respectively. Based on the Newberry Crater (which is similar in climate and topography to Medicine Lake) a conservative value of 30 inches per year can be used for Medicine Lake. This value is equal to annual precipitation at Medicine Lake. Comment AG.243 presents estimates of evaporation at Medicine Lake that are 50 inches and higher; these values are incorrect because they are based on measurements at lakes that are at lower elevation and in different climatic conditions than Medicine Lake.

Assuming that precipitation falling on Medicine Lake does not contribute to groundwater recharge (i.e., evaporation is approximately equal to 30 inches per year), then recharge to the groundwater system would be 6.34 million gallons per year. Comment AG.243 correctly notes the mathematical error on page 4-22 of the Draft EIS/EIR. The Draft EIS/EIR has been corrected on page 4-22 (last paragraph) as follows:

> "Given the proximity of Arnica Sink to Medicine Lake and the fact that both waterbodies are within the same surface water basin, it is reasonable to assume that there is some subsurface hydrological connection between Arnica Sink and Medicine Lake. Withdrawal of the estimated 6.9 million gallons of water that would be withdrawn from Arnica Sink well(s) during the first construction season would be a small fraction of the amount of annual precipitation which falls directly into Medicine Lake and would not significantly affect the lake. Assuming a lake surface area of 425 acres and a precipitation rate of 30 inches per year, approximately ~~1,593~~ 1,062 acre-feet or ~~517~~ 346 million gallons would fall directly onto the lake annually ~~(DWR 1973)~~. Annual lake evaporation is estimated at 30 inches per year, which is approximately equal to precipitation. ~~Assuming an evaporation rate of 50%, the annual recharge to the lake from direct precipitation would be approximately 258 million gallons.~~ The estimated withdrawal of 6.9 million gallons from the Arnica Sink well(s) would be equivalent to about ~~2.5~~ 1.9 percent of annual precipitation falling on the lake ~~this annual recharge~~. If the same volume were withdrawn directly from the lake, with no recharge from springs and groundwater seepage, the lake level would drop approximately 0.59 inches. Schneider and McFarland (1996) suggest that lake levels can vary naturally by several feet. The project would therefore not significantly affect lake levels. Withdrawal of 6.9 million gallons from Arnica Sink is not likely to have a measurable effect on Medicine Lake."

Comment AG.243 also claims that the Draft EIS/EIR ignores the impacts of cumulative pumping from the project and other nearby projects, including CalEnergy's proposed geothermal project at Telephone Flat. As stated above, the maximum amount of water that would be withdrawn from Arnica Sink is 6.9 million gallons during the first year of construction. The Telephone Flat project would withdraw a maximum of 16.2 million gallons of water from Arnica Sink (USFS et al. 1998). If the first year of construction of the two project coincided, water withdrawal from Arnica could be as much as 23.1 million gallons.

According to the analysis presented in the Fourmile Hill Draft EIS/EIR on page 4-22, annual recharge to Arnica Sink from the 200 acres of Arnica Sink exceeds 80 million

gallons. Actual recharge to Arnica Sink is likely much greater than this because the recharge area of the Sink is greater than 200 acres. If the maximum water withdrawal of both projects occurred during the same year, recharge to Arnica Sink could be reduced by as much as 29 percent. However, although an adverse, this cumulative effect would not be significant because this effect would be temporary (only one year at most) and recharge to Arnica Sink would be sufficient to replenish the aquifer after this effect subsided.

Once both projects are operational annual water use from Arnica Sink from both projects would be up to 3.81 million gallons (1.45 million gallons from Fourmile Hill and 2.36 million gallons from Telephone Flat), or up to 5 percent of annual recharge to Arnica Sink. Likewise, the cumulative effect of water withdrawals from the two project during operation would not have a significant effect on water availability at Arnica Sink. See also response to "Comments—Cumulative Hydrology Effects" in the Cumulative Effects Section.

References:

Sammel, E. A., and R. W. Craig. 1983. Hydrology of the Newberry Volcano Caldera, Oregon. U. S. Geological Survey Water Resources Investigation, Report 83-4091.

USFS (U.S. Department of Agriculture Forest Service), U.S. Department of Interior Bureau of Land Management, and Siskiyou County Air Pollution Control District. 1998. Draft EIS/EIR for the Telephone Flat Geothermal Project. May.

Comments—Effect on Surface Water from Groundwater Use

U.8 Calpine plans to use water from water wells located in Arnica Sink. Millions of gallons of water will be needed from the aquifer. Medicine Lake and the Arnica Sink aquifer are related. If surface water levels and domestic water well levels drop because of excessive water usage by Calpine, how will that issue be resolved? *(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)*

AG.244 The Project Would Significantly Reduce Recharge To Little Medicine Lake. The DEIR concedes that withdrawal of water from Arnica Sink could reduce the recharge to Little Medicine Lake, but concludes that the impact is insignificant without performing any analyses. (DEIR, p. 4-23.)

The area of Little Medicine Lake is about 2.4 acres, based on planimetering the USGS 7.5 minute Medicine Lake quadrangle.[32] According to the USGS survey in the area in 1992, the lake level remained fairly constant between June and September 1992. (Schneider and McFarland 1996, p. 12.) Because there is no surface inflow or outflow (USGS 1993), this suggests that seepage from the lake is probably zero and that the lake is fed by subsurface seepage. Therefore, outflow is zero, and seepage into the lake is approximately equal to evaporation minus precipitation, which is 325,900 gal/yr.[33]

The Project would remove 6.9 MG of groundwater from Arnica Sink, which is 21 times larger than the estimated recharge rate of Little Medicine Lake. If the 325,900 gal/yr of subsurface seepage were totally eliminated, the level of the lake would drop about 0.4 feet[34] during the first year of construction. If 6.9 MG were removed from the lake, the lake level would drop about 9 feet. Because the depth of the lake ranges from 10 feet in most locations, up to 25 feet (Schneider and McFarland 1996, p. 9), the lake would be nearly dried up over much of its area. Based on the DEIR significance criteria, which classifies changes in the amount of water in any surface water body as significant (DEIR, p. 4-21), the Project would result in a significant impact to Little Medicine Lake.

The DEIR should be modified to evaluate this impact using correct methodology. The impact is significant and should be mitigated by prohibiting pumping from the Arnica Sink well.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

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[32] USGS, Medicine Lake, Calif., 7.5 Minute Series (Topographic), 1993.

[33] Recharge to Little Medicine Lake = (2.4 ac)(ft/12 in)(3.259x10^5 gal/ac-ft)[(50 in/yr)(0.7) - 30 in/yr] = 325,900 gal/yr.

[34] Drop in level of Little Medicine Lake if 325,900 gal of recharge is eliminated = (325,900 gal)/(2.4 ac)(325,900 gal/ac-ft) = 0.4 ft.

AG.245 The Project Would Significantly Reduce Recharge To Other Lakes In The Area. Two other small lakes, Blanche Lake and Bullseye Lake, are present about 2 mi south of the Arnica Sink well. (DEIR, p. 3-20; USGS 1993.) These lakes are popular recreational areas. (Forest Service 1991, p. 4-211.) The DEIR concedes that withdrawal of water from the Arnica Sink well could reduce the recharge to other surface water bodies in the area, but concluded the impact would be insignificant without performing any analyses.

Bullseye Lake. The area of Bullseye Lake is about 5.3 acres, based on planimetering the USGS 7.5 minute Medicine Lake quadrangle. (USGS 1993.) According to the USGS survey in the area in 1992, the lake level dropped several feet between June and September 1992, suggesting water may discharge through the lake bottom. (Schneider and McFarland 1996, p. 12.) Because there is no surface inflow or outflow (USGS 1993), and evaporation is greater than precipitation, the lake is probably recharged by subsurface groundwater seepage. Assuming that the lake level dropped 5 feet, which was the largest reported decline in the area, lake recharge would be 8.6 MG/yr.[35]

The Project would remove 6.9 MG of water from the Arnica Sink area during the first year of construction, and additional, presumably smaller amounts, in subsequent years to supplement the supply from an on-site Calpine well. (DEIR, p. 4-24.) Therefore, the Project could potentially remove up to 80 percent of the recharge to Bullseye Lake. If the 6.9 MG of recharge were totally eliminated, the level of the lake would drop about 4 feet,[36] or be lowered by half or more since the maximum depth of the lake is only 8.2 ft. (Schneider and McFarland 1996, p. 9.) Based on the DEIR significance criteria, which classify changes in the amount of water in any surface body as significant (DEIR, p. 4-21), the Project would result in a significant impact to Bullseye Lake. Actual impacts could be much larger than presented here because the decline in lake level is probably less than 5 feet. Because recharge in this case is equal to the lake area multiplied by the decline in the water table, a smaller decline would lower the estimated amount of recharge and increase the relative fraction removed by the Project. This impact should be mitigated by prohibiting pumping from the Arnica Sink well.

Blanche Lake. The area of Blanche Lake is about 1.7 acres, based on planimetering the USGS 7.5 minute Medicine Lake quadrangle. (USGS 1993.) According to the USGS survey in the area in 1992, the lake level dropped several feet between June and September 1992, suggesting water may discharge through the lake bottom. (Schneider and McFarland 1996, p. 12.) Because there is no surface inflow or outflow (USGS 1993), and evaporation is greater than precipitation, the lake is probably recharged by subsurface groundwater seepage. Assuming that the lake level dropped 5 feet, which was the largest reported decline in the area, lake recharge would be 2.8 MG gal/yr.[37]

The Project would remove 6.9 MG of water from the Arnica Sink area during the first year of construction, and additional, presumably smaller amounts, in subsequent years to supplement the supply from an on-site Calpine well. (DEIR, p. 4-24.) Therefore, the Project could potentially remove virtually all of the recharge to Blanche Lake. If 2.8 MG of recharge were totally eliminated, the level of the lake would drop about 5 feet.[38] Because this is a shallow lake (Schneider and McFarland 1996, p. 9), Project pumping could dry it up. Based on the DEIR significance criteria, which classifies changes in the amount of water in any surface body as significant (DEIR, p. 4-21), the Project would result in a significant impact to Blanche Lake. This impact should be mitigated by prohibiting pumping from the Arnica Sink well. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.246 The Project Would Significantly Reduce Spring Flows. The DEIR indicates that there are five springs within 5 miles of the power plant, wellfield, and Arnica Sink well. (DEIR, p. 3-20.) Crystal Springs is the water supply for the Forest Service guard station on the west end of Medicine Lake and to cabins west of Little Medicine Lake. Paynes Springs I and II are occasionally used for water supply for campers and horses. (Schneider and McFarland 1996, p. 8.) Because these springs may be hydraulically connected with Arnica Sink (DEIR, p. 4-24), pumping from the Arnica Sink well may reduce spring discharge.

The DEIR does not explicitly evaluate the impact of the Project on these nearby springs, although it concedes that withdrawal of water from Arnica Sink could reduce recharge to "other water bodies in the project vicinity." (DEIR, p. 4-23.) Instead, it evaluates the impact of the Project on the Fall River springs, which are about 30 miles south of the Arnica Sink well. (DEIR, p. 4-24.)

The DEIR evaluates the impact of the Project on the Fall River springs by estimating the percent of the spring discharge that would potentially be reduced by Project pumping. This same approach is used

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[35] Recharge to Bullseye Lake = (5.3 ac)(3.259×10^5 gal/ac-ft)(5 ft/yr)/10^6 gal/MG = 8.6 MG.

[36] Drop in level of Bullseye Lake if 6.9 MG of recharge is eliminated = (6.9 MG)/(5.3 ac)(325,900 gal/ac-ft) = 3.99 ft.

[37] Recharge to Blanche Lake = (1.7 ac)(3.259×10^5 gal/ac-ft)(5 ft/yr) = 2.77 MG/yr.

[38] Drop in level of Blanche Lake if 2 8 MG of recharge is eliminated = (2,800,000 gal)/(1.7 ac)(325,900 gal/ac-ft)/10^6 gal/MG = 5.05 ft

below for springs in the Project area. The USGS reported measurements of spring discharge in 1992. (Schneider and McFarland 1996, Table 2.)

The discharge of Crystal Springs, which is an important water supply spring, is a constant 3.4 gal/min year round, based on reports by Forest Service personnel who rely on the well. Therefore, the total annual discharge is 1.8 MG/yr.[39] Because the Project would withdraw up to 6.9 MG from the local aquifer, the Project could potentially dry up this spring during the first year of construction. This is a significant impact.

The discharge from the Latunich Spring is 15.1 MG/yr (28.7 gal/min). Project pumping could reduce this discharge by up to 46 percent. The discharge of Paynes Spring I is 39.6 MG/yr, and Project pumping could reduce it by up to 17 percent. The discharge of Paynes Spring II is 12.2 MG/yr, and Project pumping could reduce it by up to 57 percent during the first year of construction.

These are substantial reductions and are significant impacts. This impact should be mitigated by prohibiting pumping from the Arnica Sink well.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

FK.3 One of the SIGNIFICANCE CRITERIA listed on page 4-21 is the Changes to the amount of water to any surface body. *(Charles F. Moss)*

HF.10 Page S5: I am concerned about the effects on Medicine Lake of using Arnica Sink as a water supply for well drilling activities. As you know doubt know, the lake level of Medicine Lake is very sensitive and has fluctuated wildly in the past 20 years due to varying snowfalls and the drought years of the '80s. What guarantees are there that drilling and pumping water from Arnica Sink-less than 2 miles from Medicine Lake--would not harm both the quality and quantity of water reaching Medicine Lake through the water table in the caldera? *(Daniel T. Spencer)*

HT.10 Will the Lake level and aquafir fall due to massive water well use during drilling & maintainance? *(Louise Thompson)*

IE.6 The next possible problem could be lake draw down. The construction of "just" the Fourmile Hill Plant will consume over 23 million gallons of subsurface water. *(Alysa Waring)*

PH4.11 Concerned about the effect of water use on Medicine Lake. If the level of Medicine Lake and/or local groundwater levels drop during a drought, would groundwater pumping be stopped? *(Mount Shasta Public Hearing)*

PH5.11 Will the lake level and the aquifer fall due to massive water well use during drilling and maintenance? *(Medicine Lake Public Hearing)*

Response—Effect on Surface Water from Groundwater Use

The comments express concern that groundwater use from the proposed project would deplete surface water bodies in the vicinity.

Comment AG.244 states that the project would significantly reduce the recharge of Little Medicine Lake. The Draft EIS/EIR, on page 4-23, states that withdrawal of groundwater from Arnica Sink could reduce the recharge to other water bodies in the project vicinity, such as Little Medicine Lake and Paynes Creek. The Draft EIS/EIR overstated the hydrologic connection of Arnica Sink with "other water bodies in the project vicinity." This statement has been revised in the Final EIS/EIR based on the discussion below.

It would be very unlikely for Little Medicine Lake to be affected by groundwater withdrawals. At its deepest level of 25 feet (Schneider and McFarland 1996), Little Medicine Lake is at an elevation of approximately 6,677 feet. The Medicine Lake caldera water table, as measured at the USFS campground well, is at approximately 6,600 feet, or 77 feet below the lowest level of Little Medicine Lake. Because the water table in the Medicine Lake caldera is so much lower than the lowest level in Little Medicine Lake, it is highly unlikely that groundwater withdrawals from the project site could affect the level of Little Medicine Lake.

[39] Annual discharge of Crystal Spring = (3.4 gal/min)(60 min/hr)(24 hr/day)(365 day/yr) = 1,787,040 gal/yr.

Comment AG.246 asserts that the project would significantly reduce the flow of springs in the vicinity. To support this assertion, the comment cites the total annual flow of Crystal and Latunich Springs and compares that with proposed groundwater extraction from the Arnica Sink area. Flow from these springs comes from elevations higher than the point of discharge from the springs, and above Arnica Sink. Crystal Spring is at an elevation of 6,860 feet and Latunich Spring is at an elevation of 6,700 feet (Schneider and McFarland 1996). Groundwater extraction from the water supply well in the Arnica Sink area will have a water table elevation of approximately 6,540 feet, or 320 feet and 180 feet below Crystal Spring and Latunich Spring, respectively. These springs are fed by local perched water tables; they are not fed by the water table within the Medicine Lake caldera. Therefore, Crystal Springs and Latunich Springs would not be affected by water withdrawals at Arnica Sink.

In addition, comments AG.245 and AG.246 employ an incorrect method in evaluating the potential impacts to Bullseye Lake and Blanche Lake, and to Crystal and Latunich Springs, respectively. Comments AG.245 and AG.246 compare the total recharge to these lakes or total flow rates from these springs with proposed groundwater extraction rates. This method cannot be used to determine impacts on lakes and springs with known or suspected hydrologic systems. This approach was used in the Draft EIS/EIR on page 4-24 to analyze potential impacts to the Fall River springs because of their (1) unusually high volume, (2) large distance from the project site, and (3) unknown hydrologic connection with the Medicine Lake Highlands. In contrast, lakes and springs within the caldera have known (or highly likely) hydrologic systems.

It is not possible for groundwater extraction at a single point (i.e., Arnica Sink) to affect a single lake or spring without affecting the entire hydrologic system (i.e., the Medicine Lake caldera). The water table within the Medicine Lake caldera exists over the aerial extent of the caldera. Any changes to water table levels, due to groundwater extraction, would also be reflected over the extent of the caldera and not from specific areas within the caldera such as individual springs (including Crystal and Latunich Springs) or lakes (including Bullseye and Blanche Lake).

In reviewing the effects of groundwater extraction within the Medicine Lake caldera for geothermal drilling, the strongest evidence that no significant impacts are likely to occur to surface waters is the absence of any recorded impacts from previous geothermal drilling activities. A total of 24 intermediate-depth temperature gradient holes and 4 deep-exploration wells were drilled within the caldera between 1981 and 1991. The majority of these wells were drilled using water wells in Arnica Sink. No significant effect on either lake water or spring flows were recorded during water extraction in Arnica Sink for those drilling activities.

Reference:

Schneider, T., and W. McFarland. 1996. *Hydrologic Data and Description of a Hydrologic Monitoring Plan for Medicine Lake Volcano, California*. Open File Report 95-750. U.S. Geologic Survey, Portland, OR.

SURFACE WATERS AND EFFECTS FROM GEOTHERMAL FLUID USE

Comments—Effects to Surface Waters from Accidental Geothermal Brine Spills

F.15 Our records of sump-waste testing and the DRAFT at pages 2-29 (describing cooling-tower drift) and 4-222 reveal that the wastewater has elevated salinity, acid-forming constituents, arsenic and boron levels. Appendix F provides estimates of emissions, but does not include the basis of the estimates. We believe that the consequences of these constituents, as they are released to the environment and as they may end up in the water resources of the area, must be discussed in the EIR/EIS. These activities and their water quality impacts will be regulated by the RWQCB. We recognize that the bulk of wastewater produced at the project will be injected to the geothermal field in conformance with regulations of other agencies -- it is the portion which is not injected which must be described and assessed by this EIR/EIS. We expect to coordinate our monitoring and reporting program with the other agencies so that the public can be assured that the useable water resources of the area are being protected.
(John R. Hannum, North Coast Regional Water Quality Control Board)

F.23 Section 4.3.6 covers water quality effects. This discussion begins with a dismissal of any potential adverse effects from the proposed project, yet also states that effects could potentially occur through accidental releases of geothermal fluids. There is no direct recognition of the consequences of emitting fluid-borne pollutants such as arsenic and boron into the environment of the project site for 45 years. Is there no fallout nor washout? Where is the "away" that these emissions go? Section 4.3.7 hypothesizes consequences of an airborne plume impacting Clear Lake or Medicine Lake and mitigates via distance and dilution. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

U.6 The detrimental effects on the surface and ground waters due to accidental hazardous spills, cooling tower drift, air inversion conditions and the loss of circulation during drilling must be addressed in writing in the Final EIS/EIR. *(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)*

DD.2 How could anyone want to degrade one of the only year-round water sources? *(Pam Henson)*

Response—Effects to Surface Waters from Accidental Geothermal Brine Spills

As stated in the Draft EIS/EIR, geothermal steam would be emitted to the atmosphere and liquids would be discharged to a lined sump. Liquids would be released during well drilling and testing (during the construction phase). The cooling tower and plant silencers would emit steam condensate as water vapor during the operation phase of the project. The discharges during well drilling and testing would occur approximately every two years, as infill wells are drilled during the project operation phase. All releases of geothermal fluids would be controlled.

The EIS/EIR does address the potential for environmental consequences and effects of the project resulting from the release of geothermal constituents. Section 4.3 of the EIS/EIR, Hydrology, addresses the potential for produced geothermal waters to affect both groundwater and surface waters. This section of the EIS/EIR also addresses the potential for the emissions of geothermal steam (with entrained chemical constituents) to affect surface waters through deposition. Section 4.7 of the EIS/EIR, Vegetation, addresses the potential for the emissions of geothermal steam to affect surface vegetation through deposition. Section 4.13 of the EIS/EIR, Air Quality, addresses the effect of the emissions of geothermal steam on the air quality of the area. As discussed in these sections, the proposed project would not be expected to have a significant effect on water resources, vegetation, or air quality as a result of geothermal fluid-related emissions.

See also response to "Comments—Chemical Composition of Geothermal Fluids" in the Geothermal Resources Section regarding the addition of proprietary data to the Final EIS/EIR. See also response to "Comments—General Deposition Effects on Surface Waters" for an evaluation of potential effects to surface waters due to the emission of geothermal fluids.

Mitigation Measure 4.3.1a would require Calpine to implement a hydrologic monitoring program that would be approved by the USFS and BLM, in consultation with other agencies (e.g., North Coast RWQCB and USGS). This program would include water quality monitoring at Medicine Lake. The proposed groundwater monitoring plan for the project would also ensure that groundwater resources would be protected. In response to comment F.15, the USFS and BLM will coordinate with the North Coast RWQCB to ensure that monitoring is carried out in a manner acceptable to the RWQCB.

Comment F.23 references the introduction of Impact 4.3.6 on pages 4-32 through 4-34 of the Draft EIS/EIR; Impact 4.3.6 addresses water quality effects from drilling, production, and injection activities. This introduction is intended to summarize the discussion of the potential for effect that is described in detail later in this impact discussion. This introduction is not intended to be a dismissal of the potential for effects to water quality.

Impact 4.3.6 addresses drilling of geothermal wells and the measures that would be implemented to ensure that geothermal fluids do not contaminate groundwater resources. This impact also discusses the potential for water quality to be affected by project operation. Geothermal fluids would be released to designated lined sumps and the plant vent silencer, and would then be injected into the geothermal reservoir. There would therefore be no effects due to geothermal fluid-borne contaminants to the surrounding environment.

Impact 4.3.6 does acknowledge the potential for accidental release of geothermal fluids during operation. Accidental releases of geothermal fluids could occur through well blowout, accidental sump overflow, or pipeline rupture. Well blowouts are extremely rare and not expected to occur. GROs require blowout prevention equipment (with periodic inspections) to prevent uncontrolled release of fluids. Sumps will be monitored and fluid levels will be maintained at no more than 3 feet from the top of the sump to prevent accidental overflow. Calpine will develop a contingency plan to address pipeline ruptures. This plan would be submitted for approval to the USFS and other agencies, as required (e.g., North Coast RWQCB). Pipeline ruptures are also rare; if one occurred, it would be quickly detected as a loss of pressure in the power plant. The approved contingency plan will specify control and clean-up procedures. In summary, release of geothermal fluids to surface water is highly unlikely. Moreover, it is not expected that significant effects to water quality would result from these releases because:

- They would be quickly identified and contained through monitoring at the wells and power plant, and
- The nearest surface water body is at least 2.5 miles from the power plant and wellfield area.

The effects of accidental spills on groundwater is addressed in response to "Comments—Effects to Groundwater from Accidental Geothermal Brine Spills" above.

Effects of airborne contaminants on surface water are addressed in Impact 4.3.7 on pages 4-34 through 4-38 of the Draft EIS/EIR. Impact 4.3.7 addresses separately the

effects of both construction-generated dust and power plant emissions on surface water quality. As discussed in the impact, the effects of fugitive dust would not be significant due to the large distance (at least 15 miles) between the source of the dust and surface water bodies downwind of the source.

The analysis of effects from project air emissions in surface water in Impact 4.3.7 includes a discussion of emission "fallout" or "washout." The conclusion that deposition effects of project emissions on water quality would not be significant is not based on the assumption that constituents would be either widely dispersed or diluted. Instead, the analysis assumed that contaminants would be concentrated in Medicine Lake. The analysis ignored natural dilution processes such as lake overturn and lake recharge. The deposition analysis was based on an extremely conservative set of assumptions (some of which could not occur) that would greatly exaggerate the project's effects. These assumptions were used in order to evaluate a "worst-case" scenario. The assumptions used in the model included:

- All emissions blowing in the general direction of Medicine Lake would be deposited, either directly or through runoff, into Medicine Lake
- All emissions deposited into Medicine Lake during the 45-year lifespan of the project would be confined to the upper two feet of the lake
- No mixing of lake waters would occur during the life of the project

These assumptions are unrealistically pessimistic to the extent that they are, either singly or in combination, impossible. Nevertheless, the analysis resulted in the conclusion that deposition would not significantly affect water quality.

Comment F.23 references the potential for an airborne plume to affect Clear Lake or Medicine Lake. As described on pages 4-34 through 4-35, air emission from the proposed project would not result in significant impacts to water quality at Clear Lake or Medicine Lake. This conclusion is based on the deposition analysis presented for Medicine Lake, which is much closer to the project site than Clear Lake (3 miles vs. 20 miles). Because the deposition analysis for Medicine Lake showed that there would be no significant impact to Medicine Lake, it was assumed that there would also be no significant effect to water bodies more distant from the project site, including Clear Lake. For more discussion of the deposition analysis for Medicine Lake, see response to "Comments—General Deposition Effects on Surface Waters" below. See also responses to "Comments—Effects of Boron Emissions on Vegetation" in the Vegetation Section.

Comment U.6 also expresses concern about the detrimental effects to surface and groundwater due to cooling tower drift, air inversion conditions, and the loss of circulation during drilling. For a discussion of the effects of cooling tower drift, see response to "Comments—Cooling Tower Drift Emissions" in the Air Quality Section.

Comment U.6 requests discussion of the detrimental effects of a loss of circulation during the drilling of production and injection wells. It is a requirement that all shallow groundwater zones be sealed by cemented metal well casings. However, in order to place the casing, each well must first be drilled through the groundwater zone using standard drilling procedures. Because the drilling process requires that drilling fluids be present in the hole at all times, these fluids are designed to not migrate into the

formations. The drilling fluid is a non-toxic bentonite clay and has a viscosity sufficient to restrict flow into the formation. As soon as any loss of circulation is detected, additives are added to the drilling fluid to prevent any further migration. The time taken to drill through shallow groundwater zones is minimal and, in many cases, the hydraulic pressure in the formation due to existing formation fluids (normally water) is sufficient to impede the flow of drilling fluids. In summary, loss of circulation is not expected to have a significant effect on groundwater because:

- Well casing and cementing protects groundwater
- Drilling fluids are not toxic
- In the event of the loss of circulation, corrective measures would be taken immediately

Comment—Effects to Surface Waters from Drilling Mud

F.2 The drilling muds and other materials which end up in pits, tanks and sumps are highly-variable and are not always managed as planned. This issue is best resolved by ensuring that the site is closely monitored and that the operator has well-conceived contingency plans.

(John R. Hannum, North Coast Regional Water Quality Control Board)

Response—Effects to Surface Waters from Drilling Mud

The proposed management of drilling mud and other materials that would end up in pits, tanks, and sumps is described in Section 2.2, Alternative 1, and Section 4.15, Human Health and Safety, of the Draft EIS/EIR. It is expected that management of these materials would occur as planned and discussed in the Draft EIS/EIR.

As suggested in the comment, the project would be monitored and the operator would have a contingency plan to ensure that material management occurs as planned. Regular inspections of the well sites by the BLM and USFS would be conducted. The North Coast RWQCB would also be expected to participate in these inspections. The MMRP required for the project would also be conducted to ensure mitigation measures are implemented. A draft of the MMRP was included in the Draft EIS/EIR.

In the event of an accident, Calpine's contingency plan for the project would ensure that the situation is corrected before any adverse effects could occur. The BLM, USFS, and North Coast RWQCB would participate in the development of this plan to ensure that contingency measures for drilling material management meet with their approval. The Central Valley RWQCB would also be consulted regarding this plan.

SURFACE WATERS AND EFFECTS FROM DEPOSITION

Comments—General Deposition Effects on Surface Waters

F.19 Section 4.2.11 Effects of Deposition of Air Emissions. This section of the DRAFT acknowledges that emissions of geothermal fluids will fall onto area soils. Runoff from, or water percolating through those soils will contain the geogenic compounds which were in the fluids. The DRAFT dismisses the potential impact of these emissions with a declaration that the soils of the area are expected to have a makeup similar to the fallout because they are derived from similar volcanic rocks. We believe that the DRAFT must assess the consequences of many year's release of fluids containing parts-per-million levels of boron and arsenic from well-vent and tower-drift/evaporation; moreover, it should be a simple matter to include analyses of soils as a part of the background information provided in the EIR/EIS. This subsection of the DRAFT declares that the water quality effects of materials transported to surface waters are addressed in Section 4.3 and that effects on soils would not be significant nor would they need mitigation. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

U.5 Paynes Springs Creek, Crystal Springs Creek, Medicine Lake, Blanche Lake, Bullseye Lake and Little Medicine Lake are the only significant surface waters in the Medicine Lake Highlands. The water quality of Medicine Lake is considered to have good clarity, low nutrient levels and good buffering capacity. All other surface water sources in the area are also believed to have excellent water quality. (Jones, R. 1983). Calpine has not thoroughly addressed the potential contamination of these surface waters. *(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)*

Y.31 Geothermal drift from the cooling towers could pollute a number of lakes and water sources. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AG.229 Deposition Of Air Emissions On Medicine Lake Is Significant. The DEIR estimates the impact of emissions from the Project on Medicine Lake by calculating the concentration of 13 metals and sulfate in lake waters. The screening-level calculations assumed that 11.2 percent (corresponding to the percent of the time that prevailing winds blow towards the lake) of total emissions over the 45 year operating life of the Project would be deposited in the top 2 ft of Medicine Lake. (DEIR, pp. 4-35 to 4-37.) The significance of deposition was evaluated by comparing the resulting concentrations to drinking water maximum contaminant levels ("MCLs") or suggested no-adverse-response levels ("SNARLs") where MCLs were not available. (DEIR, Table 4.3-3.) The DEIR concludes that deposition would not significantly impact the water quality of Medicine Lake because all estimated concentrations were less than MCLs or SNARLs.

However, these impacts are underestimated. The DEIR does not use the correct significance standards, emissions were substantially underestimated, and the principal impact of concern, acid rain, was omitted from the analysis. These issues are discussed below in more detail. When these errors and omissions are corrected, the DEIR's screening-level analyses indicate that Project emissions would adversely affect the water quality of Medicine Lake. These impacts should either be mitigated, or the analyses should be repeated using refined analysis methodology. In either case, the EIR should be revised and recirculated for public review. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

BQ.9 In the draft EIS/EIR several assumptions are made of the effect of this project on the water quality of Medicine Lake. Page 3-15 gives reference to water quality of Medicine Lake. These studies were done in 1971, 1982 and 1983, the most recent in 1992. None of these studies did any detailed analysis of water chemistries including metals and organic compounds. If the current concentrations of metals are unknown, how can the effect of air emissions from the Fourmile Hill project, on Medicine Lake (page 4-36) be determined. Given that the table in the draft EIS/EIR has arsenic, beryllium, cobalt and sulfate all approaching MCL/SNARL levels, knowing the current amounts of these metals in the lake is very important. We are asking for more information under mitigation measure 4.3.7a and how Calpine would be expected to perform a more sophisticated depositional analysis. This depositional analysis must be done before this project is allowed to be developed. Our concern is that mitigation measures 4.3.1a and 4.3.2a will only be placed into effect after water quality or water availability problems have been determined, they do not prevent these problems from developing. Mitigation measure 4.3.1a must be included in the final EIS/EIR (those parts dealing with monitoring water quality) so all interested parties can assess if these measures are adequate to protect the water quality of Medicine Lake. In addition the precipitation data for Medicine Lake is based on data generated at McCloud, CA more than forty miles away (page 3-177). If assumptions on groundwater resources are used to determine the effect of supply wells, to this project, then more accurate data must be used. Please provide a written response to these concerns. *(S. Peder and Suzanna S. Cuneo, et al.)*

BQ.14 Our concern with the draft EIR/EIS is that it fails to provide any comment on the long term effects on water quality of Medicine Lake resulting from emissions produced by this project. The draft EIS/EIR does not address the effect on lake water pH as the result of hydrogen sulfide accumulation in the water and land surrounding Medicine Lake. Without knowing the effect on lake pH levels it is impossible to determine the effect on lake wildlife as the result of emissions from the project. The assessment of water quality did not examine the possible effects of decreased water pH and the resulting effects on fish and amphibians living in and around Medicine Lake. The draft EIS/EIR did identify elements found in the

steam plume (and therefore deposited in and around Medicine Lake) including arsenic, beryllium, cobalt and lead. The draft EIR/EIS did not provide any assessment of possible metal accumulation in fish in the lake and the effect on birds (Bald Eagles and Osprey) that feed on these fish. We firmly believe that this is a serious omission and that proposed mitigation measures (measures 4.3.1a and 4.3.2a) do not adequately address this issue because these measures are activated once a problem has been discovered, they do not prevent water quality deterioration from occurring. *(S. Peder and Suzanna S. Cuneo, et al.)*

DR.1 I feel any geothermal development would change the nature of the lake. Any unknown problems could occur. *(Gerald Johnson)*

DZ.2 ...and enjoyable outing for many families. The lake will be polluted and/or drained... *(Bill and Bette Kinyon)*

HA.8 Page 3-15 EIS/EIR states, no detailed analysis of lake water chemistries, that include concentrations of metals and organic compounds is available. Page 4-37 EIS/EIR states, based on the geology and undeveloped nature of the Medicine Lake watershed, it can be ASSUMED that existing concentrations of the analyzed constituents in Medicine Lake would be extremely low. That these background concentrations combined with project deposition would not be sufficient to cause an exceedance of a water quality standard; therefore, it can be REASONABLY CONCLUDED that air emissions from the project would have an adverse, but not significant impact on the water Quality of Medicine Lake. NEPA Section 1500.3 (B) and CEQA Section 15151: Environmental impact statements and reports shall be concise, clear, and to the point, and shall be supported by evidence that agencies have made the necessary environmental analysis. *(James Shott)*

HD.13 Page 4-3 6 describes an evaluation of potential air emissions from the geothermal project on water quality. However, concentrations of the chemicals of concern in the geothermal fluid have not been analyzed. Without information on the chemical concentrations contained in the fluid (e.g., the source of the emissions), estimates on the air emissions and conclusions from the air emissions modeling have no basis. Therefore, the environmental effects of these emissions cannot be evaluated. *(Amanda Spencer)*

IE.5 The powers to be cannot guarantee there will be an adverse effects on Medicine Lake. The effects could include pollutants falling into the lake and surrounding area. The poor water quality will jeopardize the fish and insect habitat. *(Alysa Waring)*

PH3.50 In the EIS/EIR, it states that these that do go into the air will be trapped by precipitation and land back into the lake and be flushed into the lake from the surrounding snow. And it also states in the EIS/EIR that it will be trapped in the top two feet of water. And my biggest concern there is that is where the fish feed, the eagles feed on the fish. That is where people swim. *(Yreka Public Hearing)*

PH4.43 What will the effects to water quality be, including effects to Medicine Lake water quality? *(Mount Shasta Public Hearing)*

Response—General Deposition Effects on Surface Waters

Deposition effects on water quality are analyzed on pages 4-34 through 4-38 of the Draft EIS/EIR. This section includes a quantitative analysis of the effects of deposited air emission on Medicine Lake water quality over the life of the project. Estimates of air emissions generated by the proposed project were derived using actual proprietary geothermal fluid chemistry data from Well 87-13 in the Medicine Lake Highlands. The BLM has access to all of the proprietary fluid chemistry data, and has reviewed the analysis of impacts on water quality for accuracy and adequacy.

This analysis presents a "worst-case" scenario for deposition effects on water quality due to Medicine Lake's proximity to the proposed power plant and its location downwind of the power plant. In addition, Medicine Lake is an area of particular concern due to its value as a natural resource and recreation area. The analysis of effects on Medicine Lake utilized a very conservative set of assumptions which purposely exaggerated the proposed project's effects on water quality. Even with these conservative assumptions, the deposition analysis concluded that no safe drinking water standard would be exceeded over the life of the project, including those for boron and arsenic.

Since publication of the Draft EIS/EIR, the estimated emissions from the proposed project have been corrected. The corrections are described and explained in the

responses to comments in the Air Quality Section. Because the estimates of air emissions changed, the deposition analysis was revised. The revised analysis of deposition on surface waters includes an assumption that has changed since the analysis in the original model, described in the Draft EIS/EIR on pages 4-34 through 4-37. Table 4.3-3 (page 4-36 of the Draft EIS/EIR) has been revised to show the results of the corrected deposition analysis, and is reproduced below. These results are based on actual geothermal fluids from a well in the Medicine Lake Highlands. Although the data have been updated, the original conclusions in the Draft EIS/EIR have not changed.

In the deposition analysis presented in the Draft EIS/EIR, all potential pollutants were assumed to be concentrated in the upper two feet of the lake water. Because mixing is clearly shown to be occurring (Schneider and McFarland 1996), the analysis was revised in the Final EIS/EIR to include distribution of pollutants throughout the total volume of the lake. This more accurately reflects the known characteristics of the lake but does not alter the unrealistically conservative assumptions used in the analysis to document "worst-case" conditions. Two of the key assumptions used in this revised model are explained below.

First, all emissions blowing towards Medicine Lake (11.2 percent of the total emissions) were assumed to be deposited in Medicine Lake. This assumption is unrealistically conservative because all of the emissions blowing in the direction of Medicine Lake would not be deposited in the lake. Medicine Lake is approximately three miles from the proposed power plant. Emissions blowing in the direction of Medicine Lake would normally be dispersed over a large area, of which Medicine Lake would be small portion. No air dispersion estimates were incorporated into the model, so it is unknown how conservative this assumption is.

Second, the model assumed that all pollutants remained within lake water for the total life of the project. Data from lake profiles on temperature, conductance, and dissolved oxygen all show clearly that lake mixing is occurring. This assumption is also unrealistically conservative because:

- The lake is continually recharging from springs and precipitation. As a result, pollutants would become diluted within the lake.
- Lake discharge is known to occur through Paynes Springs. Because the lake level remains relatively constant over time, this indicates that the lake water is being continually replenished.

In the revised analysis, all of the estimates of the concentrations of pollutants in Medicine Lake are lower than the estimates in the Draft EIS/EIR (because emission rates are lower and the pollutants would be diluted in a larger volume of water), with the exception of mercury, which has increased. Mercury concentrations at the end of the 45-year lifespan of the project are estimated to be 0.0001 mg/L. This value is still over an order of magnitude lower than the EPA limit for mercury.

Table 4.3-3: Deposition of Air Emission on Medicine Lake

Constituent	Project Air Emissions Blowing Toward Medicine Lake (lbs/year) [a]	Estimated Concentration in Lake After 45 Years (mg/l) [ba]	MCL/SNARL (mg/l) [cb]
Antimony	1.0~~1.9~~ $\times 10^{-2}$	8.7×10^{-6}~~3.5×10^{-4}~~	3.0×10^{-3}
Arsenic	3.0~~6.3~~ $\times 10^{-1}$	2.6×10^{-4}~~1.2×10^{-2}~~	5.0×10^{-2}
Beryllium	1.1~~2.1~~ $\times 10^{-4}$	9.5×10^{-8}~~3.9×10^{-6}~~	none
Boron	1.0~~1.9~~	8.7×10^{-4}~~3.5×10^{-2}~~	6.0×10^{-1}
Cadmium	1.1~~2.1~~ $\times 10^{-4}$	9.5×10^{-8}~~3.9×10^{-6}~~	1.0×10^{-2}
Chromium	1.1~~2.1~~ $\times 10^{-4}$	9.5×10^{-8}~~3.9×10^{-6}~~	5.0×10^{-2}
Cobalt	1.1~~2.1~~ $\times 10^{-4}$	9.5×10^{-8}~~3.9×10^{-6}~~	none
Copper	1.4~~2.8~~ $\times 10^{-4}$	1.2×10^{-7}~~5.1×10^{-6}~~	1.3
Lead	1.1~~2.1~~ $\times 10^{-3}$	9.5×10^{-7}~~3.9×10^{-5}~~	5.0×10^{-2}
Manganese	4.4~~8.5~~ $\times 10^{-4}$	3.8×10^{-7}~~1.6×10^{-5}~~	5.0×10^{-2}
Mercury	1.2×10^{-1}~~2.1×10^{-5}~~	1.0×10^{-4}~~3.9×10^{-7}~~	2.0×10^{-3}
Nickel	4.4~~8.5~~ $\times 10^{-4}$	3.8×10^{-7}~~1.6×10^{-5}~~	1.5×10^{-1}
Selenium	1.1~~2.1~~ $\times 10^{-4}$	9.5×10^{-8}~~3.9×10^{-6}~~	1.0×10^{-2}
Hydrogen Sulfide[d]	162~~21.6×10^{3}~~		
Sulfate	467~~54.5×10^{3}~~	4.1~~83~~	250

Notes:

[a] Projected emissions from project construction (well venting and flow testing during confirmation drilling) and 45 years of project operation (sources include cooling towers, vent silencer, and annual well testing), divided by 45 years.

[ba] Estimated concentration of constituent in ~~the top two feet of~~ the lake after 45 years of emissions with no dilution or dispersion and given the additional assumptions outlined in the text~~above~~.

[cb] Values for antimony and boron are SNARLs, other values are MCLs. See below for definition of MCLs and SNARLs.

[d] All hydrogen sulfide blowing towards Medicine Lake was assumed to be converted to sulfate.

SOURCES: Suder 1998 (second column); EGS 1998 (third column); EPA (last column) ~~1997~~

The Draft EIS/EIR on pages 4-35 through 4-37 have been revised as follows:

"**Operation:** During the operational phase of the proposed project, air emissions would be released from the cooling tower and plant silencers (see Section 4.13, Air Quality for more information). These emissions would be composed of gases, including water vapor and noncondensable gases, and droplets of water. The water droplets would contain dissolved and suspended solids, including trace amounts of heavy metals, such as mercury and arsenic. The largest droplets would fall to the ground in the vicinity of the power plant and cooling tower. The smallest droplets may evaporate with the suspended and dissolved solids they contain forming aerosol particles which would be dispersed over a wide area.

Deposition of metals and hydrogen sulfide into lakes in the project vicinity could adversely affect the water quality of these lakes. The impact on nearby lakes would be a function of their distance from the power plant, the composition of the transported material, and the frequency of the wind blowing in the direction of the lakes. The nearest lake to the proposed power plant site is the unnamed lake located approximately 1.5 miles due east of the plant site. Although this lake is located nearest to the plant, effects would be minimal because the wind only blows in that direction approximately three percent of the time. The next nearest lakes to the power plant site would be Medicine Lake and Little Medicine Lake. These lakes are located approximately three miles south-southeast of the power plant site. The wind blows in the direction of Medicine Lake approximately 11.2 percent of the time (Suder 1997, personal communication).

~~The deposition of selected metals and hydrogen sulfide (H_2S) from project air emissions into Medicine Lake were modeled.~~ ~~I~~in order to assess the potential impacts from project air emissions to the water quality of Medicine Lake, the concentrations of selected elements and compounds in the lake were estimated using a set of assumptions that represent a worst-case scenario ~~water quality. Table 4.3-3 lists the constituents of concern to water quality in the air emissions from the proposed project.~~ It is difficult to accurately estimate deposition of project-generated air emissions onto the lake because of the number of variables involved. ~~Because of this,~~ Instead of attempting to create a complex, but realistic model of deposition on Medicine Lake, a simplified and unrealistically~~, extremely~~ conservative model (i.e., a worst-case scenario) was used instead to assess project impacts on the lake~~Medicine Lake~~. This model showed that even using very conservative assumptions (including some that physically could not occur), there would not be a significant effect on Medicine Lake water quality. The deposition~~al~~ analysis made the following assumptions:

- All of the plant emissions blowing towards Medicine Lake (11.2 percent of total emissions) were assumed to be deposited in the lake, either directly or through runoff. Table 4.3-3 lists the mass of air constituents blowing towards Medicine Lake annually as determined by the air quality analysis.
- ~~The annual total mass of all pollutants were assumed to be deposited in and confined to the upper two feet of lake water.~~
- ~~No mixing of lake waters occurs over the life of the project.~~
- The total volume of Medicine Lake = 23.78×10^9 L[40].

[40] Lake surface area = 18×10^6 ft^2 (425 acres); maximum lake depth = 140 feet. The volume of the lake was calculated by assuming the lake is the shape of an inverted cone with depth 140 feet and base surface area equal to the surface area of the lake. Using the formula for the volume of a cone, the lake volume = 840×10^6 ft^3 = $6\,282 \times 10^9$ gallons. This estimate is somewhat smaller than the actual volume of Medicine Lake because the lake is more bowl-shaped than cone-shaped. For this analysis, a lake of smaller volume would tend to overestimate the effects of air emissions deposited in the lake.

- Each potential pollutant mass was summed over a 45-year project life with no consideration of dilution due to lake recharge by springs or precipitation.
- All metals were considered to be either solubilized or contained in suspension.
- The total modeled H_2S blowing towards Medicine Lake was assumed to be converted to sulfuric acid (H_2SO_4) in the air by oxidation to sulfur dioxide and sulfur trioxide. For this analysis, the total mass of H_2S was used to estimate SO_4 loading in the ~~upper two feet of~~ lake ~~water in order to determine potential impacts to lake water pH levels~~.

The simplistic~~simplifying~~ assumptions in this depositio~~nal~~ analysis are extremely conservative, and actual changes in water quality would be substantially lower than estimated~~calculated~~ by this model. The analysis is conservative for the following reasons:

- Not all of the emission blowing towards Medicine Lake would be deposited in the lake. Many of the pollutants emitted would be deposited before reaching Medicine Lake and its watershed.
- ~~Mixing of lake waters would be expected to occur during spring and fall overturns. This mixing would substantially dilute deposited pollutants.~~
- Average rainfall in the project area is 30 inches per year. Assuming a 50 percent evaporation rate and 425-acre lake surface, recharge to the lake from direct rainfall would be approximately 530 acre-feet per year. This recharge would ~~also~~ substantially dilute deposited pollutants.

The results of the depositio~~nal~~ analysis indicate~~d~~ that concentrations of arsenic, antimony, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel and selenium in the ~~upper two feet of~~ lake ~~water~~, after 45 years of accumulation, were all significantly below regulatory limits for drinking water (Table 4.3-3). EPA-established Maximum Contaminant Levels (MCLs) were used as the primary regulatory level. Where no MCL existed, the Suggested No-Adverse-Response Levels (SNARLs) established by the National Academy of Sciences for drinking water were used.

None of the constituents would exceed either regulatory limit after 45 years of deposition. Arsenic concentrations after 45 years, based on these assumptions, are estimated to be~~would~~ 2.6×10^{-4} ~~1.2×10^{-2}~~ mg/L; the arsenic MCL is 5.00×10^{-2} mg/L. Estimates of sulfate loading indicate that ~~approximate~~ SO_4 concentrations would increase to ~~an estimated~~ 4.1~~83~~ mg/L after 45 years, using the above, highly conservative assumptions. No primary MCL for sulfate has been established but the secondary MCL is 250 mg/L. Thus, even with the extremely conservative assumptions of the depositio~~nal~~ analysis, final concentrations of pollutants would not exceed any existing water quality regulatory levels.

The above depositional analysis does not account for existing concentrations of the constituents in Medicine Lake~~ because no water quality data for these constituents are available. Based on the geology and undeveloped nature of the Medicine Lake watershed, it can be assumed that existing concentrations of the analyzed constituents in Medicine Lake would be extremely low and that these background concentrations combined with project deposition would not be sufficient to cause an exceedance of a water quality standard. Therefore, it can be reasonably concluded that air emissions from the project would have an adverse, but not significant impact on the water quality of Medicine Lake. For the same reasons discussed above, project air emissions would not be expected to have a measurable impact on other surface waters in the project area.~~ Analysis of water samples collected in Medicine Lake by Calpine in

November, 1997, indicates that all constituents are below detectable limits (the only constituent with a relatively high detection limit was sodium, at 1.0 mg/L; all other constituents had very low detection limits). Thus, the background water-quality of Medicine Lake would not measurably change the values shown in Table 4.3-3."

Comment F.19 also requests further information on the effects of deposition on the soils of the project area. The potential impacts of deposition of air emissions on soils in the project area include increased uptake of emitted compounds due to increased concentrations in the soils. Deposition effects on vegetation are discussed on pages 4-89 through 4-92 of the Draft EIS/EIR. This analysis includes an in-depth discussion of the potential effects of boron emissions. Also see the response to "Comments—Effects of Boron Emissions on Vegetation" in the Vegetation Section for a detailed discussion of the effects of boron emissions on soils and vegetation.

Comment AG.229 asserts that the analysis in the Draft EIS/EIR used incorrect standards of significance in the analysis of deposition effects on surface water quality. See the responses to comments below for a discussion of the use of the significance standards in the Draft EIS/EIR for specific constituents such as arsenic, mercury, and boron. The standards used for other constituents are based on established EPA criteria for drinking water (MCLs). As described on page 4-37 of the Draft EIS/EIR, where MCLs do not exist, SNARLs established by the National Academy of Sciences were used. An additional analysis has been conducted of the potential effects of selected constituents on aquatic organisms. The results of this analysis are presented in the response to "Comments—Effects of Water Quality on Fish and Other Aquatic Organisms" in the Wildlife Section, and are described later in this response. No adverse effects are expected.

Comment AG.229 also asserts that the project emissions were substantially underestimated. As described in the responses to comments in this section below, estimates of ammonia, arsenic, mercury, and boron emissions were accurately estimated in the revisions to the analysis in the Draft EIS/EIR above. More discussion of the air emission estimates can be found in the following responses to comments in the Air Quality Section:

- Adequacy of Emissions Calculations
- Underestimation of Emissions

The comments also question the conclusions reached in the Draft EIS/EIR about the significance of the effects of emissions on water quality. The purpose of the deposition analysis was to quantify the deposition impacts to Medicine Lake under extremely conservative and unrealistic assumptions. These conditions are presented as a "worst case" scenario, which is extremely unlikely to occur. Actual values of pollutants after the 45-year operating period of the power plant would be substantially less than the values shown in Table 4.3-3.

Comments AG.229 and BQ.14 also claim that the impact of acid rain on surface waters was omitted from the analysis in the Draft EIS/EIR. See also the response to "Comments—Effect of Acid Deposition on Surface Waters" below.

Mitigation is proposed in the Draft EIS/EIR to reduce impacts of project emissions on surface water quality. For example, Mitigation Measure 4.3.7a (see page 4-38 of the Draft EIS/EIR) requires Calpine to repeat the deposition analysis of project emissions on water quality when more data become available. These data include baseline water quality information for trace elements in Medicine Lake, and actual emission data when wells are first drilled (prior to construction of the power plant). If the updated deposition analysis indicates that the MCL or SNARL for any constituent would be exceeded over the life of the project, the BLM would implement operational restrictions to ensure that water quality standards are not exceeded.

Comment BQ.9 requests data on the current concentrations of metals in Medicine Lake with which to compare project air emissions. As described in responses to "Comments—Baseline Hydrology Information" and "Comments—Hydrologic Monitoring Plan," Calpine collected these data in the Fall of 1997. These data are presented in the Final EIS/EIR, and will also be incorporated into the updated deposition analysis that would be required under Mitigation Measure 4.3.7a, described above and on page 4-38 of the Draft EIS/EIR. Comment BQ.9 requests that the deposition analysis described in Mitigation Measure 4.3.7a be conducted before the project is allowed to be developed. Estimates of project air emissions in the EIS/EIR were based on geothermal fluid chemistry data from Well 87-13 and on estimates of project operations. These estimates were based on the best available data. Analysis of actual project air emissions, by definition, can only take place during project development (i.e., well testing) and operation (i.e., power plant operation). This analysis would occur prior to full operation, if the analysis is required. Therefore, effects greater than estimated would not occur.

Comment BQ.9 questions the origin of precipitation data used in the analysis in the Draft EIS/EIR. As stated on page 3-177 of the Draft EIS/EIR, the air quality analysis was based on the best available meteorologic data. The best available meteorologic data (i.e., data by month) came from the McCloud Ranger Station, which is located approximately 40 miles from the project site. The meteorologic data from the McCloud Ranger Station is considered adequate for the general dispersion model constructed for the proposed project.

Comment BQ.14 states that the Draft EIS/EIR did not provide any assessment of possible metal accumulation in fish in Medicine Lake and the effect on birds, including the bald eagle and osprey, that feed on these fish. Table 4.3-4 below presents the EPA criteria for aquatic organisms for four constituents: arsenic, boron, mercury, and ammonia. These four constituents were selected because (1) they would be present in the emissions of the proposed power plant in relatively high concentrations, (2) the constituents are biologically active and have the potential to adversely effect aquatic organisms, particularly through bioaccumulation, and (3) the EPA has developed water quality standards for aquatic organisms for these constituents.

These data show that the current levels of these constituents in three surface water bodies near the project site (Medicine Lake, Little Medicine Lake, and Bullseye Lake) are well below the criteria at either maximum concentrations or chronic concentrations. Data from the EIS/EIR is also presented which show the estimated levels of arsenic, boron, and mercury in Medicine Lake after the 45-year life of the project. As described

Table 4.3-4: EPA Water Quality Criteria for the Protection of Aquatic Life[1]

Compound	EPA Water Quality Criteria		Pre-Project Water Quality[2]			Post-Project Water Quality[3]
	CMC[4]	CCC[4]	Medicine Lake	Little Medicine Lake	Bullseye Lake	Medicine Lake
Arsenic	0.34	0.15	< 0.005	< 0.005	< 0.005	0.00026
Boron	—	0.75[5]	< 0.10	< 0.10	< 0.10	0.00087
Mercury	0.0014	0.00077	< 0.0002	< 0.0002	< 0.0002	0.0001
Ammonia	0.58-33[6]	0.11-2.5[6]	0.13	< 0.050	< 0.050	—

Notes:

1 All values are in mg/l, which is equivalent to ppm

2 Source: Calpine surface water quality monitoring program; Data collected in November, 1997; values at Medicine Lake are averages of three samples taken at a depth of one foot. See response to "Comment—Hydrologic Monitoring Plan" in the Hydrology Section for the methodology

3 Estimated values taken from Fourmile Hill EIS/EIR Table 4.3-3. See Section 4.3.7 in the EIS/EIR for an explanation of the derivation of these values.

4 Sources: EPA 1986, 1992, and 1997. EPA set two criteria for each contaminant: (1) CMC = criteria maximum concentration; CMC is a one hour average, not to be exceeded more than once in three years, and (2) CCC = criteria chronic concentration; CCC is a four day average concentration, not to be exceeded more than once in three years.

5 A limit set mainly to protect crops

6 Ammonia toxicity is dependent on temperature and pH; a range of toxicity values is given; the lower bound is at pH = 9 and 86°F; the upper bound is at pH = 6.5 and 32°F. The pH and temperature for Medicine Lake at the surface = 45°F and pH = 6.9; Little Medicine Lake pH = 6.8; Bullseye Lake pH = 6.9; temperature was not measured at Little Medicine Lake or at Bullseye Lake.

in the Draft EIS/EIR on page 4-36, very conservative (and often unrealistic) assumptions were made to generate these values. These estimated concentrations are also well below the EPA water quality criteria for aquatic organisms. Thus, significant effects to aquatic organisms are not expected to occur as a result of emissions and deposition of these emissions from the proposed project.

Because there would be no significant effects to aquatic organisms, including fish, from deposition, there would also be no significant adverse effects to birds that feed on these fish such as bald eagles and osprey. The bald eagle is a Federally listed endangered species. Because of its Federal status, a detailed discussion of the potential effects to the bald eagle have been included in the Biological Assessment that is being prepared for this project. This Biological Assessment will be available for review by the public at the USFS office in Alturas, California.

The USFWS has reviewed the data on the potential deposition effects on the bald eagle during the consultation process between the USFS and the USFWS (see response to "Comments—Consultation with Regulatory Agencies" in the Wildlife Section for more information). During these consultations, the USFWS concurred with the analysis in the EIS/EIR and the Biological Assessment that there would be no adverse effects to bald eagles that feed on fish in Medicine Lake. For more discussion of the effects of water quality on aquatic organisms and wildlife that feed on them, see response to "Comments—Effects of Water Quality on Fish and Other Aquatic Organisms" in the Wildlife Section.

Comment BQ.14 also states that Mitigation Measures 4.3.1a and 4.3.2a do not adequately address the deposition impacts on water quality because they are "activated once a problem has been discovered." As described above, the monitoring proposed in the EIS/EIR under Mitigation Measures 4.3.1a and 4.3.2a would evaluate the actual effects of the proposed project on surface waters, and verify that impacts would not be significant.

This monitoring program is called "mitigation" in order to ensure that it is carried out (mitigation measures are required by CEQA and NEPA to be carried out and included in the Mitigation Monitoring and Reporting Program). Data collected during the water quality monitoring program, during project start-up (i.e., initial well drilling and testing), would verify whether impacts to surface water quality are not significant. The data would also help to determine the level and type of any corrective action that may be required. As described above, these studies cannot be conducted until the initial project wells are drilled and tested.

Comment HD.13 expresses concern about the chemical concentrations of constituents in geothermal fluids and the basis for the estimates of air emissions from the proposed project. As described in Section 4.13 of the EIS/EIR, Air Quality, estimates of air emissions are based on proprietary geothermal chemistry data. These data on the chemistry of geothermal fluids in the project area are consistent with data from non-proprietary sources presented in Table 3.4-1 on page 3-39 of the Draft EIS/EIR. Additional non-proprietary geothermal fluid chemistry data has been made available since publication of the Draft EIS/EIR. These data are presented in Table 3.4-1 of the Final EIS/EIR, and in response to "Comments—Chemical Composition of Geothermal Fluids" in the Geothermal Resources Section. These additional data further support that the proprietary geothermal chemistry data on which the air quality and deposition analyses are based are representative of the chemistry of the geothermal fluid throughout the Glass Mountain KGRA.

Comment PH3.50 expresses concern about potential effects on fish and wildlife. See response to "Comments—Effect of Water Quality on Fish and Other Aquatic Organisms" in the Wildlife Section for a discussion of this issue. For more discussion of the deposition analyses of specific constituents on surface water quality, see the following responses to comments in this section below:

- Effect of Ammonia Deposition on Surface Waters
- Effect of Arsenic Deposition on Surface Waters
- Effect of Mercury Deposition on Surface Waters

- Effect of Boron Deposition on Surface Waters
- Effect of Acid Deposition on Surface Waters

References:

EPA (Environmental Protection Agency. 1997. Water quality standards; establishment of numeric criteria for priority toxic pollutants for the state of California; proposed rule. *Federal Register* **62**:42159-42208.

———. 1992. Revised tables for determining average freshwater ammonia concentrations. Internal memorandum, Office of Water, Washington, DC. July 30.

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Schneider, T. and W. MacFarland. 1996. *Hydrologic Data and Description of a Hydrologic Monitoring Plan for Medicine Lake Volcano, California.* Open-file report 95-750. U.S. Geological Survey, Portland, Oregon.

Webster, J. G., and M. H. Timperley. 1995. Biological impacts of geothermal development. Pp. 97-117 *In:* Environmental Aspects of Geothermal Development, Proceedings of the International Geothermal Association Congress, Pisa, Italy, May 18-20, 1995.

Comment—Effect of Ammonia Deposition on Surface Waters

A.27 Page 2-29 of the DEIS lists ammonia as a constituent of cooling tower drift. During the early operations at the Geysers, steam condensate containing ammonia was discharged to streams, and it was determined that the ammonia was responsible for fish kills. The FEIS should discuss the possibility of ammonia emissions in the steam condensing and affecting local water bodies, in particular during inversion conditions that could be encountered during the winter months.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

Response—Effect of Ammonia Deposition on Surface Waters

Comment A.27 references ammonia emissions at The Geysers and the potential impacts from these emissions to local fisheries. It should be noted that The Geysers is a dry steam field that contain substantially higher proportions of non-condensable gases than liquid-dominated geothermal systems like that found in the Glass Mountain KGRA. Concentrations of ammonia in The Geysers ranges from 30 to 576 ppm by weight (Truesdell et al. 1992).

Liquid-dominated geothermal systems similar to the one at Fourmile Hill, such as at Dixie Valley, Nevada, have concentrations of ammonia that range from 0.17 to 26.3 ppm by weight (Bruton et al. 1997). These values are equal to or substantially less than the lowest levels of ammonia measured at The Geysers.

Due to the similarity of the Glass Mountain KGRA with the Dixie Valley system, it is expected that ammonia concentrations at the Fourmile Hill site would be similar to that found in Dixie Valley. The concentration of ammonia in the geothermal resource at Medicine Lake is thought to be less than 1 ppm (USFS et al. 1994). The estimate of ammonia emissions in the EIS/EIR assumed that 80 percent of the ammonia in the geothermal fluid would be released from the power plant; the remaining 20 percent would be injected into the reservoir (note that this assumption likely overestimates the proportion of ammonia from the geothermal fluid that would be emitted by the project). Thus, due to the expected low concentration of ammonia in emissions, there would be no adverse effects to water quality in the region from ammonia emissions.

The comment expresses concern about potential effects of ammonia emissions during inversion conditions. During inversions there is less mixing in the atmosphere and

less mass transfer from higher to lower altitudes. As a result, deposition of gases, including ammonia, would be lower during inversion conditions than during more typical atmospheric conditions.

See also responses to "Comments—Effects of Water Quality on Fish and Other Aquatic Organisms" in the Wildlife Section, and "Comments—Arsenic, Fluoride, Sulfate, and Ammonia Emissions" in the Air Quality Section.

References:

Bruton, C. J., D. Counce, D. Bergfeld, F. Goff, S. D. Johson, J. N. Moore, and G. Nimz. 1997. Preliminary investigation of scale formation and fluid chemistry at the Dixie Valley Geothermal Field, Nevada. *Transactions of the Geothermal Resources Council* **21**:157-164.

Truesdell, A. H., W. T. Box, Jr., J. R. Haizlip, and F. D'Amore. 1992. A geochemical overview of the geysers geothermal reservoir. Pp. 121-133 *In:* C. Stone, editor. *Monograph on The Geysers Geothermal Field.* Special Report No. 17. Geothermal Resources Council, Davis, CA.

USFS (U.S. Forest Service), Bureau of Land Management, and Bonneville Power Administration. 1994. *Newberry Geothermal Pilot Project Final Environmental Impact Statement.* June.

Comments—Effect of Arsenic Deposition on Surface Waters

AG.20 According to the CEQA Guidelines, a project may have a significant effect on the environment if it will substantially degrade water quality. (CEQA Guidelines, App. G(f).) The federal regulations implementing the U.S. Geothermal Steam Act of 1970 provide that the operator shall comply with all federal and state standards relating to control of air, land, water and noise pollution. (43 C.F.R. § 3262.6.) The EIR/EIS had concluded that air depositions would not significantly affect Medicine Lake's water quality because contaminants would be diluted below concentrations that would affect water quality. (EIS/EIR, p. 4-34.) The EIR/EIS evaluated the significance of deposition by comparing contaminant concentrations to drinking water maximum contaminant levels (MCLs) or suggested no-adverse-response levels (SNARLs). (EIS/EIR, Table 4.3-3, p. 4-36.) The EIS/EIR, however, did not use the correct significance standards to evaluate the Project's impact.

Dr. Phyllis Fox undertook an extensive analysis of Project-related air emissions on Medicine Lake. Dr. Fox has determined that the EIR/EIS's analysis is severely flawed and substantially underestimates the Project's impacts on Medicine Lake. The following is a summary of the significant effects that were overlooked or understated in the EIS/EIR, as discussed in detail in the comments of Dr. Fox. Dr. Fox's comments, which are attached to this letter as Exhibit A, are incorporated by reference in these comments.

The significance standards referenced in the EIS/EIR, the MCLs and SNARLs, are insufficient to evaluate the Project's impacts on human health. These criteria do not consider metal bioaccumulation in the food chain and human consumption of contaminated organisms. (Ex. A, comment 8a.) This is particularly important in an area such as Medicine Lake, where people consume fish from the lake. (Ex. A, comment 8a; EIS/EIR, p. 3-153.) To address this issue, the U.S. EPA promulgated human health criteria that considers these factors. (Ex. A, comment 8a; 40 C.F.R. 131.36(b)(1).) Also, the EPA has also recognized that the current MCL for arsenic is insufficient to protect human health and it is currently studying a more stringent standard. (Ex. A, comment 8a.) Given these factors, the EIS/EIR should have used human health criteria in its analysis of the air emissions on water quality. (*Ibid.*)

When the correct significance standard is used to evaluate the Project's effect on Medicine Lake's water quality, the standard for arsenic is exceeded. The human health criteria for consumption of water and organisms is 0.018 μg/L. (40 C.F.R. 131.36(b)(1).) The estimated concentration of arsenic in Medicine Lake after the Project's 45-year life would be 12 μg/L, which is over 600 times higher than the level EPA says is required to protect human health. Similarly, the arsenic concentration would be over 85 times higher than the human health criteria for consumption of organisms only. (Ex. A, comment 8a.) Both of these human health criteria would be exceeded after only one year of the Project's operation. (*Ibid.*)

Thus, lead agency should recognize the Project would have a significant effect on Medicine Lake water quality because its air emissions would substantially elevate arsenic levels above significance standards. The EIS/EIR should be revised to include this significant impact and to propose appropriate mitigation measures. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.230 Arsenic Impacts Are Significant When Evaluated Using The Correct Significance Standards. Medicine Lake is both a public water supply and heavily fished by both recreators and residents who live along the shoreline. Drinking water MCLs and SNARLs should not have been relied on exclusively for evaluating the impacts of deposition on Medicine Lake. Significance levels should have included criteria for both consumption of organisms from the lake and drinking water.

First, residents and recreators who use Medicine Lake consume organisms from the lake. Many metals bioaccumulate in the foodchain and would be present at elevated concentrations in organisms exposed to deposited metals. The MCLs and SNARLs used to evaluate the deposition data do not consider bioaccumulation in the foodchain and consumption of contaminated organisms. To address this issue, the U.S. EPA has promulgated water quality criteria that apply to surface waters in California that do consider these additional factors. These criteria include human health criteria for consumption of both water and organisms and organisms only. (40 CFR 131.36(b)(1).) These criteria should also have been used to evaluate the significance of deposition on Medicine Lake water quality because organisms from Medicine Lake are consumed.

Second, the evaluation in the DEIR indicates that the estimated concentration of arsenic, 0.012 mg/L, is close to the current arsenic MCL, 0.05 mg/L. The arsenic MCL was established in 1946 long before its carcinogenicity was recognized.[41] Today, it is widely recognized that this MCL is not stringent enough to protect human health because it does not consider the fact that arsenic is a potent human carcinogen.[42] Recent work indicates that the arsenic MCL presents a lifetime cancer risk of greater than one in a thousand (2.5×10^{-3}),[43] which is 2,500 times higher than the cancer risk threshold of 1×10^{-6} conventionally used to set MCLs. The U.S. EPA is currently conducting studies to established a more appropriate (and much lower) arsenic MCL.[44] The preparers of the DEIR should have adopted a lower threshold of significance for arsenic and supplemented their arsenic analysis. The DEIR does not contain adequate support for the high arsenic threshold.

The U.S. EPA's human health criterion for the consumption of water and organisms is 0.018 μg/L for arsenic. (40 CFR 131.36(b)(1).) This threshold is current and appropriate and should have been used. The estimated concentration of arsenic in Medicine Lake at the end of the 45-year Project life would be 12 μg/L, or over 600 times higher than the level the U.S. EPA set to protect human health. Likewise, the estimated increase in concentration in Medicine Lake from Project emissions is over 85 times higher than the U.S. EPA's human health criterion for the consumption of only organisms, which is 0.14 μg/L. Both of these criteria would be exceeded after only one year of operation of the Project. Using an out-of-date significance level is improper where a current and appropriate level of significance is available. Significant emission impacts have been masked.

In sum, the Project emissions would adversely affect the water quality of Medicine Lake and result in a significant impact to public health from the consumption of organisms and water contaminated with arsenic. Actual impacts could be substantially higher because these calculations did not consider existing ambient concentrations of arsenic in Medicine Lake. The impacts described here would be proportionately larger if arsenic emissions were higher than those calculated by the applicant and used in the DEIR. This could occur, for example, if Project emissions were underestimated (Comment 1.f), or additional units were constructed in this general area. Arsenic concentrations in geothermal fluids are typically much higher than assumed in DEIR calculations. (Layton and Anspaugh 1981.) The EIR should be revised to require mitigation for this significant impact and recirculated for public review.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effect of Arsenic Deposition on Surface Waters

Estimated concentrations of arsenic in Medicine Lake after the 45-year operating period of the project have been revised based on revised estimates of air emissions (see responses to comment in the Air Quality Section for a discussion of the origin and results of the revision). Table 4.3-3, as revised above and in the Final EIS/EIR, presents

[41] U.S. Department of Health, Education, and Welfare, Public Health Service Drinking Water Standards, Publication No. 956, 1962, p. 26.

[42] Office of Environmental Health Hazard Assessment, Arsenic Recommended Public Health Level for Drinking Water, California Environmental Protection Agency, 1992.

[43] A.M. Fan, J.P. Brown, M.A. Milea, and P.D Spath, Arsenic in Drinking Water: Health Effects and Regulatory Issues in California, In: W.R. Chappell, C.O. Abernathy, and C.R. Cothern (Eds.), Arsenic Exposure and Health, Science and Technology Letters, Northwood, 1994, pp. 275-284.

[44] U.S. EPA Memorandum from R. Perciasepe to Assistant and Regional Administrators, February 6, 1995.

an estimate of arsenic concentration in Medicine Lake after 45-years of project operation of 0.26 μg/L. This value is well below applicable criteria for water quality. See also response to "Comments—General Deposition Effects on Surface Waters" above.

The comments also question the conclusions reached in the Draft EIS/EIR about the significance of the effects of arsenic deposition on water quality. The purpose of the deposition analysis was to quantify the deposition impacts to Medicine Lake under unrealistically conservative assumptions. These conditions are presented as a "worst-case" scenario, which is extremely unlikely to occur. Actual values of arsenic after the 45-year operating period of the power plant would be substantially less than the value shown in Table 4.3-3. Explanations of two of the key assumptions used in the deposition model, including why the assumptions are conservative and unrealistic, are presented in response to "Comments—General Deposition Effects on Surface Waters" above.

Comment AG.20 references 40 CFR 131.36, the health risk criteria for the human consumption of certain pollutants, and states that this should have been used as the significance standard for arsenic. The value referenced in the comment, 0.018 μg/L, has been calculated based on a threshold for human cancer risk of 1 in 1,000,000. This assumption does not always reflect natural conditions. For example, the average natural concentration of arsenic in sea water is 3 μg/L (USGS 1992), nearly 200 times higher than the level referenced in comment AG.20.

The average concentration of arsenic in soils and volcanic rocks is 5,400 to 13,000 ppb and 4,700 ppb, respectively (USGS 1975). Parts per billion (ppb) are the dry equivalent of μg/L. Medicine Lake soils are derived primarily from volcanic rocks, so they would be expected to have similar concentrations of arsenic in them occurring naturally. With average soil concentrations of arsenic at anywhere near these levels, if the value suggested by the commentor were applied (0.018 μg/L), it is likely that human health criteria could not be met anywhere in the Medicine Lake area, even without development of the proposed project. Nevertheless, the commentor does not suggest that Medicine Lake soils presently pose a threat to the residents and recreationists there.

Water samples of Medicine Lake were taken in the Fall of 1997 to provide baseline data for the water quality monitoring program (see response to "Comments—Baseline Hydrology Information" for more discussion). Chemical analysis was unable to detect any arsenic in the water samples. However, the detection limit of the standard equipment was 0.005 mg/L, over two orders of magnitude above the human health criteria referenced in comment AG.20. Thus, it is possible that Medicine Lake, which the commentor considers to be a "pristine" lake, already greatly exceeds the EPA's human health standard for arsenic. Based on the current levels of arsenic in Medicine Lake, the natural concentrations of arsenic in soils around Medicine Lake, and the detection limits of equipment to measure arsenic, it would not be reasonable to apply to the proposed project the human health standard suggested in comment AG.20.

Comments AG.20 and AG.230 mistakenly suggest that "the estimated concentration of arsenic in Medicine Lake after the Project's 45-year life would be 12 μg/L." This statement is inaccurate. The Draft EIS/EIR states on pages 4-36 and 4-37 that only if the worst-case and unrealistic scenario occurred, the levels of arsenic in the lake would be 12 μg/L. The revised estimate for arsenic is 0.26 μg/L. In reality, concentrations of

arsenic in Medicine Lake after the 45-year operating period of the proposed project would likely be substantially lower than this revised estimate.

Comment AG.230 also claims that arsenic concentrations in geothermal fluids are typically much higher than assumed in the calculations in the Draft EIS/EIR. The estimates of arsenic emissions are based on actual measurements of arsenic concentrations in the geothermal fluids of the Glass Mountain KGRA. Table 3.4-1 has been revised to include non-proprietary data that has become available since publication of the Draft EIS/EIR. This revised table is also presented in response to "Comments—Chemical Composition of Geothermal Fluids" in the Geothermal Resources Section. As shown in this revised table, arsenic has been measured in the geothermal fluids of the Glass Mountain KGRA at a concentration of 0.6 ppm (or mg/L). This value was used in the air emissions estimates for arsenic.

See also response to "Comments—Arsenic, Fluoride, Sulfate, and Ammonia Emissions" in the Air Quality Section.

Comments—Effect of Mercury Deposition on Surface Waters

AG.21 The EIS/EIR fails to recognize that Project-related mercury deposition on Medicine Lake is a significant impact because it exceeds significance standards designed to protect human health. As Dr. Fox discusses in her comments on Air Quality, the EIS/EIR substantially underestimated the Project's mercury emissions. (Ex. A, comment 8b.) When actual mercury emissions, which Dr. Fox estimates to be 52 lbs/year, are multiplied by a ratio of the EIS/EIR's estimated mercury concentration in Medicine Lake, the concentration exceeds the EIR/EIS's estimate by a factor of 55. Mercury levels also would exceed the EPA's human health criteria for the consumption of water and organisms and consumption of contaminated organisms only. (*Ibid.*; 40 C.F.R. 131.36(b)(1).) Therefore, the EIS/EIR has substantially underestimated the Project's impacts and it fails to recognize that mercury deposition would have a significant impact upon Medicine Lake's water quality and human health.

The EIS/EIR should be revised to include this significant impact and the lead agency should propose corresponding mitigation measures.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.231 Mercury Impacts Are Significant When Evaluated Using The Correct Emissions. As discussed in Comment 1.e, the DEIR substantially underestimates total mercury emissions from the Project. The DEIR asserts that mercury emissions are only 0.000188 lbs/yr, even though no chemical data have been provided for the Fourmile Hill area resource. (DEIR, pp. 3-37, 3-39.) This tiny amount of mercury for a 49.9 MW geothermal plant is wholly inconsistent with a substantial body of published literature on mercury in geothermal fluids (Comment 1.e). Actual mercury emissions, based on published emission factors for geothermal power plants, are estimated to be 45 lbs/yr (Comment 1.e). Multiplying the mercury concentration in Medicine Lake estimated in the DEIR by the ratio of these emission estimates yields an average concentration of mercury in Medicine Lake of 0.09 mg/L at the end of 45 years.[45] This concentration exceeds the mercury MCL of 0.002 mg/L used in the DEIR to evaluate impacts by a factor of 45. It also exceeds the U.S. EPA water quality criteria to protect human health from the consumption of contaminated water and organisms (0.00014 mg/L) and the consumption of contaminated organisms alone (0.00015 mg/L). (40 CFR 131.36(b)(1).)

Therefore, emissions of mercury would adversely affect the water quality of Medicine Lake and result in a significant impact to public health from the consumption of organisms and water contaminated with mercury. Actual impacts could be substantially higher because these calculations did not consider existing ambient concentrations of mercury in Medicine Lake nor did they consider the fact that acid rain, discussed in Comment 8.d, may mobilize additional quantities of mercury. The EIR should be revised to require mitigation for this significant impact and recirculated for public review.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

[45] Revised mercury concentration in Medicine Lake at the end of 45 years = $(3.9 \times 10^{-7}$ mg/L)(45/0.000188) = 0.093 mg/L.

Response—Effect of Mercury Deposition on Surface Waters

As discussed in response to "Comments—General Deposition Effects on Surface Waters" above, the deposition analysis has been revised since publication of the Draft EIS/EIR. As shown in Table 4.3-3 (as revised in that response and in the Final EIS/EIR), the mercury concentration in Medicine Lake is estimated to be 0.1 μg/L after 45-years of project operation. This level is approximately an order of magnitude less than the MCL of 2 μg/L. The Draft EIS/EIR has been revised to reflect the new estimates of mercury emissions on pages 4-244, 4-245, and F-12 through F-17.

As discussed in response to "Comments—Mercury Emissions" (in the Air Quality Section), Calpine uses abatement equipment at another geothermal facility to remove mercury from the non-condensable gas before it enters the non-condensable gas treatment equipment (called a Stretford system). The purpose of this system is to prevent mercury contamination of the sulfur cake produced in the Stretford system. Calpine would use a similar mercury-abatement system at the proposed power plant if it is necessary to ensure that mercury emissions would not exceed the estimated rates presented here, or to prevent contamination of the sulfur cake.

The comments also question the conclusions reached in the Draft EIS/EIR about the significance of the effects of mercury deposition on water quality. The purpose of the deposition analysis was to quantify the deposition impacts to Medicine Lake under extremely conservative and unrealistic assumptions. These conditions are presented as a "worst-case" scenario, which is extremely unlikely to occur. Actual values of mercury after the 45-year operating period of the power plant would be substantially less than the value shown in Table 4.3-3. An explanation of two of the key assumptions used in this model is presented in response to "Comments—General Deposition Effects on Surface Waters" above.

As stated above, actual resource chemistry and power plant emissions would be tested and verified prior to power plant operation. If measured values are significantly different from those used in the impact analysis, the analysis would be repeated using the actual values. If the new analysis results in greater effects on surface water quality, plant operations would be modified to avoid significant effects.

Comments—Effect of Boron Deposition on Surface Waters

AG.22 The EIS/EIR fails to identify boron deposition as a significant impact on Medicine Lake. Dr. Fox's comments demonstrate that the EIS/EIR's analysis substantially underestimated boron emissions. (Ex. A, comment 8c.) Boron will cause an adverse effect on Medicine Lake's water quality that must be mitigated. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.232 Boron Impacts Are Significant When Evaluated Using The Correct Emissions. As discussed in Comment 1.d, the DEIR substantially underestimates boron emissions. The DEIR claims that they are only 17.4 lbs/yr, which is wholly inconsistent with a substantial body of published literature on boron in geothermal fluids. Actual boron emissions, based on published emission factors for geothermal power plants, are estimated to be 612 lbs/yr. Multiplying the boron concentration in Medicine Lake estimated in the DEIR by the ratio of these emission estimates yields an average concentration of boron in Medicine Lake of 1.2 mg/L at the end of 45 years.[46] This concentration exceeds the boron SNARL of 0.6 mg/L used in the DEIR to evaluate impacts by a factor of 2.

Therefore, emissions of boron would adversely affect the water quality of Medicine Lake and result in a significant impact to public health from the consumption of water contaminated with boron. Actual

[46] Revised boron concentration in Medicine Lake at the end of 45 years = $(3.9 \times 10^{-7}$ mg/L)(45/0.000188) = 0.093 mg/L.

impacts could be substantially higher because these calculations did not consider existing ambient concentrations of boron in Medicine Lake. The EIR should be revised to require mitigation for this significant impact and recirculated for public review.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effect of Boron Deposition on Surface Waters

The comments suggest that the analysis in the Draft EIS/EIR underestimates the effects of boron deposition on surface waters because the Draft EIS/EIR underestimates the emission of boron from the proposed power plant. As discussed in "Comment-Boron Emissions" in the Air Quality Section, estimated boron emissions from the proposed power plant would be about 9 lbs/year, not 612 lbs/year as stated in comment AG.232. Boron emissions from the proposed facility are based on the measured concentration of boron in the Glass Mountain KGRA and conservative estimates of the performance of plant equipment. For more details on the origin of the this estimate, see the response to "Comment-Boron Emissions" in the Air Quality Section.

The boron emission rate cited in comment AG.232 is based on measurements made at The Geysers Units 5 and 6, one of the oldest operating geothermal power plants in California. It was designed in the 1960s and went on line in 1971, a period when emissions control was given less attention than it is today, and the geothermal power production industry was less sophisticated.

The proposed facility would have a lower boron emissions than Geysers Units 5 and 6, for a number of reasons. Emissions from the cooling towers alone at Geysers Units 5-6 and 13 were reported to be 2,332 pounds per year and 463 pounds per year, respectively (Lang et al. 1986). Emissions at Unit 13 are much lower than at Unit 5-6 because Unit 13 has a more modern, lower-drift cooling tower and a hydrogen-sulfide abatement system that removes some boron (see below). By contrast, projected emissions from the cooling towers and vent silencers at the proposed project are about nine pounds per year. This amount is less than 2 percent of the boron emissions of The Geysers Unit 13 because the nature of The Geysers geothermal resource is different than the Glass Mountain geothermal resource, and because the design of the proposed power plant is different than Unit 13.

An important difference between The Geysers and the Glass Mountain geothermal resource is that The Geysers is a dry steam resource, whereas the Glass Mountain resource is a two-phase resource. In dry steam resource, boron is present in the produced steam in the vapor state (as borate) or in solid particles. In a two-phase resource, most of the boron is in the aqueous phase and in solid particles.

There are significant differences in the fate of nonvolatile components of dry steam resources and two-phase resources as they pass through geothermal power plants, due both to the nature of the resources and the design of the power plants. In dry steam power plants, solids are generally separated from the steam by a single separator. All of the vapors, and any solids that are not removed in the single stage of separation, are carried through the turbine, eventually ending up with the condensate in the circulating

water of the cooling tower[47]. In the case of the proposed facility, there would be two stages of separation, each followed by a polishing separator.

This will produce a much higher degree of separation between the steam and the liquids (including dissolved boron and boron is suspended solids). As a result, a much higher fraction of the boron would be removed at the proposed facility than at a dry steam plant. Calpine's emission calculations account for the known performance of the flash vessels and polishing separators to be used in the proposed power plant. These calculations have been provided to the commentor.

The emissions of nonvolatile substances present in the geothermal fluids (dissolved and suspended solids) from the proposed plant are expected to be lower than most other single- or dual-flash geothermal power plants. The proposed project would use polishing separators followed by high-pressure and low-pressure flash tanks. This system would reduce "carryover" of geothermal brine to the turbine (included the dissolved and suspended solids) upstream of the plant silencer to levels much lower than most other dual-flash geothermal power plants. As a result, much less of the dissolved and suspended solids would be transferred to the steam condensate and ultimately to the cooling tower than in other dual-flash power plants. This would result in lower emissions factors (i.e., mass of emissions per unit energy generated, (lb/MWh) or mass of emissions per mass of steam produced (lb/lb steam) for these substances than is typical of other dual-flash power plants.

The cooling towers would have high-efficiency drift eliminators, which would reduce the emissions of boron present in the cooling tower drift to levels well below the conservative estimates presented in the Draft EIS/EIR.

Like the Glass Mountain geothermal resource, the Coso geothermal resource is two-phase resource. At the Coso Navy 1 power plant, boron in the circulating water has averaged less than 10 mg/L for the nine-year operating period of the plant. (Boron concentration in the circulating water is not expected to change significantly as the power plant ages.) However, due to the use of polishing separators downstream of each flash vessel at the proposed power plant, the concentration of boron in the circulating water would be much lower than that at the Navy 1 power plant.

The comments also question the conclusion reached in the Draft EIS/EIR about the significance of the effects of boron deposition on water quality. The purpose of the deposition analysis was to estimate the impact of deposition of boron to Medicine Lake under extremely conservative and unrealistic assumptions. These conditions are presented as a "worst case" scenario, which is extremely unlikely to occur. Actual values of boron deposition after the 45-year operating period of the power plant would be substantially less than the value presented in Table 4.3-3. An explanation of the key assumptions used in this model is presented in response to "Comments—General Deposition Effects of Surface Waters" above.

[47] An exception to this is dry steam plants with certain hydrogen sulfide abatement systems that expose the steam to liquid water (such as the Stretford system at The Geysers Unit 13). In these plants, the boron concentration in the circulating water of the cooling tower is much lower than it would be without the hydrogen sulfide abatement system.

Reference:

Lang, F. J., F. T. Bingham, F. F. Hendrix, and N. L. Crane. 1986. Boron deposition on soil and native vegetation from geothermal emissions. *Journal of Environmental Quality* 15:260-265.

Comments—Effect of Acid Deposition on Surface Waters

AG.23 The EIS/EIR fails to identify acid deposition (acid rain) as a potential significant impact on Medicine Lake water quality. In fact, the EIS/EIR fails to analyze this issue at all.

The EIS/EIR's failure to provide any information about the potential impact of acid rain is important because Dr. Fox has determined that the Project-related acid deposition would have a significant effect on Medicine Lake. (Ex. A, comment 8d.) The EIS/EIR estimates that the Project will deposit 4,500 lbs/year of sulfate on Medicine Lake. (EIS/EIR, Table 4.3-3, p. 4-36.) This corresponds to a sulfate deposition of rate of 10.6 lbs/acre-year. Minnesota, which is the only state that has promulgated an acid deposition standard, has limited sulfate deposition to 9 lbs/acre-year. (Ex. A, comment 8d.) The sulfate deposition from the Project thus exceeds the Minnesota standards. The Project's deposition rate is in the range where demonstrated significant effects occur. (Ibid.) Acid rain reduces lake water pH levels, which harms sensitive biota. (Ibid.) Also, the acid deposition on Medicine Lake could be substantially higher because the EIS/EIR substantially underestimated hydrogen sulfide emissions. (Ibid.)

The EIS/EIR should be revised to acknowledge acid deposition as a significant impact and to propose potential mitigation measures.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.233 The principal acid gases emitted by the Project, hydrogen sulfide, nitric oxides and ammonia, form sulfuric acid and nitric acid in the atmosphere.[48] These can acidify the rain (referred to as acid rain), lakes, and soils where the acid rain is deposited if the alkalinity is low.[49] Scientists commonly use alkalinity as an index of potential sensitivity because it expresses, in part, the acid-neutralizing capacity of water bodies and, thus, their relative tolerance or potential sensitivity to acid inputs. If the alkalinity of a water body is low, the acid rain will cause the pH to drop, which results in adverse ecological impacts. The acid-neutralizing capacity of a lake buffers it against large changes in pH. Acidification occurs when a watershed receives an input of hydrogen ions that exceeds its supply of buffering ions, usually bicarbonate. Acid rain in high mountain lakes, including in the Cascades where the Project is located, has been a concern for decades because lake alkalinity is frequently too low to neutralize acid rain.[50]

The DEIR states that "the total mass of H_2S was used to estimate SO_4 loading in the upper two feet of lake water in order to determine potential impacts to lake water pH level." (DEIR, p. 4-37.) However, the DEIR fails to present or discuss the results of any such analyses. Elsewhere, the DEIR suggests that acid rain is not a problem, presenting alkalinity measurements of 5.8 to 5.9 mg/L from U.S. Forest Service measurements (DEIR, Table 3.3-2) and characterizing them as providing "good buffering capacity." (DEIR, p. 3-15.)

However, this characterization is contrary to the cited data sources themselves. The 1972-73 Medicine Lake data was characterized by the author as representing "low alkalinity" and a "very poor buffer system," demonstrated by fluctuations in lake pH from slightly basic in the summer to slightly acid in the winter.[51] The author of the 1982-83 study concluded that Medicine Lake "is extremely succeptable (sic) to acid precipitation because of low buffering capacity."[52]

The alkalinity information presented in the DEIR is ambiguous because alkalinity is normally reported as mg/L as $CaCO_3$ (calcium carbonate) or as microequivalents per liter ("μeq/L").[53] Therefore, it is unclear exactly what is being reported. The original data sources are likewise ambiguous, but based on their authors' characterizations of low buffering capacity (Leydecker 1972; Jones 1983), the units are probably

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[48] J.H. Seinfeld, Atmospheric Chemistry and Physical Science of Air Pollution, John Wiley & Sons, New York, 1986, Chapter 18.

[49] S.E. Manahan, Environmental Chemistry, 5th Ed., Lewis Publishers, 1991, pp. 343-344.

[50] D.H. Landers and others, Characteristics of Lakes in the Western United States Volume I: Population Descriptions and Physico-Chemical Relationships, U.S. EPA Report EPA-600/3- 86/054a, 1987; L.B. Laird, H.E. Taylor, and V.C. Kennedy, Snow Chemistry of the Cascade-Sierra Nevada Mountains, Environmental Science and Technology, v. 20, 1986, pp. 275-290.

[51] A.O. Leydecker, Medicine Lake Water Quality Study 1971 - 72, U.S. Forest Service, Modoc National Forest, April 20, 1972, p. I-3.

[52] Richard Jones, Medicine Lake Water Quality Study 1982 and 1983, U.S. Forest Service, Modoc National Forest, 1983, p. 19.

[53] To convert alkalinity in mg/L as $CaCO_3$ to ueq/L, divide by 50 mg $CaCO_3$/meq and multiply by 1000 ueq/meq. (V.L. Snoeyink and D Jenkins, Water Chemistry, John Wiley & Sons, New York, 1980, p. 175.)

mg/L as $CaCO_3$. Presuming the DEIR intended mg/L as $CaCO_3$, these measurements would correspond to alkalinity values of 116 to 118 μeq/L, which are very low values and certainly do not represent "good buffering capacity."

Because of this ambiguity, the absence of recent measurements of alkalinity and any data whatsoever for the other three small lakes in the area, two samples were collected from each lake in the Medicine Lake area on September 21, 1997 and analyzed for alkalinity, conductivity, pH, and temperature. The samples were collected from the deepest portion of each lake at 5 ft below the water surface, except Blanche Lake, where the sample was collected at 0.5 ft below the surface because it is shallow. Samples were collected with a Van Dorn sampler, and sampling sites were accessed with a small inflatable rubber boat. The data are included in Attachment C. The average concentrations of alkalinity are as follows:

Lake	Alkalinity (μeq/L)
Medicine Lake	152
Little Medicine Lake	242[54]
Blanche Lake	105
Bullseye Lake	137

Conductivity accounts for 93 percent of the variability in alkalinity because alkalinity is the sum of carbonate species, which are normally the predominate source of alkalinity and conductivity in low-conductivity lakes. Conductivity is frequently used to estimate alkalinity. The corresponding values of alkalinity estimated from the conductivity measurements in Attachment A are 122, 218, 77, and 115 μeq/L, respectively,[55] which are consistent with the alkalinity measurement.

Numerous studies have classified waters with alkalinities less than 200 μeq/L as moderately to extremely sensitive to long-term acidification and waters with alkalinities between 200 to 400 μeq/L as sensitive to short-term, episodic acidification.[56] Therefore, Little Medicine lake is sensitive to short-term, episodic acidification, which could occur, for example, during an upset at the proposed power plant which releases large amounts of hydrogen sulfide. Little Medicine, Blanche, and Bullseye Lakes, on the other hand, are moderately to extremely sensitive to long-term acidification and may be affected over the life of the Project. Therefore, the DEIR should have evaluated the impact of acid rain on these lakes.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.235 The first state to comprehensively address acid rain was Minnesota, a state with numerous low-alkalinity lakes.[57] Based on a comprehensive review of the literature and extensive hearings,[58] Minnesota promulgated a standard to limit the amount of sulfate deposition to no more than 9 lbs/ac-yr. (Minnesota Rule 7021.0030.) The Minnesota standard is a reasonable basis for a significance standard to evaluate acid rain impacts of the Project because it is based on thorough review of the scientific evidence and extensive hearings.

According to the DEIR, 4,500 lbs/yr of sulfate from the Project from oxidation of hydrogen sulfide would be deposited on Medicine Lake (DEIR, Table 4.3-3), which has a surface area of 425 ac. (DEIR, p. 4-22.) This corresponds to a sulfate deposition rate of 10.6 lbs/ac-yr from the Project alone. Background sulfate deposition rates in the Project vicinity are unknown, but are probably about 3 lb/ac-yr based on estimates for other similar wilderness areas. (Peterson et al. 1992, Table 3.) Therefore, total sulfate deposition after the Project is operational would be about 14 lbs/ac-yr. This exceeds both the existing Minnesota acid deposition standard (9 lbs/ac-yr) and the range where scientific research has demonstrated that significant adverse impacts occur (8-12 lbs/ac-yr). (Schindler 1988.) Therefore, sensitive lakes in the area, Medicine Lake, Bullseye Lake and Blanche Lake, could be acidified by sulfate deposition from the Project. This would adversely affect the biota in the lakes, which are popular fishing destinations. (Forest Service 1991, p. 4-211.) This is a significant impact that is not discussed in the DEIR.

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[54] Little Medicine Lake was covered with a thick scum of algae and foam at the time of sampling, which may have contributed to its relatively high alkalinity compared to other local lakes. This apparently is not typical, and the U.S. Forest Service was unaware of the condition or its cause. (Reed 1997.)

[55] Alkalinity (ueq/L) = 9 42C - 8.59 where C is the conductivity in microseimens/cm (Peterson et al. 1992, p. 17).

[56] J. Omernik and G. Griffith, Total Alkalinity of Surface Waters: A Map of the Western Region, U.S. EPA Report EPA-600/D-85-219, 1986; Swedish Ministry of Agriculture, Acidification Today and Tomorrow, Ministry of Agriculture, Environment Committee, Stockholm, Sweden, 1982; A.P. Altshuller and R.A. Linthurst (Eds.), The Acid Deposition Phenomenon and Its Effects, Critical Assessment Review Papers, Volume II: Effects Sciences, U.S EPA Report 600/8-83-016 BF, 1984.

[57] J.M Omernik and G.E Griffith, Total Alkalinity of Surface Waters: a Map of the Upper Midwest Region, U.S. EPA Report EPA-600/D-85-043, 1985.

[58] Minnesota Pollution Control Agency, Report of the Administrative Law Judge, Report PCA-85-002-AK, 6-2200-34-1, 1986.

Emissions of hydrogen sulfide estimated by the applicant (14,400 lbs/yr) are high enough to adversely affect sensitive lakes in Project area due to reductions in pH. Actual impacts could be substantially higher because hydrogen sulfide emissions were apparently underestimated. As discussed in Comment 1.c, actual emissions could be as high as 106,500 lbs/yr. This emission level corresponds to a deposition rate of 78 lbs/ac-yr,[59] which is six to ten times higher than the level that the literature indicates will adversely impact biota.

In addition to sulfate from the oxidation of hydrogen sulfide in the atmosphere, the Project would also emit sulfate itself from the cooling tower. Geothermal fluids in the Medicine Lake area have high concentrations of sulfate, ranging from 42 (RWQCB 1989; DEIR, Table 3.4-1) to 510 mg/L. (Mariner et al. 1993.) Using the lowest reported sulfate emission factor for geothermal plants at other sites with comparable amounts of sulfate in their geothermal fluids (0.4 lbs/MWh) (Ellis 1978), the Project could emit up to 175,000 lbs/yr of additional sulfate. The corresponding sulfate deposition rate is 46 lbs/ac-yr.[60]

Likewise, according to the DEIR, the SCAPCD is contemplating limiting hydrogen sulfide emissions to 0.11 lbs/MW-hr. (DEIR, p. 4-220.) This emission level corresponds to a deposition rate of 35 lbs/ac-yr,[61] which is three to four times higher than the levels known to adversely impact sensitive lakes and their biota.

In either case, the sulfate deposition rate would substantially exceed levels known to adversely affect biota in sensitive freshwater ecosystems, such as the lakes near the proposed Project. Actual impacts of acid rain on lakes in the area could be substantially higher than estimated using the DEIR's emissions. Total sulfate deposition could be as high as 135 lbs/ac-yr (10.6 + 78 + 46). This exceeds the significance thresholds of 8 to 12 lbs/ac-yr by a substantial amount and is a significant impact. The DEIR must be revised to evaluate the impact of acid rain on all lakes in the vicinity of the Project. The EIR must also be revised to include mitigation for this significant impact and recirculated for public review.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effect of Acid Deposition on Surface Waters

The commentor asserts that hydrogen sulfide emissions of the proposed project were underestimated. As discussed in responses to "Comments—H_2S Emissions Calculation Methods" and "Comments—H_2S Concentration in Geothermal Fluids" in the Air Quality Section, the hydrogen sulfide emissions estimates for the proposed project are based on (1) measurements of hydrogen sulfide concentration in the geothermal fluid of the Glass Mountain KGRA, and (2) the known performance of available primary- and secondary-abatement technologies. The estimated hydrogen sulfide emission is readily achievable. It is within the range of those reported for other modern geothermal power plants, including dual-flash facilities like the one proposed at Fourmile Hill.

As discussed in the response to "Comments—H_2S Emissions Calculation Methods" in the Air Quality Section, the data on which the commentor bases the conclusion that hydrogen sulfide is underestimated are not relevant to the Glass Mountain KGRA or to the proposed power plant at Fourmile Hill. The estimates of hydrogen sulfide emissions in the EIS/EIR are accurate because they are based on measured concentrations of hydrogen sulfide in the Glass Mountain KGRA.

Comment AG.233 also states that the buffering capacity of Medicine Lake against acid rain is less than reported in the Draft EIS/EIR. The statement in the Draft EIS/EIR referenced in the comment on page 3-15 is a typographical error.

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[59] Sulfate deposition rate if hydrogen sulfide emissions equal 106,500 lbs/yr = (10.6 lbs/ac- yr)(106,500/14,400) = 78.4 lbs/ac-yr.

[60] Sulfate deposition from sulfate emissions = (0.4 lbs/MWh)(24 hr/day)(365 day/yr)(49.9 MW)(0.112)/425 ac) = 46.1 lbs/ac-yr.

[61] Sulfate deposition rate if emissions are limited to 0.11 lbs/MW-hr = [(0.11 lbs/MW- hr)(49.9 MW)(365 days/yr)(24 hrs/day)/14,400 lbs/yr)](10.6 lbs/ac-yr) = 35.4 lbs/ac-yr.

The last paragraph on page 3-15 in the Draft EIS/EIR has been revised as follows:

> "The water quality of Medicine Lake was monitored by the USFS in 1971-2, 1982, and 1983, and by the USGS in 1992 (USFS 1984; Schneider and McFarland 1996). Each of these studies found the Medicine Lake water to have ~~very~~ good clarity, low nutrient levels, and low~~good~~ buffering capacity (Table 3.3-2). Monitoring of oil, grease, and petroleum hydrocarbons in the lake found that all were below detectable levels. ~~No detailed analysis of lake water chemistries that include concentrations of metals and organic compounds is available.~~"

Comment AG.233 also claims that the low buffering capacity of Medicine Lake and other lakes in the vicinity would make them susceptible to reductions in pH from project emissions and deposition of acid-forming constituents such as hydrogen sulfide and sulfate. It was not the intent of the deposition analysis to evaluate potential changes in pH in Medicine Lake. Analysis of changes in pH would require detailed studies of the micrometeorology of the region, the chemistry of Medicine Lake, and the actual emissions of the project. None of these data are currently available. Data on the actual project emissions would only become available once the geothermal resource is tested at Fourmile Hill.

The comments make claims about the effects of sulfate and other acid-forming constituents without considering the buffering effects of carbon dioxide emissions from the power plant. Carbon dioxide normally comprises up to 90 percent of the noncondensible gases emitted from geothermal power plants. When carbon dioxide dissolved in cooling tower drift is deposited on surface waters, it results in an increase in the pH of the water. This increase in pH would, in part, ameliorate the effects of the acid-forming constituents that would also be emitted. Although this chemical process is not discussed in the EIS/EIR, it should be considered in any general discussion of the effects on pH of project emission like that found in the comments.

Comment AG.235 claims that the actual amount of sulfate emissions of the project would result in a significant and adverse amount of sulfate deposition on nearby surface-water bodies such as Medicine Lake, Bullseye Lake, and Blanche Lake. The commentor suggests the use of two significance standards for sulfate emissions, (1) the state of Minnesota's acid deposition standard (9 lbs sulfate/acre-yr) and (2) the range of sulfate deposition where scientific research has demonstrated that significant adverse effect occur (8–12 lbs/acre-yr).

The revised estimate of emissions of sulfate from the proposed project is 41,741 lbs/yr during normal operations. Of this total, approximately 11.2 percent would blow in the direction of Medicine Lake. Assuming that all of this sulfate was deposited into Medicine Lake (which would be impossible), 4,675 lbs/yr of sulfate would enter Medicine Lake. This is equivalent to 11 lbs/acre-yr of sulfate deposition on Medicine Lake (4,675 lbs/yr/425 acres). This estimate is substantially lower than the MCL for sulfate (250 mg/L) but it exceeds the estimated background sulfate deposition (3 lbs/acre-yr) and the two significance standards cited in comment AG.235 (9 lbs/acre-yr and 8–12 lbs/acre-yr). However, 11 lbs/acre-yr is a substantial overestimate of what would be the actual deposition of sulfate falling into Medicine Lake (or in any other lake in the vicinity). It is expected that actual deposition of sulfate on Medicine Lake would be substantially less than the significance standards cited in the comment.

Comment AG.235 states that emissions of hydrogen sulfide from the project could be as high as 106,500 lbs/yr, although there is no support for this value. Comment AG.235 also states that hydrogen sulfide emissions from the project could be as high as 175,000 lbs/yr, based on a reference in 1978. Geothermal power plants built in the 1970's and before were far less efficient than designs used today and the design proposed at Fourmile Hill. Thus, hydrogen sulfide emissions would be substantially less than the value cited in comment AG.235. The revised estimate of hydrogen sulfide emissions from the project is 14,378 lbs/yr. Given the technology currently available to reduce power plant emissions, this value can be easily achieved.

An appropriate level of abatement has been designed into the plant to ensure that hydrogen sulfide emissions do not exceed the estimated emission rates presented in the EIS/EIR. Calpine would consider additional methods of abatement equipment if necessary to ensure that hydrogen sulfide emissions do not exceed the emission rates presented in the EIS/EIR (see Mitigation Measure 4.13.5a on page 4-241 of the Draft EIS/EIR). In addition, Mitigation Measures 4.13.5b and 4.13.5c describe procedures that would be put in place to monitor hydrogen sulfide concentrations in the geothermal fluids and emissions. If the concentrations of hydrogen sulfide exceed the estimate in the EIS/EIR, appropriate measures (described in the mitigation) would be taken in consultation with the SCAPCD.

Mitigation is also proposed to periodically monitor the water quality of Medicine Lake. As described in responses to "Comments—Baseline Hydrology Information" and "Comments—Hydrologic Monitoring Plan," Calpine has collected and would continue to collected water quality data at Medicine Lake (including pH) throughout the lifetime of the proposed project, pursuant to the proposed monitoring plan. This plan, which would be submitted to state and Federal regulators for approval, would include a long-term monitoring program designed to identify any impacts to surface waters from project operations and any remedial action that might be necessary to correct adverse impacts from project emissions. See also response to "Comments—Potential for Acid Rain" in the Air Quality Section.

HYDROLOGY MITIGATION

Comments—Adequacy of Hydrology Mitigation

F.22 Section 4.3.2 covers effects of geothermal fluid production and injection on water quantity; it suggests that there will be no effects yet adds a mitigation measure requiring operational changes if quality/quantity impacts are discerned.*(John R. Hannum, North Coast Regional Water Quality Control Board)*

AG.28 The EIS/EIR proposes mitigation to reduce the Project's impacts on water availability and quality. These mitigation measures are inadequate because they are vague, improperly defer impact assessment, and are insufficient to alleviate the Project's impacts.

Mitigation measure 4.3.1a, which states that applicant will submit a hydrologic monitoring plan for the caldera and a "defined local area" is inadequate for several reasons. (EIS/EIR, p. 4-26.) This measure does not provide sufficient detail regarding ongoing monitoring of groundwater quality and quantity. (Ex. D (6/17/97 letter from Richard Elliot, California Department of Fish & Game); Ex. E (5/24/95 letter from Richard Elliot, California Department of Fish & Game).) First, it does not identify the "defined local area." Thus, it is impossible to determine the area being mitigated. Second, the measure requires other geothermal developers to participate in the monitoring, but it does not state what will happen if the other developers refuse. (*Ibid.*) Third, the applicant proposes to collect water level and water quality data prior to construction. The applicant, however, should provide this information in the EIR so that the public and decisionmakers can properly assess this information now. Finally, the applicant proposes to reduce groundwater pumping rates if it will have a significant adverse impact on water availability and these impacts "can be attributed to project pumping of local groundwater." (*Ibid.*) By requiring adverse

effects to be directly attributed to the applicant, the EIS/EIR ignores foreseeable natural events such as drought or the cumulative impacts attributed to other geothermal projects that should be considered if water availability becomes a problem.

In mitigation measure 4.3.2a, the applicant provides for "appropriate changes to operational procedures" if the production or injection of geothermal fluids adversely affects water quality. (*Id.* at p. 4-27.) However, it is unclear what would constitute "appropriate changes" and how the altered operational procedures would remedy water quality problems.

The EIS/EIR should provide sufficient information about its proposed mitigation measures to allow the public and decisionmakers to properly assess the measures feasibility and effectiveness.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

HD.21 Also, if groundwater availability appears to be affected by plant operations, extraction should be reduced whether or not this could be attributed to operations of the geothermal plant (p. 4-26).

(Amanda Spencer)

Response—Adequacy of Hydrology Mitigation

The effects on water availability and quality are fully analyzed in the Draft EIS/EIR on pages 4-21 through 4-42. Based on the information presented in the Draft EIS/EIR and based on additional information presented in the Final EIS/EIR, significant adverse effects on water quantity and quality are not expected. The basis for this conclusion is discussed in detail in the responses to comments presented above.

Comment F.22 references Section 4.3.2 in the Draft EIS/EIR and questions the inclusion of a mitigation measure for impacts that are considered not significant. Mitigation Measure 4.3.2a is proposed (as modified below) on page 4-27 of the Draft EIS/EIR to monitor the effects to groundwater quantity:

> "Although effects of production and injection of geothermal fluids on groundwater availability are not expected to be significant, the hydrologic monitoring plan outlined in mitigation measures 4.3.1a combined with the following mitigation measure would ensure adequate protection of groundwater availability~~resources~~.
>
> 4.3.2a If hydrologic monitoring detects significant adverse impacts to water quantity ~~or quality and these impacts can be attributed to~~ from the production or injection of geothermal fluids, the USFS and BLM shall require Calpine to make appropriate changes to operational procedures that will increase groundwater availability.~~, including~~ These changes could include changes in production and injection rates and locations. (O)"

Mitigation Measure 4.3.2a is designed to ensure that action would be taken in the unlikely event of significant adverse affects to groundwater quantity. This measure is called out as mitigation in order to ensure that it is carried out (mitigation measures are required by CEQA and NEPA to be carried out and included in the MMRP). According to CEQA, mitigation measures can be proposed that verify the impacts of a project.

Comment AG.28 references Mitigation Measures 4.3.1a and 4.3.2a (on page 4-26 and 4-27, respectively, of the Draft EIS/EIR) and claims that these mitigation measures are vague, improperly defer impact assessment, and are insufficient to alleviate the Project's impacts. Mitigation Measures 4.3.1a and 4.3.2a are intended to ensure that changes in operational procedures are made in the unlikely event that significant adverse effects occur to surface water quality or groundwater quantity. (Mitigation Measure 4.3.2a has been revised above to clarify that this measure addresses only potential impacts to groundwater quantity, not to groundwater quality.) The less-than-significant impacts to groundwater quality from geothermal fluid production and injection are discussed in Impact 4.3.6. Mitigation measures intended to further

minimize potential effects to groundwater quality from geothermal fluid production and injection are also identified in the discussion of Impact 4.3.6.

See response to "Comments—Hydrologic Monitoring Plan" below for a discussion of Mitigation Measure 4.3.1a. Comment AG.28 states that Mitigation Measure 4.3.1a does not provide sufficient detail regarding ongoing monitoring of groundwater quality and quantity. As discussed in the next response, a groundwater monitoring program is proposed for the project to monitoring groundwater quantity and quality in the project area. A summary of this program is presented in the response to "Comments—Hydrologic Monitoring Plan" below. This proposed groundwater monitoring program provides the details on the methodology and analysis that are requested in comment AG.28.

Comment AG.28 also requests a definition of the "defined local area." This definition is provided in the Hydrologic Monitoring Plan and includes the area immediately surrounding the wellfield.

Comment AG.28 questions whether other developers in the area would refuse to participate in the groundwater monitoring program. Calpine would be completely responsible for the cost of the groundwater monitoring program that is proposed in the Final EIS/EIR. If the Telephone Flat project is approved and carried out, CalEnergy would then contribute to the implementation of this plan. If the Telephone Flat project is not approved or built, Calpine would still fund and carry out the monitoring plan that is proposed in the Final EIS/EIR for the Fourmile Hill Geothermal Development Project.

In the fall of 1997, Calpine initiated a sampling program for surface water bodies within the project vicinity. The samples collected at that time provide baseline data with which to compare the chemistry of water samples that would be collected after project construction. A discussion of this sampling program has been added to the Final EIS/EIR. A summary of this program is provided in the response to "Comments—Hydrologic Monitoring Program" below. Groundwater level and groundwater quality data would be collected by Calpine in the wellfield area once the groundwater monitoring wells are installed. Calpine would install these wells prior to project construction in order to provide baseline data with which to compare future measurements (post-construction).

Comments AG.28 and HD.21 reference the last statement in Mitigation Measure 4.3.1a, that "Groundwater pumping rates shall be reduced if monitoring detects significant adverse impacts to water availability, and these impacts can be attributed to project pumping of local groundwater." This mitigation measure is designed to reduce impacts of the project to the local groundwater supply. The cumulative impacts of the project on the local groundwater supply are discussed on page 4-316 of the Draft EIS/EIR. As stated in this section, the groundwater supply in the region is expected to be sufficient to accommodate this project and other projects that are reasonably foreseeable in the area. However, if monitoring detects significant reductions in groundwater quantity that are due to the project, groundwater pumping would be halted until groundwater levels are sufficiently restored. Natural conditions that might exacerbate the drawdown

of the aquifer, such as a drought, would be taken into account when determining the ultimate cause and magnitude of reduced groundwater levels.

Comment—Method of Contamination Detection

B.21 How will leachates be detected and handled including ground and surface water contamination? What is the hydrology of the area (i.e. where does ground water and surface water go)?

(Ronald A. Iverson, U.S. Fish and Wildlife Service)

Response—Method of Contamination Detection

Groundwater and surface water contamination is not expected to occur as a result of the proposed project. The only geothermal fluid discharge would be to the lined sumps prior to the return of the fluids to the geothermal reservoir (via the injection wells). The BLM enforces requirements for ensuring that groundwater and surface water contamination does not occur. For more information, see response to "Comments—Underground Injection Control Program" above.

The proposed groundwater monitoring program would detect any unlikely and unexpected changes in groundwater chemistry. The baseline surface water sampling program conducted by Calpine has provided data regarding surface water chemistries, and these waters would be monitored to ensure that there is no significant change in chemistries due to the proposed project. Detailed information regarding these sampling and monitoring programs has been included in the Final EIS/EIR. See also response to "Comments—Hydrologic Monitoring Plan" below.

The flow of groundwater in the Medicine Lake area generally reflects the surface topography. As stated in the Draft EIS/EIR (see Figure 3.3-3), the available groundwater elevation data indicate that groundwater flows radially outward from the caldera. Thus, shallow groundwater in the Fourmile Hill area flows to the northwest. There are no surface waters in the immediate vicinity of the proposed project. At surface waters in the project region (such as Medicine and Bullseye Lakes), it is expected that water is lost from these water bodies through evaporation and possibly through soil infiltration. See response to "Comments—Local Groundwater Flow" above for more discussion of the hydrology of the area.

HYDROLOGY MONITORING PLAN

Comments—Hydrologic Monitoring Plan

D.5 Furthermore, the mitigation measure for monitoring the effects of the project on ground water levels states that "...groundwater pumping rates shall be reduced if monitoring detects significant adverse impacts to water availability...." There is no mention of what the "performance standards" are that would lead to a conclusion of "significant" adverse impact. These levels should be determined prior to commencement of any project construction or operation.

(Richard L. Elliott, California Department of Fish and Game)

N.14 As stated beforehand, the hydrology analysis in the DEIS/EIR is grossly deficient. The DEIS/EIR on page 4-26 under Mitigation Measures for water quality is deficient. The mitigation measures were not based on the results of scientific studies. The recommended mitigation measures in the DEIS/EIR are "after the fact", without supporting scientific studies, and follow the approval of the project.

The DEIS/EIR suggest that Calpine shall submit for approval by the USFS and BLM a hydrologic monitoring plan for the caldera and a defined local area. The Hydrologic Monitoring Plan for the caldera and the area should have been included in the DEIS/EIR. The DEIS/EIR is deficient without the Hydrologic Monitoring Plan and the scientific studies and reasoning which led to all of the elements in the Plan. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

U.9 Calpine must provide up-to-date water quality and quantity monitoring. A water chemistry analysis must be done prior to any drilling. The effects of air emissions (cooling tower drift, well venting,

construction etc.) on Medicine Lake and surrounding surface waters must be monitored. How else will the effects be determined? Mitigation measures (4.3.2a and 4.3.1a) only address the effects after the damage is done. *(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)*

U.12 The US Geological Survey has proposed a hydrological and geochemical monitoring plan to monitor lake, groundwater, or surface water changes from geothermal resource development at the Glass Mountain KGRA. This plan must be implemented before any further geothermal development, including the Calpine Fourmile Hill project, is activated. The USFS/BLM must insist that this monitoring be started. Please address this issue. (pg. 3-27 EIS/EIR)
(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

AD.25 Water temperatures and water flow in affected springs, streams, lakes and aquifers need to be monitored during the geothermal exploration phase as it could be adversely affected by the geothermal pumping and re-injection. It could have a negative affect to the plant and aquatic life in Payne Springs and Payne Creek, among others. *(Floyd J. Buckskin, Pit River Tribe)*

FP.11 Section 3-15 of the EIS/EIR cites water studies done at Medicine Lake in 1971, 1982, 1983, and 1992. These studies did not include an analysis of water chemistries including metals and organic compounds. The proposed project would produce air emissions that would eventually end up in Medicine Lake water systems. The table in the Draft EIS/EIR states that Arsenic, Beryllium, Cobalt and Sulfate are approaching the MCL/SNARL levels. If a baseline study for metals and organic compounds has not been completed, how can the effect of air emissions on the hydrology of the area be determined? Please provide more information about water chemistry of Medicine Lake prior to project decision.
(Eric T. Nelson and Amanda Spencer)

HD.8 The report states that a monitoring program will be implemented to evaluate shallow groundwater quality; however, without additional knowledge of the geology and hydrogeology in this area, the monitoring program cannot be effective or protective of the environment. As described above, the interpretation of the hydrology of the project vicinity is not supported by data and the understanding of the subsurface lithology is based on about a dozen wells over an approximately 30 square mile area.
(Amanda Spencer)

HD.15 Page 4-39 indicates that water from precipitation that accumulates within secondary containment areas would be directed into one of the surface sumps for eventual re-injection if "uncontaminated". The report does not state what monitoring and analyses would be performed to determine whether or not the liquid was "uncontaminated" nor the regulatory agency that would oversee this monitoring.
(Amanda Spencer)

HY.7 I wished that the BPA was more descriptive detailing the mitigation and monitoring of various sites for water quality. And which sites are selected so the Central Water District can monitor? What is the mitigation in case of leaks of contaminated water to long distances from Medicine Lake, say from seismic activities? Clean Water Act!!! *(Alice Tseng)*

PH4.44 Who will monitor changes in Medicine Lake water quality? *(Mount Shasta Public Hearing)*

PH4.45 What will prevent contamination of water quality? *(Mount Shasta Public Hearing)*

Response—Hydrologic Monitoring Plan

As discussed on pages 4-20 through 4-42 in the Draft EIS/EIR, significant groundwater and surface water contamination is not expected to occur as a result of the proposed project. This conclusion is based on analyses conducted by several hydrologists. The analyses were based on a variety of sources, including:

- Well log and fluid chemistry data
- Geophysical data
- Geologic data
- Experience at several other geothermal fields.

See responses to the following previous comments (in this section) for further explanation for the conclusion that effects to groundwater and surface water quality and quantity is not expected to occur as a result of the proposed project (in the order in which they appear):

- Potential Groundwater Depletion at Arnica Sink from Groundwater Use
- Potential Groundwater Depletion at the Project Site from Groundwater Use

- Potential Effect of Groundwater Use on Nearby Groundwater Wells
- Potential Groundwater Depletion due to Geothermal Fluid Use
- Potential Groundwater Contamination due to Geothermal Fluid Use
- Effects to Groundwater from Accidental Geothermal Brine Spills
- Effects to Surface Waters from Accidental Geothermal Brine Spills

The remainder of the response is divided into three sections, each of which describes a monitoring program that is designed to detect changes in water quality (and in the case of groundwater, water quantity) that may be due to project activities. These three monitoring programs are:

(1) Regional surface water monitoring in the Medicine Lake Highlands
(2) Production and injection well monitoring in the wellfield
(3) Groundwater monitoring in the wellfield

Regional Surface Water Monitoring Program: The comments suggest that hydrologic monitoring of nearby surface-water bodies should be conducted before construction in order to provide data with which to compare samples that are collected after project construction. The baseline surface water sampling program conducted by Calpine has gathered data regarding the chemistry of nearby surface waters. These waters will be monitored periodically through the life of the project to ensure that there is no significant change in water chemistry due to the proposed project. Detailed information regarding these sampling and monitoring programs has been included in the Final EIS/EIR and is summarized below.

Additional baseline information on water quality has been collected to evaluate and monitor the effects of the proposed project on surface water bodies in the Medicine Lake Highlands. In fall 1997, Calpine began a baseline water sampling program that included:

- Collection of water samples from Medicine Lake, Little Medicine Lake, and Bullseye Lake
- Analysis of these samples to determine their chemical composition

Comment AD.25 suggests the inclusion in the water sampling program of affected springs, streams, lakes, and aquifers, including Payne Springs and Payne Creek. Lakes that are near the project area are included in the regional water quality monitoring program. The aquifer would also be monitored through groundwater monitoring wells at the project site (see discussion below). However, springs and streams, including Payne Springs and Payne Creek, would not be monitored for the Fourmile Hill project. As discussed in the Draft EIS/EIR in Section 4.3, the proposed project would not affect the water quantity or quality at springs or intermittent streams in the Medicine Lake Highlands.

As described in the Draft EIS/EIR for the Telephone Flat project (USFS et al. 1998), Payne Springs (I, II, and III) would be monitored in conjunction with that project. Water chemistry and discharge rates would be measured in samples taken twice a year for the first three years of project operation, and annually thereafter.

The methods of the sampling program for regional surface water quality are described below.

Sampling began by taking temperature measurements at 5 to 10-foot intervals in three locations on Medicine Lake on November 8, 1997; this was done to determine the location of the thermocline. Once the thermocline was adequately defined, water samples were taken from four depths: (1) at the surface, (2) above the thermocline, (3) below the thermocline, and (4) near the lake bottom. Sampling of Little Medicine Lake and Bullseye Lake was conducted at a depth of approximately 1 foot at one location each.

Water samples were collected in a Kemmerer-type sampling device. Samples were preserved in ice during transport to the lab for analysis. Samples were analyzed for a wide variety of chemical constituents, including metals and organic compounds (as requested in comment FP.11). The constituents measured were chosen to match EPA standards and to match analyses that have been conducted or will be conducted in the area. These standards and analyses include:

- EPA National Primary and Secondary Drinking Water Standards
- Baseline Hydrogeology Evaluation Report prepared by Weiss Associates for the proposed Telephone Flat Geothermal Development Project (1997)
- USFS and USGS water quality studies of Medicine Lake (discussed on page 3-15 of the Draft EIS/EIR)
- The USGS hydrologic monitoring program at the Newberry Volcano in Oregon (described in the Newberry Geothermal Pilot Project EIS (USFS, BPA, BLM 1994))

A summary of the results of the November 8, 1997 water sampling is presented in Table 3.3-2a below (and in the in the EIS/EIR). The results indicate that the water quality of Medicine Lake, Little Medicine Lake, and Bullseye Lake is excellent. No sample exceeded EPA water quality standards for any constituent.

The geothermal well fluids would also be sampled and analyzed. Well and power plant air emissions would also be sampled and analyzed according to the SCAPCD requirements. See responses to comments in the Air Quality Section for further discussion of the air quality monitoring program.

Production and Injection Well Monitoring: The production and injection wells would be drilled and monitored in accordance with the GROs, permit conditions, and all applicable regulations, including those of the EPA Underground Injection Control Program. Wells would be constantly monitored at the power plant control room to ensure proper operation. However, if any leakage occurs (e.g., through the unlikely failure of a well casing), this leakage would be most easily and most quickly detected at the actual well location because the leakage would result in an immediate drop in well pressure. If such a drop in pressure occurred, the well would be repaired immediately.

If for some reason leakage of geothermal fluid into the groundwater was not accompanied by a pressure decline, this leakage would be detected by proposed groundwater monitoring wells that would surround the wellfield (described in detail below). These wells would monitor any changes in groundwater chemistry resulting from the proposed project.

Table 3.3-2a: Water Quality of Surface Waters in the Project Area

	Medicine Lake							Little Med Lake	Bullseye Lake
Sample Depth	**1 foot**	**5 feet**	**15 feet**	**20 feet**	**30 feet**	**55 feet**	**60 feet**	**1 foot**	**1 foot**
pH	7.0[2]	7.1[2]	6.6	6.9[2]	7.1	7.1	6.8	6.8	6.9
Chloride	<1.0[3]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sulfate	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nitrate (as N)	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Ammonia (as N)	0.17[2]	0.17[3]	0.24	0.11[2]	0.29	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon	1.3[2]	1.7[2]	1.8	1.9[2]	1.7	2.0	2.2	4.2	3.2
Antimony	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Beryllium	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Boron	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Calcium	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.8	<1.0
Chromium	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Cobalt	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Copper	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Iron	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.17	<0.10
Lead	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Lithium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Magnesium	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Manganese	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Mercury	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Molybdenum	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sodium	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.9	1.2
Vanadium	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Zinc	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Strontium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

Notes:

1 All samples were obtained on November 8, 1997, and were analyzed at an accredited laboratory. All measurements are in mg/l.

2 Value is the average of 2 to 3 surface water samples taken at different locations on Medicine Lake.

3 The "<" symbol indicates a result that was below the detection limit for that particular constituent.

SOURCE: Calpine

Wellfield Groundwater Monitoring Program: Several comments raise concerns about the need to monitor for potential effects to groundwater from leakage or spills of geothermal fluids, as well as the potential for depletion of groundwater. These comments also raise questions about how groundwater monitoring would be conducted for the proposed project. In order to address these concerns and questions, the basic components of a program to monitor groundwater quality and levels have been developed. These components have been developed through a joint effort by the following parties:

- U.S. Bureau of Land Management (lead agency)
- U.S. Forest Service (lead agency)
- North Coast Regional Water Quality Control Board (regulatory agency)
- MHA Environmental Consulting (independent, third-party EIS/EIR consultant)
- Calpine Corporation (project proponent)

In addition, the EPA has been consulted regarding the components of the groundwater monitoring program. The monitoring information presented in this Final EIS/EIR reflects the level of detail that can reasonably be generated at this time. Additional details and refinement to the elements of the program would occur through the RWQCB permitting process for the project. Proposed monitoring would conform with the requirements of the GROs, as well as the EPA's UIC program. The following information summarizes the key elements of the groundwater monitoring program that have been identified at this time.

Location of Monitoring: Groundwater monitoring would involve monitoring at the following wells:

- The proposed production and injection wells located within the wellfield
- The three proposed monitoring wells to be established around the perimeter of the wellfield

The monitoring that would be conducted at the proposed production and injection wells would be the "first line of defense" in detecting any effects to groundwater. These wells would be constantly monitored during operation for changes in pressure, which is a key indicator of leaks of geothermal fluids into the groundwater system. The monitoring of well drilling and completion that would be conducted during the construction of these wells is discussed later in this response under "Production and Injection Well Drilling and Integrity Testing." The locations of the production and injection wells are shown in Figure 2.2-3 in the Draft EIS/EIR.

The three proposed monitoring wells around the perimeter of the wellfield would provide another avenue for monitoring for groundwater effects. In the unlikely event of groundwater contamination, these wells would detect the route of migration and level of contamination if geothermal fluids enter the groundwater. These monitoring wells would also be used to monitor groundwater levels in the wellfield vicinity.

The proposed monitoring wells have been strategically located to provide the greatest opportunity to detect any groundwater contamination or depletion. These wells would be located close to the wellfield to allow for relatively rapid detection of any

contamination and significant depletion. The proximity of the monitoring wells to the wellfield would also maximize the ability to detect any contamination before it became too diluted to detect. Given the large volumes of groundwater that are present in the project vicinity, any contamination would quickly become diluted (and more difficult to detect) as it moved away from the wellfield. Figure 4.3-1 illustrates the locations of the proposed groundwater monitoring wells, which have been designated as wells M1, M2, and M3; this figure has been added to the Final EIS/EIR.

Production and Injection Well Drilling and Integrity Testing: The proposed production and injection wells would be drilled in conformance with specifications of GRO Order #2, and would be subject to the requirements of Individual Geothermal Drilling Permits (which address well drilling, casing, and cementing programs) issued for the project by the BLM under 43 CFR 3260. By conforming with these specifications and requirements, the mechanical integrity of the wells would be assured, and contamination of the shallow groundwater that overlies the geothermal reservoir would be avoided.

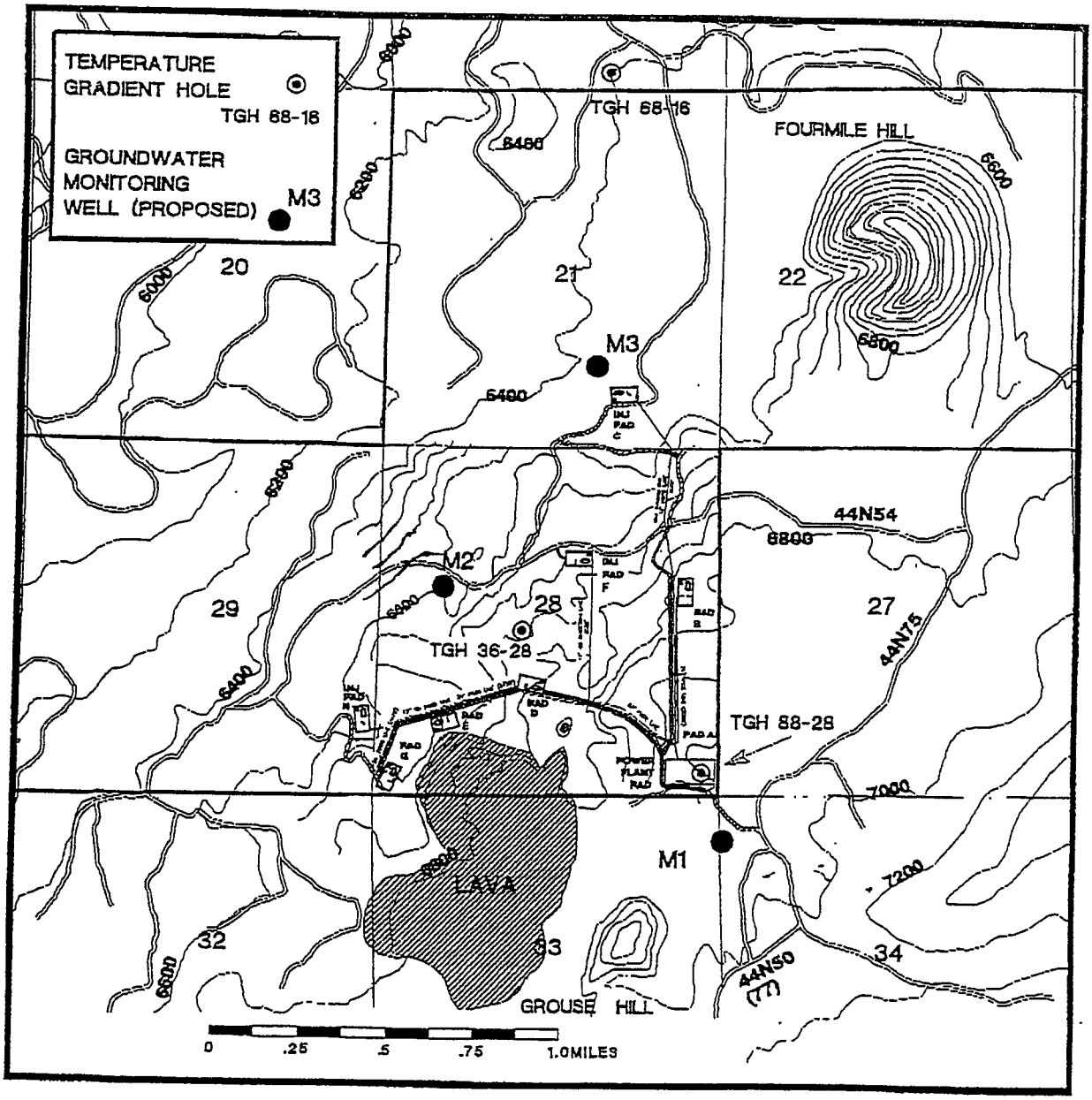
The production and injection wells would be constructed with multiple layers of casing and cement to ensure no intrusion of geothermal fluids into the groundwater. Construction of the wells would be monitored by the BLM to ensure proper construction. The wells would also be subject to pressure testing prior to operation to ensure that the wells can withstand the expected pressure and maintain their integrity during testing and operation. As required under 43 CFR 3260, Calpine would prepare a Geothermal Well Completion Report for each well after well completion, and submit these reports to the BLM. These reports would document the detailed chronological history of well completion in accordance with BLM-approved permit conditions.

As discussed previously, the proposed production and injection wells would be continuously monitored (24 hours a day) during project operations to ensure that there is no leakage of the geothermal fluid into the groundwater system. See the response to "Comments—Well Casing Program and Potential for Casing Rupture" for a detailed discussion on the requirements of GRO Order #2, and more information on well drilling and completion methods.

In addition to the GROs and the BLM's Individual Geothermal Drilling Permits, construction and operation of the injection wells would also be subject to the requirements of the EPA's UIC program. The UIC program requires that injection wells pass a stringent mechanical integrity test before injection is allowed. Periodic mechanical integrity tests would be performed during operations to ensure that the well is operating properly, and no leakage of geothermal fluids into the groundwater is occurring. For more information on project compliance with the UIC program, see the response to "Comments—Underground Injection Control Program."

Drilling of Groundwater Monitoring Wells: The three groundwater monitoring wells would each be drilled to the depth at which the temperature reaches 90°F; completion to this depth would ensure that the full depth of the shallow groundwater aquifer would be monitored. Monitoring well drilling, casing, and sealing procedures will be determined in conjunction with the North Coast RWQCB through the RWQCB permitting process. The precise methods of monitoring these procedures as they are implemented will also be determined in conjunction with the North Coast RWQCB.

Figure 4.3-1: Location of Groundwater Monitoring Wells



Schedule for Groundwater Well Monitoring: Groundwater monitoring at the three groundwater monitoring wells would be conducted during project operation. In order to establish a baseline for groundwater information, the three proposed monitoring wells would be drilled and sampled during the second year of project construction, after exploratory drilling has confirmed the viability of the geothermal resource. Baseline information would then be collected for the remainder of the construction period. Actual groundwater monitoring would commence once the power plant begins operation.

The schedule for collecting samples at the three proposed groundwater monitoring wells would be determined through conditions imposed by the North Coast RWQCB through the RWQCB permitting process. It is expected that a regular schedule for sampling would be established; this schedule could be on an annual, quarterly, or monthly basis.

Groundwater Sampling and Analysis: Once groundwater samples are collected from the groundwater monitoring wells, these samples would be analyzed for sodium chloride. Sodium chloride is by far the most abundant solute in geothermal fluids, and would be the prime indicator of geothermal contamination of groundwater. The concentrations of sodium chloride in geothermal fluids is typically hundreds to thousands of times greater than the concentrations of other geothermal fluid constituents, including toxic constituents such as mercury and arsenic. In addition, since no other natural sources of sodium chloride exist within the wellfield area, the detection of this constituent could more readily be made.

In addition to sampling for evidence of geothermal fluids, groundwater levels would be monitored at each of the three groundwater monitoring wells. This monitoring would be conducted to identify changes in groundwater levels attributable to the proposed project. Measurements of groundwater levels at the monitoring wells would be taken at the same time that the groundwater samples are collected. Groundwater levels would also be measured and monitored at the existing groundwater wells at Arnica Sink and at the USFS Administrative Site.

Groundwater sampling and level measurements from the proposed monitoring wells would most likely be performed by Calpine Corporation, under the direction of the USFS, BLM, and North Coast RWQCB. However, if deemed appropriate, one or more of these agencies may assume the responsibility for collecting groundwater samples and monitoring groundwater levels. Similar to Calpine operations at The Geysers, groundwater samples collected from the monitoring wells in the Fourmile Hill project area would be analyzed at Calpine's on-site laboratory. The use of this laboratory would allow for the quickest possible turn-around time for analysis of the samples. The samples would be analyzed for sodium chloride content and concentrations.

Reporting of Groundwater Monitoring Activities: A groundwater monitoring report for the monitoring wells would be prepared after each sampling date. In general, it is expected that a report would be completed approximately one month after a given sample is collected. Each report would summarize the results of the laboratory analysis, identify the detected sodium chloride concentration at each monitoring well, and note any possible indications of effects to groundwater from geothermal fluids. Each report would also identify the measured level of groundwater at each well, and note any possible indications of effects to groundwater levels from the proposed project.

Submittal of Reporting to Agencies: Groundwater monitoring reports would be submitted by Calpine to the following agencies:

- BLM
- USFS
- North Coast RWQCB
- Central Valley RWQCB

The Central Valley RWQCB would receive copies of the groundwater monitoring reports because the wellfield is close to areas within their jurisdiction. Other agencies interested in the monitoring of groundwater for the project (such as the EPA) could request copies of the groundwater monitoring information from the lead agencies or the RWQCBs.

Miscellaneous Comments: In order to be consistent with the provisions of the surface water and groundwater monitoring programs described above, Mitigation Measure 4.3.1a on page 4-26 of the Draft EIS/EIR is revised as follows:

"4.3.1a Prior to construction, Calpine shall submit for approval by the USFS and BLM a hydrologic monitoring plan for the caldera and a defined local area. This plan shall be implemented by Calpine, with the provision that other active geothermal developers be required to participate in the monitoring. The monitoring plan shall include, but not be limited to the following:

- Collection of baseline ~~water level and~~ water quality data at Medicine Lake, Bullseye Lake, and Little Medicine Lake.
- Calpine shall drill two to three monitoring wells (to the 90° F temperature level) around the wellfield that are down-gradient from the geothermal fluid production and injection wells (see Figure 4.3-1).
- The plan shall include a description of the wells and the well drilling procedures that will be used.
- Monitoring shall include measurement of water levels in wells and analysis of standard drinking water quality constituents.
- The plan shall include a description of the sampling and analysis schedule.
- Record of groundwater pumping rates.
- If groundwater contamination is detected, procedure for identifying and repairing the well that caused the contamination.

Groundwater pumping rates shall be reduced if monitoring detects significant adverse impacts to water availability, and these impacts can be attributed to project pumping of local groundwater. (C, O)"

Comment D.5 requests the threshold of significance for adverse impacts to groundwater availability. Significance criteria for potential hydrology effects are provided on page 4-21 of the Draft EIS/EIR. As stated on this page, a substantial depletion of groundwater resources would be considered a significant effect of the project. This significance criterion is taken directly from Appendix G of the CEQA Guidelines. This criterion does not provide a specific, quantitative level at which "substantial depletion of groundwater resources" would occur. For the proposed project, a substantial depletion of groundwater resources would be defined as a depletion that would result in a measurable, long-term, and continual trend in the reduction of groundwater. The precise measures to be undertaken if monitoring detects a substantial depletion of groundwater resources will be spelled out in the proposed groundwater monitoring plan.

Comment HD.15 questions the definition of "uncontaminated" on page 4-39 of the Draft EIS/EIR in reference to water from precipitation that would accumulate within secondary containment areas. Water would be considered uncontaminated only if it did not contain leakage or material from spills from the storage tanks containing potentially hazardous materials. If a storage tank leaked or spilled material into the secondary containment area, any fluid within it (whether it contained precipitation or not) would be analyzed prior to injection. If hazardous, the fluid would be disposed of properly. The North Coast RWQCB, the EPA, and the BLM would oversee the water monitoring program.

Reference:

USFS (U.S. Department of Agriculture Forest Service), U.S. Department of Interior Bureau of Land Management, and Siskiyou County Air Pollution Control District. 1998. Draft EIS/EIR for the Telephone Flat Geothermal Project. May.

Comment—Hydrologic Monitoring at the Fall River Springs

A.33 A hydrologic and geochemical monitoring plan has been proposed by the U.S. Geological Survey for the Glass Mountain KGRA (pg 3-27). The EPA would welcome such a comprehensive monitoring plan and strongly recommends that this kind of plan be incorporated into the proposed hydrology mitigation, monitoring, and reporting program as described on pages 5-4 and 5-5. Specifically, we feel that water quality monitoring (and collection of parameters to gage possible geothermal effects) of lakes and springs and discharge measurements from springs and the noted hot spot, serve a concrete purpose in ensuring that the cold water system is not being adversely affected. The monitoring of water supplies at Fall River (pg. 3-26) should also be part of the program. This particular monitoring program, because it involves drinking water, an existing hydroelectric facility, and an endangered species (Shasta Crayfish), should reflect a thorough understanding of source area, and proper placement of monitoring stations or wells. As aptly stated by Geonomics (1978):

> Withdrawal of geothermal fluids may alter deep ground water flow patterns, and perhaps even the surface flow rate... Any attempt to assess these effects now, and the effect of fluid reinjection, is speculative. It will require several years of continuous monitoring activity, superimposed on the known background [values] to understand the possible withdrawal and reinjection effects.

The EPA believes that the proposed and recommended monitoring efforts and baseline studies are key in reducing environmental impacts to water resources. We suggest use of monitoring protocol such as the protocol described in *Groundwater Monitoring Guidelines for Geothermal Development* (Weiss, et. al., 1979). Specifically, monitoring of production and injection wells should be done at least to the standards of the Underground Injection Control Program (UIC) regulations. The construction and inspection of injection and production wells should incorporate best available demonstrated control technology.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

D.4 Collection of base line water levels are included with the mitigation (4.3.1a), monitoring and reporting program for hydrology (page 5-4). The project proponent proposes to submit "a hydrologic monitoring

plan for the caldera and a defined local area". However, since there is a lack of evidence that the Medicine Lake Highlands are not related to Fall River recharge, the monitoring should include the Fall River area in the hydrologic monitoring plan. *(Richard L. Elliott, California Department of Fish and Game)*

S.3 It is our opinion, however, that determining the extent of that connection and its ultimate influence on Fall River Springs will be difficult to predict, and probably only worst-case and best-case scenarios could be developed. Therefore, we feel that a more important focus should be on a responsible and viable monitoring plan of the Fall River Springs system. This monitoring should include at least monthly flowrate, temperature, and conductivity measurements conducted before, during, and after geothermal energy development in the Medicine Lake area.

(M. Lee Davisson and Timothy P. Rose, Lawrence Livermore National Laboratory)

Response—Hydrologic Monitoring at the Fall River Springs

These comments suggest that monitoring of water supplies at Fall River should be part of the hydrologic monitoring program. No significant effects due to the proposed project are expected to occur to groundwater or surface water in the project vicinity or at the Fall River springs. This conclusion is supported by several recent reports and scientific studies, including:

- Bredehoeft, J. 1997a. *Potential Impacts of Fourmile Hill Geothermal Development on Springs of the Fall River*. Report prepared by the Hydrodynamics Group for Peter Stent. August.
- Bredehoeft, J. 1997b. *Potential Impacts of Fourmile Hill Geothermal Development on Springs of the Fall River Revisited*. Report prepared by the Hydrodynamics Group for Peter Stent. November.
- Mariner, R. H., W. C. Evans, and M. Huebner. 1998. *Preliminary Chemical and Isotopic Data for Waters from Springs and Wells on and near Medicine Lake Volcano, Cascade Range, Northern California*. U.S. Geological Survey Open-File Report 98-2, Menlo Park, CA. January.
- Weiss Associates. 1997. *Baseline Hydrology Evaluation Report for Telephone Flat Geothermal Project, Medicine Lake, California*. Prepared for CalEnergy Company, Omaha, NE. August.

See response to "Comments—Potential Effect to Fall River Springs" for an extensive discussion of the potential impacts to the Fall River springs. A discussion of the results of the studies cited above is also provided in this response. In response to concerns raised in comment A.33, see also responses to "Comments—Potential Groundwater Depletion due to Geothermal Fluid Use" and "Comments—Potential Groundwater Contamination due to Geothermal Fluid Use."

Due to the proposed groundwater monitoring that would occur (see response to "Comments—Hydrologic Monitoring Plan" above), it would not be necessary to monitor water supplies at the Fall River springs. Changes in chemistry are most quickly and easily detected closest to a contamination source. Contaminants become more and more diluted (and thus more difficult to detect) farther and farther away from the source). Detection of a change in groundwater chemistry becomes increasingly difficult as the geothermal fluid is diluted. This especially holds true when minute amounts of contamination are introduced into waters that do not already contain these contaminants. In the vicinity of the proposed project, the groundwater lacks almost all of the chemical constituents found in geothermal fluids. Detection of geothermal fluid leakage (in the unlikely event that it occurs) into the groundwater is therefore best accomplished in the immediate vicinity of the wellfield.

Any effects to groundwater from the proposed project would be identified first in the proposed monitoring wells that would surround the perimeter of the proposed wellfield and appropriate mitigation would be implemented well before any potential impact at Fall River springs could occur. No effects to drinking water, the existing hydroelectric facility, or the Shasta crayfish at Fall River springs are expected to result from operation of the proposed project. Because there is no reason to expect that Fall River springs would be affected by this project, it would not be necessary for the monitoring program implemented by Calpine to include monitoring at Fall River springs.

3.5 Geothermal Resources

INTRODUCTION

This section provides responses to comments on issues related to geothermal resources. The comments and responses are grouped under the following headings:

- Data on Geothermal Resource
- Effects on Life Expectancy of the Geothermal Resource
- Effects on Regional Thermal Features

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

DATA ON GEOTHERMAL RESOURCE

Comment—General Comments on Geothermal Resource Data

F.14 Section 2.2 -- Well Drilling and Testing (page 2-14), Geothermal Fluid and Runoff Controls (page 2-15) and Cooling Tower (pages 2-28 and 2-29). The DRAFT begins to describe the release of 2.9 million pounds per hour (for 30 days -- over two billion pounds) of well-testing steam and water. Some of this is to be captured in lined sumps and pumped back into wells for disposal. The DRAFT also estimates cooling tower drift at 448 lbs/hr (for the life of the project -- 177 million pounds). At page 4-27 a "net loss of fluids of approximately 475,000 pounds per hour" (for the 45-year operation phase) is mentioned.
(John R. Hannum, North Coast Regional Water Quality Control Board)

PH5.46 And is it my understanding that all venting will be—actually be reinjected into the ground again and there will not be any actual open venting except for probably the drilling of the wells?
(Medicine Lake Public Hearing)

PH5.84 What's the total volume that you produce? *(Medicine Lake Public Hearing)*

Response—General Comments on Geothermal Resource Data

The Draft EIS/EIR does not describe the release of 2.9 million pounds per hour of well-testing steam and water. The comment appears to be referencing the discussion of project flow requirements discussed in the second-to-last paragraph on page 2-14 of the Draft EIS/EIR. This paragraph states that, ultimately, the proposed production wells would need to be capable of producing a total combined steam and water flow of approximately 2.9 million pounds per hour in order to supply the necessary energy to generate 49.9 MW of electrical output at the proposed power plant. However, this statement does not mean or imply that 2.9 million pounds per hour of steam and water would be released during well testing. Not all wells would be tested at the same time, and well testing would not require full-flow conditions for the entire 30-day testing period. Average flow rates during well testing would be substantially less than 2.9 million pounds per hour. Produced fluids during well testing would include both steam and water. As noted in the comment, these waters would be collected in on-site sumps and injected into the geothermal reservoir. Steam separated from the fluid flow during testing will be discharged into the atmosphere.

The cooling tower drift rate and the net loss of geothermal fluids during operation are correctly referenced.

In response to comments PH5.46 and PH5.84, as stated in Table 4.4-1 on page 4-45 of the Draft EIS/EIR, the proposed project would produce 2.9 million pounds of fluids per hour. Of this amount, 2.425 million pounds (83.6 percent) would be injected back into

the geothermal reservoir; the remainder would be vented from the cooling towers of the power plant. During drilling, a very small amount of fluid would be released from each well (substantially less than the amount of fluid released during project operation).

Comments—Nature of the Geothermal Reservoir and Groundwater Aquifer

HD.4 Additionally, Figure 3.4.2 indicates that Medicine Lake is not connected to the shallow groundwater aquifer. Again, no basis for this interpretation is provided nor does data appear to have been collected that support this conclusion. *(Amanda Spencer)*

HD.5 Page 3-41 states that shallow groundwater within the caldera is "Probably" separated from shallow groundwater outside the caldera, further supporting that insufficient data has been collected to evaluate the hydrogeology of this area or the possible effects that this project will have on the shallow groundwater aquifer or Medicine Lake. *(Amanda Spencer)*

HD.6 In several places in the EIR/EIS, it is indicated that no information has been collected on the volume of available geothermal fluids, the reservoir's ability to recharge, source of fluids for recharge or even whether these fluids exist. Figure 3.4-3 suggests that it is unknown whether a reservoir even exists below the "impermeable zone". It would seem that this is critical information for evaluating the viability of this field if there are insufficient fluids or little to no recharge capability, the productivity of this resource is questionable. It does not appear possible for the BLM, USFS, or the public to evaluate the need for this project or the cost/benefit of the project without this information. *(Amanda Spencer)*

HD.7 Additionally, the report admits that the lateral extent of the "impermeable zone" is unknown. If the "impermeable zone" is not laterally continuous, as suggested by the report on page 3-39, recharge could come from the shallow groundwater aquifer. Therefore, without this information the possible effect on the quality or quantity of water in the shallow aquifer, or on Medicine Lake, cannot be evaluated. *(Amanda Spencer)*

Response—Nature of the Geothermal Reservoir and Groundwater Aquifer

Comments HD.4 and HD.5 reference Figure 3.4-2 and the potential connections between Medicine Lake and the shallow groundwater inside and outside the caldera. Figure 3.4-2 does not indicate that Medicine Lake is not connected to the shallow groundwater aquifer. Precipitation falling in the Medicine Lake caldera that percolates through the porous soils enters a groundwater aquifer within the caldera. Some of the input to this aquifer originates in Medicine Lake, where water slowly seeps out of the lake (clay-rich glacial deposits under the lake impede flow but do not stop it).

Connection between shallow groundwater inside and outside the caldera is uncertain. It is probable that in places the caldera ring fractures locally impede groundwater flow; elsewhere, there may be flow across the fracture system. There is, however, a consistent hydrologic gradient radially outward from the center of the caldera across the ring fracture system to the flanks of Medicine Lake Highlands. This gradient determines that groundwater outside of the caldera will always flow away from the caldera and not into it, as indicated in Figure 3.4-2 of the Draft EIS/EIR.

It is not known to what degree groundwater within the caldera flows outside the caldera. This uncertainty is due to a lack of data within the caldera. This uncertainty about the direction of groundwater flow within the caldera does not affect the analysis of groundwater flow outside of the caldera. The conclusions in the Draft EIS/EIR regarding groundwater flow from the project site would remain the same regardless of the amount or direction of groundwater flow within the caldera. Thus, it is not necessary to collect data on groundwater flow within the caldera to evaluate the potential impacts of the proposed project. See also response to "Comment—Local Groundwater Flow" in the Hydrology Section for more discussion of the hydrologic gradient in the ring fracture zone of the caldera and a revision to the Draft EIS/EIR regarding this issue.

Comments HD.6 and HD.7 question several properties of the geothermal reservoir, including the volume of available geothermal fluids, the reservoir's ability to recharge, the source of fluids for recharge, whether these fluids exist, and the lateral extent of the impermeable layer separating the geothermal reservoir from the shallow groundwater aquifer. Each of these properties of the geothermal reservoir are discussed below.

The economic viability of the geothermal reservoir would be based on the available volume, temperature, and pressure of the geothermal fluids in the reservoir. As discussed on page 3-37 of the Draft EIS/EIR, several deep test wells have been drilled in the Glass Mountain Known Geothermal Resource Area (KGRA) that indicate that the properties of the geothermal reservoir are suitable for power generation on a commercial scale. Because the data from these deep test wells are proprietary, they are not available for public review. CEQA allows the withholding of information considered to be a "trade secret" from public environmental documents such as EIRs (CEQA Section 21160). The data have been reviewed by the lead agencies and the third-party consultants who prepared the EIS/EIR.

The text of the third paragraph on page 3-37 of the Draft EIS/EIR has been revised to clarify the available data from temperature gradient wells:

> "Calpine drilled temperature gradient well 88-28 in 1994 on the proposed power plant site at Fourmile Hill (see Figure 3.3-3). Three other temperature gradient wells (36-28, 68-16, and 14-23) have been drilled previously on Calpine's Fourmile Hill geothermal leases by other companies. Hydrologic data from well 36-28 and 68-16 are presented in Table 3.3-5. No hydrology data are available from well 14-23. The zone of high temperature gradient is shallowest near the ring fracture zone which is closest to well 88-28. To the north and northwest, the depth to the high temperature gradient zone increases and the magnitude of the temperature gradient diminishes gradually (i.e., temperatures increase less rapidly with depth).
>
> ~~Three temperature gradient wells (68-16, 14-23, and 36-28) have been drilled by previous geothermal developers in addition to well 88-28 on Calpine's Fourmile Hill leases. Data from these additional three wells are proprietary and not available for public review.~~ Well 88-28 was drilled to a total depth of 3,604 feet as a corehole. The corehole was designed to study rock formations and temperatures at depth. The well was not designed to encounter or produce reservoir fluids; therefore, no reservoir fluid data are available from this well. The maximum temperature recorded in the well was sufficiently high to suggest the presence of a geothermal system capable of commercial development, if adequate geothermal fluids are available. The system would likely occur at a minimum depth of 3,500 feet below the surface."

At the project site, the volume of geothermal fluids available for production would be determined during the initial phase of the proposed project. It is possible that during this confirmation drilling phase, it could be determined that the volume of geothermal fluids present in the reservoir beneath the project site is not suitable for commercial development. If this is the case, the project would be abandoned. However, given the data from other deep wells in the Glass Mountain KGRA, Calpine is confident that commercial development would be possible at the project site. The EIS/EIR assumes that full buildout of the project would occur and it evaluates all potential environmental effects of this full build-out and operation. See response to "Comment—Need for Well Testing" in the Alternatives, Including the Proposed Action Section.

The ability of the geothermal reservoir to recharge is discussed in the Draft EIS/EIR on pages 4-43 through 4-47, and in response to "Comment—Effects on the Life Expectancy of the Geothermal Resource" below.

As discussed on page 3-41 of the Draft EIS/EIR (as revised above and in the Final EIS/EIR), the geothermal reservoir may be recharged naturally by deep, cool groundwater that originates from outside the Medicine Lake Highlands. There may also be thermal recharge to the reservoir by heat from deeper sources (e.g., magma). However, the analysis of the potential impacts of the proposed project on the local and regional geothermal reservoirs (see pages 4-43 through 4-47 in the Draft EIS/EIR) assumed that there would be no thermal recharge or recharge of producible fluids. The results of the analysis are unaffected by the amount of recharge to the reservoir of cold, deep groundwater.

The text on pages 3-39 and 3-41 of the Draft EIS/EIR has been revised to clarify the discussion on the relationship of surface water, groundwater, and the geothermal system:

> "As discussed in Section 3.3, Hydrology, the base of the shallow groundwater system in the Medicine Lake Highlands is bounded by a sequence of impermeable rocks, including tuffs (rocks formed from volcanic ash). The high-temperature gradient shown in Figure 3.4-1 below 800 feet is coincident with these impermeable rocks. ~~is interpreted to be confined by a relatively impermeable layer of clay-rich ash flow tuffs~~ which underlie the surface lavas and cinders which comprise the aquifer. A hydrogeologic cross-section through the power plant and wellfield area is presented in Figure 3.4-2. The cross section is oriented in a northwest direction and extends approximately 10 miles northwest and southeast of the project site (see Figure 3.3-3). The figure shows the separation of the shallow groundwater and the underlying geothermal system. In well 88-28, ~~the lithic~~ tuff ~~unit~~ is first encountered at a depth of approximately 800 feet below the ground surface, and is estimated to be approximately 800 feet thick. The areal extent of the ~~lithic~~ tuff unit away from the caldera is not known, although it was encountered in temperature gradient well 68-16 located one mile northwest of Fourmile Hill (Figure 3.3-3). In well 68-16, the tuff unit is found at a depth of 712 feet and extends to 1824 feet. The tuff unit ~~probably~~ dips away from the caldera and thins towards the northwest.
>
> Data from numerous temperature gradient wells in the Medicine Lake Highlands support the interpretation that there is~~the layer of lithic tuff creates~~ an impermeable barrier between the shallow, cold groundwater and the geothermal reservoir. The temperature gradient data indicate~~share~~ two important thermal characteristics which document~~reflect~~ the impermeability of the rocks which underlie the aquifer~~lithic tuff layer~~:
>
> - A cold, nearly isothermal (constant temperature) section extending from the ground surface to the base of the shallow groundwater~~water table~~
> - A rapidly increasing temperature in the impermeable~~lithic tuff~~ layer beneath the shallow groundwater~~water table~~
>
> Figure 3.4-3 shows a hydrologic/isothermal cross-section through the caldera rim fractures and illustrates the relationship between temperature and the different geologic layers. The temperature gradients measured in two temperature gradient holes are shown above the cross section in order to illustrate graphically the relationship between the temperature gradient and cold water table (Beall 1997). Data

from the four temperature gradient wells in Table 3.3-5 support the model illustrated in Figure 3.4-3. In addition to the temperature gradient data, the absence of geothermal surface manifestations (i.e., hot springs and fumaroles) outside of the caldera provides additional evidence that geothermal fluids are effectively isolated from shallow groundwater~~the clay-rich lithic tuff provides a barrier to fluid movement along faults into shallow zones~~.

In the impermeable zone below the water table, heat originating in the geothermal system flows upward through the rock by conduction. After passing through the impermeable zone, the heat encounters the lower part of the overlying water table. Because of the rapid horizontal movement of cold groundwater through the water table, heat from the underlying reservoir is quickly conducted away and subsurface temperatures remain depressed in the shallow groundwater zone (shallow groundwater temperature in the Glass Mountain KGRA ranges from 36°F to 46°F). Consequently, temperatures within the impermeable zone are cooler near the top and increase rapidly with depth. (i.e., the temperature gradient is very high)~~(Beall 1997)~~."

(Note that the fourth paragraph of page 3-41 of the Draft EIS/EIR has also been revised and is shown in the response to "Comment—Effects on the Life Expectancy of the Geothermal Resource" below.)

Calpine estimates conservatively that the local geothermal resource could have a life expectancy (i.e., the time during which geothermal fluids of sufficient temperature could be utilized commercially) of 71 to 141 years. The proposed project would be operational for 45 years. (Any extension of the operating period would be subject to further environmental review.) Based on several conservative assumptions, it is also estimated that the life expectancy of the reservoir in the Glass Mountain KGRA would be reduced by approximately 15 percent due to the proposed project.

Comment HD.6 also questions whether geothermal fluids exist. As stated above, several deep test wells drilled in the Glass Mountain KGRA confirm the existence of geothermal fluids in the reservoir. It is assumed that sufficient quantities of fluid also exist in the reservoir under the project site.

Comment HD.7 states that the lateral extent of the "impermeability zone" is unknown. Data from many temperature gradient wells drilled in the Medicine Lake Highlands (in all directions from the project site) indicate that the impermeable zone is continuous throughout the Medicine Lake Highlands where such drill data are available. Wells were not drilled outside of the Medicine Lake Highlands because the geothermal reservoir does not extend outside of the Highlands. See the following responses to comments in the Hydrology Section for more discussion of the potential impacts of geothermal development on the quality or quantity of water in the shallow aquifer, or on Medicine Lake:

- Separation of Local Groundwater and the Geothermal Reservoir
- Potential Groundwater Depletion due to Geothermal Fluid Use
- Potential Groundwater Contamination due to Geothermal Fluid Use
- Effects to Surface Waters from Accidental Geothermal Brine Spills

Comments—Proprietary Temperature Gradient Data

F.9 Introduction page 1-13. The description of completed geothermal activities mentions 25 "temperature core" wells and 4 "deep exploration test wells". Additional descriptive material about these wells is provided at page 3-35. The "proprietary" nature of information derived from these wells prevents reviewers from forming rational conclusions about what is known and not-known regarding groundwater resources of the site and its surrounds.

(John R. Hannum, North Coast Regional Water Quality Control Board)

M.7 The reader of the EIS, trying to understand it, is handicapped since much of the required credible substance is shrouded in the realm of well data stated to be proprietary. The physical geology of the geothermal system is unknown, but is presented as speculation, assumption, unsupported (at least in the EIS) interpretation, and incorrect analogy. Inconsistencies and omissions occur.

(Rick Poore, et al., Fall River Resource Conservation District)

PH1.14 Number five: The reader of the EIS, trying to understand it, is handicapped, since much of the required credible substance is shrouded in the realm of well data stated to be proprietary. The physical geology of the geothermal system is unknown, but is presented as speculation, assumption, unsupported—at least in the EIS—interpretation, and incorrect analogy. Consistencies and omissions occur.

(Dorris Public Hearing)

PH1.26 Conclusions that were based on data that are referenced as being proprietary; will those be made available for a review?

(Dorris Public Hearing)

Response—Proprietary Temperature Gradient Data

It is acknowledged that the proprietary nature of much of the data from temperature core hole and exploration wells in the project vicinity prevented reviewers of the Draft EIS/EIR from reviewing this information. CEQA allows the withholding of information considered to be a "trade secret" from public environmental documents such as EIRs (CEQA Section 21160). However, the proprietary data have been reviewed by the lead agencies and the third-party consultant for this project to ensure that there is sufficient and adequate basis for the conclusions presented in the Draft EIS/EIR.

Some of these proprietary data have been publicly released subsequent to release of the Draft EIS/EIR and are included in the Final EIS/EIR (see response to "Comment—Local Groundwater Flow" in the Hydrology Section for illustrations of these data). These data clarify and expand upon the data already presented in the Draft EIS/EIR and do not change the conclusions of the EIS/EIR. The release of these data was intended to further clarify the potential impacts of the proposed project, and was not intended to deny the public a meaningful opportunity to comment on the project.

Proprietary data from the geothermal wells in the project vicinity support conclusions about groundwater resources that were stated in the Draft EIS/EIR. This information includes data from temperature gradient wells released by CalEnergy Company, Inc. (the project proponent for the Telephone Flat geothermal project) in December 1997. These data demonstrate two important thermal patterns. These patterns are summarized on page 3-41 of the Draft EIS/EIR, as revised above:

- A cold, nearly isothermal (constant temperature) section extending from the ground surface to the base of the shallow groundwater
- A rapidly increasing temperature in the lithic tuff layer beneath the shallow groundwater

As discussed in detail on pages 3-39 through 3-41 of the Draft EIS/EIR (as revised above and in the Final EIS/EIR), these thermal patterns indicate the existence of an impermeable layer separating the shallow groundwater from the geothermal system. CalEnergy's temperature gradient wells exhibit the same pattern as the Calpine

temperature gradient wells. Thus, CalEnergy's data further support the conclusions reached in the Draft EIS/EIR. See also response to "Comment—Temperature Gradient Data" below.

Data on the chemical composition of the geothermal fluids from sumps is considered public information. Such data from two geothermal wells in the Medicine Lake Highlands is presented in Table 3.4-1 in the Final EIS/EIR and in response to "Comment—Chemical Composition of Geothermal Fluids" below. These chemical data were provided by the Central Coast RWQCB. As described in this response to comment below, these data may not accurately characterize the actual chemical composition of geothermal fluids in the reservoir.

Comment—Temperature Gradient Data

IQ.9 The interpretation of the geothermal regime in the Medicine Lake area is limited and incomplete. For example, Figure 3.4-3 Hydrologic/Isothermal Cross Section Through Caldera Rim Fractures, on Page 3-43 shows two temperature gradient holes drilled to approximately 2000 feet and 3500 feet; however, the data is extrapolated to over 6,000 feet without any supporting evidence and without even placing question marks in the extrapolated areas as is customary in geologic investigations. The figure contains several features which are inferred (the Ascending Thermal Fluids Zone (red), and the Thermal Outflow Zone (pink)) but with no evidence of their existence or position. Isothermal lines are drawn with little data to support their position. This all serves to mislead the public that more is known about the geothermal regime than actually is. *(Phil Woodward)*

Response—Temperature Gradient Data

Figure 3.4-3 presents in cross-section a schematic representation of the relative depths of the infiltration zone, the groundwater zone, the impermeable zone, and the top of the geothermal reservoir. The relative depths of these zones are shown in and adjacent to the ring fracture system of the Medicine Lake caldera. The depths of the boundaries between these zones is based on data collected at 24 temperature gradient holes up to 4,000 feet deep that were drilled throughout the Medicine Lake Highlands, both within and outside of the caldera. This cross-section, including the ascending thermal fluids zone and the thermal outflow zone, is also based on proprietary data from four geothermal exploration wells (deep-test wells) drilled to depths of up to 9,620 feet below the surface. Two of these deep holes are shown in cross sections A-B and E-F (Figures 3.3-5 through 3.3-7 in the Final EIS/EIR). The direction that geothermal fluids flow within these zones was inferred from these data and from conceptual models of the Glass Mountain KGRA (e.g., Evans and Zucca 1988; Weiss Associates 1997). See also response to "Comment—Chemical Composition of Geothermal Fluids" below for further discussion of the proprietary data.

The sole purpose of drilling temperature gradient holes is to acquire data that allow the prediction of temperatures at depths greater than the total depth of the hole. Data from two of these temperature gradient holes is presented in the inset figures above the schematic in Figure 3.4-3. The shallower of the two holes shows temperatures in excess of 300° F. The depths of the boundaries between zones are based on these and other proprietary data. The adequacy of these data has been reviewed and approved by hydrogeologists with the third-party consultant on this project.

References:

Evans, J. R., and J. J. Zucca. 1988. Active high-resolution seismic topography of compression wave velocity and attenuation structure at Medicine lake Volcano, Northern California Cascade Range. *Journal of Geophysical Research* 93:15016-15036.

Weiss Associates. 1997. *Baseline Hydrology Evaluation Report for Telephone Flat Geothermal Project, Medicine Lake, California.* Prepared for CalEnergy Company, Omaha, NE.

Comments—Chemical Composition of Geothermal Fluids

A.39 While incorporation by reference [40 CFR 1502.21] is sometimes preferable in an EIS, we feel that in certain cases inclusion of key tables, figures, or an appendix is the better choice. For instance, Pg. 3-39 (Table 3.4-1) provides a partial analysis of geothermal fluids and cites to reference for additional data. However, after inspection of this reference (Fourmile Hill EA/IS, BLM et. al., 1995) this data was not found. Table 3.4-1 should contain complete geochemical analysis of geothermal fluids (liquids and gasses) encountered to date, including potential contaminants such as arsenic, boron, hydrogen sulfide or radionuclides. We recommend inclusion in the FEIS of a clear and concise table that should list the concentration of all typical geothermal fluids. A comparative analysis should also be included of typical shallow ground water and surface waters. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

F.18 Section 3.4 Geothermal Resources, Chemistry of Fourmile Hill Geothermal Fluids. Absent a factual description of fluids which might emerge from the project site, the DRAFT includes Table 3.4-1 portraying results from analysis of a sample from Well 87-13 -- several miles southeast of the project site. Data from our files shows comparable levels of Table 3.4-1 constituents from sump samples at Wells 68-8 and 21/31-17 (also southeast of the project site). Analysis of near-geothermal fluid emitted from Well 44-33 (several miles east of the site) also fits the framework of Table 3.4-1. We have two values for boron at 45.4 and 14.9 mg/l and four values for arsenic at 10.8, 7.3, 6.02 and 5.06 mg/l. Sections 2 and 4 of the DRAFT acknowledge the likelihood of boron and arsenic in geothermal fluids. We believe that facts about geothermal fluids were to have been obtained by monitoring of exploration-phase work; instead, we are now reviewing a development-phase proposal without benefit of those facts. This deficiency frustrates our attempts to assess possible impacts of the project.
(John R. Hannum, North Coast Regional Water Quality Control Board)

F.25 The status of arsenic as a primary drinking-water contaminant at 0.50 mg/l and as a cancer-risk factor at even lower concentrations, plus the complexities arising from assays of different compounds containing the different valence-states of this element suggest that some focus be placed on the occurrence of arsenic in the geothermal fluids. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

F.26 The status of boron as a plant-toxic element in soil and water suggest that similar focus be placed on this element. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

Y.29 As a result of not fulfilling exploratory drilling, there is no accurate chemical analysis on the geothermal fluids that would be produced. These could potentially be harmful to plant and animal life due to high concentrations of poisonous metals. DEIS/EIR does not give a clear picture of what toxic materials would be brought to the surface, analysis of fluids.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

EQ.9 Evidence this project is such an environmental gamble is the brine content is not available because the exploratory wells have not been completed. There is no guarantee that the geothermal fluid will be mostly steam and water with a small amount of brine. The chance that the brine could have a lot more solids making it much more erosive and corrosive and expensive to handle especially with the high probability of toxic substances as arsenic found in many geothermal fields. *(Ronald A. Maire)*

IQ.8 No chemical data is presented on geothermal fluids produced from wells in the area. The report states that the "...data from these wells are proprietary...". Without chemical information, no clear evaluation of the geothermal system and fluid chemistry can be made. It is possible the geothermal fluids produced could be harmful to plant and animal life in the area due to high concentrations of heavy metals such as arsenic, cadmium, lead, mercury, etc. The preparers of the report are remiss in not including the chemical information. Not all chemical information on the geothermal fluids is proprietary. The Regional Water Quality Control Board, Central Valley Region sampled geothermal fluids produced from wells 68-8 and 31-17 (formerly 21-17). That information is in the public domain and is available to anyone on request. *(Phil Woodward)*

Response—Chemical Composition of Geothermal Fluids

Comments A.39, F.18, Y.29, EQ.9, and IQ.8 express concern over the limited data on the chemical composition of the geothermal fluids that are presented in the Draft EIS/EIR. Comments F.18 and IQ.8 also cite data that is available for other geothermal wells in the area and suggest including these data in the EIS/EIR. As discussed on page 3-35 of the Draft EIS/EIR, four deep-test wells have been drilled in the Glass Mountain KGRA. Three of these wells, including Well 87-13, were drilled by Unocal; the other well was

drilled by Occidental Petroleum and Phillips Petroleum. Most of the geothermal fluid chemistry data obtained from these test wells is proprietary information owned by these companies. Because these data are owned by other geothermal operators, Calpine is not authorized to release these data.

Geothermal fluid chemistry data from Well 87-13 has been made available for public review in Table 3.4-1 of the Draft EIS/EIR. Since publication of the Draft EIS/EIR, additional data from this well have become available. These data have been added to Table 3.4-1 (see below) in the Final EIS/EIR. The proprietary data have been objectively reviewed by the BLM and by the third- party consultant for this project. The BLM and the third-party consultant have determined that the data from Well 87-13 is representative of the proprietary data from the other three deep-test wells.

It is acknowledged that there are limited data on the chemistry and volume of geothermal fluids in the reservoir. The purpose of the confirmation drilling phase of the proposed project would be to collect additional data on the composition of the geothermal reservoir. For further discussion of this issue, see response to "Comment—Need for Well Testing" in the Alternatives, Including the Proposed Action Section.

The reference provided in comment A.39 for the data in Table 3.4-1 is the *Glass Mountain EA/IS*, not the *Fourmile Hill EA/IS*. The chemical analysis requested in comment A.39 is found on page 3-3 of the Glass Mountain document. See response to "Comment—Hydrologic Monitoring Plan" in the Hydrology Section regarding surface water and groundwater baseline data collection.

Comments F.25 and EQ.9 contain a request for further information on the occurrence of arsenic in the geothermal fluids. Arsenic has been considered in the analyses of potential effects on water resources, vegetation, and air quality as a result of geothermal fluid-related emissions. Section 4.3 Hydrology, of the Draft EIS/EIR addresses the potential for arsenic entrained in the emissions of geothermal steam to affect surface waters through deposition. Section 4.7 Vegetation, of the Draft EIS/EIR, addresses the potential for the arsenic emissions to affect surface vegetation through deposition. Section 4.13 Air Quality, of the Draft EIS/EIR, addresses the potential for arsenic entrained in the emissions of geothermal steam to affect the air quality of the area. As discussed in these sections, the proposed project would not be expected to have a significant effect on water resources, vegetation, or air quality as a result of arsenic contained in the geothermal fluid-related emissions. See also response to "Comments—Effect of Arsenic Deposition on Surface Waters" in the Hydrology Section and response to "Comments—Effects of All Emissions on Vegetation" in the Vegetation Section.

Comment F.26 contains a request for further information on the occurrence of boron in the geothermal fluids. Boron has been considered in the analyses of potential effects on water resources, vegetation, or air quality as a result of geothermal fluid-related emissions. This natural geothermal fluid constituent has been addressed in the same sections of the Draft EIS/EIR as described above for arsenic. As discussed in these sections, the proposed project would not be expected to have a significant effect on water resources, vegetation, or air quality as a result of boron contained in the geothermal fluid-related emissions. See also response to "Comment—Effect of Boron

Table 3.4-1: Chemical Analyses of Geothermal Fluids from Wells 87-13, 68-8, and 31-17 – Medicine Lake Caldera

	Geothermal Fluids from Well		Fluids from Sumps from Wells[2]	
Constituent (ppm or mg/L)	**87-13 (11/6/89)[1]**	**87-13 (10/13/91)[1]**	**68-8 (10/6/89)**	**31-17 (10-12-88)[3]**
Aluminum	NR	0.59	NR	NR
Arsenic	NR	0.6	6.0	5.1
Beryllium	NR	ND	ND	NR
Bicarbonate	49.0	28.0	NR	NR
Boron	NR	10	14.9	NR
Bromide	NR	ND	NR	NR
Cadmium	NR	ND	ND	NR
Calcium	7.9	4.3	27.1	NR
Chloride	1,021.2	1,085.0	1,930	1,860
Fluoride	NR	0.74	5.9	NR
Iron	NR	0.36	NR	NR
Lithium	3.1	2.2	NR	NR
Magnesium	0.1	ND	NR	NR
Manganese	NR	ND	NR	NR
Mercury	NR	ND	ND	NR
Nickel	NR	ND	ND	NR
Nitrate	NR	ND	NR	NR
Potassium	107.7	77.0	186.0	NR
Selenium	NR	ND	NR	NR
Silica	582.3	442.0	721.0	NR
Sodium	632.0	442.0	1,050.0	NR
Strontium	NR	0.025	NR	NR
Sulfate	46.9	46.0	42.4	NR
Thallium	NR	ND	0.002	NR
Vanadium	NR	ND	NR	NR
Zinc	NR	0.028	0.021	NR
Total dissolved solids	NR	2,337	4,030	3,870
pH	8.6	8.5	6.9[4]	8.0

Notes:

1 Data are flash-corrected

2 Data are from samples collected in the well sumps; it is unknown (1) how long sump fluids had been present in the sumps prior to sampling, (2) whether sump fluids mixed with precipitation or snow, or (3) whether sump fluids experienced any evaporation.

3 Formerly well 21-17

4 pH recorded only from a sample collected on 10/12/88

NR = Not reported; ND = Not detected

SOURCES: BLM et al. 1995; Weiss Associates 1997; Calpine 1998; Central Valley RWQCB 1998

Deposition on Surface Waters" in the Hydrology Section and response to "Comment—Effects of Boron Emissions on Vegetation" in the Vegetation Section.

Comment IQ.8 also states that data from geothermal production Wells 68-8 and 31-17 (formerly 21-17) are in the public domain through the Central Valley RWQCB. These data have been added to Table 3.4-1 in the EIS/EIR. However, data from Wells 68-8 and 31-17 are from fluids that were stored in the sumps. It is unknown how long the fluids had been present in the sump before the samples were taken (and if the sump fluid was either "contaminated" with snow or rainwater, which would dilute the geothermal fluids, or whether fluids evaporated, which would concentrate the geothermal fluids). Thus, it is unknown if the data from these samples are representative of the chemistry of the geothermal fluids.

Comment—Potential Effects of Geothermal Fluids

F.5 Contaminant emissions and surface deposition (fallout). Geothermal fluids are not consistently identical from well-to-well and time-to-time -- different levels of (potentially-) odiferous, corrosive, scale-forming and toxic compounds are emitted with steam and water during well-test blowing, then are part of the water-phase material which is condensed, commingled, used, treated and prepared for reinjection. These manipulations lose (into the surface environment) steam, water and whatever geogenic compounds are within geothermal fluids. Analyses of the mixtures are said to be "proprietary", thus are not provided in the DRAFT EIR/EIS. Whether or not these emissions affect water quality (or other uses of the public domain) is difficult to monitor and even more difficult to predict. Our monitoring at the Geysers reveals that powerplant runoff wastewater is consistently toxic from a variety of pollutants, thus it is added to the other wastewaters for reinjection. We do not have good information about the consequences of emissions which are deposited outside the powerplant fence line. This issue is best resolved by open, documented assessment of the baseline and monitored conditions and periodic "is there a problem?" reviews. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

Response—Potential Effects of Geothermal Fluids

This comment raises the following issues regarding geothermal fluid production and potential effects on the environment:

- The potential for variation in geothermal reservoir fluid chemistry
- The composition of geothermal fluids
- The effects of deposition of geothermal emissions falling outside the fence line
- The need for follow-up monitoring and reviews

Variations in Geothermal Fluid Chemistry: The composition of geothermal fluids has been known to vary somewhat over time (Weiss Associates 1997). The analyses of the potential effects of geothermal fluid emissions and deposition in the Draft EIS/EIR considered the variations in chemistry over time that might be experienced at the Fourmile Hill geothermal project. The projected variations were based on known information about the geothermal reservoir chemistries, as well as Calpine's experience operating at other geothermal fields.

Composition of Geothermal Fluids: The analyses and conclusions contained in the Draft EIS/EIR are based on a combination of proprietary and non-proprietary geothermal resource data. The Draft EIS/EIR provided relevant non-proprietary geothermal fluid chemistry data. The comment is correct in noting that the composition of geothermal reservoir fluids was considered proprietary at the time the Draft EIS/EIR was published. The proprietary data were reviewed by the BLM, USFS, and the third-

party contractor that prepared the Draft EIS/EIR. The Final EIS/EIR includes data for produced geothermal reservoir fluids that were used for air emissions and depositional effects. This information will also be made available to the North Coast RWQCB.

The geothermal emissions to the atmosphere that would occur during well testing are described on page 4-228 through 4-248 of the Draft EIS/EIR. More data on the composition of geothermal fluids that would be discharged to the sump have been included in the Final EIS/EIR. See also response to "Comments—Chemical Composition of Geothermal Fluids" above.

Deposition Effects Outside the Fence Line: As discussed in the Draft EIS/EIR, geothermal emissions would result from well testing and power plant emissions (i.e., from the cooling tower and vent box). All geothermal fluids emitted by the project would be contained in lined sumps (at the well pads) and the vent box (at the power plant site), and would be injected into the geothermal reservoir. The production and injection wells would be drilled and monitored in accordance with the GROs, permit conditions, and all applicable regulations (including UIC regulations) to ensure that geothermal fluids would not affect groundwater. Geothermal fluids would not be released to the environment outside of the fence lines of the well pads or power plant.

Geothermal steam would be emitted during well testing and from the cooling tower and plant vent silencer. No significant effects due to this steam emission or deposition would occur (see Sections 4.3 and 4.13 of the EIS/EIR, Hydrology and Air Quality, respectively). No significant air quality impacts would occur from the geothermal chemical constituents contained in the steam, and the steam would not pose a health hazard. The steam (and entrained constituents) would fall out primarily within the fence lines of the well pads or power plant. Surface water and vegetation would not be significantly affected by deposition of constituents outside of the project fence line (see Section 4.8 Vegetation, of the Draft EIS/EIR, and response to "Comments—General Depositional Effects on Vegetation" in the Vegetation Section for a discussion of the impacts of emissions on vegetation).

The impacts to air quality are described in Section 4.13, Air Quality, of the Draft EIS/EIR. The potential for geothermal emissions to affect vegetation and water quality outside of the fence line is discussed in Section 4.7 and Section 4.3 of the Draft EIS/EIR, Vegetation and Hydrology, respectively. See also the following responses to comments (the section in which each response is found is indicated in parentheses) for further justification that impacts of the proposed project from air emissions would not be significant:

- General Depositional Effects on Surface Waters (Hydrology)
- Effects of All Emissions on Vegetation (Vegetation)
- General Air Pollution (Air Quality)
- Health Impacts (Air Quality)
- Impacts on Environmental Health (Air Quality)
- Cooling Tower Drift Emissions (Air Quality)

Water Quality Monitoring and Reviews: The Draft EIS/EIR includes mitigation measures designed to ensure that no significant effects occur as a result of project emissions, and to provide for the baseline sampling and monitoring of water quality. The following discussion summarizes key elements of the baseline sampling and hydrology monitoring programs.

Baseline Water Quality Sampling: Additional baseline surface water quality sampling was conducted to verify predicted effects of the proposed project. The protocol for this sampling and analysis was developed in conjunction with the North Coast RWQCB. Water samples were collected and analyzed in November 1997. Samples were collected at various depths and locations from the following surface waters:

- Medicine Lake
- Little Medicine Lake
- Bullseye Lake

These samples were analyzed for total dissolved solids (TDS), pH, conductivity, chloride, sulfate, nitrate, ammonia total organic carbon, arsenic, boron, cadmium, lithium, and mercury. The results of this analysis have been presented in the Final EIS/EIR (see also response to "Comment—Baseline Hydrology Information" in the Hydrology Section). Similar data is presented in the Draft EIS/EIR for the Telephone Flat project (see Table 3.2.5 on page 3.2-14 of the Telephone Flat Draft EIS/EIR). These data will also be provided to the North Coast RWQCB.

Baseline information regarding groundwater chemistries is available from existing groundwater wells in the project vicinity. This information is included in the Final EIS/EIR. See also response to "Comment—Hydrologic Monitoring Plan" in the Hydrology Section.

Monitoring of Water Quality: Measures included as part of the proposed project, as well as mitigation measures identified in the Draft EIS/EIR, would ensure that water quality is adequately monitored, as suggested by the comment. These measures would also serve to confirm the expected less-than-significant effects of the project to water quality, and provide contingency actions in the unlikely event that water quality is affected by the project. It is expected that the North Coast RWQCB would participate in the development of a groundwater monitoring and contingency plan for the project. As suggested by the comment, periodic reviews would be conducted to ensure that monitored conditions conform with expected conditions.

Extensive water quality monitoring would be conducted for the proposed project, and the groundwater monitoring and contingency plan would be implemented. As part of this plan, production and injection wells would be constantly monitored to ensure proper operation (including the analysis of injected waste water). The drilling and casing program for the wells would prevent leakage of geothermal fluid into the groundwater. In the extremely unlikely event that this leakage occurs (e.g., through the failure of a well casing), this leakage would be detected at the actual well location by the well monitoring. This detection would be possible due to a likely immediate drop in well pressure. Monitoring the well itself would allow for immediate detection of any leakage. If such a leak is detected, contingency measures would be implemented to

remedy well leakage. These actions would include immediately shutting down the well, and repairing the well before adverse effects to groundwater quality could occur.

In addition to monitoring at the production and injection wells, three groundwater monitoring wells would be established down-gradient from the production and injection wells. These monitoring wells would be drilled to the 90° F temperature level, and baseline information would be collected prior to the initiation of project activities. These wells would monitor any changes in groundwater chemistry resulting from the proposed project. In the unlikely event that leakage of geothermal fluid into the groundwater occurs and this leakage is not accompanied by a pressure decline, the leakage would be detected by the groundwater monitoring wells. The contingency measures would then be implemented to remedy well leakage.

The mitigation measures in the Draft EIS/EIR also require on-going hydrologic and vegetation monitoring and periodic reviews. Mitigation Measures 4.3.1a and 4.3.2a on pages 4-26 and 4-27 of the Draft EIS/EIR require Calpine to monitor water quantity and quality. As discussed above, significant effects to surface water and groundwater quality are not expected. If impacts to water resources are detected, the BLM and USFS would require operational changes to ensure that water resources are not significantly impacted.

Mitigation Measure 4.3.7a on page 4-38 of the Draft EIS/EIR requires Calpine to reevaluate the expected less-than-significant depositional effects of air emissions on water quality once monitoring data and actual emission data are available. If the updated analysis indicates that any water quality standard would be exceeded as a result of the project, the BLM would require operational changes to ensure that water quality standards are not exceeded.

As stated on page 4-92 of the Draft EIS/EIR, the proposed project would not have a significant effect on vegetation through the deposition of air emissions (including entrained geothermal constituents). Mitigation Measure 4.7.2a on pages 4-92 and 4-93 of the Draft EIS/EIR requires Calpine to monitor vegetation to confirm this less-than-significant effect. If unexpected effects to vegetation occur, this mitigation measure states that Calpine, directed by the USFS, would be responsible for implementing measures to compensate for these effects.

Reference:

Weiss Associates. 1997. Baseline Hydrology Evaluation Report for Telephone Flat Geothermal Project, Medicine Lake, California. Prepared for CalEnergy Company, Omaha, NE.

EFFECTS ON LIFE EXPECTANCY OF THE GEOTHERMAL RESOURCE

Comments—Effects on the Life Expectancy of the Geothermal Resource

AG.32 The EIS/EIR's discussion about impacts to the geothermal reservoir's life expectancy is based on speculation and riddled with inconsistencies. As such, there is insufficient basis for its conclusion that there will be no significant impact to the resource.

The EIS/EIR concludes that the Project will result in a 15% reduction in the reservoir's life expectancy, and finds this impact insignificant. (EIS/EIR, p. 4-47.) However, this conclusion is based on speculation about the reservoir's characteristics and recharge sources. (EIS/EIR, p. 4-43.)

The EIS/EIR acknowledges that "[t]here are insufficient data regarding reservoir capacity and recharge processes to fully evaluate how the net loss of geothermal fluids would affect the longevity of the

geothermal resource in the local Fourmile Hill area." (EIS/EIR, p. 4-45.) In another section, the EIS/EIR states: "It is probable that if there is significant recharge to the geothermal system it either is drawn laterally in towards the heat source from [deep sources] or descends from depths through fractures in the roof of the geothermal reservoir." (EIS/EIR, p. 3-41 (emphases added).) In other words, if recharge occurs, it comes from above or horizontally. These statements demonstrate that the EIS/EIR's conclusions about the significance of this impact are based on speculative assumptions.

The speculative nature of the EIS/EIR's analysis, in combination with Dr. Fox's comments about the EIS/EIR's flawed analyses of groundwater recharge and hydrological connections in other areas, cast substantial doubt on the validity of the EIS/EIR's assumptions about impacts to the reservoir. (Ex. A, Comments 9, 10.) The EIS/EIR does not contain enough information to support its conclusions.

According to the EIS/EIR, the net loss of fluids to the reservoir (withdrawal less injection) will be 475,000 pounds per hour. (EIS/EIR, p. 4-44.) This equates to 187.2 billion pounds over the Project's 45-year operation phase. This is a substantial depletion, and does not even include the proposed CalEnergy project. The EIS/EIR should be revised to include a more thorough assessment of this impact, which certainly seems significant. As explained above, a lead agency must use its best efforts to discover and disclose all it reasonably can about a project's potential impacts. Under the circumstances, additional investigation is warranted. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.33 The EIS/EIR also relies on the renewability of the geothermal resource to conclude that there will be no short-term use at the expense of long-term productivity (§ 4.20, pp. 4-335-337) or significant irreversible environmental changes (§ 4.21, p. 4-337). These conclusions are questionable without a proper assessment of the Project's impact on the geothermal reservoir.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

BX.5 Besides, geothermal power is fleeting and quite transitory: e.g., the Mammoth and Geysers plants are losing power fast; *(Dean H. duVernet)*

BY.1 Note: Geothermal energy throughout California does not last long, and I have many articles that I will send you soon. *(Dean H. duVernet)*

CC.2 I have a question that as an amateur geologist and one time miner and timber worker and outdoor person I would enjoy very much getting a reply on. I would like to get informed on just how geologically the estimated volume of energy to be made from each well is obtained. Along with that goes the questions obvious point that can your workers really determine how much hot steam will come from a heat bed and how are these heat sources "recharged". *(Bob Eastman)*

CC.3 I've kept up with most energy problems since I watched Shasta Dam Boulder Dam and many others go into action. Thankfully they are sure workers as long as we have no bad droughts which no one has yet controlled. I have watched as nuclear energy plants have been disavowed by the American public and now at Lake County the management of the geothermal projects have a big problem.

Unless I've misread the news the annual output is now dropping at about 10 to 14 percent. To prevent wells from going dry a plan is now before the county fathers and public to take about 70 percent surface water and 30 percent waste water and from a large conduit to the sites pump it back into the hot beds for recharging. But the project authors at onset of the Geyser operations proclaimed that this was a "renewable resource" suggesting something like "perpetual motion". Unless I'm still untrained the laws of motion mechanically prevent such an event. But I myself might have suggested this notion to seek favorable publicity I do not really think that "hype" is the basic problem. After all the nuclear buffs lost terribly proclaiming that atomic waste could be handled and that global warming would soften under nuclear plants. Its sad because I bet money we would have a thousand plants by the end of this century.

If I had any advice to offer to your management it would be to drop any proclamations of endless energy sources that may not be in the future. Instead give the public the good news that with about 10 percent of Californias energy now coming from clean geothermal sources and that there is plenty available we have to endorse the plans.

The timber industry of which I was a part as a 14 yr old kid in the old woods when trees were still 4 to 6 feet in diameter is wrong to claim that the woods will always yield renewable resources while demanding that we the public give up more of our very limited national lands. *(Bob Eastman)*

CC.4 It looks like someday you may be campaigning for water systems to be operating on water from the Klamath, McCloud, Pitt rivers to recharge the heat beds. Might as well move that into your scope.
(Bob Eastman)

CS.4 We already have the example of the development of The Geysers geothermal area as a model. State and federal officials allowed massive over-development of the area at great cost to recreational use, air and water quality. Now that The Geysers are literally running out of steam, the area is a blighted mass of idle power plants, under-used transmission lines and badly eroding roadways and building sites. *(G.S. Green)*

EO.5 The BLM, protector of our public lands, had made it possible for the Medicine Lake to be carefully studied to determine whether it can be an adequate source of geothermal energy--power to the people.

The study has indicated that there is a power resource estimated to be adequate to last 50 years—but with how many wellfields and power plants in operation? *(Natalie Macy)*

IQ.19 Not only would this project not make economic sense on its own, but the concept of renewable energy is false. It is not uncommon for the geothermal source to cool off or for the geothermal fluids to become exhausted (i.e. the geysers in Sonoma County). Then the project dies prematurely. The information necessary for such an evaluation apparently does not even exist. *(Phil Woodward)*

PH3.42 You said that's a renewable resource. You mean this geothermal thing is going to renew itself? How? There is just so much down there, 10,000 feet down. How is it going to renew itself? That is your statement. *(Yreka Public Hearing)*

PH3.43 Then why do you say it is a renewable resource? *(Yreka Public Hearing)*

PH4.8 Could project be extended after 45 years? Project is a waste of time and money for only a 45-year project. *(Mount Shasta Public Hearing)*

PH5.85 You have all this evaporation and all that coming out of the ground. Where is that going to be made up? Is it water that's going into the atmosphere; are you going to be pumping water back down into the well to make up for that evaporation? *(Medicine Lake Public Hearing)*

PH5.86 You mean, you're taking that much water out of the reservoir, not remaking it up out of the surface water or something like that? Nothing? There's evaporation you're going to be taking from the top side. *(Medicine Lake Public Hearing)*

PH5.87 If they run out of water in the reservoir? *(Medicine Lake Public Hearing)*

Response—Effects on the Life Expectancy of the Geothermal Resource

Comment AG.32 questions the accuracy and consistency of the analysis in the Draft EIS/EIR regarding the life expectancy of the geothermal resource after project development. Statements made in the Draft EIS/EIR on the life expectancy of the geothermal reservoir are based primarily on the experience of the third-party consultant and of Calpine in the development of geothermal resources in other KGRAs and around the world. The conclusions in the Draft EIS/EIR are based upon the best available data from these other geothermal resources.

The comments suggest that the analysis of the geothermal reservoir should be more detailed. Until wells have been drilled into the geothermal resource and until these wells have been extensively tested, it is not possible to make detailed assessments of how the resource will behave after development. However, as done in the Draft EIS/EIR, general conclusions can be made regarding the geothermal reservoir based upon experience at other operating geothermal fields. Such conclusions are general in nature, but are not speculative; they are based on data collected at other geothermal fields with characteristics that are similar to the geothermal field at the Fourmile Hill site.

Comments AG.32 and AG.33 also state that the projected depletion of the geothermal reservoir (475,000 pounds per hour) would be a significant impact. This impact would be a depletion of approximately 15 percent of the capacity of the geothermal reservoir. This amount of depletion is not considered significant in the EIS/EIR because the majority of the reservoir capacity would be intact and would be available for future geothermal development if it occurred.

In almost all cases, the capacity of a developed geothermal reservoir decreases slowly with time. Some depletion is expected because of the nature of the geothermal resource and the method of energy production (in which a portion of the resource is lost). The extent of depletion is dependent on the size and nature of the resource and the technology and type of development that occurs. At Fourmile Hill, only a small portion of the geothermal resource would be developed; this is also the case at most geothermal

projects. Because the exact size of the geothermal resource is unknown, it is difficult to provide a precise estimate of the total proportion of the resource that would be impacted by the proposed project. The analysis in the Draft EIS/EIR estimates that the life expectancy of the geothermal resource would be reduced by 15 percent. This estimate is reasonable given existing data from other geothermal fields. It is not possible to refine this estimate until extensive drilling is completed.

The key to maximizing the geothermal resource is balancing the total amount of heat extracted with the amount of estimated natural recharge (Flynn 1997). Geothermal reservoirs are dynamic systems and will respond differently with varying development strategies. The Geysers is an example of a geothermal field that has been in continuous operation since 1960. The field was aggressively developed between 1960 and the mid-1980s. In the mid-1980s, gradual declines in pressure in the geothermal reservoir indicated that the field had probably reached its maximum development potential. However, even without the advantages of fluid injection, The Geysers has maintained consistent production for almost 40 years. The earliest power plants were brought on-line in 1960 and, although these plants were decommissioned in the early 1990s, the steam that supplied them is still being used at more efficient power plants. Unlike at The Geysers, Fourmile Hill will have the advantage of using both steam condensate and waste brine to conserve and maximize the life expectancy from the start of its operational life because Fourmile Hill would utilize a liquid-dominated geothermal system.

Many of the comments also suggest that the proposed project would have a significant adverse effect on the geothermal resource and that the production of geothermal power at Fourmile Hill would not last for 45 years. Much of the data needed to evaluate either (1) the short-term use of the geothermal resource versus long-term productivity, and (2) the impact of the loss of geothermal fluids, can only be collected after development has begun and production wells have been tested. However, as described above, the conclusions in the Draft EIS/EIR were based on data available from the Fourmile Hill area and the from the development of other geothermal systems throughout the world.

To demonstrate the reasonableness of a 45-year life expectancy for the proposed project, examples of other geothermal power plants where production has been continuous over extended periods are presented in Table 3.5-1. Most of the production that has occurred in the geothermal fields listed in Table 3.5-1 has been without the benefit of injection (only in the 1980s were the advantages of fluid injection realized). Based on the limited amount of depletion seen at other geothermal fields without an accompanying decline in production capacity, the depletion expected at the project site is not considered significant. These data have been added to page 4-46 of the Draft EIS/EIR (before the heading "Effect on Total Glass Mountain KGRA Geothermal Reservoir:").

Comment AG.32 notes a statement in the Draft EIS/EIR (page 3-41) regarding recharge to the geothermal reservoir and asserts that this statement is speculative and inconsistent with other statements in the Draft EIS/EIR. The nature of recharge to the geothermal reservoir is clarified below.

Recharge to the geothermal system occurs as development of the resource progresses. Recharge usually occurs at depth by lateral inflow to the system. This process occurs as

Table 3.5-1: Examples of Geothermal Power Plants With Extended Periods of Production

Geothermal Field	Country	Power Plant	Initial Production Date	Initial Production Rate (MW)	Current Production Rate (MW)
Larderello	Italy	Castelnuovo	1946	11	22
Taupo	New Zealand	Wairakei	1958	67	157
Namafjall	Iceland	Bjarnarflag	1969	3	3
Imperial Valley	USA	GEM 1	1979	13.4	13.4

SOURCE: Barbeir et al. 1995

a response to pressure decline within the system as fluids are extracted. Because injection occurs in areas adjacent to the resource, the nature and extent of lateral inflow cannot be determined until development has started. Although lateral inflow occurs at considerable depth, usually in the range of 3,000 to 10,000 feet, there can also be some recharge drawn into the system vertically via fractures and faults. This normally occurs at some distance from the resource where downward infiltration of cooler water is not hindered by pressures within the geothermal system. In the project area, alteration products, such as hydrothermal clays, would prevent any vertical infiltration through the fault systems. (See response to "Comments—Separation of Local Groundwater and the Geothermal Reservoir" in the Hydrology Section for data supporting this conclusion.)

In the Medicine Lake area, minor recharge into the geothermal system may occur along the caldera ring fractures. However, this recharge would occur away from the immediate area of the geothermal resource where hydrothermal alteration has not modified the natural permeability of the fracture system. This concept is illustrated in Figure 3-4.2 (as modified in the Final EIS/EIR). In Figure 3-4.2, infiltration appears to occur in the area of the resource only because the figure is a two-dimensional cross-section.

The text on page 3-41 of the Draft EIS/EIR (fourth paragraph) has been revised as follows:

> "Shallow groundwater within the caldera is probably separated from the shallow groundwater outside the caldera by shallow impermeability within the ring fracture system caused by alteration and mineral deposition. The geothermal system ~~is~~ may be ~~probably~~ recharged from deep groundwater ~~recharge since higher temperature fluids will convect vertically upwards~~. It is probable that ~~if there is significant~~ recharge to the geothermal system primarily occurs by deep lateral inflow at ~~it either is drawn laterally in towards the heat source from~~ depths considerably greater than well 88-28. ~~or descends from depths through fractures in the roof of the geothermal reservoir.~~ Some shallow groundwater recharge may occur via downward flow through fracture systems in the vicinity of the geothermal resource at Fourmile Hill in areas where permeability has not been restricted by hydrothermal alteration."

See also response to "Comments—Calculation of Groundwater Recharge" in the Hydrology Section.

Comment AG.32 also asserts that depletion of the geothermal reservoir by the proposed project plus the proposed CalEnergy project (Telephone Flat) would be substantial. The cumulative impacts to the geothermal reservoir from the proposed project plus the Telephone Flat project are discussed in the Draft EIS/EIR on page 4-316. As discussed in this section, the operation of these two projects would not result in cumulatively significant impacts on the geothermal reserves in the Glass Mountain KGRA. Effects from both projects would be minimized by injection into the reservoir of most of fluids extracted (83.6 percent at Fourmile Hill and 74.4 percent at Telephone Flat). The total fluid loss of the two plants would be between 1,075,000 and 1,225,000 lbs/hr (depending on the alternative selected at Telephone Flat), or approximately 4.78 to 5.58 cubic feet per second (also equivalent to 3,500 to 4,100 acre-ft/yr). This cumulative loss of geothermal fluid from the Glass Mountain KGRA is adverse and unavoidable, but not significant.

It is also believed that the two projects would be extracting fluids from separate and distinct portions of the geothermal reservoir. Thus, the effects of the two projects may not be additive.

Comments BX.5, BY.1, CC.2, CC.3, CC.4, CS.4, and IQ.19 assert directly or infer that the geothermal resource at Fourmile Hill would be depleted in a manner similar to that experienced at The Geysers. One cannot compare the lifetime of the geothermal reservoir at The Geysers with that of the proposed project because the two geothermal systems are very different. At The Geysers, only steam is produced and most of the steam extracted from the reservoir is lost to the atmosphere. In contrast, the Glass Mountain KGRA is dominated by water in the liquid phase. As a result, the majority of the geothermal fluids can be returned to through injection to extend the reservoir's production capacity.

Several statements in comment CS.4 need clarification. First, it is an overstatement to say that The Geysers was a "massive overdevelopment" and is "blighted by a mass of idle powerplants..." Out of a total of 31 generating units, 9 have been shut down. Of these, four were shut down because of inefficient operation. These four units were the original power plants built at The Geysers in the early 1960s. These four units have been completely dismantled and the sites have been restored. Two of the powerplant units were shut down in 1997 due to economic reasons; these plants may be brought back on line pending their sale to a new entity. Another powerplant was built prior to the identification of sufficient resource to run it and never produced electricity. This leaves two powerplants that actually sit idle as a result of reservoir depletion. The remaining powerplants still actively produce electricity, although at a level below full capacity. These units will continue to generate electricity well into the future. The Lake County wastewater pipeline (recently completed), and the Santa Rosa wastewater pipeline (proposed), will further extend the life of The Geysers.

Comment EO.5 questions how many wellfields and power plants are required to utilize the geothermal resource in the project area. Only one geothermal power plant is proposed under this project. Five production wells and three injection wells are also

proposed as part of this project. Only one other power plants and wellfield is currently proposed in the Glass Mountain KGRA, at Telephone Flat. For more discussion of this issue, see response to "Comment—Reasonably Foreseeable Geothermal Development" in the Alternatives, Including the Proposed Action Section.

References:

Barbier, E., G. Frye, E. Iglesias, and G. Pálmason, editors. 1995. Proceedings of the World Geothermal Congress, 1995, Volume 1. Florence, Italy, May 18-31, 1995.

Flynn, T. 1997. Geothermal sustainability, heat utilization, and the advanced binary technology solution. *Transactions of the Geothermal Resources Council* **21**:489-496.

EFFECTS ON REGIONAL THERMAL FEATURES

Comments—Effects on the Hot Spot from Geothermal Fluid Use

AW.3 Not in favor of destroying the Hot Spot on Glass Mtn *(Marian and Jack Blakeney)*

HT.9 What disturbance will there be in this area of underground lava tubes and hot areas such as the HOT spot? *(Louise Thompson)*

PH5.10 What disturbance will there be in this area of underground lava tubes and hot areas such as the Hot spot? *(Medicine Lake Public Hearing)*

Response—Effects on the Hot Spot from Geothermal Fluid Use

The Hot Spot is a pair of fumaroles that emit a small amount of heated water vapor and air. No geothermal fluids or geothermal steam is released at the Hot Spot, indicating that the fluids in the geothermal reservoir do not supply the Hot Spot. Because the Hot Spot is not directly connected to the geothermal reservoir, it would not be affected any changes in the amount of geothermal fluids in the geothermal reservoir. In addition, the Hot Spot is very isolated; its location within the caldera (approximately five miles from the proposed wellfield) indicates that it would not be impacted by the proposed production activities.

The last paragraph on page 3-35 of the Draft EIS/EIR has been changed to clarify the description of the Hot Spot:

> "Based on an examination of topographic maps and consultation with knowledgeable persons, the nearest surface thermal feature to the proposed power plant site and wellfield appears to be the Hot Spot, located on the northwest flank of Glass Mountain about five miles east of the power plant and wellfield area (USFS 1982; USFS and SCS 1983). This feature consists of two small-diameter fumaroles which emit a small amount of water vapor and gas, consisting mostly of air (nitrogen and oxygen). The gases are lacking in hydrogen sulfide, a ubiquitous indicator of geothermal fluids. Therefore, it appears that the emanations at the Hot Spot represent heated groundwater and not a surface leakage of geothermal fluids. ~~emit steam and gases. Discharge of gases from vents and soil temperature increases suggest only a localized release of heated gases. The most probable explanation for this thermal feature is leakage of gases from an intersection of two discrete fractures (or a single fracture) where vertical permeability extends from depth to the surface.~~ The lack of any other surface manifestations, either within or outside of the caldera, suggests that this is a very isolated and locally constrained feature. No other surface thermal features at or adjacent to the project area were found in the references consulted."

As discussed on page 4-49 of the Draft EIS/EIR, the construction, operation, and decommissioning of the proposed project is not expected to affect thermal features in the project region, including the Hot Spot.

3.6 Cultural Resources

INTRODUCTION

This section provides responses to comments on cultural resources issues. Comments and responses related to traditional cultural values and tribal issues can be found in the next section, entitled "Traditional Cultural Values." The cultural resources comments and responses are grouped under the following headings:

- General
- Section 106 Process
- Tribal Participation
- Survey Methodology
- Potential Impacts at the Power Plant and Wellfield Areas
- Potential Impacts Along the Transmission Line
- Mitigation Measures

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

GENERAL

Comment—General

R.2 The area that this project is located in is a very sensitive area, the project area contains numerous Cultural Resources, of the tangible and intangible nature. *(Dino Herrera, The Klamath Tribes)*

Response—General

The commentor's statement is acknowledged. The EIS/EIR documents existing known tangible and intangible cultural resources in Section 3.5, Cultural Resources and Section 3.6, Traditional Cultural Values. The information in these sections is based on existing literature, ground surveys, and data gathered through interviews with individual tribal members.

SECTION 106 PROCESS

Comment—State Office of Historic Preservation Review

G.1 Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) for the proposed Fourmile Hill Geothermal Development Project (SC No. 96062042).

I understand that the purpose of this document is to identify potential environmental impacts that would result from the proposed construction, operation, and decommissioning of a 49.9 megawatt geothermal power plant with associated production and injection wells, well pads, pipelines, transmission line, and access roads. The proposed power plant and wellfield would be located on Federal geothermal leases CA21924 and CA21926 in the Glass Mountain Known Geothermal Resource Area on the Klamath and Modoc National Forests in Siskiyou and Modoc Counties, California. The proposed transmission line would extend east from the power plant site for approximately 23.4 miles through the Klamath and Modoc National Forests to a proposed substation along the existing Malin-Warner transmission line near Perez, California. Alternative transmission line routes have been defined and are analyzed in the DEIS/EIR.

Once the federal lead agency for the proposed action has defined the area of potential effects (APE) for the project, I anticipate having the opportunity to comment on the effects of the undertaking on historic properties, pursuant to 36 CFR 800.4. *(Cherilyn E. Widell, State Office of Historic Preservation)*

Response—State Office of Historic Preservation Review

Comment noted. Consultations with the State Office of Historic Preservation (SOHP) have been initiated by the USFS and will be completed prior to the agencies making a decision on the project.

Comments—Section 106 Process

AD.5 1. Incomplete Section 106 Process. The Section 106 Process of NHPA appears to be only at the stage of initial identification. However, the conclusions drawn make it appear as if the whole Section 106 Process has been done. The 36 CFR 800 regulations governing this process indicate that it should be done in the early planning stages, so that effects on cultural resources and properties that are eligible to the National Register of Historic Places can be evaluated 'before specific projects are planned that may affect them' (see National Register Bulletin 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties, page 4). It is critical that the Section 106 Process, including eligibility determinations and adverse effects consultations, be done before any funds or licensing of the project is decided.

Because the Section 106 Process has not been completed, particularly the adverse effects and MOA consultations (see Appendix to this comment), statements regarding eligibility, adverse effects and mitigations have not been decided in consultation with the Tribes. It is clear that the intent of the Section 106 Process is that Tribal input is to be obtained regarding cultural resources. Therefore, statements in the EIS/EIR concerning eligibility, effects and mitigations are invalid because they are lacking the adverse effects and MOA consultations. *(Floyd J. Buckskin, Pit River Tribe)*

AD.11 Failure to follow the Section 106 Process in a timely manner puts the cart before the horse. The EIS/EIR at 4-54 states 'Potentially undiscovered prehistoric and historic resources still exist buried within or immediately adjacent to the wellfield and power plant site, freshwater pipeline, and transmission line route. Excavation...could encounter unrecorded cultural resources. Destruction or unauthorized collection of a significant unrecorded cultural resource would be considered a significant impact.' This in direct contradiction to the paragraph directly above which states that "no unmitigated effects" would be allowed. The only way to assure this is to follow the Section 106 Process which requires that evaluations, effects and mitigations be decided early in the process and before a commitment of resources or issuance of any permit. *(Floyd J. Buckskin, Pit River Tribe)*

AD.13 An important step in the Section 106 Process is evaluation of sites and cultural areas for eligibility to the National Register of Historic Places. To my knowledge, none of the areas have been submitted for eligibility to the National Register. I have seen no National Register documentation or registration forms submitted to the Pit River Tribe for review. *(Floyd J. Buckskin, Pit River Tribe)*

AD.21 In addition, any amendment or revision that would affect traditional cultural resources and properties potentially eligible to the National Register must go through the Section 106 Process under the NHPA, according to the Memorandum of Understanding with the Advisory Council on Historic Preservation (see Appendix). *(Floyd J. Buckskin, Pit River Tribe)*

AD.32 Due to the lack of Section 106 evaluations of cultural sites, the Forest Service states: (EIS/EIR at 4-54) that "Additional surface disturbance (beyond the maximum of 335.8 acres along the transmission line route) could occur during the construction phase along the proposed transmission line route as a result of off-road vehicle traffic. The USFS would require that no unmitigated effects to cultural resources occur as a result of this project." Such statements are premature and meaningless. This is a promise that cannot be fulfilled, because all the effects of construction cannot be mitigated. In addition, identification of cultural resources and their evaluation to the National Register must be made before the decision is made to permit the project. Under the NHPA Section 106 Process, mitigations are not to be decided unilaterally but are to be arrived at through a Memorandum of Agreement (MOA) or a Programmatic Agreement (PA) between the agency, the Advisory Council on Historic Presentation, the State Historic Preservation Officer, and affected parties. *(Floyd J. Buckskin, Pit River Tribe)*

Response—Section 106 Process

Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to take into account the effects of their actions on historic properties, and to afford the President's Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings. The regulations in 36 CFR Part 800 define the agencies' procedures for complying with Section 106. The Section 106 process for the Fourmile Hill project has been initiated, but not completed. The process will be completed prior to the agencies making a decision regarding the project.

The Section 106 process includes:

- Identification and evaluation of historic properties
- Assessment of effects
- Consultation with the SOHP and other interested persons, such as the tribes, to seek agreement on ways to avoid or reduce the adverse effects
- Obtain comments from the ACHP
- Implement recommendations

The procedures for inventory, evaluation, and mitigation would be defined in a Programmatic Agreement (PA) or Memorandum of Agreement (MOA) between the lead agencies, Calpine, and the State Historic Preservation Officer. The local tribes would also be consulted and invited to be a party to the agreement.

The PA or MOA would address inventory, evaluation, eligibility determination, and mitigation/data recovery efforts. This agreement would commit each of the parties to implement the requirements defined in the PA (or MOA) and the EIS/EIR. Survey and evaluation would be conducted prior to final line design. Mitigation and treatment of sites, if required, would be conducted prior to construction in areas that could be affected by the proposed project.

As stated on page 3-51 of the Draft EIS/EIR, 233 cultural resource sites have been recorded within the 134-square-mile cultural resources study area. This study area includes the power plant location, all production and injection well pads, associated pipelines and access roads. The study area also included 0.25-mile-wide corridors along the proposed and five alternate transmission line routes. Class III pedestrian surveys (conducted by walking in 30-meter transects) were conducted at the wellfield and power plant areas of surface disturbance. Sample surveys were conducted for the proposed and alternative transmission lines.

Twelve of the recorded sites have already been formally evaluated under the NHPA, and have been determined to be eligible for the NRHP by the USFS. These sites have not been formally nominated for listing on the NRHP. The eligibility determinations were based on previous studies for other projects. In response to Comment AD.13, no additional cultural resource sites have been identified for evaluation or National Register eligibility since the preparation of the Draft EIS/EIR.

The evaluation of unidentified or unknown cultural resource sites will occur upon completion of the Class III cultural resources inventory. The inventory will be conducted after a transmission line segment is selected, and prior to the commencement of surface-disturbing activities. At that time, any newly discovered cultural resource sites would be avoided (i.e., transmission line would be rerouted). If rerouting of the line is not feasible, the eligibility of the site for listing on the National Register will be determined at that time. Significant effects to eligible cultural resources would be avoided through rerouting of the transmission line, or through implementation of a data recovery program. Mitigation measures on pages 4-55 to 4-57 of the Draft EIS/EIR detail the mitigation program for these issues.

The USFS has conducted initial consultations with the SOHP to obtain concurrence on the approach to conducting the Section 106 process, including the timing of the Class III cultural resources inventory of the agencies' preferred alternative, Alternative 6. The USFS will complete the Section 106 consultation process regarding effects to cultural resources (including archaeological, historic, and traditional cultural properties) prior to making a decision on the proposed project. This methodology has been successfully implemented on other similar projects.

The Section 106 consultation package will include the archaeological survey reports (Origer 1994 and 1995; FWARG 1997 and 1998) and the Ethnographic Report (Theodoratus et al. 1998) prepared for the proposed project. This package will also be submitted to the tribes (the tribes have received a copy of the 1996 draft of the Ethnographic Report). The tribes were provided copies of the Draft EIS/EIR for review.

At several meetings the USFS representatives specifically requested the tribes' comments on mitigation measures. Calpine has also attempted to meet with the tribes to address the project and potential mitigation measures. The PA (or MOA) and the conditions of project approval would commit the parties involved (the lead agencies and Calpine) to implement the requirements defined in the PA or MOA and the cultural resource requirements outlined in this EIS/EIR.

It should be noted that the determinations made in the EIS/EIR are somewhat different from the Section 106 process. Both NEPA and CEQA require that agencies consider the effects of their actions on cultural, historic, and tribal resources. For the purposes of the EIS/EIR, potential project effects to cultural resources were considered significant and mitigation was defined. This approach is conservative and overestimates the significance of some impacts because impacts to sites not eligible for listing on the NRHP would be avoided, if possible. In Section 4.6 of the EIS/EIR, effects to any of the identified traditional cultural use sites were considered significant under NEPA and CEQA. Two of the identified sites, however, do not meet the Bulletin 38 (NPS 1992) criteria to be considered traditional cultural properties. The site in the vicinity of Arnica Sink was not located on the ground, and the site in the vicinity of Fourmile Hill was not located by the tribal members or the EIS/EIR team researchers.

Comment AD.11 references sentences on page 4-54 of the Draft EIS/EIR. The sentences are intended to acknowledge that buried resources could exist in the project area and that without mitigation, impacts could occur. Mitigation for this potential impact is provided in Mitigation Measures 4.5.1f, 4.5.1g, and 4.5.1h. The measures are designed to avoid the potential effects. Implementation of mitigation will be assured through the completion of the Section 106 process. Furthermore, permits to begin construction would not be issued prior to completion of all Section 106 requirements, and the requirements to survey, evaluate, and avoid or mitigate effects to cultural resources.

The commentor's preference to conduct all surveys and complete the Section 106 process early in the process is noted. The agencies have determined that the most

reasonable and practical approach is to conduct detailed surveys once a final alignment is identified.

References:

FWARG (Far Western Anthropological Research Group, Inc.). 1996. *Cultural Resources Sample Survey and Sensitivity Assessment for the Fourmile Hill Geothermal Project, Modoc and Klamath Forest.* Prepared for Calpine Corporation. November 1996.

FWARG. 1998. *Cultural Resources Survey of the Power Plant Location for the Fourmile Hill Geothermal Project, Klamath National Forest.* Addendum to: *Cultural Resources Sample Survey and Sensitivity Assessment for the Fourmile Hill Geothermal Project, Modoc and Klamath National Forests, Modoc National Forest Archaeological Survey Report 05-09-1055.*

National Park Service. U.S. Department of Interior. 1992. *Guidelines for Evaluating and Documenting Traditional Cultural Properties.* National Register Bulletin 38.

Origer, T.M. 1994. *An Archaeological Survey of Potential Temperature Gradient Hole Drilling Sites within the Glass Mountain KGRA, Siskiyou County, California.* Prepared for Calpine Corporation.

Origer, T.M. 1995. *Supplemental Cultural Resources Study for the Calpine Geothermal Project within the Glass Mountain KGRA, Siskiyou County, California.* Prepared for Calpine Corporation.

Theodoratus, Dr. D., G. Emberson, Dr. T. Jackson. 1998. *Medicine Lake Highland and Timber Mountain Ethnographic Report for the Fourmile Hill Geothermal Development Project, Siskiyou and Modoc Counties, California.* Prepared for MHA Environmental Consulting, Inc.

Comment—Evaluation of Historic Districts

AD.14 Two areas need to be evaluated as Historic Districts because of the numerous sites they contain, their interconnected features that have been demonstrated through Tribal field surveys, and significance of the areas as wholes. Because these districts are highly significant, they should be evaluated for National Register eligibility, well as individual sites contained within the districts.

One Historic District includes the entire Medicine Lake Highlands, from and including Shotgun Peak on the south side to Crater on the west, to Cougar Butte on the northeast side, to Mammoth Crater on the edge of Lava Beds National Monument, to the northwest slope of the Highlands below Fourmile Hill down to approximately the 5,500 foot elevation.

The other Historic District area includes Timber Mountain north to the Dry Lake area, where the proposed transmission line would occur, including the lava flow north of Dry Lake; then west from Dry Lake to East Sand Butte. The Dry Lake cultural district is an extensive archaeological site important during the Modoc Wars, also known as the Battle of Dry Lake of 1873.

Excerpts of the Section 106 Process are included in the Appendix to these comments.

(Floyd J. Buckskin, Pit River Tribe)

Response—Evaluation of Historic Districts

The request to evaluate the Medicine Lake Highlands and the Timber Mountain to Dry Lake area as historic districts is noted. This comment will be considered in the Section 106 compliance process.

TRIBAL PARTICIPATION

Comments—Tribal Participation in Cultural Resources Review

AD.9 At 4-55 and elsewhere, the EIS/EIR makes statements such as "At sites already determined eligible, prior evaluation and mitigation efforts (where conducted) shall be thoroughly reviewed to better assess the effects that this undertaking will have on the property, prior to construction activities." Information is lacking about such sites. Which were determined eligible? By whom? What was the participation of the Tribes? Why was this information not made available to the Tribes? Again, any and all mitigation activities should be part of an MOA/PA developed in conjunction with and participation of the Tribes early in the planning process. See also EIS/EIR at 4-56, where again, a determination of eligibility is put

off to the construction phase of the project "if avoidance is not feasible" and only then will a mitigation proposal be submitted to the Office of Historic Preservation. *(Floyd J. Buckskin, Pit River Tribe)*

AD.12 The way the USFS proposes to conduct the Section 106 Process in the EIS/EIR minimizes the spiritual, cultural and historic importance of the Medicine Lake area and fragments, piecemeals and runs counter to the intent of the NHPA Section 106 Process and Forest Service Manual 2360. In a historic area as significant as the Medicine Lake Highlands, greater levels of effort need to be made to identify historic properties early in the process and mitigate potential effects through an MOA/PA with affected Tribes, the State Historic Preservation Officer and the Advisory Council on Historic Preservation. *(Floyd J. Buckskin, Pit River Tribe)*

AD.42 No consultations about archaeological sites have occurred between the Forest Service and the Tribes. As a result, statements such as "The historic site located in the vicinity of the wellfield and power plant area is...unlikely to be determined eligible for the NRHP" (National Register of Historic Places) (EIS/EIR at 4-53, with similar statements elsewhere) were not determined in consultation with the Tribes. At no time was the Pit River Tribe, or to our knowledge the Modoc Tribe, ever asked about the eligibility of this or other sites. Such determinations need to be made in consultation with the Tribes before project decisions are made.

The next sentence reads like an unproven speculation: "The historic site located in the vicinity of the wellfield and power plant area...is unlikely to be determined eligible for the NRHP; thus impacts to this site are not expected." *(Floyd J. Buckskin, Pit River Tribe)*

AD.44 The Pit River Tribe was never notified of the report prepared by Far Western Anthropological Research Group (FWARG) which identified previously recorded or known archaeological sites. The FWARG has never consulted or shared its information with the Pit River Tribal Council. Apparently, the USFS did not even consult with its own Forest Archaeologist, Gerry Gates, in any Section 106 and eligibility processes. FWARG should have coordinated with the Forest Archaeologist who could have acted as an intermediary to assure involvement of the Tribes. *(Floyd J. Buckskin, Pit River Tribe)*

AD.45 At 3-46 the EIS/EIR states that 'Calpine personnel escorted FWARG archaeologists...' Why is the project proponent, Calpine, escorting the archaeologists? Why were tribal consultants not included in these field surveys? *(Floyd J. Buckskin, Pit River Tribe)*

AD.56 The Ethnographic Report is fairly adequate as far as it goes. However, a major problem has been lack of access to archaeological records (see section on Archaeology above). *(Floyd J. Buckskin, Pit River Tribe)*

Response—Tribal Participation in Cultural Resources Review

As described in the Draft EIS/EIR, Section 3.5, several cultural resource studies have been conducted in the study area for the proposed projects. Limited information about the sites is included in the EIS/EIR so that the sites and their locations remain confidential. Further information about the potentially affected sites (reports and site records) will be provided to the tribes during the consultation process and prior to a decision on the project.

The sites in the study area that have already been determined eligible for the National Register are described in FWARG (1997) and other reports (Origer 1994 and 1995). The eligibility of the cultural resources were determined based on previous work conducted in the project area for other projects. The determination of eligibility was conducted when those reports were prepared. The eligibility determinations were made by the USFS in conjunction with the SOHP. It has not been the policy of the Modoc National Forest to require Native American monitors for cultural resources inventories. The Modoc Forest notifies the tribes of undertakings that may affect cultural resources. In the past, the tribes have not been provided an opportunity to comment on Modoc Forest NRHP determinations of eligibility. The Klamath Forest consults with the tribes and tribal organizations before project clearance. The tribes will be asked to comment on eligibility determinations for the Fourmile Hill project.

Those sites that may be affected by the project and have not been evaluated for eligibility for the NRHP will be recorded, evaluated, an eligibility determination will

be made (subject to concurrence by the SOHP), and avoidance or data recovery would be conducted prior to construction. The Section 106 consultation package for this project (which will include eligibility determinations) will be sent to the tribes for review and comment prior to finalizing the package.

The appropriate information to evaluate sites that would be affected by the proposed project will be gathered prior to any surface-disturbing activities in the vicinity of these sites. A PA or MOA will be prepared in consultation with the tribes as part of the Section 106 process. The PA or MOA will provide additional detail regarding the specific procedures to be implemented for data-recovery programs, and will be presented to the SOHP prior to the construction phase of the project.

In response to Comment AD.12, the lead agencies acknowledge the importance of the area to the tribes. The agencies have conducted extensive consultations with local tribes regarding the proposed project (see Section 3.6 and Section 4.6 of the Draft EIS/EIR). As part of the consultation process, the tribes:

- Received early notice of the project upon the agencies' receipt of the Plan of Utilization and prior to public scoping for the project
- Participated in the selection of the third-party contractor (including the EIS/EIR team ethnographers and archaeologists)
- Participated in over 15 meetings with the agencies regarding the project
- Contributed data for the impact analysis through interviews conducted by the team ethnographer
- Received copies of the draft Ethnographic Report and consultation reports and provided comments
- Received advance copies of the Draft EIS/EIR
- Are participating in the Section 106 process
- Will be consulted by the USFS and BLM Line Officers for the project prior to the agencies making a decision on the project

The USFS approach does not piecemeal or run counter to the intent of the NHPA Section 106 process or Forest Service Manual 2360. The USFS and BLM consulted early with the tribes, and have taken a regional approach to cultural resource review to ensure the resources that could be affected by the proposed project are documented, evaluated, and protected. The ethnographic study for the proposed project addresses the entire Medicine Lake Highlands, Timber Mountain, and Dry Lake regions, rather than addressing only narrowly defined areas of potential effect. This regional approach to identifying and evaluating cultural and tribal resources was designed to avoid piecemealing, and to allow the decision makers to understand the regional context of resources that could be affected by the proposed project.

The tribes, the SOHP, and the ACHP will participate in the identification, evaluation and protection of prehistoric, historic, and traditional cultural properties that may be affected by the proposed project.

The need for the USFS to consult with the tribes regarding archaeological and historic sites, as well as traditional use sites, is acknowledged. The USFS conducted over 15 meetings with local tribes, and the EIS/EIR team ethnographer conducted 31 interviews with Pit River, Klamath, and Shasta tribal members regarding the proposed project and potential project effects. Consultation with the tribes is described in:

(1) The Ethnographic Report for the project (Theodoratus et al 1998)

(2) The American Indian Consultation Report (MHA 1998)

(3) The Draft and Final EIS/EIR, Section 1.7, American Indian Consultation, and Section 3.6, Traditional Cultural Values

(4) The responses to comments in the Traditional Cultural Values Section

The USFS staff and members of the EIS/EIR team met with the Klamath Cultural Heritage Committee and the Pit River Council on July 10 and July 12, 1997, respectively. The meetings were attended by staff from the USFS, the third-party consultant who prepared the EIS/EIR, the third-party ethnographer, and a representative of FWARG, the archaeological consultant. The purpose of these meetings was to discuss the Fourmile Hill project and the cultural resource and ethnographic studies that would be conducted for the preparation of the Fourmile Hill geothermal EIS/EIR.

Most of the over 15 meetings with tribal representatives, however, did not focus on archaeological resources. The local tribes will be contacted and invited to participate in the PA or MOA (see response to "Comments—Section 106 Process" above) with the SOHP for identification, evaluation, and protection of cultural resources (including historic, archaeological, and traditional cultural properties). Consultation with local tribes will continue until a decision is made about the project.

Information in the Draft EIS/EIR regarding the historic site in the vicinity of the wellfield and power plant area was not speculative, but was based on the results of the Class III pedestrian inventory of cultural and historic sites conducted in the wellfield and power plant areas. The text quoted in comment AD.42 is incomplete. The full text of the first sentence quoted is as follows:

> "The historic site located in the vicinity of the wellfield and power plant area is an active USFS road and is unlikely to be determined eligible for the NRHP; thus, impacts to this site are not expected."

The intent of the statement was to indicate that adverse effects were unlikely. The text on page 4-53 of the Draft EIS/EIR has been revised as follows to clarify the intent of the statement:

> "The historic site located in the vicinity of the wellfield and power plant area is an active USFS road, and is unlikely to be determined eligible for the NRHP due to the disturbed nature of the site. The project is not expected to cause additional adverse~~; thus,~~ impacts to this site ~~are not expected~~."

The next sentence referenced in paragraph two of the same comment refers to the same sentence quoted above. The site was not evaluated for the EIS/EIR because no adverse effects are expected to occur to the site. Nevertheless, this site will be addressed in the Section 106 consultation.

The Section 106 process is ongoing (see the response to "Comments—Section 106 Process" above) and will be completed before the agencies make a decision on the project and a Record of Decision is signed. Gerry Gates, Forest Archaeologist with the USFS Modoc National Forest, has participated in all of the cultural and archaeological studies conducted for the proposed project, including those conducted by FWARG. The survey crew included a member of the Klamath Tribes. Mr. Gates has been involved in the environmental review of the Fourmile Hill development project from the beginning, and is leading the preparation of the Section 106 consultation package. The Section 106 consultation will include tribal involvement.

Comment AD.44 states that the Pit River Tribe did not receive the archaeological survey report prepared by FWARG. The cultural resource study reports will be submitted to the tribes as part of the consultation process.

In response to comment AD.45, Calpine personnel escorted FWARG archaeologists to ensure that the area of potential effect was clearly understood and surveyed by the survey crew. The Calpine personnel escorted the archaeologists because they could give the best description and location of project facilities.

Tribal consultants were included in the field surveys to identify traditional cultural properties and uses in the area. Tribal consultants included members of the Klamath Tribe, the Pit River Tribe, and the author of letter AD (see also the responses to comments under "Tribal Participation," above, and the responses to comments in the Traditional Cultural Values Section for more information on these issues).

Reference:

MHA Environmental Consulting, Inc., 1998. *Consultations with the Pit River Tribe, The Klamath Tribes, and the Shasta Group for the Fourmile Hill Geothermal Development Project.* MHA Environmental Consulting, Inc. (Draft 1996, Revised Draft 1998)

SURVEY METHODOLOGY

Comments—Adequacy of Surveys at the Power Plant/Wellfield Area

AD.46 The preliminary archaeological survey summarized in Table 4.5-1 is insufficient to determine the validity of statements such as that found on page 4-53, stating that 'Any impacts to the prehistoric quarry located within the wellfield and power plant area as a result of surface disturbance may be avoided by placing the production/ injection line a minimum of 100 feet from this prehistoric site.' This site has not been adequately evaluated to date. *(Floyd J. Buckskin, Pit River Tribe)*

AD.55 Also, at 4-75, the EIS/EIR states that 'The wellfield and power plant site construction would not affect any archaeological sites." This cannot really be stated because the evaluation of Fourmile Hill has not yet been completed in the field work. Fourmile Hill will be surveyed in early October and may demonstrate the presence of traditional cultural properties with archaeological evidence. *(Floyd J. Buckskin, Pit River Tribe)*

AG.35 Also, the EIS/EIR did not evaluate areas in the wellfield and power plant site. For example, a prehistoric quarry was identified in that location, but has not been evaluated. (Id. at p. 3-51.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.269 Sample Survey Appeared to Omit Power Plant Site: The Draft EIS/EIR used a methodology to characterize the potential for significant cultural resources in the project area that involved a sample survey of the project components, including the transmission line routes. The text on pp. 3-46 - 3-47 mentions sampling of five well pads, connecting corridors, transmission line corridor segments, substations, the freshwater pipeline, and the power plant area generally. However, there is no indication that the actual power plant site was surveyed. Since this 10.4-acre site is fixed geographically there is no apparent reason why the entire power plant site should not have been comprehensively surveyed as part of the overall sample survey.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Adequacy of Surveys at the Power Plant/Wellfield Site

Comment AD.46 references Table 4.5-1 in the Draft EIS/EIR, which describes the estimated number of cultural resource sites along the proposed and alternate transmission line routes. The comment then expresses concern that the table is not adequate to support the conclusion that impacts to the quarry in the wellfield area would be avoided by placing facilities no closer than 100 feet from the identified quarry. The table is designed to provide information about the transmission line routes only. The Modoc Forest Archaeologist and Far Western Anthropological Research Group, Inc. (FWARG), the consulting archaeologists, believe that the 100-foot buffer is adequate to protect the quarry. The site has not been fully evaluated because it would be avoided. See also the response to "Comments—Adequacy of Mitigation Measures" later in this section.

In response to comment AD.55, it can be stated that the wellfield and power plant construction would not affect any known archaeological sites because complete Class III cultural resource surveys were completed at the proposed wellfield and power plant sites. Intensive pedestrian surveys of approximately 300 acres were conducted to identify the presence of cultural resources in the wellfield and power plant area, including the approximately 50 acres where surface disturbance would occur (FWARG 1997 and 1998).

The survey of the plant site and wellfield areas was conducted by Origer (1994 and 1995) and FWARG (1997 and 1998). FWARG prepared the *Cultural Resources Sample Survey and Sensitivity Assessment for the Fourmile Hill Geothermal Project, Modoc and Klamath National Forests;* this report addresses the entire project area, and describes previous surveys that were conducted and other archaeological and historic work done in the area. The 1997 report was supplemented with the results of additional FWARG field work in 1998 in the vicinity of the power plant site. The supplemental survey covered a larger area around the power plant site than Origer covered. No additional sites were discovered in the supplemental survey (FWARG 1998).

A description of the survey work completed can be found on pages 3-46 and 3-47 of the Draft EIS/EIR. To further clarify the survey work conducted, the third and fourth paragraphs, respectively, on page 3-46 of the Draft EIS/EIR text are revised as follows:

> "**Well Pads and Power Plant Site:** Five well pads and the power plant site were surveyed by Origer in 1994 and 1995, and by FWARG in 1996 and 1998, using intervals of...."

> "**Corridors Connecting to Well Pads:** Proposed corridors (i.e. roads and pipeline routes) for connecting the well pads to the power plant site were flagged down the center line...."

The additional field work conducted as part of the ethnographic survey (referenced in Comment AD.55) did not discover any additional archaeological evidence that would be affected by wellfield or power plant construction (Theodoratus et al. 1998). None of the 33 traditional cultural use sites are located within areas proposed for construction (see also responses to comments in the Traditional Cultural Values Section).

One prehistoric site and one historic site were identified during the survey of the wellfield and power plant site. The prehistoric quarry (FS# 05-05-57-1040) is identified as a prehistoric resource. Comment AG.35 expresses concern that the prehistoric quarry was not evaluated. The site would be avoided and would not be affected by the proposed project. The quarry has therefore not been evaluated for eligibility under the NHPA. Mitigation Measures 4.5.1c, 4.5.1d, and 4.5.1e of the Draft EIS/EIR (page 4-55 and 4-56) would be implemented to entirely avoid the area of the prehistoric quarry (as well as other resources) during project development activities. Implementation of these measures would avoid or reduce potential impacts to a less-than-significant level.

Comment AG.269 incorrectly states that the methodology to characterize the potential for significant cultural resources in the project area involved only "a sample survey of the project components, including the transmission line routes." The sample survey methodology described on page 3-46 of the Draft EIS/EIR was used only for the proposed and alternative transmission line routes. As stated above, a Class III inventory was completed for the power plant and wellfield area.

Comments—Timing for and Adequacy of Transmission Line Surveys

AD.8 At 4-55, under Mitigation Measures, we read under section 4.51a, that Calpine "shall survey, identify and record cultural resources within the proposed transmission line corridor and where ground disturbance outside of the corridor would occur...' All this should be done prior to the final EIS or any Record of Decision on the project, not "prior to the commencement of surface disturbing activities."
(Floyd J. Buckskin, Pit River Tribe)

AD.47 The preliminary archaeological survey appears to be superficial and haphazard, and the number of acres surveyed seem insufficient, particularly for significant areas such as Dry Lake where 300-400 acres of survey would be more appropriate. The only remedy for this would be a complete survey of the area before any decision to commit resources or grant any license, in order to know what would be impacted.
(Floyd J. Buckskin, Pit River Tribe)

AD.49 Again at 3-46 the EIS/EIR indicates that a sampling survey for the eight potential transmission line routes would be used to analyze the potential impacts of the proposed and alternate transmission line corridors. "After a specific transmission line corridor is chosen, Class III intensive surveys will be conducted prior to construction. These intensive pedestrian surveys will provide complete inventories of the cultural resources within the corridor...' This information needs to be developed in such a way that it can be included in the decision making process, not after a decision has already been made.
(Floyd J. Buckskin, Pit River Tribe)

AD.53 The methodology discussed at EIS/EIR 3-47 indicates that only 43.8 acres were covered by the preliminary survey for segment C1, and 44.3 acres for C2 Given the significance of the Dry Lake area, a more intensive survey is indicated. For those sections of the corridor outside the MLH, C1 and C2 contain extremely important areas. Archaeological site records should have indicated the levels of significance of those sites. *(Floyd J. Buckskin, Pit River Tribe)*

AG.36 Even the EIS/EIR's methodology is inadequate. Based on the sample survey and record search data, the EIS/EIR estimates the number of sites along the transmission line segments and finds that transmission line segments A and B have much lower densities of cultural resources than the C segments. (Id. at p. 4-53, Table 4.5-1, p. 4-54.) This estimate does not provide any information about the sites' relative content and value.

(Comments of Thomas Reid Associates, Ex. B, § 4.5.) Hence, it is impossible to determine which sites are more valuable and should be avoided. A more comprehensive survey should be completed so that the lead agency can evaluate and select the transmission line segments that would avoid valuable prehistoric and historic sites. (Ibid.)

As the comments of Thomas Reid Associates indicate, the lead agency should have required a comprehensive survey of the entire power plant area. (Ibid.) Because this site has been fixed geographically, unlike the transmission line segments, there is no reason why the EIS/EIR did not conduct a detailed survey rather than a sample survey sampling this area. Hence, the lead agency should fully evaluate this area. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.270 The Draft EIS/EIR includes Mitigation Measure 4.5.1a (p. 4-55) that calls for a survey of cultural resources prior to commencement of surface disturbing activities, but after approval of the proposed project. Transmission facilities are to be relocated if possible, to avoid historic and pre-historic sites, and if avoidance is not feasible, to evaluate sites that are listed or eligible for listing in the National Register of Historic Places. This deferral of survey until after the EIS/EIR process is completed is contrary to the purpose of an EIS which is to select an alternative that will minimize impacts to environmental resources.

Based on the sample survey and record search, the EIS/EIR analysis estimated the number of sites within the proposed and alternate transmission line corridors. However, this estimate is not a substitute for an actual survey because it provides no information on the relative content and value of the sites. A survey should be conducted to show the relative value of sites on each corridor, and how many sites could be feasibly avoided by flexibility in location of the facilities along each route, once that route was chosen. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Timing for and Adequacy of Transmission Line Surveys

The cultural resources in the project vicinity have been evaluated to understand the types of resources, the level of impact of the proposed project and alternatives, and to define mitigation measures to avoid or reduce the effect of the project on cultural resources. The proposed wellfield, power plant, and substation locations have been inventoried by qualified archaeologists (Origer 1994 and 1995; FWARG 1997 and 1998); resources in these areas would not be subject to significant effects.

Calpine has proposed the construction and operation of a 24-mile-long transmission line. The planning and environmental review process identified five alternative transmission line routes that would avoid or eliminate effects to cultural and other resources. Pedestrian cultural resource surveys of the six transmission line routes were not conducted prior to the preparation of the Draft EIS/EIR because only one route would be authorized if the project was approved. The six alternatives represent a total of more than 54 miles of potential transmission line route. The effort and expense associated with pedestrian surveys of this large an area is not warranted, given that a literature review and sample surveys conducted for the EIR provide sufficient information to determine whether significant impacts would occur.

The USFS is conducting the evaluation of the transmission line cultural resources in a phased approach. The first phase of the transmission line evaluation was to characterize the resources and analyze the effects to cultural resources for the EIS/EIR, in order to avoid unnecessary disturbance to cultural resource sites. Surveys and eligibility determinations can result in minor disturbance of sites during testing. Conducting these activities only after project approval would avoid effects to cultural resources.

The Class III pedestrian survey would be conducted along the preferred route if the project is approved. As described in Section 3.5, Cultural Resources, in the Draft EIS/EIR, the proposed and alternative transmission corridors were surveyed using a sampling survey methodology to assess impacts. Based on experience in the region,

the USFS and consultant archaeologists believe that the cultural resources along the proposed and alternative transmission line routes have been adequately characterized to allow the decision makers to make an informed decision about effects to cultural resources, and whether to approve or deny the proposed project, or to select a project alternative. The resources that would be affected by construction of one of the proposed or alternative transmission line routes have been described and characterized in the Draft EIS/EIR. The impact analysis was conducted through a program of literature review of previous studies for various USFS and other projects, with sample surveys conducted along the proposed and alternative transmission line routes. The estimated number of sites that would be affected by the proposed and alternate transmission line routes is defined in Table 4.5-1 in the Draft EIS/EIR.

The Class III cultural resources survey, evaluation, and determination of eligibility of cultural resources sites for listing on the NRHP would be conducted prior to the commencement of construction. Appropriate and proven mitigation methods are defined in the Draft EIS/EIR (Section 4.5, Cultural Resources) to avoid or reduce project impacts. The identified mitigation plans follow the guidelines of the various cultural resource protection laws, including the NHPA and the Archaeological Resources Protection Act (ARPA). The sites identified are considered adequate to define the type of mitigation program that would avoid or reduce adverse effects of the proposed project. The approach to mitigation is to first avoid impacts to cultural resources through rerouting the transmission line and adjusting pole and road placement. It is expected that most sites can be avoided, based on the typical size of the sites identified thus far.

The procedures for inventory, evaluation, and mitigation would be defined in a PA or MOA between the lead agencies, Calpine, and the State Historic Preservation Officer. The local tribes would also be consulted and invited to be a party to the agreement.

The PA or MOA would address inventory, evaluation, eligibility determination, and mitigation/data recovery efforts. This agreement would commit each of the parties to implement the requirements defined in the PA (or MOA) and the EIS/EIR. Survey and evaluation would be conducted prior to final line design. Mitigation and treatment of sites, if required, would be conducted prior to construction in areas that could be affected by the proposed project. Initial consultations with the SOHP have been conducted to confirm this approach.

The lead agencies' decisions will include consideration of all possible environmental effects and mitigation measures. The final selection of a route will be based on the information collected and surveys conducted to date. The lead agencies will be able to avoid important cultural resources sites with the planned surveys and mitigation programs. The lead agencies believe, based on studies conducted and interviews with tribal members, that Alternative 6 (which avoids Medicine Lake and the Tionesta/Timber Mountain area) would best avoid or reduce impacts, including cultural resource impacts.

Regarding comment AD.47, the importance of the Dry Lake area is acknowledged. The extent of the area to be surveyed will be determined by the transmission line route, the sites identified in the transmission line corridor, and the area of potential effect. A complete survey of the area that would be affected would be conducted prior to any construction in the area. Important resources are expected to be avoided by careful placement of transmission line poles and roads, and by adjusting the transmission line route to avoid important resources. If resources can not be avoided, appropriate data-recovery programs would be implemented, as described in the mitigation measures on pages 4-55 through 4-57 in the Draft EIS/EIR.

POTENTIAL IMPACTS AT THE POWER PLANT AND WELLFIELD AREA

Comments—Impacts to Historic Site P104H

AD.48 At 4-56 we read that 'it is recommended that no evaluation of the historic site identified at the wellfield and power plant site be undertaken, provided that the proponent's use of USFS Road 44N64 remains ordinary.' It is impossible from the information given to understand what is at stake here.

(Floyd J. Buckskin, Pit River Tribe)

AG.39 The EIS/EIR also proposes mitigation to protect cultural resources at the power plant site. Mitigation measure 4.5.1c recommends that the historic site in this area not be evaluated, "provided that the proponent's use of USFS Road 44N64 remains ordinary." (Id. at p. 4-56.) Because "ordinary use" is not defined, it is unclear what uses would not be ordinary and would trigger evaluation. Also, the mitigation measure does not state how an evaluation of the site would mitigate the Project's impacts.

Further, it appears that the proponent's use would be far from ordinary. Forest Road 44N64, which would provide the primary access road to the power plant and wellfield area, currently has a traffic volume of 10 to 20 trips per day. (Id. at pp. 3-171, 4-212.) During construction and decommissioning, the EIS/EIR estimates that over 200 trips per day would be conducted on Forest Road 44N64. (Id. at p. 4-212.) In fact, because the road cannot safely accommodate this traffic volume, the Project would have a significant impact on traffic conditions on the road. (Ibid.) Thus, because it is already apparent that the Project's use of Forest Road 44N64 would not be ordinary, the historic site should be evaluated and mitigation measures should be proposed that would reduce the Project's impacts on the site.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Impacts to Historic Site P104H

The historic site identified in the wellfield and power plant is thought to be a portion of the Long Bell Railroad system, part of which, as stated on page 3-53 of the Draft EIS/EIR, is currently being used as a Forest Service road. The portions noted within the project area no longer have sufficient integrity to be considered eligible for the NRHP. The terms "ordinary" and "ordinary use" (on page 4-56 of the Draft EIS/EIR) refer to general transportation-related roadway use (e.g., use by cars, motorcycles, and trucks) of Forest Road 44N64. "Ordinary use" is meant to exclude surface-disturbing or subsurface activities such as grading and excavation adjacent to the roadway. While the project proponent's use of the roadway may increase traffic over existing conditions, it would not have an adverse effect on the site, or affect the integrity of the site. The text of Mitigation Measure 4.5.1d in the Final EIS/EIR (which may be found on page 4-56 of the Draft EIS/EIR) has been clarified as follows:

> "In addition, it is recommended that no evaluation of the historic site identified at the wellfield and power plant site be undertaken, provided that the proponent's use of USFS Road 44N64 remains ~~ordinary~~as a roadway and does not involve any surface disturbing or subsurface activities, such as grading or excavation adjacent to the roadway."

Mitigation Measure 4.5.1d, which references the historic site, does not suggest

evaluation as mitigation. The project is expected to have no adverse effect on the site and the site is not considered eligible for the National Register; therefore, no evaluation or mitigation is defined for the site.

Comment—Impacts of the Freshwater Pipeline from Arnica Sink

AD.50 Also at 4-53, 'Placement of the freshwater pipeline is not expected to have any effects upon cultural resources in the area because of the lack of cultural resources located along the corridor.' It is hard to tell what is meant here. If the freshwater pipeline runs from Arnica Sink to the power plant site, this traverses some extremely sensitive areas, both culturally and ecologically, since it would be an intrusion into a Roadless Area. There are burial sites north of the Medicine Lake Lava Flow and sites throughout the fresh water line corridor, including gathering sites for traditional foods and medicines. Arnica Sink was identified as having a traditional hunting lodge on the northwest side. *(Floyd J. Buckskin, Pit River Tribe)*

Response—Impacts of the Freshwater Pipeline from Arnica Sink

As stated in the Draft EIS/EIR and quoted by the commentor, the freshwater pipeline is not anticipated to affect cultural resources along the pipeline route. This conclusion is based on research conducted by Origer in 1995, as stated on page 3-51 of the Draft EIS/EIR. No historic or prehistoric cultural resource sites were identified along the freshwater pipeline corridor.

The freshwater pipeline would be a temporary, hand-placed water pipeline that would be placed from the existing USFS groundwater well in the area of Arnica Sink to the wellfield area. As described in Section 2, Alternatives, Including the Proposed Action, of the Draft EIS/EIR (page 2-21), the pipeline would be placed on the ground surface generally parallel to Forest Road 49 on the north and east side to the intersection with the access road to the plant development and wellfield. The freshwater pipeline would be buried to cross beneath this portion of Forest Road 49, and would surface and parallel the access road on the north and east side of the wellfield.

No grading or excavation would be required for placing this pipeline, other than at the road crossing. Mitigation Measures 4.5.1f, 4.5.1g, and 4.5.1h specify actions that would be taken if buried cultural resources were identified during construction.

Figure 3.10-1 on page 3-139 of the Draft EIS/EIR displays the Roadless Area (Release Roadless Area or RRA) within the vicinity of the proposed project. As seen on this figure, the Mt. Hoffman RRA is closest (located to the north) to Arnica Sink. While the freshwater pipeline would generally parallel Forest Road 49 on the north side, it would be placed adjacent to the roadway and would avoid the Mt. Hoffman RRA located farther north of the Forest Road 49 (and the Arnica Sink area). Therefore, the freshwater pipeline would not affect any RRAs. No impacts to ecologically sensitive areas would be expected due to the careful hand-placement of the pipeline.

POTENTIAL IMPACTS ALONG THE TRANSMISSION LINE

Comments—Potential Transmission Line Impacts

AD.52 Under Alternatives in Section 4.5 (EIS/EIR at 4-57 and 4-58), Segments C2 and C1 contain significant archaeological features that have not yet been evaluated. Therefore statement that equate the two segments cannot be substantiated. *(Floyd J. Buckskin, Pit River Tribe)*

AD.54 The C2 area around Dry Lake is a very significant archaeological resource containing traditional Modoc hunting blinds, village sites and burial grounds. This is a very unique and complex cultural district. The

effects of transmission lines and substations would have an extremely significant adverse impact. Statements such as 'All of the impacts would be less than significant after mitigation" (EIS/EIR at 4-57) are unsupportable since evaluations have not been done and mitigation measures not been arrived at in consultation with the Tribes. National Register Bulletin 38 makes clear that standards for traditional cultural properties are to be arrived at in consultation with the Tribes. *(Floyd J. Buckskin, Pit River Tribe)*

AG.34 The analysis of Cultural Resources is inadequate because the EIS/EIR fails to provide adequate information regarding these resources. The Project area contains extensive archeological and historic resources. For example, a total of 91 cultural sites have been previously recorded within 0.25 miles of the transmission line segments. (EIS/EIR, p. 3-50.) Eight of these sites have been evaluated under the National Historic Preservation Act and are eligible for the National Register of Historic Places. (Ibid.) In addition, a "highly complex temporary camp" located along transmission line segment C1, which is both a prehistoric and historic site, is eligible for the NRHP "based on its prehistoric components." (Id. at p. 3-53.) Transmission line segments A2, B1, and C1 may be located adjacent to, or even cross prehistoric quarry zones. (Ibid.) Nonetheless, the EIS/EIR claims the Project's impact on cultural resources will be mitigated to insignificance. (EIS/EIR, Table S-5, p. S-14.) The EIS/EIR, however, fails to provide sufficient information regarding cultural resources and to adequately define measures that will mitigate the Project's impacts. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.35 A project may be deemed to have a significant impact on the environment if it disrupts or adversely affects a prehistoric or historic site or property of historic or cultural significance to a community or ethnic group. (CEQA Guidelines, App. G(j); 40 C.F.R. § 1508(9) (loss or destruction of cultural or historic resources).) The EIS/EIR acknowledges that destruction or "unauthorized collection of a significant unrecorded cultural resource would be considered a significant impact." (EIS/EIR, p. 4-54.) The EIS/EIR, however, fails to provide sufficient information about cultural resources to evaluate this impact. The EIS/EIR failed to fully evaluate potentially significant prehistoric and historic sites. It also failed to conduct an adequate sample survey or to provide information regarding the relative values of the areas surveyed.

For example, recorded areas along the transmission line corridors were not evaluated. The EIS/EIR acknowledges that the areas around the Glass Mountain flow and the Medicine Lake Highlands have not been thoroughly inventoried and remain poorly documented. (Id. at p. 3-53.) The transmission line segments may cross areas where four poorly documented prehistoric quarry zones are located. (Ibid.) Segment C1 crosses lithic scatters, but the EIS/EIR does not indicate whether these areas have been evaluated.

Also, the EIS/EIR did not evaluate areas in the wellfield and power plant site. For example, a prehistoric quarry was identified in that location, but has not been evaluated. (Id. at p. 3-51.) The area may also contain a portion of the Long Bell Railroad system, but the EIS/EIR determined that the site did not have sufficient integrity to make it worth a formal evaluation. (Id. at p. 3-53.) It seems that a preliminary assessment should have been conducted before making this determination.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Potential Transmission Line Impacts

Regarding comments AD.52 and AD.54, the commentor's discussion of the importance of sites that may be located along segment C2 is noted. Based on the sample survey conducted, segments C1 and C2 would have similar resources. There have been a number of studies of sites in the area of segments C1 and C2 conducted for various other projects, such as the PG&E/PGT pipeline and the Tuscarora pipeline. The cultural resource studies for these projects provide an understanding of the types and importance of sites along segments C1 and C2 that could be affected.

Comments AG.34 and AG.35 question the adequacy of the analysis of the effects to cultural resources. The cultural resources in the project vicinity have been evaluated to understand the level of impact of the proposed project and alternatives. The proposed wellfield, power plant, and substation locations have been inventoried by qualified archaeologists. As described in Section 3.5, Cultural Resources in the Draft EIS/EIR, the proposed and alternative transmission corridors were surveyed using a sampling survey methodology to assess impacts. A Class III inventory of the selected transmission line corridor would be conducted after a decision has been made on the project, and the applicant decides to implement the project.

The types of cultural resources that would be affected have been described and characterized in the Draft EIS/EIR. The effects of the project have been described and mitigation defined. The estimated number of sites that would be affected by the proposed and alternate transmission line routes is defined in Table 4.5-1 in the Draft EIS/EIR.

The survey, evaluation, and determination of eligibility of cultural resources sites for listing on the NRHP would be conducted prior to the commencement of construction. Eligible sites would either be avoided by the transmission line facility construction, or mitigation, such as the data-recovery programs described in the Draft EIS/EIR, would be conducted prior to construction in the site area.

The procedures for further inventory and evaluation would be defined in a PA or MOA between the lead agencies, Calpine, and the SOHP. The PA or MOA would address inventory, evaluation, eligibility determination, and mitigation/data recovery efforts. Mitigation would focus on adjustments to the transmission line route to avoid resources. This agreement would commit each of the parties to implement the requirements defined in the PA or MOA, and the EIS/EIR.

The Section 106 consultation process will be completed prior to the Record of Decision on the project. This process is being carried out by the USFS and BLM and includes tribal consultation (see Section 4.6, Traditional Cultural Values, of the Draft EIS/EIR).

The importance of the Dry Lake area is acknowledged. The alternative transmission line route was sited to avoid Dry Lake. The ethnographic study (Theodoratus et al. 1998) for the proposed project was designed to identify traditional cultural use sites and traditional cultural properties, as defined in Bulletin 38. The Section 106 process includes evaluation of sites that meet the criteria for designation as traditional cultural properties according to Bulletin 38. The USFS has evaluated the sites identified by the tribal members (and described in the Ethnographic Report) and evaluated each of the sites to determine if the sites meet the criteria to be considered as traditional cultural properties. The Draft EIS/EIR in Section 4.6, Traditional Cultural Values, describes the potential for effects to the traditional use sites identified by tribal members. Additional information regarding traditional use sites and their treatment can be found in Section 4.6 of the Draft EIS/EIR, and in the responses to comments in the Traditional Cultural Values Section.

In response to comment AG.34, implementation of Mitigation Measures 4.5.1a through 4.5.1j would reduce impacts to less-than-significant levels. Impacts would be reduced through avoidance, specified operating procedures, data recovery, flagging, and monitoring.

In response to comment AG.35, all recorded cultural resource sites that would be affected by the proposed project would be recorded, evaluated for eligibility for listing on the NRHP, and avoidance or data-recovery measures would be implemented to ensure that significant effects would not occur. Identified sites, the evaluation methods, the eligibility of sites for listing on the National Register, and appropriate mitigation measures will be reviewed with the local tribes and the SOHP, as well as the ACHP.

As stated above, the wellfield and power plant site have been surveyed and sites have been identified and described in Origer (1994 and 1995) and FWARG (1997). The conclusion that the portion of the Long Bell Railroad System does not have sufficient integrity to merit a formal evaluation was based on the examination of the resources on the ground by the archaeologists who conducted the survey and the Modoc Forest Archaeologist. As part of the Section 106 process, the conclusion will be reviewed with the SOHP, and the ACHP for concurrence.

MITIGATION MEASURES

Comments—Adequacy of Mitigation Measures

AG.38 The EIS/EIR fails as an informational document because it proposes vague and inadequate mitigation measures to alleviate the Project's impacts to cultural resources. In the absence of specific mitigation measures, neither the public nor the decisionmakers have any basis for determining whether significant impacts have been mitigated.

The EIS/EIR proposes mitigation to ensure that construction activities do not impinge on protected cultural resources. Mitigation measure 4.5.1c states that sensitive areas shall be intermittently monitored to ensure that sites are protected and avoided during construction. (EIS/EIR, p. 4-55.) First, it is unclear what constitutes a "sensitive area." This term should be defined. Second, it is unclear how often monitoring will be conducted. "Intermittent" is too vague to be provide any information as to whether the monitoring will be adequate. "Intermittent monitoring" should be defined and the lead agency should provide a monitoring schedule.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

HT.14 Relating to Indian Artifacts (Sec 4.6), if any are found, a 100′ distance will be kept free of drilling & construction. Will this be enough to protect Indian sites? *(Louise Thompson)*

PH5.15 Relating to Indian—I'm just taking four or five out of the fifteen or twenty that are listed in that book. Relating to Indian artifacts, section point—4.6, if any are found, a 100-feet distance will be kept free of drilling and construction. Will this be enough to affect—to protect the Indian sites?

(Medicine Lake Public Hearing)

Response—Adequacy of Mitigation Measures

The mitigation measures described in the Draft EIS/EIR are based on proven techniques designed to avoid or reduce impacts to the cultural resources in the project region. The first approach to mitigation would be to avoid impacts to identified resources through adjusting the location of facilities. The survey corridors and areas for biological and cultural resources studies were greater than the areas of potential effect. The study areas were defined to allow for flexibility in siting to avoid sensitive resources. The measures were developed based on experience with the cultural resources in the project region, previous evaluation and data-recovery programs, and guidance provided by the NHPA. The proposed mitigation measures are similar to those that have been approved and successfully implemented by resource agencies for other projects in the region. The defined mitigation measures provide specific actions to be taken to avoid or reduce the effects to cultural resources. The measures also include steps to take if previously unidentified resources are discovered during construction or excavation activities.

Both NEPA and CEQA provide for monitoring of mitigation measures to ensure implementation. The BLM, USFS, and Siskiyou County will enforce mitigation and be responsible for ensuring that the measures are implemented, and that the cultural resources are protected.

Mitigation Measure 4.5.1c, as it appears in the Draft EIS/EIR, is identified below (including a revision). The term "sensitive areas" in this mitigation measure refers to areas of identified cultural resources sites to be avoided.

To address comment AG.38, regarding the frequency of monitoring, the term "intermittent" refers to monitoring on a periodic basis. The mitigation measure has been revised to read as follows:

> "4.5.1c Avoid cultural resources wherever possible. To ensure that construction activities do not encroach on cultural resources slated for avoidance, sensitive areas shall be flagged prior to surface-disturbing activities, supervisory construction personnel shall be briefed on these locations (and the consequences of encroachment). And, the areas shall be ~~intermittently~~ monitored once every week during construction activities by a qualified archaeologist to ensure sites are protected/avoided."

In response to comment HT. 14, the project and USFS archaeologists agree that the 100-foot-buffer-zone distance would be adequate to protect cultural resource sites. The 100-foot distance was established for the prehistoric quarry identified on page 4-53 in Section 4.5, Cultural Resources of the Draft EIS/EIR.

The 100-foot buffer zone distance was prescribed for protection of archeological and historic sites only. The 100-foot buffer zone was not used in the analysis in Section 4.6, Traditional Cultural Values, as referenced by the commentor. All of the identified traditional sites are at least several-hundred feet from proposed activities (with the exception of the proposed transmission route that is close to Arnica Sink, although the site described to be located in Arnica Sink was not located in the field).

In response to Comment PH5.15, the 100-foot distance is used for the one identified prehistoric cultural resource site. The 100-foot buffer is considered adequate to protect the site. In the event that an unidentified archeological resource is discovered, the appropriate mitigation measures (see Mitigation Measures 4.5.1a through 4.5.1j) identified in Section 4.5, Cultural Resources, would be implemented to mitigate any potential impact during construction or surface-disturbing activities.

Comments—Feasibility of Mitigation Measures

AG.40 As the letter from Thomas Reid Associates indicates, mitigation measure 4.5.1a is impractical and infeasible. (Id. at p. 4-55; Ex. B, § 4.5.) This measure calls for the evaluation of sites that cannot be avoided. Because the evaluation process is so lengthy and expensive, the mitigation measure would delay the project indefinitely. A more feasible mitigation measure is to avoid the sites by surveying the alternative transmission line routes "so that avoidance can be factored into the selection and design of a preferred route." (Ex. B, § 4.5.)

Absent adequate and clearly defined mitigation measures, the lead agency has no basis for concluding that the Project will not have a significant impact on cultural resources.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.271 Since there are so many sites potentially affected along any of the routes (i.e. 57 to 67 sites), the provision in Mitigation Measure 4.5.1a to evaluate sites which cannot be avoided prior to construction is probably impractical. The evaluation, retrieval, and archival of cultural resources is subject to a detailed protocol under the National Historic Preservation Act (Sections 106 and 110). This protocol is a multi-step process involving survey, characterization of resource value and impacts, and extensive consultation with the State Historic Preservation Office and the Advisory Council on Historic Preservation (ACHP), as well as the Native Americans. The process for so many sites would be so lengthy and expensive that it could delay the project indefinitely. This process could not be accomplished at the preconstruction stage. Therefore, this mitigation measure is unrealistic and likely would not be effective from a practical standpoint.

The only alternative to compliance with the NHPA evaluation process is complete avoidance of impact to the sites. Therefore, the alternative routes should be surveyed prior to EIS/EIR completion so that avoidance can be factored into the selection and design of a preferred route.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Feasibility of Mitigation Measures

Mitigation Measure 4.5.1a states that a survey be conducted prior to ground-disturbing activities for the project to ensure that no unidentified cultural resource sites within the selected transmission line route are affected by construction or maintenance activities. Mitigation Measure 4.5.1c provides for flagging of cultural resource sites that are avoided to ensure impacts to the sites do not occur.

Mitigation Measures 4.5.1a and 4.5.1 are practical, feasible, and have been successfully implemented in other projects in the region. Avoidance of cultural resource sites would be the first priority of the agencies and Calpine. The final design of the transmission line would be accomplished after the cultural resources survey was conducted and the sites were evaluated. As described above, the study corridor for the proposed and alternative transmission line routes was designed to allow the route to be moved to avoid sensitive cultural or biological resources. The agencies will comply with the NHPA evaluation process, and are not seeking or suggesting an alternative to compliance.

The agencies and Calpine understand the survey, evaluation and data-recovery processes, and understand the cost and time required to implement the programs. The PA or MOA (described above) that will be developed for the project will clearly identify the steps of the process, and will streamline the consultation process with the agencies. This process has been successfully implemented on several projects in the past on USFS and BLM lands.

The process is feasible and can be implemented in the preconstruction phase of the project, due to the phasing of Calpine's project. The proposed project would not be implemented until Calpine has conducted its exploration program and identified a commercial geothermal resource. The transmission line would not be constructed until after Calpine has conducted the exploratory drilling. Adequate time would be available in the project preconstruction phase to conduct the transmission line cultural resource survey, identify sites that require evaluation, determine eligibility of the site for the National Register, and reroute the transmission line to avoid the site or implement a data-recovery program.

Comment—Deferral of Mitigation Measures

AG.41 The EIS/EIR also improperly postpones development of mitigation measures. (Sundstrom, 202 Cal.App.3d at pp. 306-08; Oro Fino Gold Mining Corp. v. County of El Dorado (1990) 225 Cal.App.3d 872, 885.) Without a reasonably complete discussion of possible mitigation measures, neither the decisionmakers nor the public can properly evaluate the severity of adverse environmental effects or the adequacy of mitigation. (Robertson, 490 U.S. at pp. 351-52.)

Deferred mitigation also violates CEQA's express mandate regarding mitigation of archaeological resources impacts. California Pub. Res. Code § 21083.2 establishes standards for determining whether a project may have a significant impact on archaeological resources, and prescribes specific methods for mitigating such impacts. (See also CEQA Guidelines, App. K.) Section 21083.2 indicates that plans for mitigation of impacts to known archaeological sites must be developed before the project is approved.

The EIS/EIR acknowledges that Project activities along transmission line segment C may require mitigation measures. (EIS/EIR, p. 4-53.) Nonetheless, the EIS/EIR states that potential mitigation along

the transmission lines will be determined by an archeologist or cultural resource specialist and could include data recovery. (Id. at p. 4-54.) Specifically, mitigation measure 4.5.1a provides for surveys after the Project has been approved. (Id. at p. 4-55; Ex. B, § 4.5.) These surveys, however, are necessary to an understanding of the Project's impacts and potential mitigation. Thus, they should have been conducted prior to EIS/EIR's preparation and discussed in the EIS/EIR.

Without surveys and more information regarding the surveys and purported mitigation measures, the public and decisionmakers cannot evaluate the measures' utility in mitigating the Project's impacts. Additionally, without surveys, the lead agency cannot determine alternative routes that may avoid impacts to cultural resources. Absent this information and adequate mitigation measures, the lead agency does not have a sufficient basis to find that the Project would have an insignificant impact on cultural resources. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

Response—Deferral of Mitigation Measures

Development of mitigation for cultural resources is not deferred. Mitigation measures for the project were developed and are described in sections 4.5 and 4.6 of the Draft EIS/EIR. The key elements of the defined mitigation would consist of:

(1) Avoidance of cultural resources sites identified in project-related surveys and previous surveys

(2) Flagging and monitoring of avoided sites

(3) Evaluation and data recovery at sites that can not be avoided

(4) Halting of construction in the immediate vicinity if subsurface cultural resources are identified during construction

The steps to be conducted to avoid or mitigate potential effects to cultural resources are clearly defined in Mitigation Measures 4.5.1a through 4.5.1j.

As described above, the surveys of the power plant and wellfield areas, and the sample surveys of the transmission line routes are adequate to characterize the project's potential effects on cultural resources and the effectiveness of the proposed mitigation. The surveys conducted for the proposed project, the results of the survey, and mitigation measures are described in the Draft EIS/EIR in Section 4.5, Cultural Resources. The lead agencies have evaluated the environmental effects of five alternative transmission line routes that were designed to avoid or reduce the effects to cultural resources. The rerouting of the transmission line to avoid identified sites (if required) would not be considered "alternative routes" but merely minor alterations in the route within the studied transmission line corridor.

Based on the results of the survey of approximately 300 acres and the identification of sites in project-related and other studies (as described in the EIS/EIR and supporting technical documents), the lead agencies have concluded that adequate mitigation is available to reduce impacts to levels below significance, as outlined in the significance criteria identified in Section 4.5 of the Draft EIS/EIR.

Comment—Need for Cultural and Historic Management Plan

AD.27 Given the extent of cultural resources in the Medicine Lake Highlands and the Timber Mountain area, a cultural and historic management plan needs to be done, as indicated by Section 110 of the National Historic Preservation Act. *(Floyd J. Buckskin, Pit River Tribe)*

Response—Need for Cultural and Historic Management Plan

The agencies acknowledge the importance and the extent of cultural resources in the Medicine Lake Highlands and the Timber Mountain areas. However, a cultural and historic management plan is not required to be prepared under Section 110 of the NHPA. The act establishes the responsibilities of Federal agencies in relation to historic properties. The agencies are obligated to establish preservation programs for the identification, evaluation, and nomination to the NRHP, but they are not required to prepare a historic or cultural resources management plan.

The agencies have taken a comprehensive and regional approach to the identification, evaluation, and protection of cultural resources through the NEPA/CEQA process, the NHPA Section 106 process, and through compliance with the various other cultural resource protection laws. The studies that have been conducted to date (Origer 1994 and 1995; FWARG 1997 and 1998; Theodoratus et al. 1998), this EIS/EIR, and the PA or MOA that will be developed through the Section 106 compliance process all detail the agencies' preservation program for the proposed project.

3.7 Traditional Cultural Values

INTRODUCTION

This section provides responses to comments on traditional cultural values issues. The comments and responses are grouped under the following headings:

- General
- Importance of the Project Region
- Regulatory Compliance
- Impacts
- Mitigation Measures
- Ethnographic Report

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

GENERAL

Comments—Commentor Support for Tribal Comments

GK.2 As the duly elected representative of the Atwamsini Band, we support and endorse the comments developed by the Tribal Cultural Resources Representative, comments submitted in behalf of the Tribe by Floyd Buckskin. *(Mary and Wallace Preston)*

HF.9 Pages S-3 and S4: As a professor of religious studies, I regularly teach about issues of American Indian religion and spirituality and conflicts with white land-use projects. While I do not presume to speak for the tribal members who have voiced their own concerns about the project, I fully endorse the concerns they raise for how this project would disrupt their traditional religious practices. *(Daniel T. Spencer, Ph. D.)*

Response—Commentor Support for Tribal Comments

The support for tribal comments is noted. Responses to tribal comments are provided primarily in this section and in the Cultural Resources Section. The reader is referred to the Comment Index to identify the commentors who represent the tribes (e.g., letter AD was submitted by Floyd Buckskin on behalf of the Pit River Tribe, and letter R was submitted by Dino Herrera on behalf of The Klamath Tribes), and to identify the location of responses to tribal comments.

Comments—Project Opposition

N.11 13. The proposed project is considered by local tribes of Native Americans to have a significant adverse effect on Medicine Lake Highlands. The Medicine Lakes Highland is a Native American sacred area of worship and is considered higher in priority of worship than Mt. Shasta. The proposed project would conflict with established religious use of the Medicine Lake Highlands and would introduce adverse visual and audible impacts that are totally out of character with the use of the area for established religious uses and activities. The proposed project would invade and interfere with religious practices of Native American tribes.

The DEIS/EIR considers the effects at significant. However, the DEIS/EIR claims that the levels of significance after mitigation is "unavoidable". It is clear to avoid the significant impacts to established religious uses and activities in the Medicine Lake Highlands are that the No Project Alternative should be selected by the U.S. Forest Service. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

P.2 The Kalapooya Sacred Circle Alliance is vehemently opposed to any further drilling or development activity at Glass Mountain due to the irreparable and unjustifiable harm that will be imposed on a well-established sacred site. The Abstract for this report indicates that even "...after mitigation, significant impacts would remain for potential conflicts with American Indian uses and values, visual effects near Medicine Lake...the potential for long-term significant and unavoidable American Indian impacts would exist under all alternatives." This project can not proceed without jeopardizing the sovereign and constitutional rights of local indigenous peoples. *(Carol Logan, Kalapooya Sacred Circle Alliance)*

P.6 I look forward to learning about the termination of this project and receiving confirmation of this event as soon as possible. It has been well-established by traditionalists, tribes and comments received by your agency as well as documentation in the Draft EIS/EIR that this proposed development will have significant, irreparable and unjustifiable impacts on a site that is held sacred by many indigenous peoples of the Northwest. *(Carol Logan, Kalapooya Sacred Circle Alliance)*

AB.2 The Native Coalition represents a broad constituency of Native American tribes and individual traditional people who are concerned about cultural values on Mount Shasta and surrounding areas. Participants in the Native Coalition include the Pit River Tribe, Shasta Nation, Resighini Rancheria, Local Indians for Education, the Intertribal Council of California, the California Council of Tribal Governments, and Save Mount Shasta. Native Coalition meetings are attended by traditional people of the Shasta, Pit River, Wintu, Karuk, Modoc, Paiute, and Wiyott Tribes, as well as individuals from the Lakota, Cherokee, Hopi, and other tribes.

We support the Pit River, Modoc/Klamath and Shasta Tribes in their opposition to these developments which would have devastating impacts on the sacred character of the whole Medicine Lake Highlands; on many individual sites and cultural resources; on the water quality of Medicine Lake and the many springs, creeks and rivers that have their sources in the Highlands; on the animals, their habitats and migration routes; on the trees and plants; on the visual and air quality; and on the peace and natural beauty of the area. *(Michelle Berditschevsky, Native Coalition for Cultural Restoration of Mount Shasta)*

AC.4 I support alternative forms of energy as a good start to sustaining the earth's precious resources, at the same time I am AGAINST anything that violates and stops peoples' abilities to practice religious and spiritual practices.

Regardless of the advantages of this project—it is wrong to destroy Sacred Places!!
(Tim McKay, North Coast Environmental Center)

AR.6 There will be a disproportionate effect on low income and minority people. For 350 years, the White Man has murdered Native Americans, stolen their lands, denied them their freedom, culture, language and religion. It is disappointing to see that the Federal Government is still at it. There is no area on the Medicine Lake Highlands that the geothermal projects won't adversely impact Native American religious sites. The only way to avoid this is Alternative 7. *(Marcia Barrow)*

AY.3 The land is sacred to the Pit, Klamath, Modoc, and Shasta Tribes of American Indians. Many ceremonial sites are located on this property. *(Theresa Brady)*

CO.1 I feel that personally myself if the good Lord wanted these so called geothermal power plants he would of put one there in the beginning of time. I don't understand how your people can come in anytime they want, any place they want, with authority or they think so anyhow and destroy our sacred lands, be it as it may, whatever our people use it for it is ours, not for you to come in tear up and destroy. It may not mean nothing to you, because evidently you don't have no values or no respect for what is to be left alone. This place is so far smog free. So don't bring something that would destroy it. It's beautiful because the Indian people respect it and loved it and take care of it. It goes to show you will do anything for a little money that folds huh! A concerned Pit River Tribal Member. *(Linda Gonzaleze)*

DJ.1 I oppose of any changes of the Medicine Lake of northern California. Because of ceremonial sites of Pit, Klamath, Modoc, and Shasta tribes past and present.

I'm a full blooded Modoc and a decented of Boston, Bague, and Scar Face Charley.

I feel anything that has to do with our tribal ceremonial sites should be left alone because of sacred things and land of the Native American Indians. *(Calvin Hutchinson)*

DP.2 Also this area is considered sacred by several tribes of Native Americans who still practice their religious rites in this area. *(DelMar Janson)*

DX.2 Our opposition is based on the environmental harm that will result and the fact that this area has religious and cultural significance for Native Americans. *(Nancy B. Kenyon)*

GE.2 I am Native American, and my family has resided in the Macdoel area for over seventy-five years. I believe that the USFS, BLM, and the United States Government are obligated to protect the rights and culture of Native Americans. The Fourmile Hill Geothermal Project is clearly a step in the wrong direction. At one time, Glass Mountain was utilized by all tribes in Northern California for the collection of obsidian, used in the making of arrowheads. It was considered a neutral zone, where fighting did not occur. It was also the site of Native American ceremonies. The USFS, BLM, and U.S. Government do not have the right to destroy or disrupt Native heritage and culture. Please show us the respect that you would ask for your people and the protection of their rights. *(Sami Jo Pohlman)*

GR.4 I support alternative forms of energy as a good start to sustaining the earth's precious resources, at the same time I am AGAINST anything that violates and stops peoples' abilities to practice religious and spiritual practices. *(Manfee Patricia Rohde)*

GU.2 The land involved is sacred to our people. There are ceremonial sites there that have been used since the beginning. This is not an area that should ever be violated. *(Dr. Robin L. Schaeffer)*

IP.3 Our ancesters walked the Mother Earth, it is our heritage. What more do you want to take from us? Leave our land in its natural state. Don't disturb our ancestors. They still live there on these grounds. Again, do not disturb our land for your gain. *(Joyce Wilson)*

Response—Project Opposition

The opposition to the project and the desire to protect the region is acknowledged. The lead agencies for the project are consulting with local tribes to ensure compliance with Federal laws to protect Native American heritage and culture. The impacts of the project identified in the comments are addressed in the Draft EIS/EIR in Section 4.6, Traditional Cultural Values, and 4.16, Socioeconomics (effects on minority and low-income populations), and 4.17, Cumulative Impacts.

IMPORTANCE OF THE PROJECT REGION

Comments—Sanctity of the Project Region

L.4 This area is also sacred to four native tribes in the region, the Pit, Klamath, Modoc and Shasta Tribes. Powerplants feeding off the geothermal resources that are the basis of the Highlands' sanctity would be a sacrilege. *(Steve Tabor, Desert Survivors)*

AC.2 This area has been and still is SACRED to the Pit River, Klamath, Modoc, and Shasta tribes for many centuries. *(Tim McKay, North Coast Environmental Center)*

AD.3 The significance of the Medicine Lake Highlands is greater and goes much beyond what has been expressed in the Ethnographic Report. What goes unexpressed is its meaning as a place of refuge, not only for spiritual purposes, but also refuge in times of disaster and persecution, as in the 1850's when the Pit River People were rounded up by the government. Everything we need for our well-being exists in the Medicine Lake Highlands. All of our needs were supplied in the way of food through plants and animals, medicines, clean water, materials for: tools and trade, as well as the awe-inspiring beauty which only testifies to the greatness of our Creator and our ability to express and communicate our enjoyment of all these gifts to the Creator.

All of this has been severely impacted everywhere through activities of the government and its agencies. The Medicine Lake Highlands still retains much of that original abundance, as evidenced by cultural features located within the Highlands. *(Floyd J. Buckskin, Pit River Tribe)*

AP.2 It also contains several sacred Native American sites. *(Ashalyn)*

AV.3 Additionally, the area is of cultural import to numerous Native American tribes. *(David A. Bish)*

BF.2 Aside from my own experience, the Medicine Lake area is considered sacred ground to its native inhabitants. I believe that this is reason enough to be preserved. Native Americans have had most of their sacred homes taken from them. *(JoAnne Cedar)*

CT.1 The threat to allow geothermal power companies to construct a power plant in the Medicine Lake Highlands is of great concern to me. This area is important to many native American Tribes as a sacred area. *(Sylvia Gregory)*

DM.2 The area has religious and cultural significance for members of the Modoc Tribe. *(Jerald Jackson)*

EZ.2 It has been a spiritual place for Indians as far back as our family remembers. We have been here since before the turn of the century. *(Joan McDermos and Family)*

FJ.3 Native Americans in this area as in other areas through this country, have felt that the land and the creatures particularly in such a vibrantly alive place as this, are sacred. *(Carolyn J. Mosher)*

GR.2 This area has been and still is SACRED to the Pit River, Klamath, Modoc and Shasta tribes for many centuries. *(Manfee Patricia Rohde)*

PH4.14 Concerned about effects to American Indians and spiritual area. *(Mount Shasta Public Hearing)*

Response—Sanctity of the Project Region

The comments regarding the spiritual and sacred nature of the region are acknowledged. The value of the Medicine Lake Highlands, Timber Mountain, and the sites identified by tribal members is acknowledged in the EIS/EIR Section 3.6 and 4.6, Traditional Cultural Values, and in the Ethnographic Report prepared for the project (Theodoratus et al. 1998). Mitigation measures and project alternatives have been

defined to reduce effects and to avoid the Medicine Lake area. The lead agencies are continuing to consult with the tribes regarding the proposed project.

The religious and cultural significance of the area for members of the Modoc Tribe, as stated in comment DM.2, is acknowledged. For the purposes of the Final EIS/EIR, references to The Klamath Tribes is intended to include the concerns of the Modoc Tribe. "Klamath Tribes" replaces "Klamath/Modoc Tribes" used in the Draft EIS/EIR. This change is made at the direction of the Klamath Tribes.

Comments—Importance of Medicine Lake

DI.8 6. Several Native American tribes consider Medicine Lake to be sacred ground. They have suffered enough under the domination of the United States government and its people. It is unconscionable to rob them of what little ceremonial ground they have left! *(Ana Holub and Richard Lucas)*

DL.2 Medicine Lake is our Sacred Grounds we've used her for our own personal healing, to cleanse our body, mind, and spirits for a long time.

It's just like maybe when "you" go to church. You feel good about life.

Remember everything here is for a Purpose. *(Charlene Jackson)*

DO.2 Please don't ruin Medicine Lake. It means a lot to us when we go and pray there. *(Tony Jackson)*

DV.4 Medicine Lake has a long historic Native American heritage—hence, the name. Our local tribes have lost enough already to the white man's greed and insensitivity. Let this area alone and do not consider it for any other commercial purpose. *(Marilee Jordan)*

DZ.4 The forest service employees seem to forget that all of "us" own that lake and land and it has a great lot of history for the Native Americans that will be destroyed. *(Bill and Bette Kinyon)*

PH4.15 Concerned about effects on integrity of the Medicine Lake Highlands. *(Mount Shasta Public Hearing)*

Response—Importance of Medicine Lake

The importance of Medicine Lake is noted. The proposed project is not expected to have a significant effect on Medicine Lake. Alternatives 1, 2, 3, and 4 would have the greatest effect on the Medicine Lake area through the construction of the proposed transmission line, and the alternative line routes defined in Alternatives 3 and 4. Alternative 6, the agencies' preferred alternative, and Alternative 5 would avoid the Medicine Lake area.

Comments—Importance of the Glass Mountain Area

P.4 This Glass Mountain area is considered sacred by many local indigenous peoples who pre-historically, historically and currently utilize and view the area as culturally and spiritually significant. *(Carol Logan, Kalapooya Sacred Circle Alliance)*

P.7 In the interest of preserving non-renewable, priceless, culturally significant resources and values, it is recommended that the USFS and BLM proceed with their obligations under federal law to ensure that the Glass Mountain area be removed as a KGRA and listed on the National Historic Register. In this way Glass Mountain will be permanently protected from degradation by resource extraction activities and preserved for its over-arching and intrinsic spiritual values. Thank you. *(Carol Logan, Kalapooya Sacred Circle Alliance)*

Response—Importance of the Glass Mountain Area

The importance of the Glass Mountain area to indigenous peoples, and the request to remove the area from the KGRA and list the property on the National Register of Historic Places (NRHP) is noted. The proposed project would not have a direct effect on Glass Mountain, which is identified by the USFS as a Geologic Special Interest Area. All of the alternatives would avoid the Glass Mountain area.

REGULATORY COMPLIANCE

Comments—Regulatory Compliance

O.21 The Medicine Lake Highlands are used for cultural practices by the Pitt River bands, the Modoc and the Klamath tribes. The LRMP states that access and use must be protected for Native American religious and cultural locations consistent with the American Indian Religious Freedom Act of 1978. It is not acceptable that possible unknown prehistoric and historic resources will be disturbed as a result of construction (EIS, 4-54). The EIS concedes that significant disturbances will occur (4-53), yet Section 106 of the American Indian Religious Freedom Act states that Federal Agencies shall protect and preserve the rights for Native Americans to freedom of cultural and religious practices through ceremonies and traditional rights (EIS, 4-59, 4-60). The resources such as Medicine Lake and the views from Mount Hoffman, in the Medicine Lake Highlands, are utilized in religious and cultural ceremonies. Disturbances from construction and subsequent alterations of the landscape will diminish their cultural and religious resources. *(Katherine Kowatch, Friends of the River)*

Y.41 We believe that the Native American historic and cultural resources that have come to light as a result of the scoping for this project should lead to a re-evaluation of the management prescriptions for the Medicine Lake Highlands and the Timber Mountain/Dry Lake area, Management Areas 61, 62 and 63. Particularly in light of the Memorandum of Understanding between the U.S. Department of Agriculture, Forest Service and the Advisory Council on Historic Preservation dated February 25, 1977. At the very least, these areas should be evaluated for eligibility to the National Register of Historic Places and for adverse effects through the NHPA Section 106 Process and the Region 5 Forest Service Programmatic Agreement.

Furthermore, any amendment or revision to the Forest Plan that would affect traditional cultural resources and properties potentially eligible to the National Register are subject to the Memorandum of Understanding of February 25, 1977 between the U.S. Department of Agriculture, Forest Service and the Advisory Council on Historic Preservation. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AB.7 We invoke the US Government's Trust Responsibility to the Indian Peoples of this land, the Executive Order on Indian Sacred Sites, the Executive Order on Environmental Justice, the American Indian Freedom of Religion Act, the National Historic Preservation Act, and National Register Bulletin 38 on Traditional Cultural Properties. The environmental document you have prepared states that impacts to Native American cultural values will be significant and adverse. Geothermal development is incompatible with existing long-standing spiritual and cultural uses of the area and its natural resources. The government itself according to its own laws must not permit this development.

The Medicine Lake Highlands are a traditional haven to Native American People and have been used as religious, ceremonial, and gathering grounds for thousands of years. They are highly significant to the cultural continuity of the Tribes of Northern California and Southern Oregon.
(Michelle Berditschevsky, Native Coalition for Cultural Restoration of Mount Shasta)

AD.16 The Department of the Interior Implementation of Executive Order 13007 on Indian Sacred Sites (512 DM 3) outlines the following objectives:

to accommodate the right of American Indians and Alaska Natives in the free exercise of religion by ensuring access to and ceremonial use of Indian Sacred Sites;

to avoid adversely affecting the physical integrity of such Sacred Sites; and

to consult with American Indian and Alaska Native Tribes on a government-to-government basis whenever the Department has reason to believe that its plans, activities, decisions, or proposed actions may compromise the physical integrity of, or access to Sacred Sites. *(Floyd J. Buckskin, Pit River Tribe)*

AD.17 The July 29, 1997 Draft Guidance for Considering Environmental Justice under the National Environmental Policy Ad issues by the Council on Environmental Quality (CEQ Guidance) states:

Environmental justice issues may arise at any step of the NEPA process and agencies should consider these issues at each and every step of the process, as appropriate. Environmental justice issues encompass a broad range of impacts covered by NEPA, including impacts on the natural or physical environment and interrelated social, cultural, and economic effects. (CEQ Guidance at 5 and 6)
(Floyd J. Buckskin, Pit River Tribe)

AD.18 The American Indian Freedom of Religion Act, the National Historic Preservation Act, and National Register Bulletin 38 on Traditional Cultural Properties also give mandates and guidance for the involvement of Tribes in the process. *(Floyd J. Buckskin, Pit River Tribe)*

AD.19 The Forest Service needs to consult its own Forest Service Manual (FSM) 2360 on Cultural Resources and the Memorandum of Understanding between U.S. Department of Agriculture, Forest Service and the Advisory Council on Historic Preservation signed February 25, 1977. This MOU is found in FSM 2360, along with Coordinating Requirements for Undertakings. The Coordinating Requirements call for "Abandon undertaking" (FSM 2361.31) if adverse effects on cultural resources cannot be mitigated.
(Floyd J. Buckskin, Pit River Tribe)

AE.6 We invoke the US Government's Trust Responsibility to the Indian Peoples of this land, the Executive Order on Indian Sacred Sites, the Executive Order on Environmental Justice, the American Indian Freedom of Religion Act, the National Historic Preservation Act, and National Register Bulletin 38 on Traditional Cultural Properties. The environmental document you have prepared states that impacts to Native American cultural values will be significant and adverse. Geothermal development is incompatible with existing long-standing spiritual and cultural uses of the area and its national resources. The government itself according to its own laws must not permit this development .

The Medicine Lake Highlands are a traditional haven to Native American People and have been used as religious, ceremonial, and gathering grounds for thousands of years. They are highly significant to the cultural continuity of the Tribes of Northern California and Southern Oregon.

(Arnold Wilkes, Vice-Chairman, Pit River Tribe)

CN.4 We invoke the US Government's Trust Responsibility to the Indian Peoples of this land, the Executive Order on Indian Sacred Sites, the Executive Order on Environmental Justice, the American Indian Freedom of Religion Act, the National Historic Preservation Act, and National Register Bulletin 38 on Traditional Cultural Properties. The environmental document you have prepared states that impacts to Native American Cultural values will be significant and adverse. Geothermal development is incompatible with existing long-standing spiritual and cultural uses of the area and its natural resources. The government itself according to its own laws must not permit this development.

The Medicine Lake Highlands are a traditional haven to Native American People and have been used as religious, ceremonial, and gathering grounds for thousands of years. They are highly significant to the cultural continuity of the Tribes in Northern California and Southern Oregon. *(Gloria Gomes)*

DQ.4 We invoke the US Government's Trust Responsibility to the Indian Peoples of this land, the Executive Order on Indian Sacred Sites, the Executive Order on Environmental Justice, the American Indian Freedom of Religion Act, the National Historic Presentation Act, and National Register Bulletin 38 on Traditional Cultural Properties. The environmental document you have prepared states that impacts to Native American cultural values will be significant and adverse. Geothermal development is incompatible with existing long-standing spiritual and cultural uses of the area and its natural resources. The government itself according to its own laws must not permit this development.

The Medicine Lake Highlands are a traditional haven to Native American people and have been used as religious, ceremonial, and gathering grounds for thousands of years. They are highly significant to the cultural continuity of the Tribes in Northern California and Southern Oregon. *(Jessica E. Jim)*

IB.3 Most upsetting of all is to learn that in 1997 the USFS would advocate such a blatant disregard for the rights of Native Americans. It appears that the ghost of Custer has arisen in the offices of the Modoc National Forest. Will the Medicine Lake Highlands become the Black Hills of the twentieth century? Do you remember what happened with G-O Road? Shame on all of you. *(Wayne Verrill)*

Response—Regulatory Compliance

Comment O.21 expresses concern that possible unknown prehistoric and historic resources may be disturbed as a result of construction. Mitigation Measures 4.5.1f, 4.5.1g, and 4.5.1h in the Draft EIS/EIR outline measures that would be taken if previously unknown resources are identified during construction. The measures would include temporarily halting construction in the area, evaluation of the resources, and mitigation if necessary; the measures would avoid significant effects to buried or unknown resources.

Comment O.21 also asserts that project effects would be contrary to the direction provided in the American Indian Religious Freedom Act (AIRFA) (Public Law 95-341). The Act states:

> "[h]enceforth it shall be the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites."

As described in Section 4.6, Traditional Cultural Values (Impacts 4.6.4, and 4.6.5), the proposed project would not limit access to sites or remove the freedom to worship in the project area.

According to studies conducted by hydrologists analyzing the effects of the proposed project, the project would not have significant hydrologic effects on Medicine Lake. The effects on Medicine Lake are addressed in the Draft EIS/EIR Section 4.4, Hydrology, and the responses to comments in the Hydrology Section. The agencies' preferred alternative would avoid the Medicine Lake area. The effects of the project on views from Mt. Hoffman and other identified traditional-use sites are addressed in the Draft EIS/EIR in Section 4.6, Traditional Cultural Values, and in Section 4.9, Visual Quality. See also responses to "Comments—Effects on Landscape Views" in this section.

Comment AB.7 asserts that the laws cited would not permit this development. None of the laws cited prohibit the proposed development.

U.S. Government Trust Responsibility to the Indian Peoples: Federal courts recognize the undisputed existence of a general trust relationship between the United States and the Indian peoples. The trust relationship developed from court decisions which recognized a distinctive obligation of trust incumbent upon the Government in its dealings with Indian tribes, which it considered domestic dependent sovereigns. The Government's trust responsibilities may be found in treaties, statutes, executive orders, and court opinions. The Government's trust responsibility encompasses a moral obligation of the highest responsibility and trust to be judged by the most exacting fiduciary standards.

Any Federal government action is subject to the United States' fiduciary responsibilities toward the Indian tribes. Because this general obligation is rather vague, Congress and the Executive direct specific trust duties to agencies through statutes or executive orders. In the case of the proposed action or its alternatives, there is no specific statutory duty under a treaty directing the agencies to manage an Indian resource on behalf of a particular group of Indians. Consequently, the agencies have met their trust responsibilities by their fulfillment of the statutes, regulations, and orders triggered by the proposed action.

This project does not occur on Indian lands. Sacred sites located on public lands are not trust assets. Indian trust assets are property, or legal interests in property, held in trust by the United States for the benefit of Indian tribes or individuals. The United States as trustee is responsible to protect and maintain rights reserved or granted to Indian tribes or Indian individuals in treaties, statutes, and executive orders. No treaties or statutes have created sacred site trust obligations on public lands, and the sacred site Executive Order 13007 explicitly states that it does not establish or "create any right, benefit, or trust responsibility" regarding access to or management of sacred sites. (EMS 7/24/98, Information Bulletin No. 98-162, BLM, Washington, D.C.)

Executive Order 13007 — Indian Sacred Sites: Executive Order 13007 (1996) states:

> "In managing Federal lands, each executive branch agency with statutory or administrative responsibility for the management of Federal lands shall, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, (1) accommodate access to and ceremonial use of Indian sacred

> sites by Indian religious practitioners and (2) avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, the agencies shall maintain the confidentiality of sacred sites."

Sacred sites are defined in the act:

> "Sacred site" means any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion, provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site."

The proposed project would not prevent access to or ceremonial use of Indian sacred sites by Indian religious practitioners. The proposed project and the alternatives would not result in physical disturbance in any of the identified traditional-use sites or sacred sites identified in the ethnographic study. The views from certain sites would be affected by project facilities. Project activities may also be audible at some of the sites. These adverse effects would be mitigated to some extent by the mitigation measures defined in the EIS/EIR in Section 4.9, Visual Resources, and Section 4.14, Noise.

Under Procedures, the Executive Order states that the agencies should:

> "[e]nsure reasonable notice is provided of proposed actions or land management policies that may restrict future access to or ceremonial use of, or adversely affect the physical integrity of, sacred site."

The lead agencies have conducted 15 meetings with the tribes to date regarding the effects of the proposed project. The tribes received advance notice of the project (prior to public notification) through meetings and mailings. The tribes were also provided copies of the Ethnographic Report and American Indian Consultation Report for the project, and advance copies of the Draft EIS/EIR. Consultations with the tribes are described in:

- The Draft and Final EIS/EIR, Section 1.7, American Indian Consultation, and Section 3.6, Traditional Cultural Values
- The American Indian Consultation Report (MHA 1998)

The proposed project mitigation measures, and the alternatives to the project, have been designed to avoid and reduce impacts to identified traditional use sites.

Executive Order 13007 also states:

> "Nothing in the order shall be construed to require a taking of vested property interests. Nor shall this order be construed to impair enforceable rights to use of Federal lands that have been granted to third parties through final agency action."

It should be noted that the geothermal leases grant Calpine the right to use the Federal lands for geothermal development and utilization. Executive Order 13007 would therefore not prohibit the proposed project.

Executive Order 12898 on Environmental Justice: Executive Order 12898 (1995) defines achieving environmental justice as the process of eliminating programs that cause:

> "[d]isproportionately high and adverse human health or environmental effects... on minority... and low-income populations."

The U.S. EPA (Interim Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses (1997)) defines environmental justice as:

> "The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, state, local and tribal programs and policies."

Environmental justice issues, specifically impacts to Native Americans, are addressed in the Draft EIS/EIR in Section 4.6, Traditional Cultural Values, and in Section 4.16, Socioeconomics (Impact 4.16.4 Effect on Minority and Low-Income Populations). The agencies have followed the Council on Environmental Quality Guidance on environmental justice issues.

National Historic Preservation Act: The National Historic Preservation Act (NHPA) requires that Federal agencies take into account the effects of their undertakings on properties included in or eligible for listing on the National Register of Historic Places. The NHPA also requires that the agencies afford the President's Advisory Council on Historic Preservation (ACHP) the opportunity to comment on such actions. The 1980 amendments to the act directed the Secretary of the Interior to study means of "[p]reserving and conserving the intangible elements of our cultural heritage such as arts, skills, folklife, and folkways..." and to recommend ways to "[p]reserve, conserve, and encourage the continuation of the diverse traditional prehistoric, historic, ethnic, and folk cultural traditions that underlie and are living expressions of our American heritage."

The NHPA also provides that in carrying out its responsibilities under Section 106, a Federal agency shall consult with any Indian tribe that attaches religious and cultural significance to properties of traditional religious and cultural importance.

The NHPA and its applicability is also discussed in the response to "Comments—Section 106 Process" in the Cultural Resources Section of this document.

The lead agencies are in full compliance with the NHPA. Consultations with tribal members are ongoing and the tribes will be provided an opportunity to comment on the draft Section 106 package that will be submitted to the SOHP and the ACHP. The package will include a description, evaluation, and where necessary, mitigation of adverse effects to traditional cultural properties.

National Register Bulletin 38 on Traditional Cultural Properties: Bulletin 38 provides guidelines for identifying, evaluating, and documenting traditional cultural properties. The guidelines in this bulletin were followed by the lead agencies. The consultation with the tribes began early in the process, and is continuing until a decision is made on

the project (as described above). The Ethnographic Report for the proposed project (Theodoratus et al. 1998) was designed to identify and document use of traditional cultural properties in the region. Bulletin 38 is also discussed in the Draft EIS/EIR under "Methodology," in Section 4.6, Traditional Cultural Values.

Forest Service Manual 2360: The Forest Service Manual identifies the procedures to be followed to comply with Section 106 of the National Historic Preservation Act. It does not state that it is mandatory to cancel or abandon an undertaking to avoid an adverse effect. However, that is a possible option.

The position of the commentors that geothermal development is incompatible with existing long-standing spiritual and cultural uses of the area and its natural resources is noted.

Comments—National Register Evaluation

Y.23 The Native American cultural significance of the entire area and of individual cultural sites seem to be lacking in evaluations for eligibility to the National Register of Historic Places. While the archaeological records have been searched and Native American comments have been given a place in the DEIS/EIR, the contrast between what they are saying and the discussion of impacts elsewhere is conflicting. Actual on-the-ground archaeological surveys are only at a preliminary stage of identification rather than an actual evaluation of impacts and adverse effects. The spiritual and cultural significance of traditional cultural properties in the area merit evaluation in light of their importance to these Native cultures, and also in light of the value that other residents and visitors place on American Indian culture.

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AD.60 The interviews that were done were adequate, but the Forest Service has put limits on new information that can be provided. They have asked that no new sites be identified, though some additional sites were identified and recorded during the field survey. And the Forest Service has prevented its consultant (Dr. Dorothea Theodoratus) from doing any new interviews other than with the persons originally contained in the original interview process during the Summer of 1996. As a result, certain important traditional people have not been consulted, particularly Willard Rhoades, the Spiritual Leader of the Pit River Tribe, and others. Interviews should be ongoing whenever another cultural consultant is identified until the ROD.

(Floyd J. Buckskin, Pit River Tribe)

Responses—National Register Evaluation

Comment Y.23 expresses concern that the Native American cultural significance of the entire area and of individual cultural sites have not been evaluated for the National Register of Historic Places (NRHP). The comment is correct that the identified sites have not yet been evaluated for eligibility for listing on the NRHP through completion of the Section 106 process of the National Historic Preservation Act (NHPA).

The sites that may be affected by the proposed project have been identified and documented through literature searches, interviews, and field investigations to verify sites. The ethnographic study area encompassed the entire project region (including the Medicine Lake Highlands, Timber Mountain, and the Dry Lake areas), rather than only the area of potential effects. These data were used to conduct the impact analysis for the NEPA/CEQA impact analysis contained in the EIS/EIR.

The USFS is currently in the process of conducting the evaluation of the sites as part of the NHPA Section 106 process. The results of the evaluations will be provided to the tribes for review and comment in the draft Section 106 package that will be submitted to the SOHP. This evaluation and eligibility determination through the Section 106 process will be completed prior to the Federal agencies making a decision on the proposed project.

The impact analysis for the NEPA/CEQA analysis was presented in the Draft EIS/EIR, and distributed to the tribes and the public for review. The EIS/EIR impact analysis was conservative. The evaluation and eligibility determinations had not been completed at the time the Draft EIS/EIR was completed. All cultural and traditional-use sites were considered important to the tribes for spiritual or cultural reasons. Impacts to these sites were therefore considered significant or potentially significant under NEPA and CEQA, even if these sites are not determined eligible for the NRHP. As stated above, the Section 106 evaluation of the spiritual and cultural significance of the traditional-use sites will be completed prior to the agencies making a decision on the project.

The archaeological and historic resources would be evaluated for NRHP eligibility according to the terms of a Programmatic Agreement (PA) or a Memorandum of Agreement (MOA). See the responses to "Comments—Section 106 Process" in the Cultural Resources Section of this document for a discussion of the evaluation of archaeological and historic cultural resource sites.

The USFS is considering management prescriptions for traditional cultural properties identified in the project region. The Forest Plan amendment to revise the Klamath Forest Standard 24-25 (referenced in comment Y.41) is not considered to affect cultural resources, as the amendment is designed to correct unenforceable language and clarify the USFS intent to comply with the AIRFA. The effects of the other Forest Plan amendments are analyzed for effects to cultural resources in the Draft EIS/EIR, Section 4.5, Cultural Resources.

Comments—Tribal Status Regarding Lands in the Project Region

P.5 The DEIS indicates that no tribes (and repeatedly indicates that the Pit River Bands/Tribes) have no legal claim or authority to the Glass Mountain Area. It should be noted that it is not a traditional indigenous value to "own" or "claim" land, especially sacred places. A discussion of this issue should have been identified in the ethnographic study/report, as a deeply held traditional belief. Very often sacred sites are not "claimed" by any single tribe or band of indigenous people, and therefore, are not included in their treaty or ceded territory. This is due to the fact that sacred sites are traditionally utilized by multiple bands/tribes of people, and are traditionally "managed" for the use of all people seeking spiritual enrichment. *(Carol Logan, Kalapooya Sacred Circle Alliance)*

AD.15 2. Other applicable statutes, executive orders and guidance documents. Under "Tribal Recommendations" at 3-69, the EIS/EIR states that "the Pit River Nation has issued a resolution against the project and stated that the project should not proceed without the approval of the Pit River Nation." Parenthetically is added "(note: the Pit River Nation does not have legal authority over the proposed project)."

The Pit River Tribal Constitution Preamble has provisions for securing "rights and powers inherent in our sovereign status as reinforced by the laws of the United States, in developing and protecting Pit River ancestral lands and all other resources... [and]...preserving our land base, culture and identity. The Constitution states that 'the territory of the tribe consists of all ancestral lands recognized by the Indian Claims Commission in its July 29, 1959 Findings of Fact and Opinions in Docket No. 347.... The jurisdiction of the tribe under this Constitution extends throughout its territory. Nothing in this article shall be construed to limit the ability of the Pit River Tribe to exercise its jurisdiction to the fullest extent permitted by Federal laws, including but not limited to land, water, property, air spaces, fish and wildlife and other resources."

Also, this statement denies the Trust Responsibility of the US Government to the Indian Peoples of this land, Executive Order 13007 on Indian Sacred Sites and Executive Order 12898 on Environmental justice. Both these executive orders mandate that affected tribal communities be appropriately involved and their views and cultural values be given weight. For consultations to be meaningful, Native People must be treated as more than just interested parties. Federally recognized Tribes should be given the same standing as other federal entities, such as the US Fish and Wildlife Service, Federal Energy Regulatory Commission, and other government agencies. In particular Article II, Sections 1 And 2 of the. Pit River Tribal Constitution. *(Floyd J. Buckskin, Pit River Tribe)*

Response—Tribal Status Regarding Lands in the Project Region

The proposed project would be located on National Forest Lands. The lands are not part of the lands identified in the treaty with the Klamath Tribes. There is no treaty between the U.S. Government and the Pit River Tribe.

Tribal Status and the legal authority of tribes over public lands and undertakings on these lands is limited to the provisions of existing treaties, statutes, regulations, policies, and executive orders. None of these laws extend tribes' legal authority to approve or deny an undertaking on public lands.

In compliance with Federal laws, the Forests consult with the tribes and other interested parties on all actions. Consultation includes taking into account tribal concerns prior to making decisions.

Comment AD.15 also asserts that the Federally recognized tribes should be given the same standing as other Federal entities. The USFS and BLM are conducting consultations with the Klamath Tribes and the Pit River Tribe. The tribes (unlike other Federal entities) have been given early access to the EIS/EIR and supporting documentation for review and comment. The lead agencies have conducted several meetings with the tribes (from October 1995 to the present) to solicit comments and suggestions about the proposed project.

Comments—Tribal Consultation/Involvement

A.6 We commend the lead agencies for including sections on traditional cultural values and initiating government-to-government relations with affected Indian tribes, whom have stated their opposition to the project. We encourage a continued dialog to resolve tribal issues and search for acceptable mitigation measures. EPA reminds the USFS/BLM that lack of resolution regarding our environmental objections in the FEIS could create additional concerns for the affected tribes.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

AD.2 We are alarmed that Tribal concerns are not being given more weight in the EIS/EIR document, and that the Tribe's concerns are played down in other sections of the document. Overall, selective scientific data is being used to minimize the significance of impacts. It may be hard for the Forest Service and project developers to understand the deep ties and concerns that the Native People have to their ancestral lands. This is not limited just to traditional cultural properties and cultural resources, but to all aspects of the natural environment of our ancestral lands. *(Floyd J. Buckskin, Pit River Tribe)*

AD.6 For example, the EIS/EIR at 4-333 under Unavoidable Significant Effects, states that 'The project would not deny tribal members access to identified sites with religious significance, would not deny the right to conduct traditional or religious practices, or affect the physical integrity of identified sites.' Such a statement was not arrived at in consultation with the Tribes. *(Floyd J. Buckskin, Pit River Tribe)*

AD.7 Also, at 4-334, we read that "The project noise and visible elements would somewhat alter the setting of the sites.' This statement minimizes the impacts and does not represent how tribal people see the impacts. It points to the need for consultations concerning effects. It also negates what tribal people have said within this EIS/EIR, particularly at 3-67 and 3-68, namely that the project and the cumulative effects with other potential geothermal projects would 'change the character of the entire Medicine Lake Highlands,' and that "visual impacts to the area will be significant,' to point to only a few. In other words, there is an extremely marked difference in the impacts as reported by tribal consultants and the reports written by MHA. The impacts are spelled out in the section on 'Tribal Concerns' at 3-66 and following, but they are altered and trivialized in other sections. *(Floyd J. Buckskin, Pit River Tribe)*

DM.3 The current process lacks government to government consultation on these projects. *(Jerald Jackson)*

Response—Tribal Consultation/Involvement

In response to comment A.6, the USFS and BLM initiated consultation with the tribes in the spirit of government-to-government consultation for this project in October 1995. This consultation was initiated prior to notifying the public of the proposed project. This consultation has continued at a staff level (with tribal cultural resources specialists,

and the USFS and BLM resource officers and specialists) and will continue until the agencies make a decision on the proposed project. The Line Officers for the USFS (the Klamath and the Modoc Forest Supervisors) and the BLM (the Alturas Resource Area Officer) will meet with the tribes in consultation prior to making a decision on the proposed project. The consultation with the tribes and the EPA has included discussions of mitigation measures. It is the intent of the agencies to resolve EPA objections. The USFS and BLM believe that the EPA concerns regarding hydrology and air quality have been addressed. The agencies have met with the EPA several times to address issues of concern, provide additional data to support conclusions in the EIS/EIR, and to resolve concerns.

The EPA comment regarding the lack of resolution of environmental objections creating additional concerns for the affected tribes is noted. The USFS is continuing to consult with affected American Indian tribes to resolve tribal issues and discuss potential mitigation. The project proponent is also participating in these discussions as appropriate.

The author of comment AD.2 expresses alarm that tribal concerns are not being given more weight in the EIS/EIR, and that the tribes' concerns are played down in other sections of the document. The Draft EIS/EIR includes extensive discussion of tribal concerns (e.g., see pages 1-21 to 1-22, 3-57 to 3-70, 4-59 to 4-81, 4-299 to 4-301, and 4-318 to 4-319). Issues are addressed in the Traditional Cultural Values discussions, as well as in the technical analyses related to various parameters (e.g., noise and visual impacts). The impacts are clearly identified as significant and unavoidable under NEPA and CEQA. The tribal concerns regarding the natural environment are acknowledged, and the impacts to the natural environment are summarized for convenience in the Draft EIS/EIR Section 4.6, Impact 4.6.7.

Regarding comment AD.6, the statement referenced is based on the locations of the sites identified by the tribal members (including the author of the comment).

Comment AD.7 asserts that the Draft EIS/EIR does not reflect the impacts reported by the tribes. The EIS/EIR reports tribal impacts as analyzed under NEPA and CEQA, and as reported by tribal members. It is recognized that the impacts perceived by the tribes may differ from impact conclusions based on NEPA and CEQA standards of significance. The statement from the Draft EIS/EIR, which is referenced by the comment, "The project noise and visible elements would somewhat alter the setting of the sites" is immediately preceded in the same paragraph by the following sentences:

> "The local tribes have stated that the proposed project would have significant adverse effects on traditional use and sacred sites in the project region, and '...would adversely affect the spiritual significance of Medicine Lake Highlands...' (Pit River Tribe 1996). The project would result in the introduction of visual and audible elements that are out of character with the traditional use sites."

The authors of the EIS/EIR consider noise and visible elements to "somewhat" alter the setting of the sites because:

- Not all traditional-use sites would have project elements visible or audible
- Noise levels at some sites would be barely audible or not audible, and, in some cases, the noise would be intermittent

- Drill rigs would not be continuously visible or audible
- Project elements would generally be in the background of views, and often not readily noticeable
- The orientation of views was not disclosed for all identified traditional-use sites, and it is acknowledged that not all traditional-use areas at a location were identified

Two of the identified sites, Site #10 and Site #14, could not be physically located by the tribal members or ethnographic research team.

IMPACTS

Comments—Project Impacts

Q.7 The EIS extensively discusses the effects of the proposed project on traditional Native American sites and religious practices, and concludes that even with mitigation, there will potentially be significant effects to these values. *(Lori J. Cooper, Klamath Forest Alliance)*

R.3 It has also been stated by the Klamath Tribes that a known Modoc religious leader, conducts and instructs Tribal members in Traditional Religious and Cultural Ceremonies in the Medicine Lake area.

The religious ceremonies that are practiced in this area should alone stop this project. The geothermal project will have negative impacts on traditional religious and cultural practices, these negative impacts come in the form of,

1. Altering the natural landscape.
2. Disrupting visual quality.
3. Interfering with spiritual solitude when praying or conducting other traditional ceremonies
4. Possible destruction of cultural artifacts
5. Noise pollution
6. Harassment of wildlife.
7. Destruction of much needed habitat for wildlife.
8. The removal of wildlife from their natural range or homes.
9. Possible negative effects to natural ground water sources.
10. Air pollution.
11. Possible damage or removal of Botanical resources (cultural plants foods and medicine).
12. Interruption of other Tribal activities (camping, socializing, gathering)

(Dino Herrera, The Klamath Tribes)

Y.5 The Medicine Lake Caldera has from time immemorial been sacred to several Native American Tribes surrounding it, and we support the position of the Pit River (particularly the Ajumawi and Atwamsini Bands), the Modoc, the Klamath and the Shasta Tribes in opposing the development on cultural grounds under the National Historic Preservation Act, American Indian Religious Freedom Act, and other statutes and guidance documents.

The Medicine Lake area's Native American cultural heritage dates back at least 10,000 years. The Pit River, Klamath/Modoc, and Shasta Tribes all have sacred ceremonial and cultural sites there. The area contains important obsidian quarries and landscape features that have played an ongoing important role in mythology, cultural patterns and social systems of these tribal cultures from prehistoric times to the present. Many of the geologic sites formed by volcanic action in the Medicine Lake Highlands are known to hold spiritual significance. For Native American culture, environmental impacts are also cultural impacts, and so the effects of this project would have double consequences.

Many residents of our area, as well as visitors, greatly value the presence of Native American culture. The concept of Sacred Geography contains thousands of years of history and culture that are part of all of our heritage. The Medicine Lake Highlands is viewed as part of the sacred pattern tying in with the sacred meaning of Mount Shasta. Native American culture is an ancient and living statement that the land, plants and animals have a life and spirit of their own and should not just be exploited for ill-conceived destructive money-making schemes.

Native American culture enhances the spiritual dimension of nature. It reminds us of the gifts we have been given and of the fact that we share the earth with other beings. The Native people deserve better treatment than they have historically had to suffer, and recent executive orders on the protection of Indian Sacred Sites (which states that adverse impacts must be avoided) and on Environmental Justice require the government agencies to give a great deal of weight to the cultural significance of the area in their decision making. The USFS/BLM personnel that are pushing this project appear to be going

through motions to disclose the extent of damage that would be done to the Native cultures, but they have let it be known that this is an unfortunate "unavoidable significant impact" and that the Native American tribes are not in a position to affect the decision. The DEIS/EIR underestimates the extent of the damage that would be done. Impacts of the proposed development would not be limited to the project boundaries or to archaeological evidence. The overall character, setting, biological and climatic make-up, integrity of location, feeling, and association all contribute to the cultural and scenic quality of the area and are incompatible with industrial development.

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AG.272 The analysis of traditional cultural values contains contradictory information. On p. 4-67, the Draft EIS/EIR states "the proposed transmission line route would be within approximately 500 feet of two traditional-use sites (Site #12 and Site #13)". On the very same page (two paragraphs down), the document states "In addition, five other traditional-use sites are located close to the proposed transmission line route; however, all are approximately 0.25 to 0.5 miles away from the line. The sites closest to the proposed line would be Sites #7, #8, #12, #13 and #14." Which is correct: 500 feet from Sites #12 and 13, or 0.25 to 0.5 miles (1250-2500 feet) away? This distinction is important when considering the impacts of the transmission line on the traditional use sites, particularly the visual and noise impacts. The EIS/EIR should clarify this information.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AK.2 This power to be generated is to be sold to Oregon and will infringe on the religious practices of Native Americans. I do not understand. We would never consider desecrating a cathedral but we have no qualm with destroying a many century's old forest which is one and the same to some folks.

(Wise Earth Council)

BQ.10 We agree with the draft EIS/EIR (page 4-66 and page. 4-75), that this project would have significant unavoidable effects on the Medicine Lake Highlands by significantly impacting traditional Native American cultural values. The draft EIR/EIS states that only the decommissioning of the project would have a long-term beneficial effect on the spiritual and religious value of the Medicine Lake Highland in that it would remove the project facilities. Unfortunately, these long-term beneficial effects would only come about after the project has been in service for more than 45 years.

(Suzanna S. Cuneo and S. Peder Cuneo)

CL.3 Native American concerns must be addressed (not glossed over). I don't think you can do that—and be satisfactory to their culture. *(Catherine Gardner)*

DN.1 I can't imagine going to a ceremonial site, with all of its destruction going on within the existing areas. Please with hope and prayer(s)—that all will do everything possible to protect and preserve—what can be done by mankind. *(Majorie Jackson)*

EQ.6 Medicine Lake has such historic Native American heritage dating back for over 9000 years or more. It is unbelievable that table S-5 of the Executive Report lines 4.5 through 4.6.6 indicate little, small or no impact on Native American Spiritual, cultural values yet in the body of the report page 4-71 lines 5 and 6 states quote, "The proposed project would therefore potentially result in an unavoidable significant impact." *(Ronald A. Maire)*

GP.4 The project urbanizes and destroys a vital Native American heritage area. *(Fred Rinne)*

Response—Project Impacts

The concern about effects on Native Americans and traditional and religious practices is noted. The adverse impacts identified in comment R.3 are identified and addressed in Chapter 4 of the EIS/EIR. Impacts have been identified to reduce or avoid effects. The project is not expected to result in the damage or removal of cultural plants, foods, or medicines. The project has the potential to result in impacts considered significant by tribal members. The project would not violate sovereign or constitutional rights of the tribes (see the responses to comments under "Regulatory Compliance" above).

Comment Y.5 asserts that "The Draft EIS/EIR underestimates the extent of the damage that would be done." The Draft EIS/EIR discloses the full effects of the project, based on the information available at the time the document was written. The EIS/EIR impact analysis addressed effects over the entire project region, and was not limited to the project boundaries. The project would not physically disturb any of the identified traditional-use sites.

Both tangible and intangible project effects were considered. The impact analysis in Section 4.6, Traditional Cultural Values, included effects on landscape views, access to sites, religious practices, and natural resources. The impact analysis in Section 4.6 is based on data gathered from tribal members about the location and use of sites in the Medicine Lake Highlands region (including the Timber Mountain and Dry Lake areas).

Comment EQ.6 references Table S-5 of the Executive Summary in the Draft EIS/EIR. Table S-5 does not indicate "...little, small or no impact on Native American Spiritual, cultural values." The letters S, L, and N represent the levels of impact: Significant (S), Less than significant (L), and No effect (N), as shown at the bottom of the table. For example, line 4.5 of the table indicates impacts to cultural resources would be potentially significant (S) prior to mitigation, but less than significant after mitigation (L). Alternative 7, the No Action alternative, would have no effect (N) on cultural resources. In Table S-5, Impacts 4.6.1, 4.6.3, 4.6.5, and 4.6.6 are considered significant unavoidable impacts.

Comment AG.272 requests clarification regarding the distance of traditional sites to the transmission line. The proposed transmission line would be approximately 500 feet from Sites #12 and #13. The Draft EIS/EIR text on page 4-67 has been revised as follows for clarity:

> "**Operation:** Operation of the proposed project would not result in surface disturbance at any of the identified traditional sites in the Medicine Lake Highlands. Operation of the project would have no effect on the physical integrity of traditional use sites. The closest site to the proposed power plant and well field is Site #7, located about one mile southeast of the proposed plant site. Site #7 is approximately 500 feet from the proposed transmission line. In addition, ~~five~~four other traditional-use sites are located close to the proposed transmission line route~~; however,~~: Sites #8, 33, 12, and 13. ~~all are approximately 0.25 to 0.5 miles away from the line. The sites closest to the proposed line would be Sites #7, #8, #12, #13, and #14.~~ These sites are less than 0.5 miles from the line."

Comments—Effects on Medicine Lake Highlands

HT.15 American Indian cosultants say the project will have a significant adverse affect on the spirituality of the Medicine Lake Highlands. 26 Indian cultural sites have been identified, kept confidential to keep tourists away. Local tribes do not consider effects according to specific sites but rather on the whole Medicine Lake Highlands region. Medicine Lake & Timber Mountain are part of a whole integrated landscape which will be significantly affected by the development. *(Louise Thompson)*

PH5.16 American Indian consultants say the project will have a significant adverse effect on the spirituality of the Medicine Lake Indian Highlands. Twenty-six Indian cultural sites have been identified, kept confidential to keep tourists away. Local tribes do not consider effects according to specific sites, but rather on the whole Medicine Lake Highlands region. Medicine Lake and Timber Mountain are part of a whole integrated landscape which will be significantly affected by the development. *(Medicine Lake Public Hearing)*

Response—Effects on Medicine Lake Highlands

The value of Medicine Lake Highlands and Timber Mountain to the tribes is acknowledged and described in the Draft EIS/EIR in Section 3.6 and 4.6, Traditional Cultural Values.

Comment—Effects on Gathering Sites

AD.24 For cultural resources, the impacts on gathering sites for medicinal plants are of particular concern.

(Floyd J. Buckskin, Pit River Tribe)

Response—Effects on Gathering Sites

The proposed project would not result in surface disturbance in or near known gathering sites for medicinal or other plants. The known gathering sites would be beyond the range that would be subject to drift effects.

Comments—Effects of Project Noise on Traditional Sites and Uses

AG.42 There is no question that the Project will have a tremendous impact on Native American cultural values. The EIS/EIR admits that the Project would have a significant impact on these values even after mitigation measures are implemented. In particular, the Project would have significant unavoidable effects on the Medicine Lake Highlands area, traditional religious practices, landscape views, and socioeconomics. (EIS/EIR, Table S-5, pp. S-14 to S-15.) The Project's noise impacts on traditional sites and uses also would be unavoidable. (EIS/EIR, Table S-5, p. S-14.)

The EIS/EIR attempts to reduce the Project's significant unavoidable impacts on cultural resources and proposes mitigation to reduce other certain impacts to of concern to Native American tribal members. As discussed below, however, the proposed mitigation measures are insufficient to achieve these goals, but they can be improved. The letter of Thomas Reid Associates provides additional comments. (Ex. B, § 4.6.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.320 The analysis of noise impacts to sites important to tribal members is so vague it appears completely dismissive. Existing or project-generated noise levels or significance criteria are not identified. The noise impact is considered significant and unavoidable simply because the impact analysis was not completed. The EIS/EIR states: "The effect [of noise on traditional cultural values] is considered potentially significant due to the uncertainty as to whether the noise would be audible at the sites, would conflict with use of sites, or occur at the same time tribal members use the sites (page 4-69, paragraph 3)." These are exactly the issues the EIS/EIR should have addressed.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.321 Page 4-68. The EIS/EIR does not demonstrate a degree of agreement between its analysis and the Native American tribal groups affected. It is understandable why no mapping of traditional sites is provided given the sensitivity of the uses of these areas, but the analysis appears to have been developed in a vacuum without feedback from tribal members. No discussion of the potentially affected noise environment is presented and it is not even clearly established what impacts would occur.

Sensitive information regarding site location does not need to appear in the EIS/EIR. However, significance criteria, description of the impact, and feasible and effective mitigation measures should be included. [Note: The impact analysis to traditional uses is nearly impossible to follow. Section 4.6.3. (Effects of Project Noise on Traditional Sites and Uses) should either be combined with the Section 4.14 (Noise) or be presented as a stand alone assessment. In the DEIR, there are continual references to "see Section 4.14, Noise" without any specific reference to which page or paragraph of the 17 pages of Section 4.14.] A mapped impact area with potential noise contours from a worst-case noise generation scenario should be developed for tribal inspection and presented along with a construction and operations schedule. Significance criteria should be developed in conjunction with tribal members. Any affected sites and uses within the impact area could then be identified by tribal members, and the development of meaningful mitigation to reduce the impact could begin.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.322 Pages 4-79 through 4-81. The alternative transmission line alignments are assessed on these pages. Despite the alternative locations of the transmission line segments, there is no identification of sensitive receptors to noise nor any assessment of the relative noise impacts to receptors if an alternative route is selected. This information is not provided in Chapter 2, Alternatives either.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.323 Page 4-68. The EIS/EIR author states that "Well-drilling and testing activities would also generate noise in the construction phase of the project and would result in the highest noise levels of construction. Construction noise sources and sound levels are discussed in Section 4.14, Noise, of this document." However, well testing is never discussed in the noise section nor are the noise levels of well drilling or well operation stated in Section 4.14. Only attenuated noise levels (i.e., the noise levels after they are reduced by an intervening distance or barrier) are given. The distance used to arrive at the attenuated noise level is also not given. The sources of the noise levels used for the various pieces of equipment or assemblages of equipment are never given (i.e., whether they are derived from another document, measured in the field or obtained from the manufacturer).

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.324 Page 4-68, paragraph 3. On page 4-69, paragraph 3, the EIS/EIR states "Construction and drilling noise levels would be highest at the traditional sites closest to the proposed wellfield and power plant. These include Sites #7, #8, #10, #12, and #13." The EIS/EIR, however, does not provide information regarding the distance of these sites from the noise sources or if noise levels would be reduced by distance, intervening barriers, vegetation and atmospheric absorption. The EIS/EIR needs to estimate the potential impact at the distances of the sensitive receptors or no conclusions can be made regarding the significance of these impacts.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.325 Page 4-69, paragraph 4. The EIS/EIR concludes that decommissioning noise impacts would be considered a short-term significant adverse effect if the noise altered the character of the site during tribal use or caused tribal members not to conduct traditional practices in the area. This statement is obvious and should have been the starting point for impact assessment. As throughout the document, the discussion of decommissioning is speculative and dismissive and does not rely on data.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.327 Page 4-69, paragraph 3. This paragraph discusses potential significant effects of operational noise on tribal sites but with no reference to any supporting analysis from elsewhere in the EIS/EIR. The analysis should reference which tribal sites would be affected by what levels of noise emanating from each type of facilities at the power plant and well field areas. The analysis should state the intensity, frequency, and duration of the noise intrusion that could be expected at each affected tribal site.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.328 Page 4-68, paragraph 6. The EIS/EIR concludes that construction-related noise would be a short-term, significant impact if it interfered with religious or ceremonial practices. The EIS/EIR states that "the impact could not be avoided and could not be fully mitigated." This conclusion has apparently been reached without any attempt to work with tribal members to develop mitigation that would give them the right to schedule uses at traditional sites if necessary during the construction period.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effects of Project Noise on Traditional Sites and Uses

The project noise setting and potential impacts are addressed in the Draft EIS/EIR in Section 3.14 and 4.14, Noise. A summary of noise impacts to Native Americans is provided in Section 4.6, Traditional Cultural Values. The reader is referred to responses to comments in the Noise Section for further discussion of the noise impact analysis, methodology, and conclusions.

The analysis of noise impacts at traditional-use sites is based on the information provided by the tribes at the time the Draft EIS/EIR was written. At that time, the exact location and timing of traditional uses was not known; this information has not been fully disclosed by the tribes to date. The analysis requested in the comments could only be completed if all the required data were disclosed by the tribes. Because not all data were disclosed, the noise impact at sites was considered significant because any audible noise might be considered significant by the tribal members. The noise impact 4.6.3 states that project-related construction noise might be audible at Sites #7, #8, #10, #12, and #13.

In response to comment A.321, the potentially affected noise environment is described in detail in the Draft EIS/EIR in Section 4.14, Noise. The general nature of impacts at sites is described on pages 4-68 and 4-69 in the Draft EIS/EIR. The actual tribal use of sites has not been fully disclosed.

At several meetings, the tribes have been asked to provide suggestions and comments on proposed and potential mitigation. The tribes were and are invited to suggest additional mitigation measures. The formal meetings with the Forest Supervisors and tribal councils have not yet taken place. No substantial proposed mitigation measures have been received to date from the tribes. See also the response to "Comments—Adequacy of Mitigation Measures" in this section.

In response to comment AG.322, the sensitive receptors to noise are identified in the Draft EIS/EIR in Impact 4.6.3 and 4.6.6d in the Traditional Cultural Values Section. A regional approach was taken for the impact analysis. Comment AG.322 requests information regarding the sensitive receptors in the vicinity of the project alternatives. The text on pages 4-79 to 4-81 of the Draft EIS/EIR identifies the traditional-use sites that would be affected if alternatives are selected. Alternative 6, the preferred alternative, would reduce or avoid transmission line construction noise effects at Sites #7, #8, #33, #12, #13, and #17.

Comment AG.323 requests information on well testing noise, and the source of the information. Noise from well testing is described in the Draft EIS/EIR in Table 4.14-3. See also responses to "Comments—Noise from Well Testing and Venting."

In response to comment AG.324, the distances to the sites and impacts could not be determined because the exact location of traditional use was not known. The site locations are all at least one mile from the proposed power plant site. Noise levels would be reduced by distance, intervening barriers, vegetation, and atmospheric absorption, and described in the Draft EIS/EIR Section 4.14, Noise.

The noise effects of decommissioning would be similar to noise effects during construction. See the response to "Comments—Noise Impacts During Decommissioning" for additional information.

Comment AG.327 questions the supporting analysis for the conclusion regarding the impacts of operational noise on tribal sites. The impact analysis is based on the modeling described in Section 4.14; the noise analysis in Section 4.14 is referenced on page 4-68.

Comment AG.328 suggests that there was no attempt to work with the tribal members to develop mitigation. As stated above, several meetings with the tribes were held to discuss the project and potential mitigation. Mitigation Measure 4.6.3a was designed to avoid conflicts with tribal use of sites. Table 3.6-1 on page 3-58 of the Draft EIS/EIR identifies the meetings with the tribes regarding the proposed project.

Comments—Effects on Access to Traditional Sites

A.64 The area of the Proposed Action is a documented sacred/ traditional area of northeast California tribes. EPA is concerned that the project could prohibit access to Indian sacred sites, in violation of Executive Order 13007, generally based on worst-case impacts as discussed in sections on water and air resources. To address this concern, we strongly urge incorporation of our various recommendations into the FEIS, especially the additional requested information and assurance for collection of baseline data, and recommended monitoring and mitigation measures.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

R.4 Through the development of this Geothermal project it has the ability to compromise traditional access by Tribal members to a cultural area, furthermore this development may cause Tribal members to altogether abandon cultural use of the entire area. *(Dino Herrera, The Klamath Tribes)*

Response—Effects on Access to Traditional Sites

Comment A.64 expresses concern that the project could prohibit access to Indian sacred sites, in violation of Executive Order 13007. The impact analysis is based on worst-case impacts as discussed in the Air Quality and Hydrology Sections. The proposed project would not prohibit access to Indian sacred sites. Please see the responses to comments

under "Regulatory Compliance" in this section, and the responses to comments in the Hydrology and Air Quality Sections.

Additional data have been provided in the hydrology responses to comments to support the conclusions in the Draft EIS/EIR that there would be no adverse effects to water quality or water quantity as a result of the proposed project. EPA recommendations have been incorporated into the Final EIS/EIR, including the recommended additional information, collection of baseline data, and recommended monitoring and mitigation measures.

In response to comment R.4, the proposed project would not compromise traditional access to known cultural areas. The comment that tribal members may choose to discontinue cultural use of the area is noted and acknowledged in the Draft EIS/EIR.

Comments—Effects on Landscape Views

AD.34 During overcast periods, refracted light will be visible at some distance from the project and affect all the sites. This could have a significant visual impact to the traditional cultural properties, especially during use periods by Native People. This may cause the Tribal People to cease using these areas. Seeking other areas is not really an option, because the identified areas are those associated with traditional use and meaning over time. *(Floyd J. Buckskin, Pit River Tribe)*

AD.36 At Table 4.6-1, page 4-73, there would be night time visibility at all sites, either from lighted steam plumes or refracted from clouds. The glow would be seen throughout Northern California and Southern Oregon. The lights would be seen more from the north side of the Medicine Lake Highlands. However, the impacts would be significant throughout the area and beyond. *(Floyd J. Buckskin, Pit River Tribe)*

AD.38 Project development will be visible from a number of sacred sites, such as Indian Butte, Cougar Butte, Badger Mountain, Mount Hoffman, Red Shale Mountain, some with a viewshed of transmission lines, and others having a viewshed to the well site, pipe lines and transmission lines. *(Floyd J. Buckskin, Pit River Tribe)*

AD.41 All the six alternatives to the transmission line have visual impacts to traditional cultural properties as identified in the Ethnographic Report. *(Floyd J. Buckskin, Pit River Tribe)*

Response—Effects on Landscape Views

Comment AD.34 asserts that during overcast periods, refracted light will be visible at some distance from the project and affect all the sites. During overcast periods with low clouds, many traditional sites would be in the clouds. The potential for refracted light was considered in the impact analysis in the Draft EIS/EIR Section 4.9, Visual Resources. Mitigation Measure 4.9.2 requires that Calpine prepare and submit to the Klamath National Forest for approval a detailed Exterior Lighting Design and Management Plan that incorporates specific guidelines to reduce the night lighting effects. Measures include limiting lighting, prohibiting uplighting, use of low-brightness fixtures, and shrouding lights. Project lighting would therefore not be expected to create refracted light that would be visible at all of the identified tribal sites. The lighting on drill rig masts would be visible from certain sites; however, the lighting on the masts would also be directed down and shrouded.

The proposed power plant and wellfield facilities would not be visible from the sites identified in comment AD.38; steam plumes from venting wells and the power plant would be visible from these sites. The agencies' preferred alternative could be visible from the sites as well.

The Draft EIS/EIR acknowledges that views of the project facilities could affect the views from traditional-use sites. Traditional-use sites were not disclosed in the EIS/EIR in order to protect the confidentiality of the sites. A visual analysis was conducted to

determine the effects of the project on views from traditional-use sites (see Table 4.6-1 and Table 4.9-1). Transmission line segment A2 and the power plant steam plume would be visible from Mt. Hoffman in views to the east and west (respectively), if the proposed project were approved. Alternative 6, the agencies' preferred alternative would not use segment A2. This impact would not occur if the agencies selected the preferred alternative instead of Alternative 1 (the proposed action).

Comment—Visual Effects from Transmission Lines

AD.31 The Ethnographic Report for the Fourmile Hill Project, at the Summary of Chapter 5, page 25, states that 'If the project is approved, the route that passes far north of Medicine Lake is viewed as the most feasible alternative ' This is no longer true, due to the location and identification during field work in September 1997, which demonstrated the presence of several important traditional cultural properties with archaeological evidence, namely Indian Butte, Cougar Butte, Lookout Butte. Fourmile Hill will be surveyed after the current comment period and may demonstrate the presence of traditional cultural properties with archaeological evidence. Alternative 6 would have high adverse impact on the visual quality at Indian Butte, Cougar Butte, Lookout Butte, Fourmile Hill due to the close proximity of the transmission line to those sites.

(Floyd J. Buckskin, Pit River Tribe)

Response—Visual Impacts from Transmission Lines

The Ethnographic Report (Theodoratus et al. 1998) has been revised to acknowledge the concern stated in comment AD.31. The draft Ethnographic Report prepared in 1996, and the Draft EIS/EIR addressed Indian Butte, Cougar Butte, and Lookout Butte. The transmission line would be visible from the identified sites, depending on the location of the traditional-use sites on the buttes. Certain vantage points on Fourmile Hill would have a view of the power plant area, but the location of tribal use was not identified in the field. Tribal consultants and the team ethnographers and archaeologists were not able to locate physical evidence of the site that tribal members described in interviews. The visibility of the project from those sites is described in Table 4.6-1 in the Draft EIS/EIR. The views from a traditional-use site at Fourmile Hill can not be determined at this time, as the location could not be identified.

The impacts identified in the comment are acknowledged in the Draft EIS/EIR.

Comments—Effects of Amending the Klamath National Forest Land & Resource Management Plan Standard 24-25

AG.45 The EIR acknowledges that the Project would conflict with Klamath National Forest Land Resource Management Plan (LRMP) Standard 24-25 and that such conflict could be considered a significant impact under CEQA. (CEQA Guidelines, App. G(a); see also 40 C.F.R. § 1502.16(c) (EIS should include discussion of possible conflict with land use plans, policies and controls).) The EIS/EIR proposes amending the Standard to avoid any such inconsistency with Standard 24-25. Such an amendment, however, would still constitute a significant impact under CEQA because it would conflict with the established religious uses of the area. (CEQA Guidelines, App. G(w).) Accordingly, the lead agency should identify the Project's impact on Native American rights and practices as significant.

The Pit River Bands and Klamath/Modoc peoples have used the Medicine Lake Highlands and Timber Mountain areas since prehistoric times. (EIS/EIR, p. 3-63.) These culturally sensitive traditional use areas are important for hunting and gathering, mineral/rock resources, social interaction, spiritual activities, religious ceremonies, and medicinal purposes. (Ibid.) The "traditional activities in these areas remain significant and integral to the practices and beliefs of the tribal peoples of the area" and the physical features remain culturally significant. (Id. at p. 3-65.) The Medicine Lake Highlands and Timber Mountain areas are "tangible properties" that are viewed by the tribal peoples as "integrated parts of a whole landscape." Thus, the cultural resource is viewed holistically and cannot easily be separated into discrete neatly bounded sites. (Id. at p. 3-66.)

The Native American tribes have expressed concern that the Project will limit their ability to practice their spiritual and traditional cultural activities in the area. (Id. at p. 3-67.) For example, the Project may alter the area's characteristics so drastically, through impacts to views, wildlife, noise, vegetation, and other resources, that the tribal peoples may choose not to practice spiritual activities there. (Ibid.)

According to the CEQA Guidelines, a project may have a significant effect on the environment if it will "[c]onflict with adopted environmental plans and goals of the community where it is located" (CEQA Guidelines, App. G(a)); "[d]isrupt or adversely affect . . . property . . . of cultural significance to a community or ethnic or social group . . ." (App. G(j)); or "[c]onflict with established . . . religious . . . uses of the area" (App. G(w)). (See also CEQA Guidelines § 15131(b) (noting that disturbance of religious practices from noise may be a significant environmental impact).) Klamath National Forest LRMP Standard 24-25 provides:

Protect traditional Native American rights and practices (Public Law (PL) 95-341) to insure the integrity of the site and to assure that use will continue to occur and will not be impaired.

The EIS/EIR admits that Project may conflict with this goal. (Id. at p. 4-78.) Specifically, the EIS/EIR admits that the Project "could conflict with established religious use of the Medicine Lake Highlands and would introduce visual and audible elements that are out of character with the area." (Id. at p. 4-64.) Local tribal members believe the proposed Project will conflict with their religious use of the area and will have a significant adverse effect on their religious and spiritual use of the region. (Id. at p. 4-65.) Additionally, "[i]f tribal members choose to discontinue use of sites, or if the project noise or visible elements impaired use of sites, the proposed project would be inconsistent with the current Klamath LRMP standard 24-25, as written." (Id. at p. 4-78.) Accordingly, this conflict constitutes a significant impact on the environment and should be acknowledged as such.

The EIS/EIR proposes to amend Standard 24-25 to remove any inconsistencies that would be considered significant under CEQA. The amendment would reflect protections afforded under American Indian Religious Freedom Act (42 U.S.C. § 1996). (EIS/EIR, p. 4-78.) The EIS/EIR claims that Standard 24-25 is unenforceable because the continued use of traditional sites cannot be assured. (Ibid.) The EIS/EIR also appears to argue that Standard 24-25 provides more rights than allowed under AIRFA, and thus, Standard 24-25 "was written in error." (Ibid.) According to the EIS/EIR, the Klamath National Forest will consider whether to amend the LRMP. (Ibid.)

The EIS/EIR acknowledges that the amendment may be significant under CEQA because "it could result in a conflict with an established religious use of an area . . . ." (Id. at p. 4-79; CEQA Guidelines, App. G(w).) The EIS/EIR admits that any amendment to Standard 24-25 would be considered a significant impact under CEQA. (EIS/EIR, p. 4-79.)

However, the EIS/EIR states that the amendment is not significant under NEPA. (Ibid.) The EIS/EIR provides no support for this assertion. (Ibid.) The amendment will affect not only the Project area, but entire Klamath National Forest. The lead agency should fully analyze the effect of the proposed amendment and provide support for its final determination regarding the amendment's significance. At the very least, the lead agency will be required to comply with certain NEPA procedures even if the amendment is deemed insignificant. (36 C.F.R. 219.10(f); Forest Service Handbook: Land and Resources Management Planning Handbook, FSH 1909.12, ch. 5.4.) These procedures should be discussed so the public and decisionmakers have a complete understanding of the amendment process and impacts. Without this information, the lead agency has no basis for its determination that amending the Klamath National Forest LRMP is insignificant. Hence, the Project should be identified as having a significant impact on traditional cultural values and appropriate measures should be proposed to mitigate this impact. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

BQ.13 On page 4-78 the tribes have stated the project would affect the spirituality of the Medicine Lake Highlands. As stated in the draft EIS/EIR, this would be inconsistent with current Klamath LRMP standard 24-25 and would be a significant finding under CEQA. The response of the draft EIS/EIR is to amend the Klamath LRMP. We are asking if any other project in the Klamath National Forest would be impacted by the change in the LRMP or if this amendment is being done only to facilitate the development of the Fourmile Hill project. Please detail, in a written response, any other project impacted by this change in the Klamath LRMP and any Native American response to this change in standard 24-25. *(Suzanna S. Cuneo and S. Peder Cuneo)*

Response—Effects of Amending the Klamath National Forest Land and Resource Management Plan Standard 24-25

The Draft EIS/EIR discusses possible conflicts with the land use plans, policies, and controls in Section, 4.10, Plans and Policies. Applicable plans and policies are also discussed in the various resource sections.

Standard 24-25 was designed to protect the Native American rights in accordance with the AIRFA. The amendment to the standard is considered by the Klamath Forest to afford the same protection as the original standard, but with enforceable language.

The project could result in a conflict with established religious uses of the area. The tribes may choose not to use sites in the project region and their use might be affected by sights, sounds or smells of the project (as stated in the Draft EIS/EIR on p.4-78). These potential project effects are considered significant under CEQA.

It is unknown whether tribal members would choose to discontinue use of sites in the Medicine Lake Highlands due to the proposed project; tribal use continues at a site on Timber Mountain that was affected by a road.

The Draft EIS/EIR does not admit that the project may conflict with the *goal* of Standard 24-25. The goal of the Standard is to protect Native American rights and practices consistent with Public Law 95-341, the AIRFA. The potential conflict with the *existing language* of the Standard is acknowledged.

Standard 24-25 was written in error and was unenforceable as written. The revision of the Standard corrects language to clarify the intent of the Standard to provide full protection and compliance with AIRFA. The proposed amendment was determined to be not significant under National Forest Management Act planning guidelines, on criteria established under U.S.C. 1604(F)(4), 36 CFR219.10(f), and Forest Service Manual (FSM) 1922.51 as it is an action that does not significantly alter the multiple use goals and objectives or desired future condition for long-term land and resource management. The amendment is considered a minor change in Land and Resource Management Plan (LRMP) standards and guidelines. The amendment would not have the potential to result in significant effects to the environment and is not considered to be significant under NEPA.

The USFS has complied with the Forest Service Handbook: Land and Resources Management Planning Handbook, FSH 1909.12. The plan change is considered insignificant, as it merely corrects language with no change in the protection afforded to Native Americans.

In response to comment BQ.13, the Klamath National Forest believes that no other project would be impacted by the change in the Klamath LRMP, as the change would not be substantive. The change in the standard would not reduce protections for the tribes.

There have been no comments from Native Americans regarding the change in Standard 24-25.

MITIGATION MEASURES

Comments—Adequacy of Mitigation Measures

AD.10 The point with all mitigation measures is that they cannot be decided unilaterally but must be part of an MOA process with the Tribes before the Final EIS and ROD. See 36 CFR 800.11(c)(2)(iii).

(Floyd J. Buckskin, Pit River Tribe)

AG.43 The Native American tribal members have expressed concern about the Project's effects on natural resources (water quality, vegetation, and wildlife), and archaeological and historic resources. (EIS/EIR, p. 4-75.) The EIS/EIR claims that the Project's effects on these resources would be insignificant after implementation of the proposed mitigation measures. (EIS/EIR, Table S-5, p. S-14, p. 4-77.) The EIS/EIR refers to mitigation measures discussed "under the appropriate section" in the EIS/EIR (e.g., hydrology, vegetation, etc.). (Id. at p. 4-77.) Similarly, these Comments discuss the inadequacies of the EIS/EIR's mitigation measures in the appropriate sections.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.44 Although certain impacts would be significant and unavoidable even after mitigation measures have been implemented, the EIS/EIR attempts to reduce these impacts. These proposed mitigation measures, however, can be improved. For example, the EIS/EIR proposes mitigation measure 4.6.3a to reduce noise impacts on traditional sites and uses. (EIS/EIR, p. 4-69.) This measure, however, places the burden on Native American tribal members to contact Calpine to determine activity schedules. (Ibid.) It is not appropriate to impose mitigation duties on innocent third parties. Calpine must implement this mitigation measure by apprising tribal members of its activities. Additionally, Calpine should secure a calendar of Native American activities (if one is available) and implement mitigation measures during those activities. Also, mitigation measure 4.6.3b proposes a monitoring program to determine project-related noise levels, but does not provide any information as to what will be done with the results or how excessive noise may be mitigated. (Ibid.)

The applicant has expressed a willingness to consider tribal members for Project-related employment and, accordingly, mitigation measure 4.6.7a requires Calpine to make a "specific outreach" to local tribes for hiring. (Id. at p. 4-77.) This measure is inadequate, however, because it is unclear what constitutes a "specific outreach". The mitigation measure should outline a specific outreach plan and identify hiring goals.

The EIS/EIR should discuss measures that will reduce the Project's impacts on traditional cultural values, even though the impacts cannot be reduced to insignificance.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.329 Page 4-69 re: Mitigation 4.6.3a. The mitigation measure describes a means for tribal members to communicate with Calpine regarding scheduling during the construction period. However, the measure does not describe any meaningful or enforceable means for tribal members to influence the Calpine construction schedule. Tribal members may simply "contact" a Calpine representative. There is no arbitration party nor any compulsion on the part of Calpine to cooperate.

The mitigation measure also states that Calpine and the USFS shall consult with appropriate local tribes to determine which sites should be evaluated for noise effects. The measure calls for a monitoring program which would determine the actual project-related noise levels.

"A monitoring program shall be defined that would determine actual project-related noise levels (with monitoring during drilling and power plant operation)."

The measure, as worded, is actually a deferred impact analysis which should have been completed for this EIS/EIR analysis.

The measure also carefully states that "Rescheduling certain project activities to minimize effects also may be considered." This wording is so vague that it eliminates operational noise impacts from further mitigation if impacts to traditional activities occur when the project is fully operational.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.330 Page 4-69 re: Mitigation 4.6.3b. A poorly defined monitoring program is identified in Mitigation Measure 4.6.3b which "would determine actual project-related noise levels" but provides no means of mitigating the impact if one is determined to exist. This clearly appears to be an attempt to defer analysis of impacts to traditional cultures until after public review is completed.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

BQ.12 We also want to know if other concerned parties would be able to reschedule Calpine's activities as allowed for by Native Americans. Under Mitigation Measure 4.6.7a, how many jobs does Calpine actually plan on providing to Native Americans and what are the job descriptions? The work force description provided on page 2-57 would indicate that personnel involved in the construction and operation of this plant require specialized skills and training. Does Calpine intend to provide training to Native Americans so they could gain employment or does the lack of specialized skills preclude them from many of these jobs? Please include a response to these questions.

(Suzanna S. Cuneo and S. Peder Cuneo)

Response—Adequacy of Mitigation Measures

The lead agencies have and are continuing to meet with the tribes to discuss the project and obtain suggestions for mitigation measures. Mitigation measures and project Alternatives 2 through 6 were designed to mitigate potential effects to tribal members. It is acknowledged, however, that the mitigation measures may not reduce impacts to levels below significance.

One of the purposes of the interviews with tribal members conducted by the team ethnographers was to determine any potential mitigation measures or adjustments to the project that would reduce or avoid impacts on tribal use of the region. The

recommendations suggested by the tribes during interviews are included in the Draft EIS/EIR in Section 3.6. The tribal recommendations included:

(1) **Preparation of a Cultural Resources Management Plan**—As described in the response to "Comment—Need for Cultural Resources Management Plan" (in the Cultural Resources section, the agencies believe that the NEPA/CEQA process and the Section 106 process will identify management prescriptions for protection of cultural resources.

(2) **Cultural sites should be left undisturbed**—The agencies decision to conduct cultural resources surveys only for the selected transmission line route and various mitigation measures are designed to minimize impacts to cultural resources.

(3) **Address cumulative projects in the entire area**—The agencies have addressed the reasonably foreseeable cumulative projects in the EIS/EIR.

(4) **Bury the transmission line, or if not feasible, place the line to the north of Medicine Lake among the mountains in the low areas around Mt. Hoffman, Aspen Crater, and Indian Butte (the northern route was determined infeasible due to the presence of traditional use areas in this vicinity)**—As described on page 2-74 to 2-76 of the Draft EIS/EIR, it would not be feasible to bury the transmission line. It is acknowledged that the northern transmission line route might be visible from traditional use sites (depending on the angle of view of the transmission line and the orientation of the view); however, the proposed transmission line would have greater effects due to the proximity to Medicine Lake.

(5) **Use Klamath and Modoc members who are trained in cultural resources survey methods**—Klamath Tribe members were used as part of the survey crew for the archaeological sample survey work performed for the proposed project. Tribal crew members will be used for additional work on the project, if qualified and available.

(6) **Institute a general policy (rather than specific use permits) that would allow tribal people to use the area for traditional practices, such as gathering, hunting or spiritual purposes**—Permits are generally not necessary, because most Indian religious and ceremonial practices are solitary or involve only a few people for a short period of time. The Forest and public land users may not even be aware that an activity is occurring or has occurred. In specially designated areas, such as where sensitive species exist, or where there is competition for special uses, a tribe or individual may be issued a Special Use Permit to authorize an activity and to limit the duration of the event and the number of participants, among other things. Memoranda of Understanding can address questions of competing uses and exclusivity of access and use during certain time periods. Generally, any gathering of fewer than 75 persons does not require a permit. Additionally, the Forests have generally not required permits for the gathering of medicinal plants, or foodstuffs, like epos, to individual users for personal use. Wood gathering permits and camp fire permits are available for all Forest users. Hunting is regulated by the California Department of Fish and Game. The USFS is considering this request.

(7) **Involve tribal personnel in siting the facilities and protecting sensitive localities**—The USFS has provided the tribes with a number of opportunities to comment on the proposed project, including meetings, site visits, and interviews with ethnographers. The tribes have been given opportunities to comment on the scope of work for the project EIS/EIR, the Draft EIS/EIR, the tribal consultation report, and the Ethnographic Report. The consultation is ongoing.

(8) **No further development in the Medicine Lake Highlands**—The concern about development is noted.

The author of comment AG.43 asserts that various mitigation measures are inadequate. Please see responses to comments on mitigation in the technical sections for responses.

Comment AG.44 suggests that Mitigation Measure 4.6.3a can be improved. Mitigation Measure 4.6.3 provides for the tribes to contact Calpine because the tribes are not known to use the project region on a regularly scheduled basis (no calendar of Native American activities is known to exist, as referenced in comment AF.44), based on data gathered in tribal interviews and comments provided to the USFS in meetings.

Mitigation Measure 4.6.3 does not represent deferred impact analysis. The impact is identified as potentially significant and the monitoring is defined to confirm the conclusion. If unacceptable levels of noise are identified:

(a) Certain project activities may be rescheduled

(b) Calpine would consider additional noise attenuating measures, such as temporary noise shields

Comment BQ.12 requests additional clarification of Mitigation Measure 4.6.7a. The specific outreach is defined to include mailing a letter to the Klamath, Pit River, and Shasta tribal councils giving 60-days notice of hiring, and including names and numbers of people to contact regarding construction, operation, and maintenance jobs. The notice shall be redistributed 30 days prior to hiring. The lead agencies do not choose to impose hiring goals for the project.

Comment AG.329 suggests that Mitigation Measure 4.6.3a include requirements for Calpine to cooperate with tribal requests. It is acknowledged that impacts are potentially significant. The monitoring program is designed to verify the impact analysis and provide for additional mitigation if feasible once the plant is operational, and if more information becomes available regarding the timing, location, and extent of tribal use of affected sites.

Responses to comments from the author of letter AG.43 regarding adequacy of mitigation measures for parameters (e.g., hydrology and vegetation) are provided in the responses to comments on the individual parameters.

ETHNOGRAPHIC REPORT

Comments—Access to Archaeological Records

AD.43 The Modoc National Forest has refused to release archaeological site records concerning our own culture. The site records were not even released to the ethnographer contracted to do the Ethnographic Report by the Forest Service. As a result, the field survey with tribal consultants was not completed. Until the late 1980's, the Forest Service has always provided us with records or maps at our request. To remedy this situation, a process leading to an MOA for release of the records needs to be established with each Tribe. This needs to be done in a timely manner so that the effects of the proposed Fourmile Hill Project on archaeological sites can be evaluated in order to be included in the Final EIS/EIR.

(Floyd J. Buckskin, Pit River Tribe)

AD.59 The Ethnographic Report also does not treat archaeological features associated with sacred sites and known burial sites. The exact location not yet identified because of lack of access to archaeological records.

(Floyd J. Buckskin, Pit River Tribe)

AD.63 Information is mentioned in various places of the EIS/EIR that has bearing on Native American cultural resources. For example, at 4-57, mitigation measures mention "maps of sensitive cultural resources that clearly outline significant site boundaries." These maps should be provided to the tribes, not as part of mitigations but in order to give us access to information you have about our cultural resources. All

cultural information should be shared with the affected Tribes, including archaeological site records, preliminary archaeological surveys, etc. Tribal groups should have access to records, maps and information in order to better evaluate our own cultural resources. Agencies and project proponents should be aware that they are imposing a burden on the Tribes by proposing projects in sensitive cultural areas.
(Floyd J. Buckskin, Pit River Tribe)

Response—Access to Archaeological Records

Please see response to "Comments—Tribal Participation in Cultural Resources Review" in the Cultural Resources section regarding tribal access to archaeological records and the preparation of a MOA. The tribes will be invited to participate in an MOA or PA for the project.

The sites identified in the Ethnographic Report were visited with tribal consultants subsequent to the preparation of the Draft EIS/EIR and the draft Ethnographic Report. The archaeological evidence at each site was recorded on site records for each of the traditional-use sites.

Access to archaeological records has not been denied to tribal members or the project environmental review team. Archeological data are available to the tribes.

The agencies acknowledge the comment that projects proposed in sensitive cultural areas impose a burden on the tribes.

Comments—Ethnographic Report

AD.57 The Ethnographic Report lacks in-depth study of culturally important natural resources. These include medicinal plants, native food plants, and identification of significant gathering areas for these resources, especially with regard to the Pit River Tribe whose members traditionally use those areas. Also, it should be mentioned that for Native People, all natural resources are cultural resources, since the landscape and our relationship to it is an interconnected whole. As a result, impacts to natural resources are also impacts to cultural resources. For example, by-products settling out of the steam released from the cooling towers would have long-term adverse effects on the natural resources of the area, as these natural resources are ingested or used not only by the wildlife but also the Native People. Evaluation of impacts to these natural resources from a cultural point of view is lacking in the EIS/EIR.
(Floyd J. Buckskin, Pit River Tribe)

AD.58 The Ethnographic Report is inadequate in its treatment of the association of the Project Area with the Modoc Wars; also the area's association with the round-up of the Pit River people in the 1850's when Tribal People went there for refuge; Chief White Horse of the Ajumawi Band and Buckskin Jack of the Atsuge Band were connected to these events. *(Floyd J. Buckskin, Pit River Tribe)*

AD.60 The interviews that were done were adequate, but the Forest Service has put limits on new information that can be provided. They have asked that no new sites be identified, though some additional sites were identified and recorded during the field survey. And the Forest Service has prevented its consultant (Dr. Dorothea Theodoratus) from doing any new interviews other than with the persons originally contained in the original interview process during the Summer of 1996. As a result, certain important traditional people have not been consulted, particularly Willard Rhoades, the Spiritual Leader of the Pit River Tribe, and others. Interviews should be ongoing whenever another cultural consultant is identified until the ROD.
(Floyd J. Buckskin, Pit River Tribe)

Response—Ethnographic Report

The comments on the Ethnographic Report are noted. The author of letter AD has provided the team ethnographer with specific comments that have been incorporated into the final Ethnographic Report (Theodoratus et al. 1998).

The data on culturally important natural resources were provided by tribal members, including the author of letter AD. The proposed project area of effect is not known to contain any medicinal plants, native food plants, or gathering areas.

It is acknowledged in Section 4.6 of the Draft EIS/EIR that natural resources are important to the tribes.

Cooling tower drift would not have an adverse effect on vegetation or tribal members (see also pages 4-89 to 4-92 for effects of drift on vegetation, and Section 4.15, Human Health and Safety in the Draft EIS/EIR). The drift would not be expected to affect culturally important plant populations. The project would not affect known gathering sites.

Comment AD.60 incorrectly asserts that the USFS placed limits on new sites and information that can be provided. The study was conducted by independent ethnographers, Dr. Dorothea Theodoratus and Geri Emberson. Dr. Thomas Jackson and Tom Martin participated in the field work for the project and Dr. Jackson participated in the preparation of the report and site records. The scope of work was jointly determined by the lead agencies, Dr. Theodoratus, and the EIS/EIR third-party consultant.

The ethnographic study (referenced in the comment) was conducted in several phases. The first phase involved:

- Preliminary literature search
- Interviews with tribal members
- Preparation of a draft report (Theodoratus and Emberson 1996)

Based on the results of the first phase of the study, the team proceeded with Phase II of the research. Phase II of the research included:

- Additional interviews with tribal members
- Review of USFS records
- Field verification of sites with tribal consultants
- Preparation of a final report and site records

Phase II of the study identified six additional traditional-use sites. These sites are described in the final Ethnographic Report (Theodoratus et al. 1998). The effects to the newly identified sites would be similar to the effects on sites described in the Draft EIS/EIR. The sites are all at least as far away from the proposed project as those described in the Draft EIS/EIR.

Dr. Theodoratus conducted additional interviews in three sessions in 1997 in addition to those conducted in 1996. Mr. Rhoades and other tribal consultants who were available subsequent to the 1996 interviews were interviewed in 1997. Available and interested members of the Pit River and Klamath Tribes were interviewed. Additional interviews could provide corroborating data on traditional use in the region. The data obtained characterizes the importance of the project region to the tribes and serves as the basis for identifying impacts on the tribes and traditional use.

3.8 Vegetation

INTRODUCTION

This section provides responses to comments on vegetation issues. The comments and responses are grouped under the following headings:

- General
- Effects of Emissions on Vegetation
- Other Effects on Vegetation
- Potential Impacts to Special-Status Plants
- Impacts to Specific Plant Communities
- Vegetation Mitigation

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

GENERAL

Comment—General Questions

PH4.48 How many acres would be disturbed at the power plant and wellfield area? *(Mount Shasta Public Hearing)*

Response—General Questions

Table 2.2-1 on page 2-12 of the Draft EIS/EIR summarizes the amount and type of disturbance that would occur in the power plant and wellfield area. According to this table, approximately 50 acres would be disturbed in this area.

Comments—Vegetation Section Adequacy

J.2 We also believe that the analysis provided in the Draft EIR/EIS is not sufficient to address the botanical concerns which we have for this unique and pristine area, which are outlined below.
(Vivian Parker, California Native Plant Society)

J.6 The assessment of direct, indirect, and cumulative effects to rare plants in this document is also inadequate. *(Vivian Parker, California Native Plant Society)*

AG.46 An EIS/EIR must contain a sufficient degree of analysis to provide the decision-makers with information that enables them to make a decision which intelligently takes account of environmental consequences (CEQA Guidelines § 15151; Adler, 675 F.2d at p. 1085; Sierra Club, 701 F.2d at p. 1029.) The EIS/EIR must contain facts and analysis, not just bare conclusions or opinions. (Concerned Citizens, 42 Cal.3d at p. 935; Seattle Audubon, 798 F.Supp. at p. 1473.) The EIS/EIR fails to provide sufficient information regarding vegetative resources and improperly defers its assessment of the Project's impacts on these resources. It also does not provide an adequate description of mitigation measures. Without this information, the lead agency has no basis for finding that the Project would not substantially affect an endangered, rare, or threatened species of plant or its habitat, or diminish habitat for plants. (CEQA Guidelines, App. G(c), (t).) Further, the EIS/EIR must identify all significant impacts and consider mitigation measures. The EIS/EIR overlooks significant impacts on vegetation and it must be revised and recirculated.
(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

Response—Vegetation Section Adequacy

The potential direct, indirect, and cumulative impacts of the proposed project on special-status plants were addressed in the Draft EIS/EIR according to the requirements of NEPA and CEQA. See response to "Comments—Cumulative Impacts to Vegetation" in the Cumulative Effects Section.

The Draft EIS/EIR provides sufficient information on vegetative resources to satisfy the requirements of NEPA and CEQA. Under NEPA, an EIS must "describe the

environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than is necessary to understand the effects of the alternatives." (40 CFR 1502.15). The Draft EIS/EIR provides enough information to understand the effects of the proposed project on vegetative resources. Under CEQA, the Draft EIS/EIR provides sufficient information on vegetative resources to "support an analysis of the significant environmental effects of the proposed project and its alternatives" (CEQA Guidelines Section 15125). Information in the Draft EIS/EIR that supports the required analyses under NEPA and CEQA includes:

- The locations of all special-status plants that occur in the project area (see Table 3.7-3 on page 3-83, Figures 3.7-1 through 3.7-8, and the text on pages 3-73 through 3-94)
- Lists and descriptions of all special-status plants that may occur in the project area (see pages 3-73 through 3-75 and Table C-1 in Appendix C)
- Descriptions and general locations of all plant communities in the project area, including communities that are considered sensitive (see Figures 3.7-1 through 3.7-8 and the text on pages 3-73 through 3-94)

The Draft EIS/EIR does not improperly defer its assessment of the project's impacts. The Draft EIS/EIR describes in detail the potential impacts of the proposed project to special-status plants (see pages 4-93 through 4-94 and pages 4-97 through 4-105) and to plant communities (see page 4-84 through 4-93 and pages 4-97 through 4-105). In Tables 4.7-1 and 4.7-2 on pages 4-85 and 4-98, respectively, the Draft EIS/EIR quantifies the amount of vegetation, categorized by vegetation type, that would be removed by the proposed project. Table 4.7-2 also includes quantitative estimates of the amount of vegetation that would be removed by all of the proposed alternatives.

The Draft EIS/EIR provides a discussion of mitigation measures that meet the requirements of NEPA and CEQA. Under NEPA, an EIS must contain "Means to mitigate adverse environmental impacts" (CFR 40 Section 1502.16(h)). According to CEQA, an EIR "shall identify mitigation measures for each significant environmental effect identified in the EIR." (CEQA Guidelines Section 15126 (c)). NEPA and CEQA define appropriate mitigation to include:

- Avoiding the impact altogether by not taking a certain action or parts of an action
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action
- Compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20 and CEQA Guidelines Section 15370)

Based on the information presented above, the Draft EIS/EIR addresses the potential impacts of the project on vegetative resources (see pages 4-82 through 4-105). In this section, the Draft EIS/EIR also addresses whether these impacts are "adverse" (under NEPA) or "significant" (under CEQA). (See pages 4-82 and 4-83 of the Draft EIS/EIR for a discussion of the regulatory framework behind the analysis of the potential

impacts of the project on vegetation.) The Draft EIS/EIR complies with CEQA by identifying all potential significant impacts to vegetation. The Draft EIS/EIR identifies two impacts that, before mitigation, would be considered significant:

- Effects on special-status plants (pages 4-93 and 4-94)
- Effects on sensitive plant communities (pages 4-94 and 4-95)

Five mitigation measures (4.7.3a, 4.7.3b, 4.7.4a, 4.7.4b, and 4.7.4c) are proposed to offset the potentially adverse impacts to special-status plants and to sensitive plant communities. After mitigation, the impacts to these resources would be reduced to a level below significance. All other impacts to vegetation are considered not significant; thus, no further mitigation is required.

The Draft EIS/EIR includes mitigation measures for all adverse and significant effects to vegetation that are identified in the Draft EIS/EIR. Mitigation measures for potentially significant impacts to vegetation are described in detail on pages 4-88 through 4-100 of the Draft EIS/EIR. The Draft EIS/EIR goes beyond compliance with NEPA and CEQA by proposing measures that are designed to reduce or avoid impacts that may or may not be adverse (e.g., Mitigation Measures 4.7.1c, 4.7.1d, 4.7.2a). These measures are called out as mitigation (even though there is no requirement to do so under NEPA or CEQA) to ensure that they would be carried out.

Comment—Vegetation Mapping

AJ.3 Figure 3.7-4. 'Vegetation resources along proposed transmission line route segment C1.' This shows the vegetation opposite much of the populated Tionesta area to be big sagebrush scrub and opposite the remaining populated area to be northern juniper woodland. (Section 16 of Township 44N Range 6E). In fact, much of the southern part of the study corridor is ponderosa pine forest.

(Larry Hearne, et al., Tionesta Residents)

Response—Vegetation Mapping

The comment on mapped habitat types in the vicinity of Tionesta is noted. The botanical resources surveys conducted for the Draft EIS/EIR within the transmission line study corridors had three goals: (1) identify all locations of special-status plants, (2) identify habitats that are considered sensitive (e.g., wetlands), and (3) map the general habitat types present. Detailed mapping of widespread habitat types that are not considered sensitive (such as big sagebrush scrub and northern juniper woodland) was not conducted for the Draft EIS/EIR. The information in the Draft EIS/EIR about these habitat types is intended to provide a general guide to the vegetation of the area.

The location of plant communities in Figure 3.7-4 is based on a report prepared for the project by Biosystems Analysis, Inc. (1996). Biologists at Biosystems Analysis mapped plant communities throughout the Tionesta region. The locations of plant communities were derived from USFS timber stand maps and verified through aerial photography and ground truthing. The Biosystems maps show that ponderosa pine Forest is found on Timber Mountain and in small patches in and north of Tionesta. However, none of these patches of ponderosa pine Forest are within the transmission line study corridor depicted in Figure 3.7-4 of the Draft EIS/EIR. Thus, due to the general nature of the vegetation maps and the fact that ponderosa pine Forest is not a sensitive community, Figure 3.7-4 does not require revision. Note that Figure 3.7-1, 3.7-2, and 3.7-5 have been

corrected to more accurately illustrate the plant communities in the power plant and wellfield area.

Reference:

BioSystems Analysis, Inc. and JRP Historical Consulting Services. 1996. Biological and Cultural Resource Assessments for the Calpine Transmission Line Project, Volume 2—Appendices. February.

EFFECTS OF EMISSIONS ON VEGETATION

Comments—Effects of All Emissions on Vegetation

AG.67 Similarly, air emissions from the Project will cause deposits of fluorine, bromine, lithium, strontium, and barium on vegetation. These other metal deposits would also cause significant impacts that must be mitigated.

The EIS/EIR should be revised to reflect the Project's impact on vegetation from toxic metal emissions and the lead agency should propose mitigation measures.
(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

AG.236 In addition to its impacts on lakes, acid deposition is also known to adversely affect forest soils and the vegetation dependent upon it. Acid rain can acidify soils. This solubilizes metals, which can reach toxic concentrations in soil solutions. Many tree species, for example, are sensitive to the concentration of free aluminum in the soil solution, and a pH decline from 5.0 to 4.0 may increase the free aluminum concentrations by 1000 fold. Soil pH also affects nutrient availability by reducing the concentrations of calcium, magnesium, potassium, and phosphorous in solution.1 The EIR should discuss this potential problem. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.250 In addition to boron, the Project would emit comparable or larger quantities of fluorine, bromine, strontium, and barium (Comment 1.g). All of these substances are toxic to plants at the concentrations that would likely result from Project emissions.[2] The DEIR does not evaluate the impact of any of these other elements on local vegetation. Fluorine, in particular, is far more toxic than boron.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

DK.6 I am also still concerned about the possibility of air pollution from the proposed power plant and its effect on the forest. It does not appear that the developer is properly addressing this issue to insure that the forest will not be hurt. If this is not done, then I would have to be totally opposed to the entire project. *(Roger G. Hyytinen, Hyytinen Engineering)*

Response—Effects of All Emissions on Vegetation

The potential effects of air emissions from the proposed project on vegetation are described on page 4-89 through 4-93 of the Draft EIS/EIR. The Draft EIS/EIR evaluated the potential effects of deposition during project operation from the cooling towers and from well venting. The Draft EIS/EIR did not evaluate the specific effects of fluorine, bromine, lithium, strontium, and barium on vegetation because these elements would be present in either low or extremely low concentrations (see response to "Comment— Chemical Composition of Geothermal Fluids" in the Geothermal Resources Section for more information). The concentrations of these elements that would be found in the geothermal fluids would not be sufficient to cause damage to plants near the power plant. See responses to comments below under the following headings for a discussion of the potential effects of each element:

- Effects of Boron Emissions on Vegetation

[1] D. Binkley, Sensitivity of Forest Soils in the Western U.S. to Acidic Deposition, In: R.K. Olson, D. Binkley, and M. Bohm (Eds), The Response of Western Forests to Air Pollution, Springer-Verlag, New York, 1992, pp. 153-181.

[2] A. Kabata-Pendias and H Pendias, 1992; M. Ya. Shkolnik, Trace Elements in Plants, Elsevier, Amsterdam, 1984.

- Effects of Fluorine Emissions on Vegetation
- Effects of Lithium Emissions on Vegetation
- Effects of Bromine Emissions on Vegetation
- Effects of Barium and Strontium Emissions on Vegetation

Comments—Effects of Well Venting on Vegetation

AG.49 Without any supporting data, the EIS/EIR states that the effect of well venting on vegetation would be adverse but not significant. (EIS/EIR, p. 4-89.) It is clear that this conclusion is not based on factual data because the EIS/EIR later proposes to develop a monitoring plan to evaluate and confirm the insignificant depositional impacts to vegetation in mitigation measure 4.7.2a. (*Id.* at p. 4-92.) (Ex. B, § 4.7.) Absent this information, there is insufficient evidence to support the lead agency's conclusion that the impacts of well venting are insignificant.

(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

AG.276 On page 4-89, the last paragraph discusses impacts of well venting on vegetation. The last sentence of the paragraph says "the effect would be adverse but not significant." However, on page 4-92, under Mitigation Measures, the EIS/EIR relies on future studies to actually determine that the impact is insignificant. The EIS/EIR cannot rely on future studies to find an impact insignificant. These studies must be incorporated in the EIS/EIR.

(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

Response—Effects of Well Venting on Vegetation

The conclusion that well venting would not cause a significant effect is based on the following:

- Research on the effects of geothermal emissions on vegetation (Malloch 1979; Malloch et al. 1979; Jones and Stokes 1984; Leitner 1993, 1995)
- Analysis of well-venting emissions effects on the vegetation types that are present in the area
- Analysis of the effects on vegetation of cooling tower and well testing emissions

Based on these scientific data and analyses, the conclusion that well venting would not cause a significant effect is justified.

The comments also suggest that proposing a monitoring plan implies that the impacts of deposition on vegetation are significant and that the monitoring plan reduces these impacts to a level below significance; this is not the case.

The monitoring plan is designed to provide for close inspection of the health of vegetation adjacent to the deposition sources (i.e., wellfield and power plant). This monitoring program was not proposed to offset significant effects. Instead, it was proposed to go beyond compliance with CEQA to verify and monitor any adverse (but less-than-significant) effects. If any adverse effects are detected (regardless of the level of impact), appropriate action would be taken to reduce or eliminate the effect. This action could include the replacement of plants that are damaged. If no adverse effects are detected, no action would be necessary. The text of the Draft EIS/EIR on page 4-92 has been changed to clarify the intent of the vegetation monitoring plan:

"**Mitigation Measures**

Although the expected depositional effects of the proposed project on vegetation would be less than significant, the following mitigation measure is recommended to reduce or eliminate any adverse effect on vegetation from project emissions:

4.7.2a Calpine shall develop and implement a monitoring plan in coordination with the USFS to document the ~~evaluate and confirm the insignificant~~ depositional impacts to vegetation in the vicinity of the power plant resulting from project operation. The plan shall include the following:"

This plan was included as a "mitigation measure" in order to ensure that it would be carried out. As described on page 5-1 of the Draft EIS/EIR, all mitigation measures would be included as part of the Mitigation Monitoring and Reporting Plan that is required by state and Federal law. Calling the vegetation monitoring plan a mitigation measure ensures that implementation of the plan would be monitored and enforced.

The comments also suggest that the future studies proposed for the monitoring plan be incorporated into the EIS/EIR. As explained above, the impact analysis of well venting on vegetation was adequately discussed in the Draft EIS/EIR. This analysis concluded that there would be no significant effect of deposition from well venting on vegetation.

Contrary to the suggestion in the comments, the studies that are proposed in the future do not provide information for the impact analysis. Instead, these studies would verify the actual effects of the proposed project on surrounding vegetation and verify that impacts are not significant. These measures are called out as mitigation in order to ensure that they are carried out (mitigation measures are required by CEQA and NEPA to be carried out and included in the Mitigation Monitoring and Reporting Program). According to CEQA, mitigation measures can be proposed that verify the impacts of a project.

The results of these studies would be combined with the results of the vegetation monitoring plan to determine whether damage to vegetation, if it occurs, is related to project activities. These data would also help to determine the level and type of corrective action that may be required. These studies cannot be conducted until the proposed project is in the operational phase. The methodology for these studies has been defined (Malloch et al. 1979; Leitner 1995) for geothermal projects at The Geysers and Coso geothermal power plants; similar methodology would be used in the project area.

References:

Jones and Stokes Associates, Inc. 1984. *The Geysers Vegetation Stress Monitoring Study-1983 Annual Report.* Prepared for Pacific Gas and Electric Company Department of Engineering Research. San Ramon, CA. 239 pp.

Leitner, B. M. 1995. Operational monitoring at Navy 1, Navy 2, and BLM power plants, Coso Known Geothermal Resource Area, 1994. Prepared for California Energy Company, Omaha, NE.

Leitner, B. M. 1993. Assessment of impact assessment and mitigation measures, Coso Known Geothermal Resource Area, China Lake Naval Air Weapons Center. Prepared for MHA Environmental Consulting, San Mateo, CA.

Malloch, B. S. 1979. The effects of geothermal power plant operation on vegetation. Paper presented at the Edison Electric Institute Workshop on Biology, Portland, OR. September 18-20.

Malloch, B. S., M. K. Eaton, and N. L. Crane. 1979. Assessment of vegetation stress and damage near The Geysers power plant units. Pacific Gas and Electric Company Department of Engineering Research Report 420-79-3. 88 pp. plus appendices.

Comment—Effects of Hydrogen Sulfide Emissions on Vegetation

J.7 There is no scientific data to assess the impacts of hydrogen sulfide emissions on rare plant, fungi, lichen, or bryophyte populations. *(Vivian Parker, California Native Plant Society)*

Response—Effects of Hydrogen Sulfide Emissions on Vegetation

As stated in the Draft EIS/EIR on pages 4-89 through 4-92, projected emissions of hydrogen sulfide would not adversely affect vascular plants in the vicinity of the proposed power plant and wellfields. Because no special-status vascular plants are known to occur in the vicinity of the power plant (see Figure 3.7-1), no impacts to these resources would occur. A preliminary assessment of survey and manage lichens and bryophytes indicated that no suitable habitat for these species is present in the power plant area (Leitner 1997). Because suitable habitat for these survey and manage species does not appear to be present in the power plant area, no impacts from project emissions are expected to occur to these species. See also responses to "Comment—Mitigation for Impacts to Special-Status Plants," "Comment—USFS Survey and Manage Plant Species," and "Comment—Effects on Special-Status Fungi and Lichens" below.

Reference:

Leitner, B. 1997. Final Botanical Resources Report for the Fourmile Hill Power Plant Development Area and Additional Transmission Line Segments A1, A2, and C2. Prepared for Calpine Corporation, September.

Comments—Effects of Boron Emissions on Vegetation

AG.60 Mitigation measure 4.7.2a recommends that the applicant develop and implement a monitoring plan to assess the depositional effects on vegetation. (EIS/EIR, p. 4-92.) Boron can cause plant stress and damage. (*Id.* at p. 4-91.) Further, as discussed below, according to the comments of Dr. Fox, boron will have a significant impact on vegetation. (Ex. A, comment 13.) Without accurate information about depositional effects, the public and decisionmakers are precluded from evaluating the adequacy of the monitoring plan, resulting data, and potential mitigation.
(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

AG.66 The EIS/EIR fails to identify toxic metal deposition as significantly affecting local vegetation. (EIS/EIR, p. 4-92.) Dr. Phyllis Fox's comments demonstrate that the EIS/EIR's analysis of boron deposition is misleading and incorrect. (Ex. A, comment 13.) Boron deposition will cause a significant adverse effect to vegetation. *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

AG.249 The DEIR estimates the impact of boron emissions from the cooling tower on downwind vegetation. The DEIR analysis relies on a study performed by PG&E at The Geysers ("Malloch Study").[3] This initial study was followed by two years of additional investigation, which was published in the open literature. In the followup study, boron deposition rates and concentrations in soil saturation extracts and vegetation downwind of two plants, Unit 5-6 and Unit 13, were related to vegetation conditions ("Lang Study").[4] Based on the Malloch Study, the DEIR concludes that boron emissions would not adversely impact vegetation because the estimated maximum boron deposition for the Project is comparable to or somewhat less than that measured at Unit 13, where the vegetation exhibited no symptoms of boron toxicity. (DEIR, pp. 4-91 to 4-92.) However, the followup study shows that this conclusion is incorrect. Vegetation near Unit 5-6 was damaged more because Unit 5-6 had been operating longer and because there were more sources of boron nearby. The DEIR fails to acknowledge these facts. The DEIR should apply the results of the follow-up study, instead of relying on incomplete and outdated information.

The DEIR claims, based on the Malloch Study, that "although elevated concentrations of boron were found in plant tissues near the cooling towers, no visible symptoms of boron toxicity were found, and

[3] B.S. Malloch, M.K. Eaton, and N.L. Crane, Assessment of Vegetation Stress and Damage near The Geysers Power Plant Units, PG&E Research Report 420-79-3, San Ramon, CA, 1979.

[4] F.J. Lang, F.T Bingham, F.F. Hendrix, and N.L. Crane, Boron deposition on soil and native vegetation from geothermal emissions, Journal of Environmental Quality, v. 15, no. 3, 1986, pp. 260-265.

the leaves of mixed conifer forest surrounding the power plant unit did not exhibit symptoms of boron toxicity. A similar pattern of increased concentrations of boron is expected to occur in the leaf tissue of vegetation near the proposed power plant site. Although conifers in the vicinity of the power plant may accumulate boron to some extent, the levels would not be expected to affect the health of these species, and no visible effects to this vegetation are expected." (DEIR, p. 4-92.)

The Lang Study investigated two units at The Geysers. Vegetation downwind from one of these, Unit 5-6, had substantial damage, while vegetation downwind of the second, Unit 13, indeed had no visible damage. However, at the time that this study was done, Unit 13 had only been in operation for 2.3 years, while Unit 5-6 had been in operation for 10.3 years. The study explained that the reasons for the differences in vegetation damage were due not only to differences in emissions, but also "to the shorter operating history of Unit 13 compared to Unit 5-6." (Lang Study, p. 262.) The Project would operate for 45 years, allowing substantial amounts of boron to accumulate in downwind soils and vegetation. Therefore, the statement in the DEIR applies only to the first 2.3 years of operation of the Project and does not consider the accumulation of boron over time.

Boron accumulates in soils and vegetation over time.[5] According to DEIR estimates, 8.25 lbs of boron from the cooling towers would be added to downwind soils every year. At the end of the 45-year life of the Project, 371 lbs of boron would be present in downwind soils and local vegetation. Studies indicate that foliage boron generally increases linearly with the concentration of boron in the soil solution.[6] Therefore, boron concentrations in both soil and vegetation would roughly increase linearly over the lifetime of the Project.

The regression relationships and other information from the Lang Study can be used to estimate the impact of boron deposition on downwind vegetation. Using the results for Unit 13 (0.06 - 3.75 lbs/ac-yr), whose measured deposition rate is similar to the Project, the estimated DEIR boron deposition rate of 1.43 pounds per acre per year ("lbs/ac-yr") corresponds to a boron soil saturation extract concentration of about 0.27 mg/L after 2 years of deposition.[7] (Lang Study, Fig. 1.) At the end of the 45 year operating life of the Project, the boron soil saturation extract concentration would be about 5.3 mg/L.[8]

The PG&E study reviewed the boron plant toxicity data and concluded that boron soil saturation extract concentrations of less than 1 mg/L were generally safe for all plants, that concentrations of 1.0 to 5.0 mg/L were slightly toxic to some plants, that concentrations of 5.0 to 10 mg/L were moderately toxic to many plant species, and that concentrations over 10 mg/L were severely toxic to all tested plants. (Lang Study, p. 262.) Therefore, at the end of the lifetime of the Project, 5.3 mg/L of boron would be high enough to be moderately toxic to many plant species.

According to the DEIR, the predominant vegetation adjacent to and downwind of the Project is lodgepole pine forest (DEIR, Fig. 3.7-5), although other vegetation including mixed conifer forest is present. (DEIR, Table 3.7-1.) Boron toxicity data are not available for lodgepole pine. However, the PG&E work investigated a digger pine, a related species, and other mixed conifer forest species. These studies found substantial visible foliage injury around Unit 5-6, including tip burn and marginal chlorosis and necrosis, with visible injury ranging from 0 to 94 percent of the foliage area on some species. (Lang Study, p. 263.)

Based on the PG&E work, a boron soil saturation extract concentration of 5.3 mg/L corresponds to a foliage boron concentration of 170 in digger pine, the only pine that was investigated. (Lang Study, Fig. 2.) This boron level was associated with about 3 percent visible foliage injury. For other species, this level of soil boron corresponded to 1,090 mg/kg of boron in foliage and 75 percent visible foliage injury. (Lang Study, Fig. 3.)

Other Emissions. In addition to failing to note that the comparison unit had operated only 2.3 years, the DEIR also fails to note that the cooling towers are not the only source of boron emissions. The PG&E study also pointed out that another reason that no vegetation damage was found at Unit 13 was because in addition to the cooling tower, there were "fewer nearby B(oron) emission sources (e.g., steam wells, natural fumaroles, other cooling towers)." (Lang Study, p. 262.)

The DEIR boron deposition rate for the Project is calculated using only the boron emissions of 8.25 lbs/yr from the cooling tower. (DEIR, p. 4-91.) However, other sections of the DEIR indicate that boron is

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[5] A. Kabata-Pendias and H. Pendias, Trace Elements in Soils and Plants, 2nd Ed., CRC Press, Boca Raton, FL,1992, pp. 153-161.

[6] A.M. El-Sheikh, A. Ulrich, S.K. Awad, and A.E. Mawardy, Boron Tolerance of Squash, Melon, Cucumber, and Corn, J. Am. Soc. Hort. Sci., v. 96, 1971, pp. 536-537.

[7] Using the regression equation for Unit 13, $\ln Y = -1.70 + 0.85 \ln X$ where Y is soil boron saturation extract concentration in mg/L and X is the boron deposition rate in kg/ha-yr. For a boron deposition rate of 1.43 lbs/ac-yr (1.60 kg/ha-yr), the soil boron concentration $Y = \exp[-1.70 + 0.85\ln(1.60)] = 0.27$ mg/L.

[8] Assuming uptake is linear over the 45 year operating life of the Project, at the end of 2.3 years, the boron soil saturation extraction concentration would be 0.27 mg/L. (PG&E Study, Fig. 1.) By proportions, the concentration at the end of 45 years would be (0.27 mg/L)(45 yrs)/2.3 yr = 5.28 mg/L.

routinely emitted from other sources, principally the vent silencers, which are also located at the power plant. (DEIR, pp. F-6, F-14.) Additional amounts of boron are also emitted during upsets and well venting. (DEIR, pp. F-13, F-17.) The total routine operational boron emissions from the Project are reported to be 17.4 lbs/yr. (DEIR, p. 2-45.) Therefore, the actual boron deposition rate would be about twice as high as the value used in the DEIR to estimate the boron deposition rate. The actual boron deposition rate would be about 3 lbs/ac-yr.[9]

Repeating the calculations presented above using 3 lbs/ac-yr yields a boron soil saturation extract concentration of 0.51 mg/L at the end of 2.3 years and of 10.1 mg/L at the end of 45 years. According to the Lang Study, 10 mg/L is the threshold for severe plant toxicity. (Lang Study, p. 262.) A boron soil saturation extract concentration of 10.1 mg/L corresponds to a foliage boron concentration of 232 mg/kg in digger pine and about 7 percent visible foliage injury. In other tree species, it corresponds to 1,660 mg/kg in foliage and injury of essentially all foliage. (Lang Study, Figs. 2, 3.)

Finally, as discussed in Comment 1.d, the applicant apparently underestimates toxic emissions. Actual boron emissions would probably be about 612 lbs/yr, consistent with measurements made at The Geysers in the Lang Study, not 17.4 lbs/yr. The corresponding deposition rate would be 106 lbs/ac-yr, which is 74 times higher than the value used in the DEIR. Impacts would be proportionately more severe and would be significant as discussed above.

In sum, the emissions of boron from the Project are high enough to damage downwind vegetation. The impacts described here would be proportionately larger if boron emissions were larger than those used in the DEIR. This could occur, for example, if emissions are underestimated (Comment 1.d), or additional units were constructed in this general area. This is a significant impact that was not revealed in the DEIR and which must be mitigated. The impact of boron emissions on vegetation should be re-analyzed using the results of the Lang Study and the revised EIR recirculated for public review.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effects of Boron Emissions on Vegetation

The comments express disagreement with the conclusion reached in the Draft EIS/EIR on page 4-91 and 4-92 that the potential effects to vegetation from boron emissions would not be significant. The comments disagree with this conclusions because of the claims that the Draft EIS/EIR:

- Equates the effects of boron emissions on vegetation at Unit 13 at The Geysers over 2.3 years with the potential effects of the proposed project over 45 years
- Underestimates the actual boron deposition of the proposed project
- Fails to analyze of the effects of boron accumulation in soils and vegetation over the lifetime of the proposed project
- Fails to cite the damage to digger pines from boron emissions that was observed at The Geysers Unit 5-6
- Underestimates the projected boron emissions from the proposed project by excluding sources of boron other than the cooling tower (e.g., vent silencers, upsets, and well venting)

Responses to each of the claims in the comments are presented below, after a discussion of the source of the information used in the Draft EIS/EIR. Details and support for the assumptions made in the Draft EIS/EIR could not be included in the Draft EIS/EIR due to space limitations. Instead, support for the assumptions made in the Draft EIS/EIR are presented below.

Background: Concern about the effects of geothermal emissions began in the 1970s when vegetation near operating power plants at The Geysers showed extensive stress and damage. Boron was shown to be the principal cause of this stress and damage because it accumulated in the plants in toxic concentrations (Malloch et al. 1979). The

[9] Actual boron deposition rate = (1.43 lbs/ac-yr)(17.4 lb/yr/8.25 lb/yr) = 3.02 lbs/ac-yr.

pattern of leaf damage on plants near the power plants was consistent with boron toxicity. Moreover, the concentration of this element in leaf tissue was high enough to account for all of the symptoms. Boron toxicity was most pronounced in vegetation near older power plants, which had higher rates of drift (and greater boron emissions) from the cooling towers. After this initial discovery of plant damage, seven years of monitoring vegetation followed. Data were collected at old, high-emission power plants and newer, low-emission power plants (Jones and Stokes Associates 1984, 1986). Monitoring was also carried out at the Coso KGRA (in Inyo County, CA) to assess vegetation stress and damage near operating power plants (Leitner 1996, 1997).

Comparison between the Proposed Project and The Geysers: The Draft EIS/EIR based its evaluation of the potential effects of boron deposition on vegetation on two factors:

(1) The known effects of boron deposition on vegetation at The Geysers, and

(2) A comparison of the amount of boron emission and deposition at The Geysers and the projected boron emission and deposition at the proposed Fourmile Hill project.

The proposed project was compared to The Geysers because (1) vegetation monitoring has been conducted for a longer period at this site than at any other (as described above), and (2) evaluating the effects at The Geysers would be a conservative approach because boron emissions at The Geysers are much greater than would be expected at the proposed project, as explained below.

As stated in the EIS/EIR, emissions of boron from the proposed project are projected to be much lower than that measured at The Geysers. Emissions from the cooling towers alone at Geysers Units 5-6 and 13 were reported to be 2,332 pounds per year and 463 pounds per year, respectively (Lang et al. 1986). Emissions at Unit 13 are much lower than at Unit 5-6 because unit 13 has a more modern, lower-drift cooling tower and a hydrogen-sulfide abatement system that removes some boron. By contrast, projected emissions from the cooling towers and the vent silencers of the proposed project would be 8.6 lbs/yr. This amount is less than 2% of the boron emissions at the modern Unit 13 at The Geysers.

A critical difference between The Geysers and the proposed project is the nature of the geothermal resource. The geothermal fluid at The Geysers is composed of steam only (a "dry" resource). In dry steam, the boron (as borate) is also in a vapor state, and moves with the steam through the power plant. As the steam is condensed, the boron is strongly partitioned into the liquid phase. Because steam condensate makes up 100% of the circulating water at The Geysers, essentially all of the boron from the fluid becomes part of the circulating water. An exception occurs when the hydrogen sulfide abatement system exposes the steam to a liquid prior to its entering the power plant (such as in the Stretford abatement system at Geysers Unit 13). When a hydrogen sulfide abatement system is installed, most boron is partitioned into an aqueous solution prior to entering the power plant. As a result, the boron levels in the circulating water are much lower than they would be without a hydrogen sulfide abatement system.

As described above, emissions of boron at the proposed power plant would be substantially lower than measured emissions at The Geysers Unit 13. As stated in the

Draft EIS/EIR on page 4-91, vegetation monitoring at The Geysers Unit 13 found elevated concentrations of boron in plant tissues near the cooling towers (Jones and Stokes Associates 1986). However, no visible symptoms of boron toxicity were found. Because the emission of boron at the proposed power plant would be less than 2% of the boron emissions at Unit 13 at The Geysers, it is reasonable to conclude that boron would not cause visible damage to any vegetation in the project vicinity. However, a vegetation monitoring program is proposed in the EIS/EIR (described below) to verify that impacts to vegetation from project emissions are not significant.

Comparison between the Proposed Project and the Coso KGRA: It is also useful to compare the project emission of boron at the proposed project with boron emissions at the Coso KGRA, a geothermal field with properties similar to that at Fourmile Hill.

At the Coso Navy 1 power plant, where the resource includes steam and water (bi-phase) but has no hydrogen sulfide abatement, boron in circulating water has averaged less than 10 mg/l (or 10 ppm) for the nine-year operating period of the plant (boron concentration in the circulating water is not expected to change substantially as the power plant ages) (Leitner 1996, 1997). The proposed power plant at Fourmile Hill would also be expected to have concentrations of boron of less than 10 mg/l in the circulating water because the proposed power plant at Fourmile Hill also utilizes a bi-phase resource. Due to a similar power capacity and similar technology, power plant emission at the proposed project would be similar to that at Coso.

A vegetation monitoring system was established at the Coso power plants in the event that boron concentrations in the circulating water might increase, as they did at The Geysers. After five years of monitoring, there was no visible damage to vegetation, no elevated concentrations of boron in leaf tissue and no trends of increasing boron concentration in circulating water. Because the concentration of boron in the circulating water of the proposed project would be comparable to or less than that at Coso, it is reasonable to conclude that boron emissions at the proposed project site would not adversely affect vegetation. It is acknowledged, however, that vegetation at the proposed project (i.e., primarily mixed conifer forest) may respond differently to boron exposure than the vegetation at Coso (i.e., primarily creosote bush scrub).

The monitoring program was then scaled back to simply measuring the concentration of boron and other elements in the circulating water quarterly. If concentrations exceed certain levels, additional monitoring will resume. This appears unlikely, however, because the boron will continue to partition into the brine. A monitoring program similar to the one in use at Coso is proposed for the Fourmile Hill project (see Mitigation Measure 4.7.2a on page 4-92 of the Draft EIS/EIR).

Boron Deposition Calculations: The analysis in the Draft EIS/EIR showed that emissions and deposition of boron would be very low. This conclusion was based on the following calculations. Total boron emissions are projected to be 8.6 lbs/yr. As a general rule, 50% of dissolved solids fall as drift; the remainder becomes aerosol particles. Of the 4.3 lbs/yr that may fall as drift, about 10.4 percent would be blown in the prevailing wind direction (south-southeasterly). Thus, 0.45 lbs/yr (= 4.3 lbs/yr x 0.104) of boron would be carried in that direction. To estimate the deposition rate for boron near the power plant, a very conservative (and unrealistic) assumption was

made: all of the boron blowing in the prevailing wind direction would fall between 50 meters and 100 meters of the power plant. (Vegetation monitoring studies at The Geysers (described below) have shown that boron deposition is greatest between 50 meters and 100 meters from the cooling towers (Jones and Stokes 1986; Lang et al. 1986).)

Using this conservative assumption, boron would be greatest in the prevailing wind direction, between 50 m and 100 m from the power plant. The area over which this amount of boron would fall is approximately 0.3 acres (= 1/16th the area of a circle with a 100 m radius minus the portion of the "wedge" with a radius of 50 m). Thus, boron deposition, at its absolute maximum, would be 1.5 lbs/acre-yr (= 0.45 lbs/yr / 0.3 acres). Actual deposition of boron in the prevailing wind direction would likely be much lower.

Boron deposition in directions other than the prevailing winds, or farther than 100 meters from the power plant would be substantially less than 1.5 lbs/acre-yr, because:

- The wind blows less frequently in directions other than that of the prevailing wind
- Power plant deposition rates fall sharply past 100 meters because of large area over which it is spread (Jones and Stokes Associates 1986; Lang et al. 1986)

This maximum value of 1.5 lbs/acre-year can be put in perspective by comparing it to agricultural soils that are naturally deficient in boron. Some agricultural lands have a tendency to be low in boron because their soils do not hold sufficient quantities of boron in the root zone. For these soils, boron is recommended as an additive to fertilizer. Application rates are typically in the range of 2 to 3 lbs/acre-year to replace boron lost through leaching. This value is comparable to the absolute maximum amount of boron that could be deposited in a small fraction of the area surrounding the proposed power plant.

Boron Accumulation in the Soil: Comment AG.249 claims that 371 pounds of boron would be present in downwind soils and local vegetation at the end of the 45-year life of the project. This value is false because the comment incorrectly assumes that boron emissions equal boron deposition in a particular area. Assuming that all of the boron remained in the soil and accumulated over the lifetime of the project, the concentration of boron at the end of the project in the soil between 50 and 100 m of the power plant, in the direction of the prevailing winds, would be, at most, 67.5 lbs/acre (= 1.45 lbs/acre-year x 45 years), not "371 lbs," as stated in the comment (no unit area given in the comment).

However, as described above, this maximum value is unrealistically high, and it only would apply to a small fraction of the area surrounding the power plant (0.3 acres in the prevailing wind direction). As discussed above, maximum accumulation of boron in other areas would be substantially less than this value.

In addition, boron would not remain in the soil long enough to reach its maximum value at the end of the project (whether that would be 67.5 lbs/acre or other lower values). Soil texture and precipitation affect the accumulation of boron in soils. The power plant area is dominated by coarse soils (see Table 3.2-1 in the EIS/EIR). The possibility of boron accumulating to toxic levels in coarse soils is far less than in fine-

textured soils (Jones and Stokes Associates 1986). This is because coarse soils are very porous and do not hold water long within the root zone of plants. In addition, the form of boron found in geothermal fluid is borate, which is highly soluble. Thus, in the project area, boron would be in solution as borate in soil water, and this soil water would quickly percolate out of the root zone through the porous soils. Thus, boron would not persist in the root zone long enough to accumulate in concentrations toxic enough for plants.

Actual deposition rates of boron at The Geysers support the conclusion that estimated deposition rates of boron at Fourmile Hill would be substantially less than 1.45 lbs/acre-yr over the vast majority of area surrounding the power plant and that boron accumulation in the soil would not be significant. At Unit 13 at The Geysers, where boron emissions were estimated at 463 lbs/yr (compared to an estimated 8.6 lbs/yr at Fourmile Hill), measured boron depositions averaged 1.2 lbs/acre-yr (0.3% of the total emission) at stations less than 200 m from the cooling towers, decreasing to 0.7 lbs/acre-yr or less at stations farther away.

Assuming that factors such as droplet size, cooling tower design, and weather are approximately the same at The Geysers as at Fourmile Hill, depositions of boron at the proposed project would be roughly proportional to emissions at the more modern Geysers Unit 13 power plant. Since the total boron emissions of the Fourmile Hill power plant complex are projected to be less than 9 lbs/yr, deposition would average less than 0.05 lbs/acre-yr within 200 m of the source. Accumulation of boron over the entire 45-year operating lifetime of the project would therefore be less than 2 lbs/acre within 100 to 200 m of the source. This amount is less than the first two years of depositions at Unit 13, during which no visible symptoms were observed of boron toxicity in vegetation.

Boron Accumulation in Vegetation: Comment AG.249 also suggests that boron concentrations in vegetation would increase linearly over the lifetime of the project in the same way that they would increase in the soil. Plants naturally acquire boron through their roots by the uptake of borate or boric acid (Taiz and Zeiger 1991). As discussed above, the concentration of boron in the soil (primarily as borate) at the end of the project would not be sufficient to induce a toxic response in plants.

Comment AG.249 overstates the importance of boron uptake in plants to cause a toxic response. Plants tend to be much more sensitive to foliar applications of dissolved solids than to soil applications. The reason for this is that a foliar application comes into direct contact with living cells in the leaf, and also because leaves do not possess exclusionary mechanisms, as do roots. By contrast, soil application of dissolved solids will move through the soil column more slowly, interacting with the soil itself, and adsorbing onto soil particles. Because plant roots contact only a portion of the soil column, and because much of the boron deposited on the soil would be leached away, only a small fraction of boron eventually comes into contact with roots.

For example, plant fertilizers are generally applied to the soil, but in extreme cases of deficiency, more rapid uptake is achieved by applying fertilizers as a solution to the leaves. When one applies fertilizers to the leaves, the general rule is to use an application rate only one-tenth as much as a soil application (Malloch et al. 1979; Jones and Stokes Associates 1986). Lang et al. (1986) also refer to this tendency in their

discussion of leaf area being an important factor in the sensitivity of natural vegetation to boron in cooling tower drift.

A recent study provides an indication of the level of emissions required to produce damage to vegetation. Lichens are known to be sensitive to changes in air quality and have been useful indicators of the effects of air emissions at geothermal power plants (e.g., Loppi 1996, 1997). In a recent study of foliose lichen in central Italy, the concentration of boron in lichens adjacent to four geothermal power plants (in operation since between 1969 and 1991) was not significantly different from that in lichens at a remote, control site (Loppi 1997). Similarly, concentrations of boron in the soil were not significantly different adjacent to the power plant relative to soil at the control site. Boron emissions at the oldest power plant unit (Piancastagnaio 2) have been approximately 21,000 lbs/yr (the combined emissions of four nearby power plants, which generate a total of 68 MW, are approximately 75,000 lbs/yr), or over three orders of magnitude greater than the predicted emissions at Fourmile Hill. Thus, boron emissions at the project site would not likely affect vegetation in the area, including lichens.

Damage to Pines at The Geysers: Comment AG.249 notes that boron toxicity data are not available for lodgepole pine, but that foothill (digger) pine was damaged by cooling tower drift in the vicinity of Geysers Units 5-6 (Lang et al. 1986). As noted above, the boron emissions from The Geysers Units 5-6 were much greater than the projected emissions from the Fourmile Hill power plant (2,332 lbs/yr vs. 8.6 lbs/yr). Because the proposed project would result in approximately 0.3% of the boron emissions of The Geysers Unit 5-6, a comparison of effects to conifers between the two plants is not warranted. Furthermore, Lang et al. (1986) concluded that conifers, having less leaf area than broadleaf trees, were the least sensitive species to foliar applications of boron in cooling tower drift. Lodgepole pine is likely to be similarly low in sensitivity. Thus, due to its low sensitivity to boron and the low levels of boron deposition on its leaves, lodgepole pine would not be adversely affected by boron emissions near the proposed power plant.

Additional Sources of Boron: The Draft EIS/EIR concluded that deposition from the proposed power plant may cause nearby vegetation to accumulate boron to some degree. However, the Draft EIS/EIR also concluded that this accumulation is not likely to cause acute stress to this vegetation. The calculations were based on projected emissions from both the cooling towers and the vent silencers. Emissions from the power plant are projected to be about 0.8 lbs/yr from the cooling tower about 7.8 lbs/yr from the vent silencers. Because the two sources are situated on opposite sides of the power plant complex, more than 330 feet apart, the area where their drift would have the greatest additive effect over time is within the power plant complex itself. Because this area is unvegetated, the amount of boron deposited on vegetation would actually be substantially less than 8.6 lbs/yr. The two sources of boron would have little cumulative effect, and the areas of highest deposition near each would receive levels of boron that are very unlikely to cause significant damage, either through foliar application or through accumulation in the soil.

Comment AG.249 also suggests that boron emissions from upsets and well venting would increase the estimate of total boron emission from the proposed project. Upset

conditions (defined on page 4-223 of the Draft EIS/EIR) would not result in significant additional sources of boron emissions because:

- The installation of a turbine bypass system would route produced steam around the turbine to the condenser in the event of an upset (see page 4-220 of the Draft EIS/EIR);
- Upset conditions in which the turbine bypass system fails or is turned off would be very infrequent and of short duration (see page 4-225 for an estimate of the frequency and duration of upsets over the life of the proposed project); and
- Steam venting directly from the wells during upset conditions contains few large droplets which could hold boron that would be deposited on the ground nearby.

Thus, upset conditions would not be a significant new source of boron. As discussed in the response to "Comment—Effects of Well Venting on Vegetation" above, boron emissions from well venting would not substantially contribute to the total boron emissions of the project.

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Comment—Effects of Fluorine Emissions on Vegetation

AG.251 About 0.4 lbs/MWh of fluorine are emitted by geothermal power plants. (Ellis 1978.) Therefore, about 175,000 lbs/yr would be emitted by the Project. Fluorine is considered to be the most hazardous and phytotoxic trace pollutant among the common air pollutants such as ozone, SO_2, and NOx. The amount of fluorine normally accumulated from the soil is small, and there is little relationship between the concentration of fluorine in the soil and that in the plant. Therefore, most fluorine is accumulated directly from the atmosphere, where it is usually present as hydrofluoric acid, into the leaf through stomata and the cuticle. Fumigation experiments indicate that plants accumulate from 1 to 4 ppm F per $\mu g/m^3$ per day ("ppmF/$\mu g/m^3$-day").

Fluorine adversely affects plant metabolism, retards growth, inhibits reproduction, causes foliar injury, and reduces yield. Many conifers, including lodgepole pine and ponderosa pine, which are common in

the study area (DEIR, Table 3.7-1), are highly susceptible to needle injury during the period of needle elongation. Thereafter, they are classified as tolerant. The presence of sulfur dioxide apparently aggravates these conditions.[10] Wide spread forest damage from fluorine has been documented around fluorine sources in a number of locations. For example, severe morbidity and mortality in ponderosa pine and lodgepole pine forest was documented on 2000 acres surrounding an aluminum reduction plant in Montana.[11] Susceptible plants are injured by foliar concentrations between 20 and 150 ppm (dry weight). Finally, fluorine in forage is toxic to animals at low concentrations.[12] Concentrations greater than 30 to 40 ppm dry weight in forage are toxic to animals.[13] (Kabata-Pendias and Pendias 1992, p. 249.)

These thresholds would be readily exceeded by Project emissions and would probably result in significant damage to local vegetation and wildlife. Using the DEIR's analysis, if the emission of 14,400 lbs/yr of hydrogen sulfide results in an annual average concentration of 0.092 $\mu g/m^3$ at Grouse Hill, the peak concentration (DEIR, p. F-47), then the emission of 175,000 lbs/yr of fluorine would result in an ambient concentration of 1.1 $\mu g/m^3$ at Grouse Hill.[14] Fumigation experiments demonstrate that 1 to 4 ppmF/$\mu g/m^3$-day of fluorine are accumulated by leaves. Using the lowest reported accumulation rate, at the end of the 45 year plant life, theoretically, the foliage of vegetation between the plant and Grouse Hill would have fluorine concentrations of up to 18,100 ppm F.[15] The upper end of the injury range for sensitive plants, 150 ppm, would be exceeded after only 136 days of operation of the Project. Finally, at Lava Beds National Monument, foliar fluorine concentrations would reach 199 ppm[16] at the Visitor Center and 721 ppm[17] at the southwest corner after 45 years of operation. Therefore, conifers and other vegetation throughout a wide geographic area and wildlife dependent upon it, could potentially be damaged by fluorine emissions from the Project. This is a significant impact that should be mitigated.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effects of Fluorine Emissions on Vegetation

Fluorine, primarily as hydrogen fluoride gas, has been identified as a phytotoxic pollutant when it occurs above a certain concentration. Aluminum smelters often have fluoride emissions in the range of hundreds of tons per year, which can result in phytotoxicity (Murray 1982). Impacts to vegetation near aluminum smelters have prompted research into the tolerance of vegetation to fluoride. Studies have shown that sensitive agricultural plants will tolerate 0.8 $\mu g/m^3$ of hydrogen fluoride in continuous fumigation with no significant reduction in growth (Greenhalgh and Brown 1982).

As described in response to "Comment—Arsenic, Fluoride, Sulfate, and Ammonia Emissions," emissions of fluorine from the proposed project would be approximately 1.7 lbs/yr. Most of this fluorine is expected to be emitted in the aqueous state, rather than as a gas (Ellis 1978). As noted in the comment, fluorine in solution is not readily absorbed by plants. However, given the projected fluoride gas emissions, the concentration of emissions at the source would be below the threshold for damage to vegetation. Because vegetation nearest to the cooling tower would be exposed to

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[10] D.F. Adams and others, Atmospheric Pollution in the Ponderosa Pine Blight Area, Industrial and Engineering Chemistry, v. 44, no. 6, 1952, pp. 1356-1365.

[11] W.H. Smith, Air Pollution and Forests, Springer-Verlag, New York, 1990, pp. 493-494.

[12] L.P. Gough, H.T. Shacklette, and A.A. Case, Element Concentrations Toxic to Plants, Animals, and Man, U.S. Geological Survey Bulletin 1466, 1977, pp. 25-26.

[13] L.H. Weinstein, Fluoride and Plant Life, J. Occup. Med., v. 19, 1977, pp. 49-78; E. Groth, Fluoride Pollution, Environment, v. 17, 1975, p. 29.

[14] Fluorine concentration = (0.093 g/m3 H2S)(175,000 lbs F/14,400 lbs H2S) = 1.1 g/m3.

[15] Fluorine concentration in foliage of vegetation between the plant and Grouse Hill = (1.1 g/m3)(1 ppmF/ g/m3-day)(365 days/yr)(45 yrs) = 18,068 ppm.

[16] Foliar fluorine concentration at Lava Beds National Monument Visitor Center = (0.000997 g/m3 H2S)(175,000 lbs F/14,400 lbs H2S)(1 ppmF/ g/m3-day)(365 days/yr)(45 yrs) = 199 ppm. The annual average hydrogen sulfide concentration is from the DEIR, p. F-47.

[17] Foliar fluorine concentration at southwest corner of Lava Beds National Monument = (0.00361 g/m3 H2S)(175,000 lbs F/14,400 lbs H2S)(1 ppmF/ g/m3-day)(365 days/yr)(45 yrs) = 721 ppm. The annual average hydrogen sulfide concentration is from the DEIR, p. F-47.

concentrations of fluorine well below that at the source, there would be no adverse impact on vegetation.

References:

Ellis, A. J. 1978. Geothermal fluid chemistry and human health. *Geothermics* 6:175-182.

Greenhalgh, W. J., and G. S. Brown. 1982. Effect of airborne fluorides on grapevines. *In:* F. Murray (ed.), Fluoride emissions, their monitoring and effects on vegetation and ecosystems. Academic Press, New York, NY.

Murray, F., ed. 1982. Fluoride emissions, their monitoring and effects on vegetation and ecosystems. Academic Press, New York, NY.

Comment—Effects of Lithium Emissions on Vegetation

AG.252 Lithium is present in high concentrations in geothermal fluids from the Medicine Lake area. (DEIR, Table 3.4-1.) About 0.8 lbs/MWh of lithium are emitted by geothermal power plants with comparable amounts of lithium. (Ellis 1978.) Therefore, about 350,000 lbs/yr would be emitted by the Project. Lithium is typically very soluble in soil pore water and readily absorbed by vegetation. It is toxic to some plant species at foliar concentrations of 4 to 40 ppm and damages root tips and foliage. (Kabata-Pendias and Pendias 1992, p. 92.) These thresholds would be readily exceeded by Project emissions and may result in significant damage to local vegetation.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effects of Lithium Emissions on Vegetation

Although the comment states that lithium is present in high concentrations in geothermal fluids, data available for the Glass Mountain KGRA indicate that lithium would be present in low concentrations. Analysis of geothermal brine at Telephone Flat showed that lithium was present at only 3.1 mg/l (3.1 ppm) (USFS et al. 1998). Similarly low concentrations of lithium are expected to be present at the Fourmile Hill site.

Lithium and lithium compounds are expected to be partitioned into the liquid phase (i.e., the brine) of the geothermal resource. As a result, the brine would contain much more lithium than would the steam or the steam condensate. Because all of the geothermal brine would be reinjected into the reservoir (and none of the brine would go to the power plant or cooling tower), the concentration of lithium in the circulating water of the cooling tower would be substantially lower than the 3.1 mg/l found in the brine.

Experiments with plants grown in culture solutions containing 3.5 mg/l of lithium showed some reduction in growth (Gough et al. 1979). The lithium concentration in the brine would be below this threshold and would not cause damage to plants. As discussed above, the steam condensate would have a much lower concentration of lithium. As a result, the steam condensate would have harmless levels of lithium even if it was applied directly to plant leaves. Thus, the amounts of lithium received as a foliar deposition by plants near the wells, vent silencers, and cooling tower would not have a significant effect.

References:

Gough, L. P., H. Shacklette, and A. Case. 1979. *Element Concentrations Toxic to Plants, Animals, and Man*. U.S. Geologic Survey Bulletin 1466. 80 pp.

USFS (U.S. Department of Agriculture Forest Service), U.S. Department of Interior Bureau of Land Management, and Siskiyou County Air Pollution Control District. 1998. Draft EIS/EIR for the Telephone Flat Geothermal Project. May.

Comment—Effects of Bromine Emissions on Vegetation

AG.253 About 0.7 lbs/MWh of bromine are emitted by geothermal power plants. (Ellis 1978.) Therefore, about 300,000 lbs/yr would be emitted by the Project. Plants readily take up bromine from soils. Bromine is typically elevated in vegetation grown in volcanic soils. Bromine is toxic to vegetation and its effects are similar to salts and boron, including chlorosis and tip necrosis. (Kabata-Pendias and Pendias 1992, p. 253.) The impact of bromine emissions may be significant and should be evaluated.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effects of Bromine Emissions on Vegetation

At Telephone Flat in the Medicine Lake Highlands, bromine, in the form of bromide, was found to be undetectable in samples of condensate from geothermal wells (USFS et al. 1998). Cases of bromine toxicity in plants are rare and have generally been related to accumulation of bromine compounds such as ethylene dibromide and methyl bromide following soil fumigation to control pests (Gough et al. 1979). Over the operating lifetime of the project, levels would be extremely low of bromide ions that would accumulate in plants through the deposition of cooling tower drift. In fact, increased bromine levels would probably be undetectable in vegetation near the proposed power plant.

References:

Gough, L. P., H. Shacklette, and A. Case. 1979. *Element Concentrations Toxic to Plants, Animals, and Man*. U.S. Geologic Survey Bulletin 1466. 80 pp.

USFS (U.S. Department of Agriculture Forest Service), U.S. Department of Interior Bureau of Land Management, and Siskiyou County Air Pollution Control District. 1998. Draft EIS/EIR for the Telephone Flat Geothermal Project. May.

Comment—Effects of Barium and Strontium Emissions on Vegetation

AG.254 Barium and strontium occur at concentrations that are similar to bromine. Both are readily taken up by plants and toxic to plants at low concentrations. Strontium in vegetation is toxic to plants at 30 ppm actual weight, while barium is toxic at 220 ppm. Antagonistic interactions occur when the two co-occur. (Kabata-Pendias and Pendias 1992, pp. 115-120.) These thresholds would be readily exceeded by Project emissions.

In sum, the emissions of phytotoxic elements may be present in sufficient concentrations in power plant emissions to adversely affect local vegetation and wildlife that is dependent on it. The DEIR failed to evaluate the impact of any substance except boron. The impact of deposition of all phytotoxic elements should be determined by estimating ambient concentrations, deposition rates and soil concentrations and using standard bioconcentration factors to extrapolate soil concentrations to vegetation concentrations. An ecological risk assessment should be completed to determine the effect of toxic pollutant emissions on local vegetation and wildlife using standard U.S. EPA procedures. (U.S. EPA 1992.) The DEIR should be revised accordingly and recirculated for review.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effects of Barium and Strontium Emissions on Vegetation

There is no evidence to suggest that either barium or strontium will be present in geothermal emissions at levels that would cause damage or toxicity to plants. Analysis of geothermal brine at Telephone Flat in the Medicine Lake Highlands showed that barium and strontium were present at 0.03 and 0.025 mg/l, respectively (USFS et al. 1998). Like boron and lithium, barium and strontium will partition strongly into the liquid phase of the geothermal resource. Their concentration would be several orders of magnitude higher in brine than in steam condensate. As a result, most of these elements would be injected into the geothermal reservoir and would not reach the cooling towers. Therefore, barium and strontium would likely be below the limits of detection in steam or steam condensate and would also be far below levels that would harm vegetation.

Reference:

USFS (U.S. Department of Agriculture Forest Service), U.S. Department of Interior Bureau of Land Management, and Siskiyou County Air Pollution Control District. 1998. Draft EIS/EIR for the Telephone Flat Geothermal Project. May.

OTHER EFFECTS ON VEGETATION

Comments—Effects of Transmission Line Construction

O.16 The EIS also admits that populations of California pinefoot, Ash penstemon, Baker's globe mallow and tall woolly marbles may exist along segment C1 of the preferred alternative. The loss of these populations are noted as being significant as a result of placement of the transmission line but cannot be avoided (EIS, 4-93). However, it is clear that the first objective of the LRMP is to ensure the viability of sensitive plants and care for their habitats (3-25). The construction of the transmission line throughout this segment will be in violation of the Modoc LRMP and should be avoided.
(Katherine Kowatch, Friends of the River)

AG.63 Additionally, the impacts associated with this mitigation measure are not discussed. For example, if the transmission line facilities are moved, then the impacts on the new location should be discussed such as effects on sensitive plant communities, cultural sites, wildlife habitat, vegetation loss, and views. (See, e.g., EIS/EIR, Table 2.4-1, pp. 2-67 to 68.) Without this information, the public and decisionmakers are precluded from assessing the presence and extent of any wetlands.
(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

PH3.16 It was also glossed over rapidly that there would be—try to be a minimal amount of clearing under the transmission lines? What does "minimal" mean? I mean, every transmission line I have ever seen had almost everything cleared out underneath in case of arcing, broken cables, whatever.*(Yreka Public Hearing)*

PH3.22 Going back to your clearcut operation on your power line, I believe that you said you are not going to clearcut it underneath for 125 feet? Is that what you said? *(Yreka Public Hearing)*

PH3.23 So is it a hundred-foot clearcut? *(Yreka Public Hearing)*

PH3.24 How many miles of clearcut at a hundred and twenty-five foot right-of-way are we looking at?
(Yreka Public Hearing)

Response—Effects of Transmission Line Construction

Concern is expressed in comment O.16 about the potential loss of populations of special-status plants as a result of the construction of the transmission line corridor, particularly along segments A1, A2, B1, and C1. Special-status plants of concern that may be located in the transmission line corridors include the California pinefoot, ash penstemon, Baker's globemallow, and tall woolly marbles (see Table 3.7-3 on page 3-83 of the Draft EIS/EIR). The Draft EIS/EIR states on page 4-93 that impacts to populations of these species would be significant if they were present along the transmission line route *and they were not avoided.* However, Mitigation Measure 4.7.3a on page 4-94 is proposed to reduce the level of impact to below significance. Mitigation Measure 4.7.3a proposes that early summer and preconstruction surveys be conducted for these and all other special-status plants. These surveys would identify and mark the exact location of all populations of these plants.

The final and exact alignment of the transmission line would be selected only after populations of special-status plants are identified and mapped. The final transmission line would be selected (within the chosen corridor) to avoid these populations. The final alignment of the transmission line would also be based on other factors such as topography and location of other sensitive resources (e.g., wetlands, stands of the old-growth Forest, snags, streambeds).

Comment AG.63 suggests that impacts from the specific transmission line alignment (determined after the preconstruction surveys) must be addressed. In the Draft

EIS/EIR, impacts to vegetation and wildlife were assessed within a transmission study corridor that was over 1,000 feet wide. Adjustments of the transmission line alignment that are based on the results of the preconstruction surveys would occur only within that study corridor. Thus, the potential environmental impacts of the transmission line alignment have already been evaluated in the Draft EIS/EIR.

In response to the comments given at the Yreka public hearing, the amount and type of clearing along the transmission line is described in Tables 2.2-2 and 2.2-3 on pages 2-37 and 2-44 of the Draft EIS/EIR, respectively. The amount of clearing along the transmission line by habitat type is given in Tables 4.7-1 and 4.7-2 on pages 4-85 and 4-98 of the Draft EIS/EIR, respectively.

Comments—Effects of Herbicides

N.21 The DEIS/EIR failed to disclose and evaluate the site specific vegetation manipulation practices, including the effects to sensitive plant species. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

N.23 The DEIS/EIR failed to disclose and evaluate whether the application of herbicides and any other chemicals will occur during the right-of-way maintenance practices, and also the direct, indirect, and cumulative impacts to water quality in surface bodies of water and groundwater resulting from the use of herbicides and any other chemicals associated with the construction and maintenance of the transmission corridor. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

PH3.58 Do you expect to spread any herbicides under the power line? *(Yreka Public Hearing)*

Response—Effects of Herbicides

The Draft EIS/EIR has been changed on page 2-51 (fifth paragraph) to clarify that no herbicides would be used to control vegetation:

> "Various techniques would be utilized to control or eliminate vegetation growing within or adjacent to the transmission facilities that could interfere with reliable transmission line service. These techniques would involve~~include~~ hand and mechanical cutting of vegetation, but not the use of herbicides. The method of control depends on a number of considerations, including type of vegetation, prevailing weather, accessibility of the terrain, economic cost, and effectiveness."

Comments—Effects of Exotic Species

J.13 The section of the EIR (pg. 4-96) which deals with noxious weed invasions as a result of this project states that no weed inventory or management plan is in place at the time, and no surveying for noxious weeds has taken place to date. The assessment states that introduction of weeds into the Medicine Lake Highlands area would "not be considered a significant effect." What scientific research did you use to make this determination, and what was the criteria used to measure the impacts? *(Vivian Parker, California Native Plant Society)*

AG.51 The EIS/EIR also fails to provide sufficient information regarding the introduction of exotic pest plants (weeds) into the environment. Weeds, which present a threat to native ecology because they displace native plants, could be introduced into the area by the Project's vehicles. (*Id.* at p. 4-96; Ex. B, § 4.7.) Thomas Reid Associates comments on this issue and recommends mitigation. (Ex. B, § 4.7.) *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

AG.280 Page 4-96 of the EIS/EIR states that "during project construction and maintenance, the seeds of weedy plants could be introduced into the project area by construction and maintenance vehicles. While the introduction of weeds would not be considered a significant effect, avoidance of weed introduction would be desirable." Why is the introduction of weedy plants not considered a significant effect? Prevention of the spread of exotic pest plants into previously pristine habitats is major goal of the California Native Plant Society and the California Exotic Pest Plant Council. The mitigation measure for this impact (4.7.5a) should include more details on the post-construction monitoring protocol so that its adequacy can be evaluated. We recommend that any invasive pest plants that become established in the area should be subject to control throughout the 45-year life of the project and beyond, if necessary. *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

Response—Effects of Exotic Species

The Draft EIS/EIR addresses the introduction of weeds on page 4-96. As discussed in this section, the introduction of noxious weeds is not considered a significant effect because most weeds in California are invasive at low to mid-elevations, not at higher elevations and climatic conditions that are typical of the Medicine Lake Highlands. The proposed transmission line would be located at mid-elevations, where the spread of noxious weeds would be more likely. However, construction of the transmission line on the Modoc Plateau would require much less disturbance to vegetation than it would at higher elevations (see pages 4-84 through 4-88 of the Draft EIS/EIR for more discussion of this issue). The lower disturbance would substantially reduce the chance that the project would introduce a new weed to the area.

Despite the presence of some noxious weeds within the Klamath and Modoc National Forests, the botanical resource inventory of the wellfield and power plant area found that noxious weeds are currently not common in the Medicine Lake Highlands. Furthermore, none of the species listed on the following page were found in the project area. The few exotic species that were found in the power plant and wellfield area were largely restricted to disturbed areas such as log decks and skid trails. The spread of these species into undisturbed habitat as a result of project activities is highly unlikely because of the prevalence of human-induced disturbance in the area for many years.

Large-scale logging by clear-cutting has occurred on the Klamath and Modoc National Forests for decades in areas close to the proposed project, and clear-cutting results in much greater disturbance than proposed by the proposed project. Assuming that the exotic species already present in the Medicine Lake Highlands have been in the area for some time, the fact that they are restricted to disturbed habitats strongly suggests that they are unable to colonize undisturbed habitat. Thus, it is highly unlikely that the project would result in the spread of existing weed species.

It is acknowledged that activities associated with the proposed project may introduce new noxious weed species into the area (such as the ones listed in table on the next page) that have the potential to spread into undisturbed habitats. As a precautionary measure, the applicant is committed to a program of weed inventory, prevention, control, and monitoring in areas where surface disturbance would occur as a result of the proposed project (see Mitigation Measure 4.7.5a on page 4-96 of the Draft EIS/EIR).

Preventing the introduction of new noxious weeds and controlling the spread of existing noxious weeds is a stated goal of the Klamath and Modoc National Forests (USFS 1991, 1994). The Modoc National Forest has identified several noxious weeds that already pose a threat to native vegetation and wildlife in the Forest. These species are listed in Table 4.7-1a. These species would be the primary targets of the weed control plan that Calpine would develop with the USFS as described in Mitigation Measure 4.7.5a.

Comment AG.280 suggests that details of the proposed weed control plan should be provided in the EIS/EIR. It is premature to propose a detailed weed control plan for the Draft EIS/EIR because the transmission line alignment has not yet been selected. Once the transmission line alignment has been selected, detailed floristic surveys would be

Table 4.7-1a: Invasive Exotic Plants Known to Occur on the Modoc National Forest

Species	CalEPPC List[1]	CDFA List[2]
Acroptilon repens Russian knapweed	–	B
Carduus acanthoides plumeless thistle	Need More Information	A
Centaurea solstitialis yellow star thistle	A-1	C
Centaurea squarrosa squarerose knapweed	–	A
Conium maculatum poison hemlock	B	–
Hypericum perforatum Klamathweed	–	C
Isatis tinctoria Dyers woad	Need More Information	B
Linaria genistifolia ssp. *Dalmatica* Dalmation toadflax	–	A
Melilotus officinalis sweet clover	Considered But Not Listed (restricted to disturbed sites)	–
Onopordum acanthium ssp. *Acanthium* Scotch thistle	–	A
Salvia aethiopis Mediterranean sage	Need More Information	B
Tribulus terrestris puncture vine	–	C

Notes:

1 California Exotic Pest Plant Council Lists: A-1 = Most Invasive Wildland Pest Plants: Widespread; B = Wildland Pest Plants of Lesser Invasiveness; Need More Information = Species' status is uncertain; more information is needed.

2 California Department of Food and Agriculture Lists: A = The agency mandates that these species be targeted for eradication or containment; B = These species are more widespread and therefore difficult to contain and the agency allows county Agricultural Commissioners to decide whether to target them for eradication or containment in their jurisdictions; C = These weeds are so widespread that the agency does not endorse state- or county-funded eradication or containment efforts except in nurseries or seed lots.

SOURCES: USFS 1991; CAL EPPC 1996; CDFA 1998

conducted to identify all exotic plants within and adjacent to this alignment. Once these species have been identified and mapped, an appropriate and detailed weed control plan would be drafted.

Comment AG.280 also recommends that any invasive pest plants that become established in the area should be subject to control throughout the 45-year life of the project and beyond, if necessary. A control program lasting beyond 45 years would not be necessary. Weeds are most likely to become established soon after the ground is first disturbed. This time period would coincide with the revegetation period, either just after project construction or just after decommissioning and removal of project structures (see Mitigation Measure 4.7.1d on page 4-89 of the Draft EIS/EIR). The revegetation effort would include a vigorous program of monitoring and removal of weedy plants. This effort would continue until the revegetation was considered successful. The revegetation success criteria would include the absence of any noxious weeds.

Although the majority of the disturbance would occur during project construction and decommissioning, there would be some ground disturbance associated with periodic maintenance that would occur throughout the life of the project. This maintenance would include periodic clearing or topping of trees and shrubs within the transmission line corridor. Mitigation Measure 4.7.5a has been revised to emphasize periodic monitoring throughout the life of the project:

> "4.7.5a Calpine shall develop and implement a weed control plan under the direction of the USFS. This plan shall be modeled on the plan for the Tuscarora natural gas pipeline project segment on the Modoc National Forest, and shall include the following elements:
>
> - Development of a list of weeds for which control measures are required
> - An inventory of existing weed infestations within the project area
> - Wash stations for construction vehicles entering the project area and at staging areas along the transmission line route
> - Post-construction monitoring and control of weed infestations that will occur periodically throughout the life of the project, under the direction of the USFS. (C, O, D)"

References:

CalEPPC (California Exotic Pest Plant Council). 1996. Exotic pest plants of greatest ecological concern. Unpublished report. World Wide Web site, http://www.igc.apc.org/ceppc/worst.html. August.

CDFA (California Department of Food and Agriculture, Division of Plant Industry). 1998. Pest ratings of noxious weed species and noxious weed seed. Sacramento, CA. January 6.

USFS. 1991. *Modoc National Forest Land and Resource Management Plan.* U.S. Forest Service, Pacific Southwest Region.

USFS. 1994. *Klamath National Forest Land and Resource Management Plan.* U.S. Forest Service, Pacific Southwest Region.

POTENTIAL IMPACTS TO SPECIAL-STATUS PLANTS

Comments—General Impacts to Special-Status Plants

L.3 Significant forest resources would be damaged by this project, and the forest as a viable life community would be jeopardized. We need to protect our forests from damage. Forests like these protect biodiversity. In addition, we must retain beautiful, spirit-sustaining places to enjoy and rever.
(Steve Tabor, Desert Survivors)

O.15 The EIS lists several plant species which are sensitive, protected, threatened or endangered. Examples of such species in the proposed geothermal project area include: Ash beard tongue, Ash penstemon, Baker's globe mallow, California pinefoot, Gray penstemon, Hall's sedge, Liddon's sedge, Sugar stick, Tall woolly marbles and Volcanic daisy (EIS, 3-83).

The EIS concedes that there will be the loss of a population of Hall's sedge and several populations of Sugar stick, Gray penstemon and Volcanic daisy, which are found in the proposed plant and wellfield areas (4-93). The EIS states the impact from the losses of these populations will not be significant, but even so, the LRMP states that the Forest Service will conserve sensitive plant populations by identifying and protecting their specific habitats. Care will be taken not to adversely affect their habitats and ensure species viability (3-25). It is highly questionable that such care has been implemented when the EIS has acknowledged that several species of sensitive plants will be lost as a result of construction. The Modoc LRMP also requires that Species Management Guides be developed for all species on the sensitive plant list (4-21). We urge that the management prescription be followed for all sensitive plants in order to ensure their viability. *(Katherine Kowatch, Friends of the River)*

X.5 Issues of particular concern to the MMAS include the disruption of habitat for the special-status species ash beardtongue, Liddon's sedge, gray penstemon, and volcanic daisy.
(Michael Hauptman, Mount Shasta Area Audubon Society Board of Directors)

DY.4 The flora and fauna remain healthy and are vital to maintaining such natural communities for future generations. *(Daniel Kiely)*

DU.4 ...huge swaths of forest will be cut down so that unsightly power lines can carry small amounts of expensive to produce power, *(Charles B. Jones)*

Response—General Impacts to Special-Status Plants

These comments express concern that populations of special-status plants would be lost as a result of this project. However, in the Draft EIS/EIR, mitigation is proposed to avoid the loss of populations of special-status plants. Comment O.15 cites page 4-93 of the Draft EIS/EIR. On this page, the Draft EIS/EIR states that "The proposed action may result in the loss of a population of Hall's sedge and several colonies of sugar stick in the wellfield and power plant area, and several populations of gray penstemon and volcanic daisy on segment C1." These losses could occur only if no mitigation is implemented. The Draft EIS/EIR continues by saying that, even without mitigation, the potential loss of these populations is not considered significant under CEQA or NEPA. This loss would not be considered significant because the losses would be small (in number and area) and these four species are only marginally special-status (see Table 3.7-2 of the Draft EIS/EIR for the status of these species).

Mitigation Measure 4.7.3a proposes preconstruction surveys to identify additional populations of these and other special-status plants and to mark the known populations of these four species. Known populations would then be avoided during construction. Thus, as described below, no impacts to these species would occur as a result of the project and implementation of Mitigation Measure 4.7.3a.

Small populations of Hall's sedge that occur as a colonizing species on one or two log decks may be impacted as a result of wellpad construction. Mitigation measures would include the use of this species in revegetating graded areas because it grows best in open soil (see response to "Comment—Mitigation for Impacts to Special-Status Plants").

Because of the expected increase in suitable habitat for Hall's sedge, the population size of this species would likely increase.

As stated in the Draft EIS/EIR on page 4-94, all known populations of sugar stick within the wellfield and power plant development area would be avoided. Preconstruction surveys would be carried out to ensure that known populations of sugar stick are clearly marked and avoided and no new sugar stick populations are impacted. Gray penstemon and volcanic daisy were found within the study area for the transmission line corridors in localized populations. Because of the small extent of these populations, it is anticipated that these populations would be avoided as part of the project design.

Comment O.15 also states that Species Management Guidelines be developed by the Modoc National Forest according to the Land and Resource Management Plan (LRMP). The Modoc LRMP states as a guideline that the Forest Service shall "Within the planning period, develop Species Management Guides for all species on the Forest sensitive plant list" (page 4-21). This directive was intended as a guideline and not a requirement of all projects within the Modoc National Forest. Modoc National Forest is currently preparing such guides for all sensitive plants.

Comment—CDFG Concerns Regarding Special-Status Plant Species

D.1 The California Department of Fish and Game (DFG) has reviewed the subject draft EIS located within the Glass Mountain Known Geothermal Resource Area (KGRA) on the Klamath and Modoc national forests in Siskiyou and Modoc counties. The project proposes to construct a 49.9-megawatt (MW) geothermal power plant with five production well pads and associated pipelines, access roads and a 24-mile transmission line. Approximately 388.5 acres of habitat will be affected by the proposed project.

The draft environmental impact report (EIR)/EIS addressed many of our previous concerns including floristic surveys that locate special status plant species. Identified populations of special status species will be marked and avoided. *(Richard L. Elliott, California Department of Fish and Game)*

Response—CDFG Concerns Regarding Special-Status Plant Species

Comment D.1 is noted. As discussed in Mitigation Measure 4.7.3a on page 4-94 of the Draft EIS/EIR, preconstruction surveys of the proposed transmission line route would be conducted that would be similar to the 1997 floristic surveys of the wellfield and power plant area. The purpose of these surveys is to precisely delineate populations of special-status plants immediately prior to construction (i.e., to provide the most up-to-date locations of these plants) to ensure that these plants are avoided during construction of the power plant, wellfield, and selected transmission line route. Populations of state- and Federally listed species, CNPS List 1 and 2 species, and Category 2 species that are listed in the Northwest Forest Plan would be avoided. In addition, a buffer zone would be established between any population of these species and construction activities in order to minimize disturbance to these populations. As discussed in Mitigation Measure 4.7.3a, other special-status plants would be avoided where possible.

Comments—USFS Survey and Manage Plant Species

J.9 Forest Service "Survey and Manage" species were inadequately dealt with in this document. The Forest Service is required to survey for Category 2 species for all projects which will be implemented after 1999. Extensive surveys to find high-priority sites for species management of Category 3 species was to be underway in 1996. No survey information is provided in this document. The EIR states that "survey protocols have not been developed" for accomplishing this fundamental work. Adequate management of late-seral habitat, identified in the President's Plan for management of forests in the range of the Northern Spotted Owl, cannot be accomplished until this information is collected. The Record of

Decision for this management plan was signed on April, 1994. We do not believe that lack of a "survey protocol" is a sufficient excuse for not implementing this important element of the President's Plan. Survey protocols already in place for many years in the field of environmental impact analysis, such as those used to survey for rare plants, should be an adequate starting place for lichen, fungi, and bryophyte surveys. *(Vivian Parker, California Native Plant Society)*

K.12 Surveys to protocol must be conducted for "survey and manage" species (S&G [Standards and Guidelines], p. C-4-5 and p. C-49-61, Table C-3). *(Ryan Henson, California Wilderness Coalition)*

Response—USFS Survey and Manage Plant Species

These comments express concern that USFS survey and manage species were not adequately addressed in the Draft EIS/EIR. All survey and manage vascular plants were surveyed in the power plant and wellfield area for the Draft EIS/EIR (see Table 3.7-2). The Draft EIS/EIR provides an adequate discussion of these vascular plant survey and manage species. See response to "Comment—Effects on Special-Status Fungi and Lichens" regarding survey and manage fungi and lichens.

Comment J.9 also states that the U.S. Forest Service must survey for Category 2 and 3 survey and manage species according to the policies in the Northwest Forest Plan (also known as the "President's Plan" or "Option 9"). Pages C-4 through C-6 of the standards and guidelines of the Northwest Forest Plan describe the requirements and recommendations for survey and manage species. The requirements for survey and manage species are summarized below for each of the four categories:

- Category 1: Manage known sites; use techniques such as prescribed fire to enhance habitat; prohibit ground disturbance in some cases
- Category 2: Survey prior to ground-disturbing activities over large areas or for specific projects
- Category 3: Conduct extensive surveys to find high-priority sites for species management; surveys prior to ground-disturbing activities are not required
- Category 4: Conduct general regional surveys; gather information to determine the appropriate level of protection; species in this category include arthropods, fungi (other than ones classified as 1, 2, or 3), bryophytes, and lichens.

As described in the Northwest Forest Plan, site-specific surveys are required for ground-disturbing activities only for species listed under category 2. Because many survey and manage species are listed under multiple categories, a species listed under category 1 may also require site-specific surveys. The USFS is currently conducting extensive surveys for plant species listed under category 3. For example, the Klamath National Forest has completed Forest-wide surveys for survey and manage lichens, fungi, and vascular plants (Jim Stout, Klamath National Forest, *personal communication*, 1998). The Klamath National Forest is currently conducting surveys for survey and manage bryophytes and expects these surveys to be completed soon. Preliminary data from these surveys, where they apply to the proposed project, have been included in the Final EIS/EIR.

As stated in Mitigation Measure 4.7.3a on page 4-94 of the Draft EIS/EIR, all special-status plants would be surveyed again before construction of the project. All USFS survey and manage species would be included in this survey.

Although not required by the Northwest Forest Plan, surveys for survey and manage fungi and bryophytes will be conducted by qualified mycologists and bryologists in

the spring and fall of 1998 in the power plant and wellfield area. These surveys will identify any survey and manage non-vascular plants (i.e., all categories) that might be affected by the proposed project. If populations of these species would be impacted by the project, appropriate mitigation measures would be developed in consultation with the USFS. Mitigation measures that would be developed would depend of the size and extent of the populations and their survey and manage status.

Comments—Omission of Special-Status Species

AG.47 The EIS/EIR fails as an informational document because it does not provide sufficient information about the Project's impacts on vegetation. One flaw is that the EIS/EIR does not contain a complete list of the species ranging in the Project area. For example, the Trinity buckwheat (*Eriogonum alpinum*), which is a state endangered species and a federal species of concern, should have been discussed. (Ex. B, § 4.7; Ex. F (7/3/96 letter from Joel Medlin, U.S. Fish & Wildlife Service).) Additionally, Ashland's thistle, McDonald's rockcress, Yreka phlox, slender orcutt grass, and the Siskiyou mariposa lily are listed species in that exist in Siskiyou County. *(Ibid.)*

(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

AG.273 The EIS/EIR does not address several listed plant species known to exist in Siskiyou County as provided in the California Dept. Fish and Game Internet site. State listed plants on the CDFG list are: Ashland's thistle, McDonald's rock cress, Trinity buckwheat, Yreka phlox, Siskiyou mariposa lily, and slender orcutt grass. The EIS/EIR should address these species if there is suitable habitat for such species in the project area. *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

Response—Omission of Special-Status Species

The list of plant species within the project area presented in the Draft EIS/EIR is complete. This list in Table 3.7-2 includes plant species that are reasonably expected to occur in the project area based on the species' range and habitat type. The species listed in the letter from the USFWS (comment AG.47, Ex. F) cites plants that are listed by the USFWS that are found within all of Siskiyou and Modoc Counties. These counties are very large, and some of the habitats contained within them do not occur in the project area. Because some of the species in the USFWS list could not reasonably occur within the project area, it is not necessary to discuss all of the species on the USFWS list.

The six species listed in comment AG.273 were not discussed in the Draft EIS/EIR or in the botanical report prepared for this project (B. Leitner 1997) because suitable habitat does not occur in or near the project site. The botanical surveys for this project occurred during the flowering period for all six sensitive species cited in comment AG.273. These botanical surveys were conducted to identify all plants within the project area, not just sensitive species that were expected to occur there. Thus, although suitable habitat for the six species cited in the comment does not exist in the project area (with the possible exception of slender orcutt grass), all of these species would have been identified had they been present in the project area. Furthermore, five of the six species cited are perennials. Perennial species tend to be seen more easily than annual species because their underground storage reserves allow them to persist even during unfavorable years.

An explanation of why the six species cited in the comment were not included in the Draft EIS/EIR is presented below. Biological information for each species is taken from standard botanical references (Hickman 1993; Skinner and Pavlik 1994).

Ashland thistle (*Cirsium ciliolatum*) is a perennial herb that is listed as endangered by the state of California and is on CNPS List 2. This species is found in central Siskiyou County over 50 miles west of Fourmile Hill in cismontane woodland and valley floor

grasslands. Because of the large distance between the project site and the few known locations of the species, suitable habitat is unlikely to occur on the project site.

McDonald's rock cress (*Arabis macdonaldiana*) is a perennial herb in the mustard family that is found in lower and upper montane coniferous Forests. This species is found in the Coast Range in Oregon and California. In California, it is found in Del Norte, Mendocino, and Trinity Counties. This species is listed as endangered by the CDFG and the USFWS. The nearest known location of this species to Fourmile Hill is over 100 miles away. No suitable habitat for this species is present on the project site due to the large distance from known populations and the strong difference in climate between the project site and the Coast Range where this species is found.

Trinity buckwheat (*Eriogonum alpinum*) is a perennial herb that often reproduces vegetatively through rhizomes. This species is found in a variety of high-elevation habitats, including alpine boulder fields, subalpine coniferous Forests, and upper montane coniferous Forests. In upper montane coniferous Forest, Trinity buckwheat is often found on serpentinite soils. Trinity buckwheat is known to occur in Siskiyou and Trinity Counties near Mt. Eddy and Cory Peak. This species is listed by the CDFG as endangered and is a Federal species of concern. The nearest known location to the project is approximately 40 miles southwest of Fourmile Hill. The only habitat present in the project area that could support Trinity buckwheat is upper montane coniferous Forest. However, no serpentinite soils are present in this habitat in the project area. Thus, due to the lack of habitat for this species, and the large distance between the project site and the nearest known population, this species is not expected to occur on the project site.

Yreka phlox (*Phlox hirsuta*) is a perennial herb that is known from only two occurrences near Yreka, California, in Siskiyou County. Yreka phlox occurs on dry serpentinite talus slopes in open Jeffrey pine/incense cedar Forests. Yreka phlox is listed as endangered by the CDFG and a Federal species of concern by the USFWS. The nearest population of Yreka phlox is over 40 miles west of Fourmile Hill. Due to the distance from the project site and the absence of suitable habitat in the project area, Yreka phlox is not expected to occur in the project area.

Siskiyou mariposa lily (*Calochortus persistens*) is a perennial bulb that is found in open, rocky areas within lower montane coniferous Forests. Siskiyou mariposa lily is known to occur is Siskiyou County approximately 50 miles west of Fourmile Hill in the Klamath Mountains. This species is listed as rare by the CDFG and as a species of concern by the USFWS. Suitable habitat for this species may be present on the project site. However, the large distance between known localities makes its presence on site very unlikely. This species was not found during the survey of the project area in 1996.

Slender orcutt grass (*Orcuttia tenuis*) is a small annual grass that is restricted to vernal pools in northern California. It is known to occur in the extreme southeast corner of Siskiyou County, approximately 15 miles from Fourmile Hill. Suitable habitat for the slender orcutt grass may be present in the project site at Dry Lake, on the Perez USGS quadrangle. Portions of this area may be considered a vernal pool, which may support the slender orcutt grass. However, this species was not observed during the botanical surveys for this project. The southern portion of Dry Lake occurs within the corridor for

alternative transmission line segment C2. Due to the sensitivity of this habitat, if a transmission line alignment was chosen that included alternative segment C2, the final alignment would avoid all habitats that could be considered wetlands, including Dry Lake (see Mitigation Measure 4.7.4b on page 4-100 of the Draft EIS/EIR). If slender orcutt grass occurs in Dry Lake, there would be no significant impacts to this species from the proposed project with implementation of defined mitigation.

Table 3.7-2 has been expanded in the Final EIS/EIR to include all special-status plants that may occur in the project area. This table has also been reorganized alphabetically by species within broad taxonomic groups.

References:

Hickman, J. C., ed. 1993. *The Jepson manual: higher plants of California.* University of California Press, Berkeley, CA.

Leitner, B. 1997. *Final Botanical Resources Report for the Fourmile Hill Power Plant Development Area and Additional Transmission Line Segments A1, A2, and C2.* Prepared for Calpine Corporation, September.

Skinner, M. W., and B. M. Pavlik. 1994. *Inventory of rare and endangered vascular plants of California*. Fifth edition. California Native Plant Society, Sacramento, CA.

Comment—Effects on Boggs Lake Hedge-Hyssop

J.5 The State-listed endangered plant species *Gratiola heterosepala*, or Boggs Lake hedge hyssop, is known to occur within the geothermal area. Why was this species left out of this analysis? What mitigations are proposed to protect this rare plant? *(Vivian Parker, California Native Plant Society)*

Response—Effects on Boggs Lake Hedge-Hyssop

Boggs Lake hedge-hyssop was considered during the botanical surveys for this project (see Table 3.7-2). Boggs Lake hedge-hyssop is an annual member of the snapdragon family (*Scrophulariaceae*). Its habitat is seasonal wetlands that hold water for relatively long periods of time, such as deep vernal pools and perhaps freshwater marshes. It has a somewhat disjunct distribution: it occurs from the western Central Valley floor and Sierra Nevada foothills in Fresno County and the Coast Range valleys in Lake County through Lassen and Modoc counties and southern Oregon. Boggs Lake hedge-hyssop is the only endangered plant (state listed) that has the potential to occur in the project area.

The nearest published record of Boggs Lake hedge-hyssop to the study site is southeast of segment C2 of the alternative transmission line corridor (USDA and USDI 1994). No suitable habitat for the Boggs Lake hedge-hyssop is present in the proposed wellfield and power plant area. Table 3.7-5 of the Draft EIS/EIR notes that potential habitat for the Boggs Lake hedge-hyssop is present in the vicinity of Dry Lake in the transmission line study corridor for alternative segment C2. This was the only part of the study area that appeared to contain significant, suitable habitat. During the field surveys of Dry Lake, only the common hedge-hyssop (*Gratiola ebracteata*) was observed (Leitner 1997).

Because Boggs Lake hedge-hyssop does not occur within the project site, nor is it expected to occur due to the lack of suitable habitat (with the possible exception of Dry Lake near segment C2), mitigation for this species is not required. However, if this species is found during the preconstruction surveys for the project, mitigation

measures would be implemented to avoid or reduce impacts to this species. These mitigation measures would be developed with the USFS according to the Management Plan for this species (USDA and USDI 1994).

References:

Leitner, B. 1997. *Final Botanical Resources Report for the Fourmile Hill Power Plant Development Area and Additional Transmission Line Segments A1, A2, and C2.* Prepared for Calpine Corporation, September.

USDA (U.S. Department of Agriculture) and USDI (U.S. Department of Interior). 1994. *Gratiola heterosepala* Conservation Strategy. Lassen and Modoc National Forests, Bureau of Land Management Alturas and Redding Resource Areas. Unpublished. 26 pp. plus appendices.

Comment—Effects on Talus Collomia

O.17 The EIS states that Talus Collomia is a U.S.F.S. sensitive plant species and is on the C.N.P.S. list (3-75). The Modoc LRMP states that populations of this plant be monitored and protected (4-212); however, such populations may occur on the proposed geothermal project area. The EIS makes no mention of this species, yet it is clear that surveys are required to identify the habitat of this species in order to avoid adverse impacts. *(Katherine Kowatch, Friends of the River)*

Response—Effects on Talus Collomia

This species was considered during the botanical surveys for this project (see Table 3.7-2). Talus collomia is a perennial member of the phlox family (*Polemoniaceae*). Its habitat is volcanic talus, at elevations from 2,210 to 3,500 meters (7300 to 11,600 feet). It is known in California from fewer than five occurrences in Shasta and Siskiyou counties, as well as from Oregon and Washington. Talus collomia occurs near the project area, on Little Mt. Hoffman, less than five miles to the south of the proposed power plant. The site containing talus collomia on Little Mt. Hoffman was visited by the botanists for this project to assess the habitat for this species (Leitner 1997). The botanical surveys conducted for this project were performed during the flowering period of talus collomia; however, no talus collomia was found in the project area. Furthermore, based on the field visit to Mt. Hoffman and the known habitat elsewhere, no suitable habitat for this species was present in the project area.

Reference:

Leitner, B. 1997. *Final Botanical Resources Report for the Fourmile Hill Power Plant Development Area and Additional Transmission Line Segments A1, A2, and C2.* Prepared for Calpine Corporation, September.

Comments—Effects on Special-Status Fungi and Lichens

J.10 A survey of Table C-3 species in the ROD reveals that habitat exists for thirty-plus species of fungi, lichens, and bryophytes associated with late-seral lodgepole and red fir. The EIR states that only two fungi may occur in the area: *Nivatogaster nubigenum* and *Gyromitra gigas*. This is erroneous and there is no scientific documentation of how this determination was made. Habitat needs to be identified using sound scientific principles and an adequate survey needs to be undertaken by a trained mycologist, lichenologist, and bryologist in order to analyze the impacts to these species from this proposed project. *(Vivian Parker, California Native Plant Society)*

J.12 The EIR also states (pg. 4-93) that even if old-growth associated fungi and lichen species are impacted, these impacts would not be "considered significant." Considering that no surveying has been undertaken to determine the locations of these species, and that no information exists as to their health, viability, and distribution, by what criteria are you measuring these impacts, and what scientific data do you have to document that impacts will not be significant? *(Vivian Parker, California Native Plant Society)*

O.18 In addition to Talus Collomia, the false truffle is protected under the Record of Decision for Option 9. Specifically, this species of false truffle requires management of known sites and extensive surveys and managing of sites (ROD, C-49), yet the EIS cannot cite its exact location in the project area. This is a clear violation of the Option 9 Record of Decision. Before further planning is developed for the Fourmile Hill Geothermal Project, extensive surveys must be conducted to locate the fungi populations and to manage for them. Clearly, constructing a geothermal power plant in their habitat will violate the management of the false truffle and any losses of this species is not acceptable despite the claims made in the EIS (4-9.7).
(Katherine Kowatch, Friends of the River)

AD.62 There is an overall lack of data on vegetation. This is of special concern to us, because there are a number of traditionally used plants that should be considered in the evaluation of impacts. The Fourmile Hill project area is a very important gathering area for Matsutake and other mushrooms. At 3-73, although the EIS/EIR claims that the false morel 'would not likely be found in the project vicinity," we have seen many false morels in the Fourmile Hill project area and in the entire Highlands.
(Floyd J. Buckskin, Pit River Tribe)

AG.48 Another flaw is that the EIS/EIR states that the false truffle, which is a special-status fungus, is likely to be found in the Project area. (EIS/EIR, p. 4-94.) Despite acknowledging that the Project will affect the truffle and other fungus and lichen species, the EIS/EIR concludes that the impacts will not be significant. (*Ibid.*) The EIS/EIR, however, fails to provide any scientific or factual data supporting its conclusion. (Ex. B, § 4.7.) *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

AG.274 On page 4-93, the EIS/EIR states "the false truffle is a special-status fungus likely to be found in late seral forests in the project area, particularly within the well field and power plant areas. These and other fungus and lichen species mentioned in the Northwest Forest Plan may be impacted, although these potential impacts are not considered significant." The EIS/EIR should discuss the reason why these impacts are not significant. *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

Response—Effects on Special-Status Fungi and Lichens

Comment J.10 questions the source of information on the potential for survey and manage fungi to occur within the project area (page 3-73 of the Draft EIS/EIR) and suggests that more survey and manage fungi may occur in the project area. The Draft EIS/EIR states that two survey and manage fungi may be present in the project area, the false truffle (*Nivatogastrium nubigenum*), and false morel (*Gyromitra gigas*). This information is based on the records of the Klamath National Forest, Goosenest Ranger District. The Klamath National Forest has conducted inventories for survey and manage fungi. According to the results of these inventories, three species of survey and manage fungi have been reported from the Goosenest Ranger District within 10 miles of the project: false truffle, a species in the uncommon cup fungi group, and false morel.

The false truffle is known from three records at distances of between 6 and 10 miles west and northwest of the project site. There is one record of a species in the uncommon cup fungi group, *Sarcosphaeria eximia crassa* (no common name), located about 10 miles southwest of the project area. No other survey and manage fungi have been recorded by the USFS within 10 miles of the project site.

False morel was listed in the Draft EIS/EIR as potentially occurring in the project area. This species is known to occur in the Goosenest Ranger District of the Klamath National Forest only along the Little Shasta River near Solomons Temple, approximately 35 miles west of the project site. However, because similar habitat is present within the project area, this species may be present.

Efforts to evaluate the potential occurrence of survey and manage lichens, bryophytes, and fungi within the project area are continuing. Because of the extremely limited data available on the ecology and distribution of these species, surveys for these species could not be conducted during the initial biological surveys for the project. However, a

recent survey for these species was conducted in the project area. The results of this survey have been added to the Draft EIS/EIR on page 3-73:

> "Judy Harpel, the USFS survey and manage coordinator for bryophytes and lichens for the Northwest Forest Plan, visited the Medicine Lake Highlands in September, 1997. During her visit, she ascertained the potential occurrence of survey and manage bryophytes and lichens in the region. Ms. Harpel found no evidence of suitable habitat for any of the USFS survey and manage bryophytes and lichens in the Medicine Lake Highlands. Furthermore, Ms. Harpel doubted that suitable habitat would be found at lower elevations on the east side of the Medicine Lake Highlands, towards the Modoc Plateau. These conclusions are documented in a letter by Allison Sanger, Modoc National Forest botanist, dated October 6, 1997."

Suitable habitat for survey and manage lichens or bryophytes does not appear to be present within the project area. Despite the apparent absence of suitable habitat, the absence of USFS survey guidelines or protocols, and the extremely limited ecological information on survey and manage fungi, Calpine will conduct habitat assessment surveys for the three fungi species listed above as part of the preconstruction surveys for all special-status plants (see Mitigation Measure 4.7.3a on page 4-94 of the Draft EIS/EIR). If these three species or any other survey and manage fungi are found on the project site, impacts to these resources would be avoided or minimized as directed by the USFS.

As stated in comments J.12, AG.48, and AG.274, the Draft EIS/EIR determined that, if old-growth associated fungi and lichen were found within the project area, impacts to these species would not be significant (page 4.93). This determination is based on the legal status of these species, not on published or unpublished data on these species. Fungi and lichens that are associated with old-growth Forests are listed as survey and manage species by the USFS. This is a new designation that was defined in the Northwest Forest Plan of 1994.

According to the significance criteria described on pages 4-83 and 4-84, impacts to "rare or endangered species" would be considered significant, depending on the level of impact and the environmental setting. Rare or endangered species are defined to include USFS "sensitive" species but do not include USFS "survey and manage" species. Thus, impacts to survey and manage species would not be considered a significant impact (under NEPA or CEQA) regardless of their presence or abundance within the project area. However, impacts to survey and manage species were still considered in the Draft EIS/EIR. Furthermore, preconstruction surveys for survey and manage fungi would be carried out by the applicant. If any are found, the applicant would carry out mitigation as directed by the USFS.

IMPACTS TO SPECIFIC PLANT COMMUNITIES

Comments—General Effects on Old-Growth (Late-Seral) Forests

J.11 Old-growth stands of red fir in the Medicine Lake Highlands are relicts of the vast stands of red fir which once existed in the area. These stands should have been inventoried for old-growth associated species as part of this NEPA process. In addition, research of lodgepole stands in the area revealed that even 6-7 inch diameter lodgepole were approximately seventy-five years old. This is an indication of the unique and fragile, as well as slow-growing, nature of the plant community. Recovery of these sites is likely to be slow, if at all possible. *(Vivian Parker, California Native Plant Society)*

N.22 The DEIS/EIR failed to disclose and evaluate the direct and cumulative impacts to the loss of old growth trees which will be harvested to construct the transmission corridor. And the DEIS/EIR failed to disclose and evaluate the cumulative impacts to old growth trees as a result of the Fourmile Hill Geothermal Project, Telephone Hill Geothermal Project, past forest activities, and future forest activities.
(Robert J. Baiocci, Fall River Wild Trout Foundation)

X.3 Issues of particular concern to the MMAS include the removal of 21.7 acres of late seral Red fir.
(Michael Hauptman, Mount Shasta Area Audubon Society Board of Directors)

Y.48 The criteria used for determining impacts on old growth does not apply to lodgepole pine forests because of the slow growth of trees under the harsh conditions present at the Medicine Lake Highlands. The DEIS/EIR uses the standard of measuring trees at chest height, but a seven inch diameter lodgepole pine can be 80+ years old. Presence of old growth species (pine marten, etc.) and the actual age of the trees should be the determining criterion. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

DH.2 The development of a geothermal project in the Medicine Lake Highland area would be destructive to this old-growth lodgepole forest. *(Katherine Holmes)*

PH3.17 This is out of the caldera, and this is a lodgepole tree. And this tree is—was cut right at the ground, that slab, and that tree is 75 years old. So our trees up there, we don't—they don't grow very fast. And it is seven inches across. And I suppose old growth probably gets into the 200 year, is what they consider old growth. I don't know what—what the Forest Service says old growth is. This is an idea of a tree when it is cut. I don't think there is anybody in here that is 75 years old. Maybe, but that's how long it takes to grow a tree up there this size. *(Yreka Public Hearing)*

Response—General Effects on Old-Growth (Late-Seral) Forests

These comments express concern about the loss of old-growth (late-seral) Forest as a result of the proposed project. As stated on page 4-108 of the Draft EIS/EIR, effects to old-growth Forest and individual trees and snags with a dbh greater than 18 inches would be significant. Mitigation Measures 4.8.1c, 4.8.1d, and 4.8.1e are proposed to reduce the impacts to old-growth Forests to a level below significance. Mitigation Measure 4.8.1c proposes to avoid impacts to this habitat type wherever possible. Where impact avoidance is not possible, Mitigation Measures 4.8.1d and 4.8.1e propose to replace the lost habitat and individual snags and trees according to USFS guidelines.

Comment J.11 addresses the loss of special-status species that are associated with old-growth Forests. Inventories were specifically conducted for special-status animal and plant species that are typically associated with old-growth red-fir Forests (e.g., Galea Wildlife Consulting 1995; Biosystems Analysis, Inc. 1996; B. Leitner 1997). A discussion of each of these species can be found in the Draft EIS/EIR in Sections 3.7 and 3.8. Impacts to species that do not have special status (i.e., species that are not listed by the USFS, CNPS, CDFG, or USFWS) but are typically found in old-growth red-fir Forests were not considered in the Draft EIS/EIR. General impacts to old-growth red-fir Forests are discussed on pages 4-84 through 4-89 of the Draft EIS/EIR.

Comment J.11 and Y.48 address the loss of old lodgepole pines that are small in size. It is acknowledged that some trees smaller than 18 inches in diameter may be greater than 75 years old. However, the retention or replacement of all trees greater than or equal to 18 inches dbh (see Mitigation Measure 4.7.1a on page 4-88) would preserve a large majority of those trees considered to be "old-growth." The determination of tree age based on tree size is a proven and efficient method that has been used by the Forest Service for decades. According to Mitigation Measure 4.7.1a, the removal of all trees would be kept to a minimum. This would include trees less than 18 inches in diameter and more than 75 years old.

For a discussion of the cumulative impacts to vegetation, see pages 4-318 and 4-319 of the Draft EIS/EIR and response to "Comment—Cumulative Impacts to Vegetation" in the Cumulative Effects Section.

References:

BioSystems Analysis, Inc. and JRP Historical Consulting Services. 1996. *Biological and Cultural Resource Assessments for the Calpine Transmission Line Project, Volume 1—Report.* February.

Galea Wildlife Consulting. 1995. *Biological Survey Report, Fourmile Hill Assessment Area.* October.

Leitner, B. 1997. *Final Botanical Resources Report for the Fourmile Hill Power Plant Development Area and Additional Transmission Line Segments A1, A2, and C2.* Prepared for Calpine Corporation, September.

Comments—Effects on Wetlands

D.2 In addition, wetlands located along a segment of the proposed transmission line will also be avoided. *(Richard L. Elliott, California Department of Fish and Game)*

O.20 A sensitive meadow community, which has been located in segment A1 of the preferred alternative, is eligible for wetlands status. This area contains 750 acres, which lay between Medicine Lake and the Medicine Lake Glass Flow area. Such a meadow would fall under protection as a riparian reserve under the ROD for Option 9, and must be protected accordingly. Management guidelines for this meadow should continue to follow the proper mitigation measures. *(Katherine Kowatch, Friends of the River)*

X.6 Issues of particular concern to the MMAS include disruption of a relatively pristine wetland meadow. *(Michael Hauptman, Mount Shasta Area Audubon Society Board of Directors)*

AG.50 The EIS/EIR states that the removal of lodgepole pine in a meadow would not affect meadow habitat. (EIS/EIR, p. 4-94.) Construction of transmission line segment A1 would affect approximately 1.4 acres of meadow and lodgepole pine habitat. (*Ibid.*) The EIS/EIR appears to compare the removal of lodgepole pine to losses from natural causes such as disease, fire, and fluctuations in groundwater. (*Id.* at p. 4-95.) The EIS/EIR fails to provide any factual basis for its assertion that pine removal would not affect meadow habitat and it fails to recognize that the Project's impacts cannot be characterized as being similar to natural losses. Rather, the Project will cause losses in addition to any natural losses. Thus, the EIS/EIR's analysis of the Project's impacts on the meadow and lodgepole pine habitat lacks any factual foundation. *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

AG.71 The EIS/EIR is inconsistent in its assessment of wetlands or riparian areas and associated wildlife. The EIS/EIR implies that there are no wetland or riparian areas that would be affected by the Project. For example, in the regional overview, the EIS/EIR states that there is little surface water, few permanent streams or riparian habitats, and few springs, meadows, or wetlands and that amphibian species richness is low. (EIS/EIR, p. 3-99.) However, the EIS/EIR also refers to Riparian Reserves delineated by the USFWS and to potential wetlands along transmission line segment A1. (EIS/EIR, Mitigation Measure 4.3.5a, p. 5-6, p. 4-94.) Thus it is unclear whether the Project will affect wetland or riparian areas and associated wildlife species. The EIS/EIR should provide a discussion of these areas so that the public and decisionmakers can ensure that all of the Project's impacts on wildlife have been evaluated. *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

PH2.2 And they do go over and land on that lava bed directly across from the lake or live where your A1 is. They land on that and feed back in there. And there's also a swampland back in there that is not noted in this, showing the salamanders and stuff that are back on this lower side of this—there are some salamanders. I'm not a biologist so I don't know which ones are the endangered salamanders and so forth, but I know there are some around Burney that are. *(Klamath Falls Public Hearing)*

Response—Effects on Wetlands

As discussed on page 4-95 of the Draft EIS/EIR, implementation of Mitigation Measures 4.7.4a, 4.7.4b, and 4.7.4c would ensure that all areas that may be considered jurisdictional wetlands would be avoided during construction of the transmission line. As a result, there would be no impact to any wetland habitat, including the

meadow along segment A1. See also response to "Comment—Need for Wetland Delineation" below for a discussion of the need to perform wetland delineations.

Note that Mitigation Measure 4.7.4a has been strengthened to include the designated buffer zone around certain wetlands (those wetlands designated as Riparian Reserves under the Northwest Forest Plan). See response to "Comment—Riparian Reserves" in the Plans and Policies Section for a discussion of this issue and the revised mitigation measure.

In response to comment AG.50, the Draft EIS/EIR on page 4-94 (last paragraph) has been changed to clarify the expected impacts to the meadow community along segment A1.

> "Approximately 1.7 acres of this meadow habitat could be affected by the construction of segment A1 through the development of access roads through the meadow and construction activities for the transmission line itself. ~~The removal of lodgepole pines in the meadow along the corridor would not be considered to have an effect on this meadow, and would not be expected to affect the acreage of meadow habitat. High elevation meadows typically experience long-term cycles of encroachment and loss of lodgepole pine due to disease, fire, and fluctuations in groundwater level.~~ Mitigation measures are identified to avoid potential impacts to the meadow area from segment A1 construction."

In response to comment AG.71, the description of water availability on page 3-99 of the Draft EIS/EIR is meant to provide a regional overview of the habitats in the Medicine Lake Highlands. The description cited in the comment does not imply that no wetland or riparian habitat would be impacted by the project. The sentence merely states the fact that wetland and riparian habitat is rare in the region. The Draft EIS/EIR discusses the project-specific impacts to wetland and riparian habitat in Section 4.7 and to Riparian Reserves in Section 4.10.

Comment PH2.2 also expresses concern about potential effects to salamanders in the project area. As described in section 3.8 of the Draft EIS/EIR, no special-status salamanders are known to occur or are expected to occur in the project area because an absence of suitable habitat. Therefore, there would be no significant impact to this type of wildlife.

Comments—Need for Wetland Delineation

B.12 As part of the project action, Calpine Corporation proposes to avoid impacts to wetlands by routing the transmission lines around them. However, wetlands along the proposed transmission line routes have not yet been delineated. We recommend that wetland delineation take place as soon as possible to ensure that the proposed mitigation measures can be accomplished.

(Ronald A. Iverson, U.S. Fish and Wildlife Service)

AG.55 Another flaw is that mitigation measure 4.7.4b is internally inconsistent. (Ex. B, § 4.7.) The measure first states that sensitive plant communities in potential wetland areas along transmission line segment C1 shall be avoided. (EIS/EIR, p. 5-16.) However, the measure also states that construction activities shall be timed to avoid wet periods in which habitat disturbance may be greater. (*Ibid.*) It is unclear whether the mitigation measure recommends avoiding these potential wetlands completely or only during wet periods. *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

AG.62 Also, mitigation measure 4.7.4b proposes delineating the extent of potential wetlands prior to construction and siting the transmission line facilities to avoid these areas. (EIS/EIR, p. 5-16; see also Ex. B, § 4.7.) This delineation should have been completed as part of the impact assessment. (Ex. F (July 3, 1996 letter from Joel Medlin, U.S. Fish & Wildlife Service).)

(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

AG.64 Similarly, the EIS/EIR states that a meadow area along transmission line segment A1 may meet wetlands criteria. (*Id.* at p. 4-94.) This assessment should have been completed by this stage of the environmental review process. Without information about potential wetlands, the Project's impacts on these areas cannot be assessed. *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

AG.279 The mitigation calls for conducting a wetlands delineation on areas of "potential wetlands" prior to construction. Such a delineation is customarily done as part of the environmental review of a project and not deferred to the mitigation stage. Based on the results of the delineation, the mitigation is then developed and would consist of habitat replacement. This mitigation leaves one wondering if and how the wetlands can be avoided, what is the nature of the wetlands, and whether they are important in the overall ecology of the area. Also the discussion in measure 4.7.4b is contradictory because it first states that "small potential wetland areas along segment C1 of the transmission line shall be avoided." Then the EIS/EIR later states that "habitat disturbance shall be minimized and construction activities shall be timed to avoid wet periods in which habitat disturbance may be greater." Which is the correct statement? *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

Response—Need for Wetland Delineation

As discussed on page 4-95 of the Draft EIS/EIR, mitigation measures are proposed (Mitigation Measures 4.7.4a, 4.7.4b, and 4.7.4c) to ensure that all areas that may be considered jurisdictional wetlands would be avoided by the transmission line. This avoidance would be accomplished by locating transmission line facilities in areas that are clearly uplands.

Due to the limited extent of wetlands in the project vicinity and based on a preliminary field review by the USFS and a botanist, full avoidance of wetlands would be easy to accomplish. For example, transmission line segment A1 can be rerouted to the north between Medicine Lake and the Medicine Lake Glass Flow to avoid the seasonal wetland in that area. In addition, segment C2 of the alternative transmission line could be easily moved to the north to avoid Dry Lake and any of the nearby, small wetland patches. When avoidance would not be possible, the spacing of transmission line poles would be increased so that no disturbance to wetlands would occur.

To ensure that all wetlands are avoided, a qualified wetlands biologist would conduct pre-construction surveys to clearly mark the potential wetland areas along the selected transmission line route. Areas marked by the biologist would then be avoided using the methods described above. Because there would be no impacts to any habitat that might be considered wetland, it is not necessary to conduct a formal wetland delineation.

In response to comments AG.55 and AG.279, Mitigation Measure 4.7.4b has been revised to more clearly state its purpose:

> "4.7.4b The~~Sensitive plant communities in the~~ dispersed, small potential wetland areas along segment C1 or C2 of the transmission line shall be avoided. A qualified biologist shall delineate the extent of these potential wetland areas prior to construction, and transmission line facilities shall be sited to avoid these areas. Habitat disturbance in areas other than potential wetland habitat shall be minimized, and construction activities shall be timed to avoid ~~wet~~ periods of wet weather in which habitat disturbance (e.g., soil erosion and compaction) may be greater. Access roads and support structures for this portion of segment C1 or C2 shall be placed in uplands. (C)"

Comments—Consultation with Regulatory Agencies Regarding Wetland Impacts

A.17 The Forest Service should consult with appropriate agencies, including the U. S. Army Corps of Engineers, regarding the applicability of Section 404 of the Clean Water Act. The FEIS should include proposed mitigation measures to compensate for significant environmental impacts, including potential wetlands impacts. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

A.56 Segment A1 of alternatives 1 through 4 may pass through a wetland area. If so, a Section 404 permit under the Clean Water Act may be required. Section 404 regulates the discharge of dredge or fill material into waters of the United States, including wetlands and other "special aquatic sites." We recommend that the USFS and BLM consult with the U.S. Army Corps of Engineers regarding this matter. The applicability of this permit should be noted in Table 1.4-1.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

Response—Consultation with Regulatory Agencies Regarding Wetland Impacts

The USFS has consulted with various appropriate agencies regarding the proposed project and applicable regulations, including Section 404 of the Clean Water Act. An interested parties letter was sent to the U.S. Army Corps of Engineers (COE) during project scoping. Letters were sent to the COE South Pacific Division Headquarters in San Francisco, and to the COE Sacramento District in Sacramento. No response was received from either office. In addition, copies of the Draft EIS/EIR were distributed to both COE offices. No comment letter on the Draft EIS/EIR was received from either COE office.

The Draft EIS/EIR includes mitigation measures to compensate for identified environmental impacts, where appropriate. As discussed in the Draft EIS/EIR and in the response to "Comment—Effects on Wetlands" above, the proposed project (with implementation of Mitigation Measures 4.7.4a, 4.7.4b, and 4.7.4c) would avoid all areas that could be potentially classified as wetlands. As a result, the project would not discharge dredge or fill materials into these potential wetland areas. The proposed project would therefore not result in effects to wetlands that would be regulated under Section 404 of the Clean Water Act. Wetlands would also be avoided under Alternatives 2 through 6. It is therefore not expected that a permit from the COE would be required for the project (or the alternatives) under Section 404 of the Clean Water Act.

Table 1.4-1 on page 1-10 of the Draft EIS/EIR identifies only required permits and approvals. Since a permit from the COE is not expected to be required for the project (or the alternatives) under Section 404 of the Clean Water Act, a COE permit was not identified in Table 1.4-1.

Comment—Effects on Other Plant Communities

X.4 Issues of particular concern to the MMAS include the removal of 26.6 acres of natural Ponderosa pine forest. *(Michael Hauptman, Mount Shasta Area Audubon Society Board of Directors)*

Response—Effects on Other Plant Communities

Comment X.4 is incorrect in stating that the proposed project would remove 26.6 acres of ponderosa pine Forest. As shown in Table 4.7-2 on page 4-98 of the Draft EIS/EIR, the proposed project would remove 15.8 acres of this habitat type and disturb (i.e., tree topping but not removal) 10.8 acres of ponderosa pine Forest. The alternative transmission line alignments would involve either more or less removal and disturbance of this habitat type:

- Alternative 2: 15.6 acres removed, 10.7 acres disturbed

- Alternative 3: 40.9 acres removed, 49.0 acres disturbed
- Alternative 4: 40.7 acres removed, 48.9 acres disturbed
- Alternative 5: 15.8 acres removed, 10.8 acres disturbed
- Alternative 6: 15.6 acres removed, 10.7 acres disturbed

None of the estimated project impacts to ponderosa pine Forest listed above are considered significant under CEQA because this habitat type is extremely abundant in the project area and in the state, and it is not listed as a sensitive plant community.

VEGETATION MITIGATION

Comments—General Vegetation Mitigation

AG.54 The EIS/EIR fails as an informational document because it does not contain an adequate discussion of mitigation measures. (Robertson, 490 U.S. at pp. 351-52; Oro Fino, 225 Cal.App.3d at p. 885.) One flaw is that the EIS/EIR contains incompatible mitigation measures. Mitigation measure 4.7.1d prescribes replanting transmission line rights-of-way with native species such as ceanothus, manzanita, and bitter brush. (EIS/EIR, p. 4-89.) However, these plant species are highly flammable. (Ex. B, § 4.7.) Accordingly, this mitigation measure appears to be incompatible with the fire control requirements defined in measure 4.15.5g. (EIS/EIR, p. 5-41.)
(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

AG.56 The letter from Thomas Reid Associates addresses additional instances where the EIS/EIR's discussion of mitigation measures is inadequate. (Ex. B, § 4.7.)
(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

AG.59 The EIS/EIR improperly postpones assessment of the Project's impacts on vegetation. The EIS/EIR repeatedly proposes mitigation measures that require monitoring during Project implementation to assess impacts on vegetation. This impact assessment should be part of the EIS/EIR process so that any significant impacts can be evaluated, and mitigation or alternatives proposed that would reduce the Project's effects on vegetation. Deferral of this assessment violates CEQA's and NEPA's requirements that environmental review occur at the earliest feasible stage in the planning process and prior to project approval. (Sundstrom, 202 Cal.App.3d at pp. 306-08; Seattle Audubon, 798 F.Supp. at p. 1482.)
(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

AG.65 By postponing environmental impact assessment, the EIS/EIR deprives the public and the decisionmakers of the opportunity for meaningful review of the Project's impacts and to propose mitigation measures. *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

AG.277 The mitigation measures for impacts on vegetation identified at 4.7.1 are vague and leave the reader wondering how and if the measures will actually mitigate impacts. For instance, in 4.7.1a the use of the phrase "kept to a minimum" or "minimized" is used. What does this mean? The loss of vegetation should be quantified. Mitigation measure 4.7.1.b does not clearly state what the compensation will consist of. Mitigation measure 4.7.1d seems to be in direct conflict with mitigation measures to maintain fire buffers in and around the transmission line corridors. It states that "areas cleared within the transmission line right-of-way shall be seeded or planted with native perennial grasses and low growing shrubs such as ceanothus, manzanita, and bitter brush." These latter species are highly flammable species. *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

Response—General Vegetation Mitigation

In response to comment AG.54, the Draft EIS/EIR provides an adequate discussion of mitigation measures. Under NEPA, an EIS must contain a "Means to mitigate adverse environmental impacts" (CFR 40 Section 1502.16(h)). According to CEQA, an EIR "shall identify mitigation measures for each significant environmental effect identified in the EIR." (CEQA Guidelines Section 15126 (c)). NEPA and CEQA define appropriate mitigation to include:

- Avoiding the impact altogether by not taking a certain action or parts of an action
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation

- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action
- Compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20 and CEQA Guidelines Section 15370)

The Draft EIS/EIR complies with CEQA by identifying all potential significant impacts to vegetation (see pages 4-82 through 4-105). In this section, the Draft EIS/EIR also addresses whether these impacts are "adverse" (under NEPA) or "significant" (under CEQA). The Draft EIS/EIR identifies two impacts that, before mitigation, would be considered significant:

- Effects on special-status plants (pages 4-93 and 4-94)
- Effects on sensitive plant communities (pages 4-94 and 4-95)

Five mitigation measures (4.7.3a, 4.7.3b, 4.7.4a, 4.7.4b, and 4.7.4c) are proposed to offset the potentially adverse impacts to special-status plants and to sensitive plant communities. After mitigation, the impacts to these resources would be reduced to a level below significance. All other impacts to vegetation are considered not significant; thus, no further mitigation is required. The Draft EIS/EIR includes mitigation measures for all adverse and significant effects to vegetation that are identified in the Draft EIS/EIR. Mitigation measures for vegetation are described in detail on pages 4-88 through 4-100 of the Draft EIS/EIR. Indeed, the Draft EIS/EIR goes beyond compliance with NEPA and CEQA by proposing measures that are designed to reduce or avoid impacts that are not significant but may be adverse (see discussion below).

Comments AG.54 and AG.277 reference Mitigation Measure 4.7.1d and suggest that there is a conflict between the fire management requirement and the suggested species list for transmission line revegetation. It is true that ceanothus, manzanita, and bitter brush are flammable shrubs. However, because of their short height and low biomass, they provide less fuel for a fire than much of the existing vegetation (e.g., mature pines and firs) within the proposed and alternative transmission line routes. The species referenced in comments AG.54 and AG.277 are recommended because one of the goals of revegetation within the transmission line corridor would be to establish species that are native to the region. Shrub diversity is relatively low in the Medicine Lake Highlands area, particularly in the understory of the coniferous Forest habitats. Because of this low diversity, the choices of shrubs for revegetation are limited. The use of manzanita, ceanothus, or bitter brush are recommendations only; the revegetation plan developed by Calpine would be subject to approval by the USFS. The USFS would weigh the risks and benefits (i.e., flammability versus use of locally native species) of using particular species in revegetation according to USFS policy.

In response to comment AG.56, see responses to comments throughout this section for discussions of the comments raised in the Thomas Reid Associates letter (Exhibit B of comment AG.56).

As discussed in the Draft EIS/EIR, the actual placement of the transmission line is somewhat flexible. The preferred transmission line route would be designed to minimize environmental impacts within the chosen transmission line alignment. Sensitive species and sensitive habitats occur in relatively small patches throughout the project area; it would therefore be possible to install the transmission line so that these species and habitats are avoided. For example, all habitats that could be considered wetland would be avoided through implementation of mitigation measures (for further discussion of impacts to wetlands, see response to "Comment—Effects on Wetlands" in this section).

The Draft EIS/EIR does not postpone the assessment of the project's impacts on vegetation. The impacts of the proposed project are assessed in Sections 4.7 (pages 4-82 through 4-105) and 4.8 (pages 4-108 through 4-111). Monitoring is defined to verify, not assess, potential project impacts that are already less-than-significant. In other words, these impacts are less than significant even before mitigation. As a result, no mitigation is required under CEQA. CEQA allows monitoring to be included in mitigation measures, as long as the purpose of the monitoring is to verify impacts, not to assess them.

The Draft EIS/EIR goes beyond compliance with CEQA by proposing measures that are designed to reduce or avoid impacts that are not significant but that may be adverse (e.g., Mitigation Measures 4.7.1a, 4.7.1c, 4.7.1d, 4.7.2a). These measures are called out as mitigation (even though there is no requirement to do so under CEQA) to ensure that they would be carried out.

Comment AG.277 cites Mitigation Measure 4.7.1a and questions the use of the phrase "kept to a minimum." On pages 4-84 through 4-88, the Draft EIS/EIR concludes that impacts to general vegetation (not including sensitive plant communities, which are discussed separately on page 4-94) would not be significant. Under CEQA, if there is no significant impact, mitigation is not required. However, the Draft EIS/EIR proposed mitigation measures to reduce the impacts to general vegetation even further, exceeding the requirements of CEQA. Mitigation Measure 4.7.1a is among those measures proposed to reduce already less-than-significant impacts.

Because Mitigation Measure 4.7.1a goes beyond compliance with CEQA and NEPA, it is not necessary to clarify its terms. According to Mitigation Measure 4.7.1a, during the design and construction of the project, vegetation clearing would be kept to a minimum. There would be some flexibility in the location of the selected transmission line route within the selected transmission line corridor. Mitigation Measure 4.7.1a instructs the designers and construction crews of the transmission line route to minimize vegetation loss whenever possible. This could be accomplished by rerouting the transmission line through:

- Areas with existing clearings or disturbances (e.g., through recent clearcuts or old roads)
- Low-density forests instead of moderate- or high-density forests
- Shrubland instead of forest

Comment AG.277 also states that the loss of vegetation should be quantified. It is assumed that the comment suggests quantifying the loss of vegetation after implementation of Mitigation Measure 4.7.1a. Vegetation loss before mitigation is already quantified in the Draft EIS/EIR in Tables 4.7-1 and 4.7-2 on pages 4-85 and 4-98, respectively. It is not necessary to quantify vegetation loss after mitigation because this loss is not significant before mitigation. As discussed above, Mitigation Measure 4.7.1a exceeds the requirements of CEQA. Thus, quantifying the effects of this mitigation measure is not necessary.

Comment AG.277 also states that Mitigation Measure 4.7.1b does not clearly state what the mitigation would be. Mitigation Measure 4.7.1b references Mitigation Measure 4.8.1 on page 4-110 of the Draft EIS/EIR. Mitigation Measure 4.8.1 outlines specific actions that would be taken to reduce the level of impact to late-seral (old-growth) Forests and to individual trees and snags with a diameter at breast height of greater than 18 inches. Because this vegetation provides habitat for sensitive wildlife species, it is desirable to preserve the habitat in the region. Mitigation Measures 4.7.3 and 4.7.4 describe steps that would be taken to avoid impacts to special-status plant species and to sensitive plant communities. With these measures, impacts to these resources would be avoided. Thus, further mitigation to offset significant losses are not required.

Comment—Mitigation for Impacts to Special-Status Plants

J.4 Six species of rare ("special status") plants were found to occur in the project area, with an additional fifteen species noted as probable inhabitants due to historical records in the vicinity and presence of potential habitat in the project area. This indicates a high level of rare plant diversity in an area which is not presently degraded by industrial development. We do not believe that simple avoidance mitigation is sufficient to adequately protect rare plant habitats. Most rare plants are rare because of their sensitivity to disturbances, in particular industrial development. There are often other factors involved besides simple mechanical loss of habitat. The pollination ecology, insect vectors, and other elements in the reproductive biology of these rare plants which could be potentially impacted by the development of this project, and associated changes in air quality and hydrology, are not even addressed. There is no evidence in this analysis that the ecology of any of these rare plants has been researched. What scientific evidence has been used to determine that the mitigation proposals will be adequate to ensure the viability of these rare plant populations? *(Vivian Parker, California Native Plant Society)*

Response—Mitigation for Impacts to Special-Status Plants

Six special-status plant species were observed in the vicinity of the proposed project and/or the proposed alternatives (see Table 3.7-4). Twenty-one other special-status plant species may occur within the project area, based on the presence of potential habitat. These 15 species are considered potential inhabitants of the project area, not "probable" inhabitants, as stated in the comment.

The comment states that avoidance mitigation is not sufficient to adequately protect rare plant habitat. Under CEQA, mitigation is required for significant environmental impacts. The term significant is defined in various ways, depending on the type of impact being considered. See pages 4-83 to 4-84 of the Draft EIS/EIR for a discussion of the criteria used to determine whether an impact to botanical resources would be significant. Under CEQA and NEPA, avoidance is considered adequate mitigation to offset direct environmental impacts. Both CEQA and NEPA define mitigation to include "Avoiding the impact altogether by not taking a certain action or parts of an action" (CEQA: PRC Section 21083 and 21087; NEPA: 40 CFR Section 1508.20).

The comment also states that most rare plants are rare because of their sensitivity to disturbances, and in particular, their sensitivity to industrial development. This statement is refuted by a wide body of ecological literature. According to this literature, there are many reasons why rare plants are rare; disturbance (whether natural or human-caused) is only one of those reasons (e.g., Menges 1990; Fiedler and Ahouse 1992; Pavlovic 1994). In fact, some rare plants actually require disturbance to persist. In some cases, human activities mimic the disturbance and allow a species to be maintained or even spread into new areas. For example, Hall's sedge (*Carex halliana*) seems to prefer dry, open meadows. Because recently disturbed areas provide habitat similar to dry meadows, Hall's sedge also colonizes sites that have been logged, provided that other soil, moisture, and light conditions are suitable (Leitner 1997).

The comment also states that there is no evidence in the Draft EIS/EIR that the ecology of these sensitive plants has been researched. As described on pages 3-71 and 3-72 of the Draft EIS/EIR, accepted botanical reference material was consulted in the preparation of the supporting biological reports and in the preparation of the Draft EIS/EIR. This material included standard texts, floras, published articles, unpublished reports, and personal communications with recognized experts. More details of the reference material used to prepare the reports can be found in the biological reports themselves, which are cited on pages 3-71 and 3-72 of the Draft EIS/EIR. More details on the ecological requirements of two species, Hall's sedge and sugar stick, are presented below.

Hall's sedge (*Carex halliana*) has been intensively surveyed in certain portions of the Medicine Lake Highlands in 1996 and 1997. As a result, the habitat of this species is better understood than most other special-status plants in the region. The natural habitat for Hall's sedge is in open edges of dry meadows in pumice soils. Extensive natural populations are found in the dry meadows between Medicine Lake and Schonchin Springs and farther north. This type of natural habitat is rather uncommon in the Cascade Mountains of California in general and in the Medicine Lake Highlands area in particular. Several very small natural populations of Hall's sedge have been found elsewhere in the Medicine Lake Highlands recently.

It appears that human disturbance associated with logging or other clearing and grading provides habitat that is similar to the natural dry meadow habitat that Hall's sedge typically occupies. As a result, colonies of up to several thousand plants have been found in association with areas logged for lodgepole pine. In addition, small colonies have been found in association with log decks and wellpads where pumice soils are combined with a relatively open canopy and a slight topographic low point that allows for some accumulation of moisture. The latter is the habitat where Hall's sedge was found in the power plant and wellfield development area.

Sugar stick (*Allotropa virgata*) has been well studied in recent years, in part as a result of its identification in the Northwest Forest Plan as an old growth associate. This species is known to be a mycotroph, associated with living conifers as well as fungi (Wogen 1996). Based upon this understanding, the Forest Service has directed the establishment of a 100-foot protective zone around sugar stick colonies. This buffer zone is intended to protect the plant itself, as well as its conifer and fungal associates.

The comment also presents a concern that the project may have adverse indirect effects on rare plant populations through effects on pollinators and other species that may interact positively with the plants. However, this concern is based on the assumption that (1) there are other species that are critical to the persistence of the species-status plants, or (2) that these other species would be significantly and adversely affected by the proposed project. There is currently no evidence to suggest that either of the previous two assumptions are true.

The potential effects of the proposed project on air quality and hydrology are discussed in the Draft EIS/EIR in Sections 4.13 and 4.3, respectively. A discussion of the potential effects of air emissions on vegetation surrounding the proposed power plant is found on pages 4-89 through 4-93.

References:

Fiedler, P. L., and J. J. Ahouse. 1992. Hierarchies of cause: Toward an understanding of rarity in vascular plant species. Pp. 23-47 in: Fiedler, P. L., and S. K. Jain (eds.). Conservation Biology: The theory and practice of nature conservation, preservation, and management. Chapman and Hall, New York, NY.

Menges, E. S. 1990. Population viability analysis for an endangered plant. *Conservation Biology* 4:52-62.

Pavlovic, N. B. 1994. Disturbance-dependent persistence of rare plants: Anthropogenic impacts and restoration implications. Pp. 159-193 in: Bowles, M. L., and C. J. Whelan (eds.). Restoration of endangered species: Conceptual Issues, Planning, and Implementation. Cambridge University Press, Cambridge, MA.

Wogen, N. S. 1996. Draft Management Recommendation for Candy Stick or Sugar Stick (*Allotropa virgata* Torrey and Gray). Version 1.0. 42 pp. April. (Available from USFS in Alturas, CA).

Comments—Pre-Construction Survey Mitigation

AG.61 Mitigation measure 4.7.3a requires floristic surveys of the transmission line route, and wellfield and power plant areas. (*Id.* at p. 5-15.) Populations of special status species are to be marked and avoided. (*Ibid.*) These surveys should have been completed as part of the impact assessment process. Without these survey results, the public and the decisionmakers cannot properly assess the significant of the Project's impacts and determine whether mitigation measures are necessary. Further, the measure does not indicate what will happen if the populations cannot be avoided. (Ex. B, § 4.7.)
(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

AG.278 The proposed measures in the EIS/EIR (Measure 4.7.3a, p. 4-94), which consist of carrying out floristic surveys of the transmission line corridor, well field, and power plant area, are aimed at assessing the impact, not mitigating it. This information is necessary at the EIS/EIR stage in order to: (1) quantify the impact of the project on special status species, and (2) determine which alternative transmission line would have the least impact. The mitigation measure also has dubious feasibility since the individual populations of the plants may be so extensive that they cannot feasibly be avoided. In that case, it is even more important to know which transmission line routes would best minimize unavoidable impacts to the special status plants. Since the mitigation is speculative, there is no basis for the EIS/EIR to conclude that implementation of this measure would reduce impacts on special status plants to less than significant (p. 4-94). *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

Response—Pre-Construction Survey Mitigation

The floristic surveys conducted for the Draft EIS/EIR and conducted in the project area were of sufficient extent and duration to be able to assess the potential impacts of each alternative transmission line alignment. These surveys would have detected all but the smallest populations of a special-status plant within the project area. Indeed, several

small and large populations of special-status plants were found within the project area (see Table 3.7-3 on page 3-83 of the Draft EIS/EIR).

According to Mitigation Measure 4.7.3a on page 4-94, all populations of special-status plants that were found during the surveys for the project would be avoided during project construction. There is sufficient information about the locations of special-status plants to determine the relative impact of each alternative transmission line alignment and to determine whether impacts to special-status plants would be significant.

Although detailed surveys for special-status plants were conducted for the proposed project, it is possible that some special-status plants went undetected during these surveys, or that some special-status plants may have established in the project area subsequent to these surveys. In order to be sure that impacts to special-status plants would be avoided or minimized, the Draft EIS/EIR proposes that preconstruction surveys be conducted of the power plant and wellfield areas and of the selected transmission line alignment. If any new populations of special-status plants are identified during these surveys, they would be avoided whenever possible (e.g., by realigning the transmission line within the selected corridor). If they could not be avoided, appropriate mitigation measures would be developed that would be subject to Forest Service approval. This mitigation could include a variety of techniques to reduce impacts, including (1) transplanting the individual plants that would be impacted, (2) seeding or planting new individuals elsewhere, or (3) enhancement of existing habitat for special-status plants (e.g., removal of exotic species, removal of grazing, creation of suitable habitat).

Comments—Mitigation for Impacts to Late-Seral Forest and General Wildlife Habitat

Q.4 The EIS/EIR indicates that effects of the project construction on late seral forest and individual trees and snags equal to or greater than 18 inches would be significant. The loss of old growth and other late seral habitat and the value they have for many species cannot be mitigated in the short term.
(Lori J. Cooper, Klamath Forest Alliance)

T.13 The proposed mitigation measures are undefined and unmeasurable: the loss of mature and old-growth forest that took centuries to grow cannot be effectively mitigated by minimizing the amount destroyed. Nor can paying for an undetermined amount of prescribed burning elsewhere adequately compensate for its loss, as indicated in the DEIS/EIR. *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

U.23 Several stands of old growth red fir will be impacted by the proposed geothermal development, these trees must not be cut. But far worse, is the devastation that will happen to the old growth lodge pole pine because of the power plant and transmission line construction. Old growth lodge pole pine is not determined by the "chest height" formula. It is determined by the wildlife that inhabits the area, wildlife such as the northern goshawk, northern spotted owl, American martens, hairy woodpeckers and several other species. Please address these issues in writing.
(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

AG.92 Another flaw is that the proposed mitigation measures are insufficient to reduce the Project's impacts on the environment. For example, mitigation measure 4.8.1, which proposes to reduce habitat loss through vegetation management, is inadequate. (EIS/EIR, p. 4-110.) Measure 4.8.1c states that transmission lines will be located in certain areas whenever possible. However, the measure does not explain how the impact will be mitigated if it is not possible to relocate the transmission line. (Ex. B, § 4.8.) Without sufficient information about potential mitigation, it is impossible to determine whether the proposed mitigation measure would reduce the Project's impacts to insignificance. (Ex. B, § 4.8.)
(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

AG.275 Mitigation Measure 4.8.1d states that "for stands of late seral stage forest lost due to project construction, compensation shall be provided by Calpine... and could include activities such as silvicultural enhancement in the form of thinning understory or prescribing underburning techniques of an acreage equivalent to that of the project activities." It is not clear how these activities would provide compensation for loss of late seral forest because, by definition, late seral forest has taken many decades

to become mature. Is the purpose of these activities to speed up the conversion of young forest to a late seral type forest? The EIS/EIR needs to state why the proposed mitigation would provide compensation for the forest lost. *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

AG.291 On page 4-110, the discussion of mitigation measures 4.8.1 should be expanded and clarified so that the reader can fully understand the mitigation and evaluate whether the mitigation reduces the impacts to a level of insignificance. Just saying something will be minimized or compensation shall be provided is inadequate. For instance, in measure 4.8.1c the mitigation is to locate "transmission line facilities in areas such as log decks, previously logged forest stands, and areas of small class-size trees, whenever possible." What if it is not possible? Then this is not a mitigation. The mitigation discussion leaves the reader uncertain about whether the mitigation will be effective.
(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

Response—Mitigation for Impacts to Late-Seral Forest and General Wildlife Habitat

As stated on page 4-110 and 4-111 of the Draft EIS/EIR, Mitigation Measures 4.8.1c, 4.8.1d, and 4.8.1e are designed to reduce the effects of the proposed project on late-seral Forest stands to a level below significance. Because replacement of lost stands or individual trees would take time, a small amount of late-seral Forest would be lost until the replacement trees could develop. While this impact would be considered adverse, the temporary loss of a portion of this habitat type is not considered significant.

In response to comments AG.92 and AG.291, Mitigation Measures 4.8.1c through 4.8.1e are designed to reduce the potential impacts to late-seral Forests to a level below significance. Mitigation Measures 4.8.1d and 4.8.1e state that all stands of late-seral Forest and all snags and trees ≥ 18 inch dbh would be replaced by Calpine. These mitigation measures alone would reduce the impact to late-seral Forest to a level below significance. However, Mitigation Measure 4.8.1c has been added to minimize the need to replace lost stands and individual trees. Because the exact location of the transmission line (within the selected alignment corridor) has not been determined, there would be some degree of flexibility in siting the transmission corridor. According to Mitigation Measure 4.8.1c, one factor that would be considered (along with many other constraints, including technical, topographic, safety, and other environmental constraints) would be the impact to late-seral stands. Whenever practical, the transmission line would be sited to avoid late-seral stands or minimize the impact to these stands. This "fine-tuning" of the transmission line location would be accomplished as one of the last stages of project construction. Thus, Mitigation Measure 4.8.1c cannot be expanded upon further.

In response to comment AG.275, Mitigation Measure 4.8.1d was designed to replace lost stands of late-seral (i.e., old-growth) Forest by accelerating the development of early- or mid-seral Forest. The Northwest Forest Plan, on page B-5 and B-6 of the Standards and Guidelines, identifies several techniques that could be used to accomplish this goal:

- Thinning or managing stands the overstory to produce large trees.
- Managing stands to release advanced regeneration of different tree species to produce a more diverse overstory (this technique would be most applied in stands that were formerly managed for single tree species).
- Use of prescribed, cool fires to reduce ground fuel and competition from understory species. This would reduce the risk of large, damaging fires that would "reset" the successional process.

- Underplanting and limiting understory vegetation control to begin development of multistory stands that are more diverse in species composition.
- Killing trees to make snags and coarse woody debris.

These techniques were designed to accelerate the development of late-seral stands within Late-Successional Reserves. However, these same techniques can be used in other lands (such as Matrix lands) on which the proposed project would occur.

Mitigation Measure 4.8.1e is designed to replace any large snags that would be lost as a result of project construction. Replacement of these snags would be accomplished with a variety of techniques. These techniques are described in the Northwest Forest Plan and include:

- Reserving green trees (over and above minimum levels) for future snag recruitment
- Creating snags from existing green trees by killing the trees and leaving the standing
- Topping existing snags to reduce their risk of falling and extending their effective life as snags

See also response to "Comment—Impacts to Old-Growth (Late-Seral) Forest" in this section and response to "Comment—Northern Spotted Owl" in the Wildlife Section for further discussion of potential impacts to late-seral Forest and its associated wildlife species.

Comments—Revegetation Plan

AG.58 Revegetation should be considered successful when there is eighty percent coverage within five years. (Ex. E.) Without more information regarding mitigation, there is no basis for the lead agency to conclude that the Project's impacts on vegetation would be mitigated to insignificance.
(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)

AG.281 Mitigation Measure 4.3.3e for Transmission Line Revegetation is Inadequate. Mitigation Measure 4.3.3e, p. 4-30, states: "Calpine shall seed as recommended by USFS the area of the transmission line right-of-way disturbed during construction with low-growing native plants if such plants do not naturally revegetate the area within three years." The mitigation measure is inadequate because it does not explain why the area would be expected to revegetate within three years. If there is sufficient soil erosion and loss of topsoil during the construction period, the disturbed area may be unable to revegetate. Three years is too long to wait to commence artificial planting, because if natural revegetation is too slow, additional erosion can occur that will make revegetation of the disturbed sites increasingly difficult. The mitigation measure should be revised to state that if revegetation does not meet certain criteria (e.g., USFS criteria for plant cover, density and height, if such exist) by the beginning of the growing season in the second year, then natural revegetation will be supplemented with artificial seeding or planting until the criteria are met.

In addition, the EIS/EIR should first prove that the USFS believes that natural revegetation is feasible by quoting the guideline or regulation that states what the USFS requirements actually are for seeding disturbed areas or for allowing natural revegetation to take place. Second, the USFS guidelines may contain other measures which encourage natural revegetation such as sediment traps or salvage of topsoil that contains seeds. The EIS/EIR needs to demonstrate that if USFS procedures are followed, the areas disturbed by construction are likely to revegetate naturally within the first year so that additional erosion will not occur. *(Lizanne Reynolds, et al., on behalf of Plumbers & Steamfitters U.A. Local 342, et al.)*

Response—Revegetation Plan

As a condition of approval for this project, the project applicant would be required to develop a detailed reclamation and revegetation plan before the power plant, wellfields, and transmission lines are decommissioned (see page 4-88 of the Draft EIS/EIR). As described on page 2-54 of the Draft EIS/EIR, Calpine would be required

to post a reclamation bond with the BLM and USFS to ensure that the reclamation plan would be carried out (see below). Conceptual information about the decommissioning plan, which would include reclamation and revegetation, is provided on pages 2-54 to 2-56 of the Draft EIS/EIR.

Conceptual information only is required for the proposed reclamation and revegetation plan at this time. It would be premature to write a reclamation and revegetation plan or a decommissioning Plan of Action for inclusion in the Final EIS/EIR because such plans would not be implemented for approximately 45 years. Regarding the reclamation and revegetation plan, revegetation techniques are being continually developed and improved every year. In 45 years, revegetation and restoration techniques will likely be substantially different from those in use today. Moreover, this plan would be written to comply with the requirements of the USFS; USFS requirements for revegetation plans may also change substantially in 45 years.

Comment AG.58 references a letter sent by the California Department of Fish and Game (CDFG) on May 24, 1995 to the Siskiyou County Air Pollution Control District (Exhibit D in comment letter AG). In this letter, the CDFG comments on the EA/IS for the Glass Mountain Unit Geothermal Exploration Project. Comment AG.58 echoes a comment within the CDFG letter and recommends that success criteria be included in the revegetation design for the project.

However, in their May 24, 1995 letter, the CDFG recommended different success criteria than comment AG.58 does. The CDFG recommended that "revegetation can be considered successful when the sites have revegetated at a level of eighty percent of the adjacent ground cover within five years." In contrast, comment AG.58 recommends that "Revegetation should be considered successful when there is eighty percent coverage within five years." The former recommendation is based on the surrounding and undisturbed vegetation; the latter recommendation is an absolute percent that is not dependent on the surrounding vegetation. The detailed reclamation and revegetation plan would include success criteria that have appropriate references (either surrounding vegetation or absolute measures), based on the USFS guidelines at the time.

Mitigation Measure 4.7.1d on page 4-89 of the Draft EIS/EIR states that a revegetation plan shall be prepared for the revegetation of the transmission line, wellpads, pipelines, and power plant, under the direction of the USFS. This revegetation plan would include quantitative and defensible success criteria.

Comment AG.281 is noted. The text of Mitigation Measure 4.3.3e on page 4-30 of the Draft EIS/EIR has been changed so that revegetation is required within the first year after construction and it is consistent with Mitigation Measure 4.7.1d on page 4-89:

> "4.3.3e Calpine shall seed and plant as recommended by USFS the area of the transmission line right-of-way disturbed during construction with low-growing native plants to provide soil stabilization. Seeding and planting shall occur before the next growing season after construction. Native plants that ~~if such plants do not~~ naturally revegetate (such as resprouting shrubs) should be utilized to the fullest extent possible. ~~the area within three years.~~ This mitigation measure shall be consistent with Mitigation Measure 4.7.1d.(C)"

3.9 Wildlife

INTRODUCTION

This section provides responses to comments on wildlife issues. The comments and responses are grouped under the following headings:

- General
- Potential Impacts to Special-Status Wildlife
- Impacts to Specific Special-Status Wildlife
- Wildlife Mitigation

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

GENERAL

Comments—Wildlife Section Adequacy

T.12 Endangered species information, effects and mitigation analyses, and Endangered Species Act consultations with the U.S. Fish and Wildlife Service, are all incomplete at this time, from what we are able to discern in the DEIS/EIR. *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

AG.68 The EIS/EIR lacks scientific and factual data, meaningful analysis, and adequate mitigation measures to support its conclusion that the Project will not have a significant impact on wildlife. Without this information, the lead agency does not have sufficient evidence to conclude that the Project will not substantially affect an endangered, rare, or threatened species or its habitat, interfere with the movement of any resident or migratory species, or diminish habitat for wildlife. (Guidelines, App. G(c), (d), (t).) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.77 The EIS/EIRs determination that the Project will not have a significant impact on wildlife species is impermissibly based on unsupported assumptions and conclusions, and conflicts with information in the EIS/EIR itself. (See Concerned Citizens, 42 Cal.3d at p. 935; Seattle Audubon, 798 F.Supp. at p. 1482.) Absent adequate scientific and factual data, there is no basis for concluding that there are no significant impacts on wildlife. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Wildlife Section Adequacy

The EIS/EIR describes the environment that would be affected if the proposed project or one of the alternatives is approved and built. The environment is described based on several wildlife surveys and habitat assessments that were conducted for the proposed project and for other projects in the vicinity (see response to "Comment—Adequacy of Wildlife Surveys" below for more details). Significance thresholds are described in the Draft EIS/EIR on pages 4-107 and 4-108. The effects of the project were analyzed under all the applicable laws and policies, including NEPA, implementation guidelines of the BLM and USFS, CEQA, and the Federal and state Endangered Species Acts. The impact analysis presents a determination of significance for each impact and proposes mitigation measures for impacts that are significant or potentially significant. Mitigation is also defined for adverse but less-than-significant effects. See also response to "Comment—Wildlife Mitigation" at the end of this section for further discussion on wildlife mitigation.

Comments—Consultation with Regulatory Agencies

B.1 The draft document identifies two federally listed threatened species, the bald eagle (*Haliaeetus leucocephalus*) and northern spotted owl (*Strix occidentalis caurina*), that may be affected by the construction, operation, and decommissioning of the Fourmile Hill Geothermal Development Project. Section 7(a)(2) of the Act requires that any action authorized, funded, or carried out by a Federal agency will not jeopardize the continued existence of an endangered or threatened species. As a result, this

section of the Act, and its implementing regulations, require Federal agencies to initiate formal consultation with the Service when a Federal action may affect a listed endangered or threatened species.

Section 9 of the Act prohibits the "take" of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such wildlife species. Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or shelter (50 CFR §17.3). Take incidental to otherwise lawful activity may be authorized through the formal - consultation process if a Federal agency is involved with the permitting, funding, or carrying out of the project. Initiation of formal consultation is required between that agency and the Service pursuant to section 7 of the Act if it is determined that the proposed project may affect a federally listed species. Federal agencies must confer if they determine that the continued existence of a proposed species may be jeopardized by the project. Such consultation or conference could result in a biological opinion that addresses anticipated effects of the project to listed and proposed species and may authorize a limited level of incidental take. *(Ronald A. Iverson, U.S. Fish and Wildlife Service)*

B.14 Based on the above considerations, we have concluded that the proposed action constitutes a major construction activity which may affect three federally listed species. Therefore, we recommend that the USFS and BLM review their requirements for compliance with section 7 of the Act, and contact the Service regarding formal consultation requirements. We further recommend that consultation be completed prior to publication of the final environmental document that is prepared for development of the Glass Mountain KGRA. Thus, the Service recommends that the Draft EIS/EIR be revised to disclose and analyze all impacts of foreseeable future development for this area.

(Ronald A. Iverson, U.S. Fish and Wildlife Service)

N.30 The DEIS/EIR did not disclose and include formal recommendations by the U.S. Fish and Wildlife Service and the California Department of Fish and Game regarding their recommendations to prevent the killing and/or harming of threatened and endangered species, special-status bird species, and bird species. The failure of the U.S. Forest Service and the U.S. Bureau of Land Management not to consult with the U.S. Fish and Wildlife Service and the California Department of Fish and Game regarding the killing (taking) and/or harming of threatened and endangered species, special status bird species, and bird species is a violation of the U.S. Fish and Wildlife Coordination Act, and also renders the DEIS/EIR deficient. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

N.32 The U.S. Fish and Wildlife Coordination Act requires the U.S. Forest Service and the U.S. Bureau of Land Management to consult with the U.S. Fish and Wildlife Service and the California Department of Fish and Game concerning the potential direct, indirect, and cumulative impacts to public trust resources as a result of the proposed project.

The DEIS/EIR failed to disclose whether the U.S. Forest Service and the U.S. Bureau of Land Management consulted with the U.S. Fish and Wildlife Service and the California Department of Fish and Game in the development of mitigation measures for specific special-status species habitat protection, and also for the loss to habitat. The DEIS/EIR failed to include recommendations by the U.S. Fish and Wildlife Service and the California Department of Fish and Game regarding the loss of habitat to specific special-status species. The DEIS/EIR is deficient and in violation of the U.S. Fish and Wildlife Coordination Act without consultation with the U.S. Fish and Wildlife Service and the California Department of Fish and Game, including their recommendations, being included in the DEIS/EIR.

(Robert J. Baiocci, Fall River Wild Trout Foundation)

N.33 The federal Endangered Species Act requires the U.S. Forest Service and the U.S. Bureau of Land Management to consult with the U.S. Fish and Wildlife Service regarding any potential impacts to threatened and endangered species and their habitat. The DEIS/EIR fail to show the U.S. Forest Service and the U.S. Bureau of Land Management consulted with the U.S. Fish and Wildlife Service in the development of mitigation measures and the taking of threatened and endangered species. The DEIS/EIS is deficient and in violation with the Federal Endangered Species Act without consultation with the U.S. Fish and Wildlife Service concerning the potential effects to and taking of threatened and endangered species and their habitat. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

AG.96 The Project Must Comply with the Requirements of the Endangered Species Acts

The EIS/EIR acknowledges that the Project is subject to the federal and state endangered species acts. (EIS/EIR, p. 1-10; 16 U.S.C. § 1536; Cal. Fish & G. Code § 2090.) These acts prohibit the taking of listed species without a permit. (16 U.S.C. § 1538(a)(1)(B); Cal. Fish & G. Code § 2081.) Under federal law, taking a species includes not only direct harm to a species, but also habitat modification that actually injures the species by impairing breeding, feeding, or sheltering. (50 C.F.R. § 17.3; Babbitt v. Sweet Home Chapter of Communities for a Great Oregon (1995) ___ U.S. ___, 115 S.Ct. 2407.)

Prior to the issuance of a take permit, the lead agency must undertake a consultation process. (16 U.S.C. § 1536(a)(2); Cal. Fish & G. Code § 2090.) This includes the completion of a biological assessment that identifies any listed species that the proposed action is likely to affect. (16 U.S.C. § 1536(c)(1).)

In this case, the Project clearly has the potential to take listed species. (Ex. B, § 4.8.) The EIS/EIR, however, does not evaluate the Project in light of the statutory requirements. For example, it is unclear whether a biological assessment has been completed for the Project. Although the lead agency completed a biological assessment/evaluation during the Project's exploratory phase, it focused on well pad drilling. (Galea & Oberlag, Fourmile Hill Geothermal Exploration Project: Biological Evaluation/Assessment (1996); EIS/EIR, p. 7-11.) Thus, the assessment would require a substantial upgrade to adequately evaluate impacts associated with the current Project. The EIS/EIR does not identify whether the lead agency completed a more comprehensive biological assessment. The EIS/EIR also does not indicate whether the federal or state consultation processes have begun or the results of the consultation processes.

Absent such information, the public and decisionmakers cannot evaluate the Project's impacts on listed species and there is no basis for concluding that impacts will be mitigated or that permits would be issued. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.294 The project clearly has the potential to take (kill, harass, harm) listed endangered species. The EIS/EIR addresses loss of habitat for listed species, but not actual take of individuals. The EIS/EIR should identify whether the project will be subject to a federal Endangered Species Act Section 7 consultation between the U.S. Forest Service and the U.S. Fish and Wildlife Service that will address take and mitigation for take of listed species.

The EIS/EIR also does not discuss the potential need for a management authorization under Fish and Game Code section 2081 for any California listed species.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Consultation with Regulatory Agencies

Sections 7 and 9 of the Endangered Species Act (ESA) are discussed in relation to the proposed project on page 4-106 of the Draft EIS/EIR. Consistent with these sections of ESA, the USFS has been conferring with the USFWS during the environmental review process. The goal of these conferences has been to (1) discuss the potential effects of the project on the two Federally listed species that occur in the vicinity of the proposed project, the bald eagle and the northern spotted owl; (2) discuss the potential effects of the project on the Federally listed Shasta crayfish, which occurs approximately 35 miles from the project area; and (3) discuss the required content of the Biological Assessment that is being prepared for submittal to the USFWS.

A meeting and site visit was conducted with USFWS staff in August 1996. Three other meetings were held with the USFWS, in December 1997, March 1998, and April 1998. In the Fall of 1998, the USFS will submit the Biological Assessment for the project to the USFWS for their consideration.

The potential for take of wildlife species (as described in Section 9 of the ESA) is discussed in Section 4.8 of the Draft EIS/EIR on pages 4-114 through 4-125. According to the EIS/EIR, take is not expected to occur of Federally listed species. Mitigation measures are defined to avoid the potential for take, reduce the potential for habitat modification, or avoid or reduce other adverse effects to special-status wildlife species, including Federally listed species. These measures would ensure that the project would not jeopardize the continued existence of these species. See also responses to "Comment—Bald Eagle" and "Comment—Northern Spotted Owl" for more details on the two Federally listed species that occur in the project vicinity.

Comments N.30, N.32, and N.33 state that the Draft EIS/EIR did not disclose or include the recommendations of the USFWS or the CDFG to minimize the effects of the project on Federal- and state-listed species. In fact, the Draft EIS/EIR has incorporated all of the recommendations that the USFWS and CDFG provided during the scoping of this project. The USFWS sent their comments in a letter dated July 3, 1996, and the CDFG sent their comments in a letter dated July 9, 1996. As stated by the CDFG in a letter

dated October 16, 1997 that was sent during the public comment period on the Draft EIS/EIR, "The draft environmental impact report (EIR)/EIS addressed many of our previous concerns including floristic surveys that locate special status plant species." The remaining concerns of the CDFG are thoroughly addressed in the Final EIS/EIR (see responses to letter D referenced in the index). The USFWS had many comments on the Draft EIS/EIR that they did not raise during the public scoping period. However, these comments are also thoroughly addressed in the Final EIS/EIR (see responses to letter B referenced in the index).

Comments N.30, N.32, and N.33 also suggest that the EIS/EIR does not comply with the Federal Fish and Wildlife Coordination Act. According to the USFWS, this project does not qualify under the Fish and Wildlife Coordination Act. Therefore, compliance with this Act is not required.

Comments AG.96 and AG.294 cite the need for the Draft EIS/EIR to discuss whether a management authorization would be required for state-listed species under Fish and Game Section 2081. Section 2081 of the California Fish and Game Code (as amended in 1997) gives the California Department of Fish and Game the authority to issue permits for the importation, export, take, or possession of a state-listed species. Such a permit is necessary only when a project may result in the death of a species that is listed by the state as threatened or endangered.

As described in Tables 3.7-2 and 3.8-1 of the EIS/EIR, there are four state-listed species that occur or might occur in the project area:

- Boggs-Lake hedge-hyssop (endangered)
- Bald eagle (endangered)
- Great gray owl (endangered)
- Swainson's hawk (threatened)

Because take would not occur of any of these four species, a permit under Section 2081 would not be required. The Boggs-Lake hedge-hyssop was not found during the botanical surveys for this project (see response to "Comment—Effects on Boggs Lake Hedge-Hyssop" in the Vegetation Section for further discussion); thus, no impacts would occur to this species.

As described in response to "Comment—Bald Eagle" below, bald eagles occurring in the project area would not be affected by the proposed project. Therefore, take of this species would not occur.

As described on page 3-104 of the Draft EIS/EIR, potential habitat for the great gray owl occurs along the proposed transmission line segment A1 near Little Medicine Lake and south of the Medicine Lake Glass Flow. Suitable habitat for the great gray owl is not present anywhere else in the project area. Because no take would occur of this species from project activities, no permit is required.

As described on page 3-108 of the Draft EIS/EIR, the Swainson's hawk may occur along segment C1 of the proposed transmission line. Because disturbance to vegetation on the Modoc Plateau would be minimal (see the Vegetation Section for further discussion),

there would be no take of this species. Thus, no permit would be required for the Swainson's hawk.

Comments—Adequacy of Wildlife Surveys

B.10 Several plant and animal Federal species of concern may be affected by the proposed action. These include the: spotted bat (*Euderma maculatum*), Pacific fisher (*Martes pennanti pacifica*), small-footed myotis bat (*Myotis ciliolabrum*), long-legged myotis bat (*Myotis volans*), northern goshawk (*Accipiter gentilis*), rough sculpin (*Cottus asperrimus*), Egg Lake monkeyflower (*Mimulus pygmaeus*), and Columbia yellow cress (*Rorippa columbiae*). We recommend that project-specific surveys be conducted for all of these species that may be directly affected by project actions. We recommend that mitigation measures be developed to reduce or avoid direct and indirect project impacts to all of the species listed above. One of the benefits of considering Federal species of concern early in the planning process is that, by exploring alternatives, it may be possible to avoid conflicts that could develop, should a species of concern become listed before the project is complete. *(Ronald A. Iverson, U.S. Fish and Wildlife Service)*

Y.24 Wildlife and botanical on-the-ground surveys are inadequate.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

Response—Adequacy of Wildlife Surveys

Table 3.8-1 in the Draft EIS/EIR lists the spotted bat, Pacific fisher, small-footed myotis bat (called the Western small-footed myotis bat in the Draft EIS/EIR), long-legged myotis bat, and northern goshawk as species that could potentially occur on the project site or in the project vicinity. Studies of these species have been conducted on the project site and in the vicinity (BioSystems Analysis 1996; Galea Wildlife Consulting 1995, 1996a; P. Leitner 1997). These studies were either habitat assessments or surveys for specific species. A discussion of the results of these studies and the potential impacts of the project on these species is found in the Draft EIS/EIR on the following pages:

- Spotted bat: 3-109, 4-115, 4-119, 4-124, 4-128
- Pacific fisher: 3-111, 4-115, 4-120, 4-128
- Western small-footed myotis bat: 3-110, 4-115, 4-119, 4-124, 4-128
- Long-legged myotis bat: 3-108, 4-115, 4-119, 4-124, 4-128
- Northern goshawk: 3-105, 4-115, 4-116, 4-121, 4-123, 4-128

The only animal species listed in the comment that was not discussed in the Draft EIS/EIR is the rough sculpin (*Cottus asperrimus*). This species is a Federal species of concern and a threatened species in California. The rough sculpin is found approximately 30 miles south of the project site in Fall River and one of its tributaries, Bear Creek (Thelander and Crabtree 1994). Impacts to the Fall River hydrologic system from the proposed project are not expected to occur. If a direct connection between the geothermal system and the Fall River area existed, the effects of the project would be negligible and not significant (as discussed in the response to comment referenced below). Because the project would not affect Fall River, Bear Creek, or Fall River springs, no discussion of this species is necessary.

See response to "Comment—Wildlife at Fall River Springs" in this section for a detailed discussion of the potential for effects to wildlife at the Fall River springs. See response to "Comment—Groundwater Connection with Fall River Springs" in the Hydrology Section for a detailed discussion of the potential for a connection between the project area and the Fall River springs.

The two plants listed in the comment that are Federal species of concern (the Egg Lake monkeyflower and Columbia yellow cress) were searched for in the botanical surveys

for this project (B. Leitner 1997). No individuals of either species were found at the proposed power plant site or in the wellfield area. Table 3.7-2 has been expanded and revised to include more of the information presented in the supporting botanical documents for this project.

Mitigation Measure 4.7.3a on page 4-94 of the Draft EIS/EIR calls for early summer floristic surveys and pre-construction surveys of the proposed transmission line route, as well as the wellfield and power plant area. The purpose of these surveys is to precisely delineate populations of special-status plants immediately prior to construction (i.e., to provide the most up-to-date locations of these plants). These surveys will ensure that special-status plants are avoided during construction of the power plant, wellfield, and the selected transmission line. Populations of CNPS List 1 and 2 species and Category 2 species that are listed in the Northwest Forest Plan would also be avoided. In addition, a buffer zone would be established between any population of these species and construction activities in order to minimize disturbance to these populations. As discussed in Mitigation Measure 4.7.3a, other special-status plants would be avoided where possible.

See response to "Comment—Wildlife Mitigation" at the end of this section for a discussion of the specific preconstruction surveys for wildlife that would be conducted.

References:

BioSystems Analysis, Inc. and JRP Historical Consulting Services. 1996. *Biological and Cultural Resource Assessments for the Calpine Transmission Line Project, Volume 1—Report*. February.

Galea Wildlife Consulting. 1995. *Biological Survey Report, Fourmile Hill Assessment Area*. October.

Galea Wildlife Consulting. 1996a. *Biological Survey Report, Mount Hoffman Assessment Area*. June.

Leitner, Barbara. 1997. *Botanical Resources Report for the Fourmile Hill Geothermal Project, Modoc and Klamath National Forests*. Final Report. Prepared for Calpine Corporation. September.

Leitner, Philip. 1997. *Habitat Suitability Assessment for Special-Status Bat Species on the Proposed Transmission Routes for the Fourmile Hill Geothermal Project*. April.

Thelander, C. G., and M. Crabtree, editors. 1994. *Life on the Edge: a Guide to California's Endangered Natural Resources: Wildlife*. BioSystems Books, Santa Cruz, CA.

Comment—Wildlife Survey Methodology

B.9 We recommend that the Draft EIS/EIR include a detailed description of the methods, timing, location, and results of surveys conducted for federally listed species. This information is important in the section 7 informal and formal consulting process to determine the effects of the proposed action on listed species and the types of mitigation measures that may be appropriate to minimize the potential impact of take. For example, it is not clear from the draft document if the proposed mitigation measures are adequate to minimize the impact of harm to or harassment of listed species as a result of nighttime illumination and noise disturbance due to project construction and operation, and/or noise disturbance due to increased traffic and other human activities. *(Ronald A. Iverson, U.S. Fish and Wildlife Service)*

Response—Wildlife Survey Methodology

A table has been added to Appendix C of the EIS/EIR to provide more information about the methodology that was used in the biological studies that were conducted for this project (see Table 2 of Appendix C of the Final EIS/EIR, which is also attached at the end of this section). This table provides a general overview of the methodologies of the primary wildlife and botanical reports used in the preparation of the Draft EIS/EIR. A detailed description of the study methodology for each of the many surveys

referenced in the Draft EIS/EIR was not included due to space constraints. However, the detailed methodologies will be included in the Biological Assessment for the proposed project. This Biological Assessment will be submitted to the USFWS in the spring of 1998. In addition, the specific reports may be consulted for further details concerning methodology. All of the studies that are referenced in the Draft EIS/EIR are available for public review at the Modoc National Forest Supervisor's office in Alturas, California.

The comment also expresses concern about the effects of noise and nighttime illumination on wildlife. The Draft EIS/EIR provides an extensive discussion of the potential effects of noise from project construction, operation, and decommissioning on wildlife in general and on special-status wildlife in particular (see pages 4-111 through 4-125). The analysis contained in the Draft EIS/EIR adequately addresses potential noise effects on wildlife and determines that no significant effect would be expected.

In addition, no significant effect on wildlife would be expected from nighttime illumination. Nighttime lighting would be brightest during the construction phase of the project. The drill rig masts at the well pad sites and the power plant site would be lit at night during construction. During the operational phase of the project, the power plant site would be lit at night. Occasional infill-well drilling would occur (about two years) over the life of the project. During these operations, rig masts would be used that would be lit at night. The transmission lines would not be lit during construction or operation. The Draft EIS/EIR outlines several mitigation measures on page 4-146 that would substantially reduce the effect of nighttime lighting. These measures include the preparation of a detailed Exterior Lighting Design and Management Plan that would be submitted to the Klamath National Forest for approval.

Comments—Wildlife Range Information

AG.69 The EIS/EIR fails as an informational document because it does not provide sufficient information about wildlife species in the area. For example, the EIS/EIR does not contain a complete list of the animal and plant species ranging in the Project area.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.72 The EIR/EIS fails to provide sufficient information to support its conclusions about the Project's effect on wildlife species. The EIS/EIR repeatedly states that the Project's impacts on various species are insignificant because the associated habitat losses constitute only a small portion of the overall habitat. The EIS/EIR, however, does not provide adequate data about the habitat types to support this conclusion, as required by CEQA and NEPA. (See Concerned Citizens, 42 Cal.3d at p. 935; Seattle Audubon, 798 F.Supp. at p. 1479.) For example, Figure 3.7-1 does not show the continuation of the habitat types into the areas adjacent to the Project site. (Ex. B, § 4.8.) Also, the EIS/EIR does not indicate the relative value of habitat types areas, such as the red fir forest, to wildlife species. Thomas Reid Associates discusses this issue in more detail. (Ex. B, § 4.8.) Thus, the EIS/EIR does not provide the necessary scientific or factual data to support its determination that habitat losses are insignificant.

The EIS/EIR should provide more detailed data regarding these species overall population and distribution, including species range maps. (Ex. B, § 4.8.) Absent such data, and in light of the available information, there is insufficient evidence to conclude that that Project will not significantly affect these species. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.84 The EIS/EIR repeatedly finds that the Project will not affect sensitive species because Project-related habitat losses constitute only a small portion of the habitat available. The EIS/EIR's analysis fails to recognize that the issue is not the Project's percentage contribution to total habitat loss, but whether any habitat loss is significant in light of the existing environment. (Kings County Farm Bureau v. City of Hanford (1990) 221 Cal.App.3d 692, 718.) As the letter from Thomas Reid indicates, the EIS/EIR does not contain information regarding the available habitat types and their relative value. (Ex. B, § 4.8.) It also does not quantify the remaining habitat, so it is impossible to assess whether the habitat losses truly are only a small percentage of the available habitat. Without this information, and particularly the information regarding the relative importance of the lost habitat, the EIS/EIR does not afford any

scientific or factual basis for its conclusion that the Project will not significantly affect sensitive species. (See Concerned Citizens, 42 Cal.3d at p. 935; Seattle Audubon, 798 F.Supp. at p. 1482.) Thus, it fails as an informational document. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.85 For example, the EIS/EIR states that the blue grouse (*Dendrapagus obscurus*), a USFS Management Indicator Species, is likely a year-round resident in the wellfield and power plant areas and along certain transmission line segments. (EIS/EIR, p. 3-104.) The grouse has been observed in the wellfield and power plant areas. (*Ibid.*) Approximately 128 acres of habitat will be lost as a result of the Project. (*Id.* at p. 4-114.) The EIS/EIR, however, finds no significant impact to the blue grouse because the habitat lost is only a small fraction of the total habitat available. (*Ibid.*)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.86 The Cooper's hawk (*Accipiter cooperii*), a California species of special concern, has been observed in the wellfield and power plant area. (*Id.* at p. 3-104.) Suitable nesting and hunting habitat is present in the wellfield and power plant area and along the pipeline and certain transmission line segments. (*Ibid.*) The Project will cause the loss of approximately 154 acres of suitable habitat. (*Id.* at p. 4-114.) The EIS/EIR finds no significant impact because the habitat lost is only a small fraction of the total habitat available. (*Ibid.*) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.87 The EIS/EIR makes similar findings for the golden eagle (*Aquila chrysaetos*), despite suitable foraging habitat and observation of a nest site. (*Id.* at pp. 3-104, 4-116.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.88 The EIS/EIR must provide scientific and factual data regarding sensitive species' habitat, including its relative value. Without this information, the public and decisionmakers cannot assess the Project's impacts on wildlife and evaluate mitigation measures.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.287 Current Species Range is Relevant to Impacts. The EIS/EIR does not provide enough specific information on species to get an idea of the current range and distribution of the species. Given that the EIS/EIR says that impacts on species are considered not significant because the population impacted is such a small part of the overall population, much more detailed data should be provided for these species. In particular, species range maps should be provided. Specifically this is true for: Hall's sedge, sugar stick, gray penstemon, and volcanic daisy (page 4-93); blue grouse, cooper's hawk, golden eagle, hairy woodpecker, loggerhead shrike, pileated woodpecker, sage grouse, Swainson's hawk, pallid bat, Townsend's big-eared bat, American badger, American martin, mule deer, Oregon snowshoe hare, and pronghorn sheep (pages 4-114 to 4-120).
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Wildlife Range Information

These comments suggest that range maps be provided for all special-status plant and wildlife species in order to properly assess the impacts of the project. In the interest of saving space, details about the range and habitat requirements of special-status species listed in the Draft EIS/EIR were incorporated by reference. CEQA permits the incorporation by reference of all or portions of publicly-available documents (Guidelines Section 15129).

The current distribution of these species can be verified in the materials that were prepared and consulted for the Draft EIS/EIR. These materials describe in detail the habitat requirements and the ranges of all special-status species that may occur in the project area. The biological references cited in the Draft EIS/EIR include:

- Botanical and wildlife reports prepared for this project
- Reports prepared for similar projects in the vicinity of the proposed project
- Standard, widely-available botanical and wildlife references (e.g., Zeiner et al. 1990a, 1990b; Hickman 1993; Skinner and Pavlik 1994)

As stated in the Draft EIS/EIR, all of these documents are publicly available from the USFS in Alturas, California. Additional information on the range of special-status plants is found in responses to comments in the Vegetation Section.

Comment AG.72 references Figure 3.7-1 in the Draft EIS/EIR. Note that Figure 3.7-1, 3.7-2, and 3.7-5 have been corrected in the Final EIS/EIR to more accurately illustrate the plant communities in the power plant and wellfield area. Comment AG.72 also suggests mapping habitat types in areas adjacent to the project site. Figures 3.7-2 through 3.7-8 illustrate vegetation resources within approximately 1,000 feet on either side of the proposed and alternative transmission line routes. This illustration of vegetation within a 2,000-foot-wide corridor is adequate to evaluate the potential impacts of the project. It is beyond the scope of the EIS/EIR to map vegetation resources within the Medicine Lake Highlands and Modoc Plateau.

Comments AG.85, AG.86, and AG.87 specifically mention three species for which they request justification for the determination of no significant impact: Blue grouse, Cooper's hawk, and golden eagle. In an effort to satisfy this request, the range of these three species is quantified below within a five-mile radius of the power plant and wellfield area. In addition, the expected proportion and value of habitat loss for each species is estimated.

Blue grouse are found throughout northern California at middle and high elevations in all mountain areas (Zeiner et al. 1990). At these elevations, blue grouse are found in mixed conifer Forests that are relatively close to patches of open shrubland and grassland. Because of the broad habitat requirements of this species, more than 50% of the total land area of Siskiyou and Modoc counties is suitable blue grouse habitat. Within a five-mile radius of the wellfield and power plant area, there are over 47,000 acres of habitat suitable for the blue grouse (= total area minus lava flows, open water, and barren areas). The proposed project would result in the loss of approximately 128 acres of blue grouse habitat that is typical of the surrounding area. Assuming the area of reference is the region within a 5-mile radius of the project site, the projected loss of blue grouse habitat is about 0.27% of the total area available to the species.

In the case of Cooper's hawk, the species is a breeding resident throughout most of the wooded portion of California (Zeiner et al. 1990). All of Siskiyou and Modoc counties are considered to be suitable summer and/or winter range for this species. Within a five-mile radius of the wellfield and power plant area, there are over 47,000 acres of habitat suitable for the Cooper's hawk (= total area minus lava flows, open water, and barren areas). The proposed project would eliminate approximately 154 acres of habitat suitable for the Cooper's hawk that is typical of the surrounding area. Even if the area of reference is just the region within a five-mile radius of the project site, the projected loss of Cooper's hawk habitat is about 0.33% of the total area available to the species.

Golden eagles are uncommon but widely distributed throughout California (Zeiner et al. 1990). All of Siskiyou and Modoc counties are considered to be suitable summer and winter range for this species. Within a five-mile radius of the wellfield and power plant area, there are over 47,000 acres of marginal foraging habitat for the golden eagle (= total area minus lava flows, open water, and barren areas). Approximately 175 acres of habitat suitable for the golden eagle that is typical of the surrounding area would be lost as a result of the proposed project. Even if the area of reference is just the region within a five-mile radius of the project site, the projected loss of golden eagle habitat is about 0.37% of the total area available to the species. Alternatively, the typical territory size of a golden eagle in northern California is 48 square miles, or 30,720 acres (Smith

and Murphy 1973). Using this reference, the projected loss of habitat from the proposed project would be approximately 0.6% of the area of a single golden eagle territory.

CEQA Guidelines specify 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 (CEQA Guidelines, Appendix G). Based on the analyses presented above, the loss of less than 1% of available habitat within 5-miles of the project area for blue grouse, Cooper's hawk, and golden eagle would not substantially reduce the habitat of these species. Thus, impacts to blue grouse, Cooper's hawk, and golden eagle would not be significant.

Comment AG.87 also references a golden eagle nest observed in the project area. Because the golden eagle nest site is approximately 1.5 miles from transmission segment C1 and 3 miles from transmission segment C2, project activities would have no effect on this site.

Comment AG.287 cites 19 species for which range maps should be provided in the Draft EIS/EIR. Range information is provided above for three of the 19 species listed in comment AG.287. As discussed above, range information for the other 16 species mentioned in comment AG.287 is provided in the botanical and wildlife reports that were prepared for this project or that were prepared for projects nearby. These reports are publicly available from the USFS office in Alturas, California.

References:

Hickman, James (ed.). 1993. *The Jepson manual of higher plants of California.* University of California Press. 1400 pp.

Skinner, Mark, and Bruce Pavlik. 1994. *Inventory of rare and endangered vascular plants of California,* Fifth Edition. California Native Plant Society, Sacramento, CA. 338 pp.

Smith, D. G., and J. R. Murphy. 1973. *Breeding ecology of raptors in the eastern Great Basin of Utah.* Scientific Bulletin of the Biological Service 18, No. 3. Brigham Young University, Provo, UT.

Zeiner, D. C., W. F. Laudenslayer, Jr., K. E. Mayer, and M. White (eds.). 1990a. *California's wildlife. Vol. II. Birds*. California Department of Fish and Game, Sacramento, CA. 732 pp.

Zeiner, D. C., W. F. Laudenslayer, Jr., K. E. Mayer, and M. White (eds.). 1990b. *California's wildlife. Vol. III. Mammals*. California Department of Fish and Game, Sacramento, CA. 407 pp.

POTENTIAL IMPACTS TO SPECIAL-STATUS WILDLIFE

Comments—General Impacts to Special-Status Wildlife

L.2 The Medicine Lake Highlands is a unique natural area that provides significant habitat to many species of birds and animals, most of which are not common in our state. Specifically, the Northern and California Spotted Owls, American Marten, Goshawk, Pileated Woodpecker, Bald Eagle, Osprey and Peregrine Falcon all would be adversely affected. Two roadless areas, Mount Hoffman and Burnt Lava Flow, provide good habitat for these species. We need to protect wildlife habitat, which is rapidly disappearing in our state. *(Steve Tabor, Desert Survivors)*

N.25 The DEIS/EIR states that special-status habitat would be lost from construction of project facilities at the wellfield and power plant area, and the clearing of vegetation along the transmission line corridor. The DEIS/EIS further states that for some species the loss of habitat for northern spotted owl, hairy woodpecker and pileated woodpecker would be considered a loss of habitat. Further, the DEIS/EIR states that the proposed project "could" also affect special-status species through noise and human

disturbance during construction, which "could" result in abandonment of a territory or reproductive failure.

The DEIS/EIR alleges that based on the proposed mitigation measures (4.8.3a to 4.8.3n) the levels of significance would be less than significant. This seat-of-the pants finding that the levels of significance would be less than significant is misleading and grossly deficient.

Based on the data (Table 4.8-2) included in the DEIS/EIR, the document shows that 1,230 acres will be lost to bird species habitat, 946 acres will be lost to bat species habitat, and 625 acres will be lost to mammal species habitat as a result of the proposed project. And that the total loss is 2,801 acres to bird, bat, and mammal species habitat.

The information contained in the DEIS/EIR regarding the potential impacts to specific special-status species and their habitat is very limited, and in some cases misleading information.

The mitigation measures cited in the DEIS/EIR for specific special-status species and their habitat provides surveys and studies which should have been conducted and included in the DEIS/EIR. The DEIS/EIR is deficient without including the results of the special special-status species surveys and studies. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

O.11 There are also several areas which support terrestrial management indicator species as well as state and federal sensitive, threatened or endangered wildlife species. Examples of such wildlife include: cooper's hawk, the golden eagle, the bald eagle, the great gray owl, the hairy woodpecker, the loggerhead shrike, northern goshawk, northern spotted owl, osprey, pileated woodpecker, sage grouse, pine marten and several more. Specific management guidelines must be followed to maintain and ensure the survival of these species, which includes any mandated evaluations and surveys for such species like pine marten, northern goshawk, bald eagle and northern spotted owl. *(Katherine Kowatch, Friends of the River)*

X.2 The transmission line in segments A1, A2, B1, and C1 will cause unavoidable damage to the flora and fauna in its path, as well as causing a detrimental break in the now relatively unbroken forest there. The once completely forested area through which the line is proposed to course has already been completely disrupted by previous extractive ventures there, and much of the wildlife which happened to survive until now hangs by a tentative thread. Further disruption by this project can do naught but harm. *(Michael Hauptman, Mount Shasta Area Audubon Society Board of Directors)*

AR.1 This is a pristine area which will undergo adverse impacts on wildlife. It will alter migration routes for Black Tail Deer and Black Bear. The wells and plant site plus the transmission line routes will heavily impact endangered species and other sensitive species such as Bald and Golden Eagles, Blue Grouse, Coopers Hawk, Goshawk, Spotted Owl, Osprey, Pileated Woodpecker, several species of Bats, plus Marten and Snow Shoe Hare. See EIR Table 3.8-2. I might add that just because some species were not spotted doesn't mean they're not there. If the habitat is right, they will be there. I lived in this area for 2-1/2 years before I saw a Black Bear. *(Marcia Barrow)*

AS.2 The large and diverse population of raptors frequenting this area require large expanses of unbroken old growth forest. The cutting of many acres of timber and associated support structures including roads will negatively affect wildlife populations of this ecologically important region. *(Brian B. Beard)*

CW.2 This area is one of the most pristine wilderness areas we have left, and a critical wildlife habitat. *(Barbara Hannelore)*

DZ.3 ...and no more wildlife will be seen. *(Bill and Bette Kinyon)*

EQ.5 The birds and wildlife in the area including the spotted owl, an endangered species, abound in the area. *(Ronald A. Maire)*

FM.3 The wildlife will start disappearing. *(Ana Mulvaney)*

FP.13 The document lists 12 federal and 19 state special status species. Many of these are species which generally survive best in wilderness and/or remote area. This proposal and associated developments (see cumulative impacts section) would undoubtedly drive many of these species out of the area. Please address the following potential project effects on wildlife.

- Effects of nightlight pollution and noise pollution on nesting Bald Eagles and Osprey,

- Effects of heavy metal pollution (from air or water pollution sources) on the fish (and associated predators like eagles and osprey) of Medicine Lake,

- Effects of proposed powerline route (A1) adjacent to use area (Medicine Lake) of above 2 species, please contrast this with other alternatives,

- Effect of water withdrawals of all potential projects combined on the Shasta Crayfish and other listed species in the Fall River drainage. Please discuss the status of the USGS study on groundwater relationship between the Medicine Lake area and Fall River and clarify the lead agencies position on this issue.

- Effects on all listed species on the cumulative effects of this proposal and Telephone Flat (and any other proposals in the KGRA the lead agencies may be aware of) *(Eric T. Nelson and Martha Spencer)*

GG.1 I am writing to express my concern regarding the plans of CalEnergy and Calpine to construct a geothermal power plant in the Medicine Lake Highlands. Such an undertaking would certainly have a detrimental effect on wildlife in the area as it would change the face of the landscape with the proposed electric towers and new roads. *(D. R. Popplewell)*

GO.3 Bald eagles, osprey, and other sensitive species may be harmed. *(June Ringer)*

GP.5 This development, with infrastructure and habitation, will kill wildlife, either by disturbing and harassment, or by electrocution by transmission lines. *(Fred L. Rinne)*

HT.2 The public has been alerted to the status of endangered species all over the world. Shouldn't the developers of our natural resources have to be concerned with protecting threatened species? Case in point:

In the EIS Project book, in Section 3.8, are listed 22 birds, including 8 bats and 6 mammals who frequent this area. I have personally seen most of the creatures on this list. Forest stands with late successsional characteristics such as high canopy closure and large tree diameter provide favorable habitat for these species. Special habitat features such as lava flows, cliffs, caves, rock outcrops, large defective trees, and large snags are important for many wildlife species. All of these features abound in the area proposed for power plant construction and in the transmission line corridor.

We all object to the spoiling of the South American rainforests and the So. East Asian lands. Should we then do the same thing in our area to satisfy the interests of the big money crowd? 22 birds and 6 mammals existing in this area are listed on the Federal and State Endangered & threatened species and also on the California Species of Special Concern whose future is in doubt due to habitat destruction. Since birds and deer can't talk, we'll have to speak up for them.... *(Louise Thompson)*

PH5.3 The public has been alerted to the status of endangered species all over the world; shouldn't the developers of our natural resources have to be concerned with protecting threatened species? Case in point: In the EIS project book, in section 3.8, are listed twenty-two birds, including eight bats and six mammals who frequent this area. I have personally seen most of the creatures on this list. Forest stands with late successional characteristics such as high canopy closure and large tree diameters provide favorable habitat for these species. Special habitat features such as lava flows, cliffs, caves, rock outcrops, large defective trees and large snags are important for many, many wildlife species. All of these features abound in the area proposed for power plant construction and in the transmission line corridor. We all object to the spoiling of the South American rain forests and the Southeast Asian lands. Should we then do the same thing in our area to satisfy the interests of the big money crowd? Twenty-two birds and six mammals existing in this area are listed on the federal and state endangered and threatened species, and also on the California Species of Special Concern, whose future is in doubt due to habitat destruction. *(Medicine Lake Public Hearing)*

Response—General Impacts to Special-Status Wildlife

A discussion of the potential impacts to special-status wildlife species is presented in Section 4.8 of the Draft EIS/EIR on pages 4-106 through 4-134. Specific mitigation measures are proposed on pages 4-123 through 4-125 for most of the species listed in comments L.2, N.25, and O.11. These mitigation measures often include pre-construction surveys for these species (e.g., Mitigation Measures 4.8.3a, 4.8.3b, 4.8.3d, 4.8.3e, and 4.8.3k), and mitigation to reduce potentially significant effects. Impacts to the remaining species listed in the comments are not significant because those species and their habitats do not occur in the project area or would not be substantially impacted by the project. Thus, for these remaining species, mitigation measures are not required.

The EIS/EIR provides an adequate discussion of the special-status wildlife and plant species that may occur in the project area. Although additional surveys would occur prior to construction, the potential effects to all special-status species have been appropriately analyzed and described. In addition, mitigation has been defined to avoid adverse and significant effects to special-status species. See responses to comments in this section under "Effects on Specific Wildlife Species" for additional information on special-status animals. See responses to comments in the Vegetation Section for additional information on special-status plants.

Comment L.2 states that two roadless areas, Mount Hoffman and Burnt Lava Flow, provide good habitat for special-status wildlife listed in the comment. Segment A2 of the proposed transmission line would pass through the Mount Hoffman released roadless area (see response to "Comment—Mt. Hoffman Released Roadless Area" in the Plans and Policies Section for more discussion of this issue). The Burnt Lava Flow is approximately five miles south of the project area. Thus, no impacts to the Burnt Lava Flow would occur as a result of this project.

Comment N.25 incorrectly states that there will be a loss of 2,801 acres of habitat for bird, bat, and mammal species as a result of the project. Table 4.8-2 provides an estimate of the amount of habitat loss from the project for each species. However, there is substantial overlap in the habitat requirements of these species. As a result, there is also substantial overlap in the amount of habitat lost to each species. For example, suitable habitat for the long-eared myotis is virtually identical to that of the long-legged myotis. Thus, the 154 acres of habitat that would be lost to the long-eared myotis as a result of the project is the same habitat that would be lost to the long-legged myotis. Habitat loss in Table 4.8-2 cannot be added together. See Table 4.7-1 for the amount of habitat expected to be lost as a result of the project. The values in Table 4.7-1 can be added together to estimate the overall loss of habitat.

Comment O.11 references the need to follow specific management guidelines (including evaluations and surveys) for the pine marten, northern goshawk, bald eagle, and northern spotted owl. Surveys have been conducted to USFWS protocol for these species (except the pine marten) within the proposed power plant and wellfield area (Galea Wildlife Consulting 1995a). Surveys for pine marten to USFS protocol were not conducted because their presence had already been confirmed in the area by the USFS. Instead, a survey was conducted to detect marten use of dens within 0.25 miles of proposed geothermal well sites (Galea Wildlife Consulting 1995b).

In other areas of the project, surveys and habitat assessments have been conducted (e.g., Gutierrez and Dames & Moore 1993; BioSystems Analysis 1996). The mitigation measures listed on pages 4-123 through 4-125 were designed to comply with all established Federal and state protocols and management guidelines on special-status species. In many cases, these protocols are cited directly (e.g., Mitigation Measure 4.8.3a).

Many of the comments express concern about the potential impacts to particular wildlife species. For further discussion (beyond what is already in the EIS/EIR) of potential impacts to sensitive wildlife species, see the following responses to comments in this section (listed in the order in which they appear):

- Bald Eagle
- Mule Deer and Animal Migration Routes
- Northern Goshawk
- Northern Spotted Owl
- Osprey
- Pine Marten and Pacific Fisher
- Special-Status Bats
- Swainson's Hawk

Comment FP.13 expresses concern about particular impacts of the proposed project. See the response to comments under the following headings for a discussion of these issues:

- Wildlife at Fall River Springs (this section)
- Effects of Water Quality on Fish and Other Aquatic Organisms (this section)
- General Deposition Effects on Surface Water (in the Hydrology Section)
- Potential Effects to Fall River Springs (in the Hydrology Section)
- Various topics in the Cumulative Effects Section

Comment FP.13 also expresses concern about the potential for nightlight pollution and noise pollution on nesting bald eagles and ospreys. The only area in which bald eagles and ospreys are known to nest in the vicinity of the project is south of Medicine Lake. Segment A1 of the proposed transmission line would cross the area on the north side of Medicine Lake. Because the transmission line would not be lighted or would not produce any noise, there would be no impacts from light or noise to nesting bald eagles or ospreys during project operation. Project construction of segment A1 would result in temporary construction noise but no nightime illumination (construction would occur only during the day). Temporary and low-level noise from construction would not be a significant impact on bald eagles or ospreys that may be nesting several miles away.

Comments GG.1 and GP.5 express concern about the potential for bird electrocution by transmission lines. A stated on page 4-126 of the Draft EIS/EIR, there would no chance of electrocution of birds because the transmission wires would be separated by a distance that would exceed the wingspan of the largest bird in the area. See also "Effects of Transmission Lines on Birds" below.

References:

BioSystems Analysis, Inc. and JRP Historical Consulting Services. 1996. *Biological and Cultural Resource Assessments for the Calpine Transmission Line Project, Volume 1—Report*. February.

Gutierrez, R. J. and Dames & Moore 1993. *Biological Assessment of the Northern Spotted Owl. Unocal Glass Mountain Geothermal Project*. Report prepared for Unocal Company.

Galea Wildlife Consulting. 1995a. *Biological Survey Report, Fourmile Hill Assessment Area*. October.

———. 1995b. *Fourmile Hill Project Area Results of American Marten Surveys, 1995*.

Comments—Wildlife Exposure to Sump Contents

B.8 On page 3-37, the draft document states that no geothermal fluid samples have been obtained from the geothermal system in the Fourmile area and therefore, no water quality analysis of the groundwater underlying the proposed project is available. The Service is concerned that the open sumps proposed as part of the project action may contain water that is toxic to wildlife species. Foraging bald eagles may be attracted to the area if sumps or other collection basins attract and/or entrap waterbirds or other wildlife species. The presence of open water, if visible, in an otherwise arid landscape may draw these species to the project area and thereby expose them to potentially toxic material. No mitigation measures to reduce or avoid this injury to listed or other species is proposed as part of the project action.

Without any information on the potential water quality contained within the proposed sumps and absent any mitigation measures to protect migratory birds from exposure to contaminants, the Service must conclude that some take of migratory birds may occur over the life of the project. Because the Migratory Bird Treaty Acts prohibit take, we also recommend that the project applicant contact the Service's Law Enforcement Division at (541) 883-6900.

In an August 27, 1997, letter to your office (enclosed), the Service's Klamath Falls Fish and Wildlife Office requested information on the potential exposure of listed species and migratory birds to contaminants as

a result of another geothermal project that is proposed for the Glass Mountain KGRA. We recommend that the same type of information be developed for the Fourmile Hill Geothermal Development Project and that such information be incorporated into a revised Draft EIS/EIR for the subject project. In addition, we recommend that the project proponent develop a monitoring or contingency plan that includes provisions for suspension of operations if losses of fish or wildlife occur.

(Ronald A. Iverson, U.S. Fish and Wildlife Service)

N.5 The DEIS/EIR Failed to Disclose, Evaluate, and Mitigate the Potential Adverse Direct, Indirect, and Cumulative Impacts to Plants and Animals Resulting From Geothermal Fluids as a Result of the Proposed Project

8. Mr. Woodward further stated that:

"No chemical data is presented on geothermal fluids produced from wells in the area. The report states that the "...data from these wells are proprietary...". Without chemical information, no clear evaluation of the geothermal system and fluid chemistry can be made. It is possible the geothermal fluids produced could be harmful to plant and animal life in the area due to high concentrations of heavy metals such as arsenic, cadmium, lead, mercury. etc. The prepares of the report are remiss in not including the chemical information. Not all chemical information on the geothermal fluids is proprietary. The Regional Water Quality Control Board, Central Valley Region sampled geothermal fluids produced from wells 68-8 and 31-17 (formerly 21-17). That information is in the public domain and is available to anyone on request."

We reference letter of September 12, 1997 to Randall Sharp, USFS/BLM; Fourmile Hill Geothermal Development Project; EIS/EIR Coordinator; from Phil Woodward, Registered Geologist; Certified Engineering Geologist; Certified Hydrogeologist.

The DEIS/EIR is deficient without the geothermal fluid information and data as cited above. The DEIS/EIR also failed to disclose, evaluate, and mitigate the potential direct, indirect, and cumulative impacts to plant and animal life (all life stages) resulting from geothermal fluids from the proposed project. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

AG.76 The EIS/EIR also fails to adequately assess noise impacts, impacts from the sumps on birds or the many impacts associated with the transmission line corridor. These impacts are discussed in more detail in the letter from Thomas Reid Associates and in the comments of Dr. Fox. (Ex. B, § 4.8; Ex. A, Comments 18, 19.)

Without this information, the public and decisionmakers cannot fully evaluate the Project's impacts on wildlife or evaluate mitigation measures.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.296 The EIS/EIR does not discuss the impacts of the sumps on birds. The EIS/EIR states: "Liquid wastes produced during well drilling consist of water, non-toxic drilling additives, rock cuttings and geothermal fluid...The liquid fraction would be directed to a lined sump with an impermeable clay or artificial liner..." (p. 4-33.) Figure 2.2-4 of the EIS/EIR (p. 2-13) shows that the lined sumps at each well pad would be 120′ x 120′ x 10′ deep. This is 14,400 square feet, or about 1/3 or an acre. Many species of birds are attracted to water features and would land on the sumps. The EIS/EIR should discuss the composition of the liquid waste and other materials in these sumps and its impacts on birds. In particular, there may be solids in the liquid fraction that would form a scum or sticky substance at the edge of the sump in which birds could become trapped. In addition, when there is a well blowout, the emergency plan is to pump the geothermal injection brine to the sumps (p. 4-283). This brine contains high levels of heavy metals and other substances which could be toxic to birds which might regularly roost on the ponds.

If there is an adverse impact on birds, then a mitigation measure should be proposed to prevent birds from landing on the ponds, such as the type of fine netting that is used to prevent birds from landing on industrial waste ponds and sewage ponds.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

FE.1 After an onsite inspection and a review of available maps it appears the creation of sumps will be a great attractant for wildlife as a water source. There is nothing in the draft EIS/EIR about the expected water temperature or chemical contaminates that may be in the sumps, but there must be a recognized danger because the EIS/EIR specifies terrestrial animals are to be fenced away from the sumps. The issue of protecting birds and bats must be addressed. *(Ray Miller)*

Response—Wildlife Exposure to Sump Contents

As discussed in the Draft EIS/EIR, the contents of the sumps that would be located at the well pads are expected to be non-hazardous. While some of the geothermal fluid materials contained in the sumps could be considered toxic in sufficient concentrations, these materials would not exist in the sump waters in concentrations that would be considered hazardous.

The conclusion that sump contents would not be hazardous applies primarily to humans. The geothermal fluid materials in the sump waters would not be expected to be hazardous to wildlife. It is acknowledged that some wildlife have a lower threshold of toxicity than humans to certain chemicals (possibly including those in the geothermal fluids). Several factors (described below) would prevent wildlife from being exposed to toxic materials in the sump waters in quantities that could pose a hazard or result in take of wildlife species.

Geothermal fluids would only be present in the sump waters during the initial drilling and testing phase of the project, and during intermittent in-fill well drilling. These drilling activities would occur for approximately 60 to 90 days. During other periods, the sumps would either be empty (i.e., would not contain water that could attract wildlife) or would contain only non-hazardous rainfall or snow. Wildlife could be exposed to geothermal fluid materials in the sumps for 60 to 90 days.

In addition, as discussed in the Draft EIS/EIR on page 4-112, drilling and testing would cause temporary and intermittent noise that would disturb wildlife in the immediate vicinity. This disturbance would likely cause wildlife to avoid the well pads and their associated sumps. Because geothermal fluid materials would only be present in the sumps during drilling and testing, it is expected that wildlife would not be present at the sumps when the geothermal fluids would be present.

As discussed on page 2-15 of the Draft EIS/EIR, fencing would be placed around the perimeter of each sump. This fencing would prevent terrestrial wildlife species from accessing the sumps at any time. In summary, the proposed project would not be expected to result in take of Federally listed species due to exposure to toxic materials in the sumps for the following reasons:

- The expected low concentrations of toxic materials
- The temporary and short-term presence of geothermal fluid materials in the sumps only during drilling
- The presence of fencing around the sumps
- The expected avoidance of the sumps during drilling because of noise and human presence

Despite the low probability that birds or bats (including special-status species) would come in contact with geothermal fluids in the sumps, the following mitigation measure has been added to the EIS/EIR:

> "4.8.3o In order to eliminate the chance of wildlife coming in contact with geothermal fluids that are temporarily and infrequently present in the sumps, netting or other protective measures (as agreed to by the USFWS) will be placed over each sump and fencing will be placed around the perimeter of the sumps. If netting is used, the netting material and mesh size will be sufficient to prevent birds or bats from contacting the contents of the sump but not to trap birds or bats in the netting itself. (C, O)"

In addition, the project description of the geothermal fluid and runoff controls on the well pads has been modified to include this provision (page 2-15 of the Draft EIS/EIR):

> "Although sump contents are not expected to be hazardous, measures would be taken by Calpine to prevent wildlife from attempting to drink and/or utilize the fluids

> contained in the sumps, as directed by the USFS. Fencing would be placed around the perimeter of the sumps to prevent mammals from accessing the sumps. Netting or other protective measures (as agreed to by the USFWS) would be placed on top of the sumps to prevent birds from accessing the sumps."

Implementation of Mitigation Measure 4.8.3o would eliminate any chance that birds or bats (including special-status species) would come in contact with geothermal fluids in the sumps.

Comment B.8 also suggests that the Final EIS/EIR provide information about potential exposure of wildlife to contaminants, citing an August 27, 1997 letter from the USFWS that is attached to the USFWS comment letter on the Fourmile Hill Draft EIS/EIR. The August 27 letter was submitted by the USFWS to the USFS as part of the scoping process for the proposed Telephone Flat project. In comment B.8, the USFWS requests that similar information on contaminant exposure that was requested in their August 27 letter for the Telephone Flat project be provided in the Final EIS/EIR for the Fourmile Hill project. See responses to "Comment—Wildlife Exposure to Toxic Materials," "Comment—Wildlife Exposure to Power Plant Emissions," and "Comment—Effects of Water Quality on Fish and Other Aquatic Organisms" below regarding contaminant exposure issues raised in the USFWS August 27 letter about the Telephone Flat project. See also responses to comments in the Hydrology Section regarding comment 2e in the August 27 USFWS letter.

Comments AG.76 and AG.296 also suggest that birds could become trapped in solids that might form around the edge of the sumps when they are filled. Due to the chemical composition of the geothermal fluids (described in Table 3.4-1 on page 3-39 of the Draft EIS/EIR), a substance that is sticky enough to trap birds is unlikely to form in the sumps. The geothermal fluids have a high concentration of chloride. Evaporation of water from the fluid may cause a film to form around the edge of the pond, but this film would be composed primarily of salt (e.g., chloride or potassium salts). This compound could not trap even the smallest bird. Moreover, the short duration of ponding within the sumps would limit wildlife exposure substantially. As stated above, the netting proposed as Mitigation Measure 4.8.3o would eliminate any chance that birds or bats would come in contact with geothermal fluids in the sumps.

Comment AG.296 also questions the available data on the chemistry of the geothermal fluid. Chemistry data collected from geothermal wells at other locations in the Glass Mountain KGRA are considered to be representative of the geothermal fluid chemistry that would be encountered in the Fourmile Hill project area. These data have been reviewed in determining the potential for effects to wildlife and plant species from the Fourmile Hill project. In addition, text which clarifies the information on geothermal fluid chemistry has been added to the EIS/EIR. Sufficient information is provided in the Final EIS/EIR to support the conclusions made in the Draft EIS/EIR regarding potential effects from geothermal fluids to wildlife and plants. See response to "Comment—Chemical Composition of Geothermal Fluids" in the Geothermal Resources Section regarding the fluid chemistry of the geothermal resource at the Glass Mountain KGRA.

See response to "Comment—Wildlife Exposure to Noise" below for a discussion of the effects of noise on wildlife. See response to "Comment—Effects of Transmission Lines

on Birds" below for a discussion of potential impacts due to bird collisions with transmission lines.

Comments—Wildlife Exposure to Toxic Materials

B.17 What is the potential exposure from contaminants?

What hazardous materials will be used and/or stored within the area? What is the contingency plan in case of a spill (how will spills be handled)? How will storage, use, and spill response prevent impacts to threatened and endangered species, and migratory birds? *(Ronald A. Iverson, U.S. Fish and Wildlife Service)*

B.18 What is the chemical composition of the geothermal brine water and is it consistent? What analysis will be performed (i.e. hydro-carbons, and ICP metals scan plus additional analysis for arsenic, selenium, and mercury) and how often will water be analyzed? What are the detection limits? What are the quality control and quality assurance procedures to be used to verify results? What will the capacity of the sump ponds be (should be at least 110% of maximum potential input to prevent overflow)? What are the potential impacts to threatened and endangered species, and migratory birds? *(Ronald A. Iverson, U.S. Fish and Wildlife Service)*

B.19 How will waste waters, sludge, hazardous materials, and other wastes be handled to insure proper disposal? What discharges may occur and will they require a National Pollution Discharge Elimination System (NPDES) permit and/or a Regional Water Quality Control Board (RWQCB) permit? What discharges will be allowed under any NPDES and/or RWQCB permits and what restrictions will apply? How will storage, handling, and disposal prevent exposure to threatened and endangered species, and migratory birds? *(Ronald A. Iverson, U.S. Fish and Wildlife Service)*

Response—Wildlife Exposure to Toxic Materials

Section 4.15 of the Draft EIS/EIR on pages 4-275 through 4-288 provides a discussion of the use and storage of hazardous materials. This section also includes a discussion of the proposed contingency plans in the event of emergencies such as a fire, well blowout, or spill of hazardous materials. It is expected that the proper storage, use, and spill response of hazardous materials that is described in the EIS/EIR would prevent impacts to wildlife species from hazardous materials.

The chemical composition of the geothermal brine is expected to be consistent with the chemical constituents presented in Table 3.4-1 on page 3-39 of the Draft EIS/EIR. The production wells would be continuously monitored for levels of chemical constituents. Quality control measures are described in Section 2.2, Alternative 1.

As described in Section 2.2, the sumps would have a capacity of 750,000 gallons. A spacing of 3-feet between the top of the fluid and the top of the sump (i.e., freeboard) would be maintained at all times to prevent overflow. This capacity would be sufficient to accommodate all geothermal fluids that would be generated. See response to "Comment— Wildlife Exposure to Sump Contents" above for a discussion of the potential impact of these fluids on wildlife.

The handling and disposal of waste waters, sludge, hazardous materials, and other wastes are described in the EIS/EIR in Section 2.2, Alternative 1, and Section 4.15, Human Health and Safety. Based on correspondence with the North Coast Regional Water Quality Control Board (RWQCB), the RWQCB expects to issue Waste Discharge Requirements (WDR) and a Monitoring and Reporting Program to ensure that waste discharges are managed and monitored to protect surface and groundwater resources. A National Pollution Discharge Elimination System (NPDES) permit may be required for the project. The allowable project discharges and restrictions would be spelled out in the WDR. Following the proper handling and disposal procedures described in the Draft EIS/EIR and RWQCB permit requirements would ensure that no impacts to wildlife species would occur.

Comments—Wildlife Exposure to Power Plant Emissions

B.20 What will the chemical composition of air emissions from geothermal steam or other gaseous discharges be? What potential impacts to the surrounding area may occur including water quality, vegetation, invertebrate and vertebrate species, and micro-biotic community (acute/chronic)? How will effects of these discharges impact threatened and endangered species, migratory birds, and old growth/late successional forest characteristics? *(Ronald A. Iverson, U.S. Fish and Wildlife Service)*

AO.4 There are so many small animals that feed off the grasses and brush and the chemicals have to effect them, as well as the eagles and other birds in the area. What will this do to the deer and elk? No one seems to care. *(Mildred J. Aquila)*

HT.3 Eagles, goshawks & ospreys are known to have nests adjacent to Medicine Lake which is suitable foraging habitat for them. How long will they stay when the air becomes polluted with hydrogen sulfide and sulphur dioxide? We're told not to worry because we can't smell it, but it's still there and affects the environment. *(Louise Thompson)*

PH3.39 You say there's going to be hydrogen sulfide and sulfur oxide emissions. And I have heard it is going to put it out at nights and you say you can't smell them. But it is still there. How is this going to affect the birds and the wildlife up there? We have—every day we see this osprey. It is a pair, and they have got a young one with them now. So there is a nesting site right within a couple of hundred feet of the lake. There is an eagle that is nesting up there and has a mate and offspring. There is a Great Blue heron that's there. These birds are not going to stick around if there is going to be hazardous stuff floating around there. They are going to go elsewhere. So it's going to ruin our birding up there. How do you answer that? *(Yreka Public Hearing)*

PH5.4 Eagles, goshawks and ospreys are known to have nests adjacent to Medicine Lake, which is suitable foraging habitat for them. How long will they stay here when the air becomes polluted with hydrogen sulfide and sulfur dioxide? We're told not to worry because we can't smell it, and it's still there, and it affects the environment. *(Medicine Lake Public Hearing)*

Response—Wildlife Exposure to Power Plant Emissions

The chemical composition of project air emissions are discussed in Section 4.13, Air Quality, as are potential impacts to air quality from these emissions. Potential impacts to hydrology from deposition of air emissions are described in Section 4.3, Hydrology. Potential impacts to vegetation from deposition of air emissions are described in Section 4.7, Vegetation.

Due to the extremely low concentrations of potentially toxic air emissions that would be generated by the proposed project, it is not expected that any significant effects to invertebrate or vertebrate species or micro-biotic communities would occur (see Tables 4.13-6, 4.13-7, and 4.13-8). Likewise, project air emissions would not significantly affect old growth/late-successional forest, threatened and endangered species, or migratory birds, including bald eagles, goshawks, or ospreys (see response to "Comment—Effects of Water Quality on Fish" for more discussion of this issue). For further discussion of the potential for project emission to impact vegetation (and, indirectly, wildlife), see responses to comments under "Effects of Emissions on Vegetation" in the Vegetation Section.

Comments—Wildlife Exposure to Noise

A.62 Additionally, we recommend that BLM/USFS review construction operations and well testing schedules to determine whether they may affect seasonal nesting and mating activities of sensitive species, and the public's enjoyment of the recreation experience. If impacts are anticipated, appropriate mitigation measures should be discussed in the FEIS. *(Deanna M. Weiman, U.S. Environmental Protection Agency)*

Q.5 The EIS/EIR also states that noise effects of the proposed project's construction and well-drilling phases would "temporarily" displace wildlife from an area up to 400 feet from the sources of noise disturbance. These activities will take place in the summer and fall months over a three-year period, so it is more likely that this disturbance will be permanent, not temporary. The wildlife is not going to take a sabbatical during the noisy times, they are going to pack their bags and leave town! As more and more habitat is degraded (as this proposed project admittedly will do), wildlife will have less places which provide good habitat to move into. *(Lori J. Cooper, Klamath Forest Alliance)*

Y.39 The effects of noise on wildlife and on the areas that are supposed to be avoided under the Forest Plan presents a problem that is not being addressed in the DEIS/EIR (please see section on Forest Plans below). Noise knows no boundaries, and there would be no areas within 4 miles that would escape these effects. While the noise of construction may be relatively temporary, lasting several years, the effects on eagle nesting could be drastic, particularly in the vicinity of Fourmile Hill.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AG.264 Some wildlife, including snakes, salamanders, frogs, toads, and many insects are sensitive to vibration because they use it for communication to define territory, for mating calls, to detect predators, and for other purposes. (Bommer and Bruce 1996, p. 16). The DEIR should be revised to discuss and quantify vibration impacts and to propose mitigation, as appropriate.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.284 The EIS/EIR states (p. 4-112) that during the construction phase wildlife would not experience adverse physiological effects from high noise levels because the temporary human activity and moving machinery would cause wildlife to avoid construction sites during these periods. This statement shows a lack of understanding of the impact to wildlife and of assessing potential impacts to wildlife. The reason wildlife would leave the area is because of the noise and disturbance associated with construction. The act of leaving the area itself indicates that there has been an impact to the wildlife caused by the noise and construction activity. The act of displacement itself may indicate that the wildlife have in fact experienced adverse physiological effects, as well as potential disruption of mating or foraging, interference with territorial behavior. The EIS/EIR should fully evaluate this impact and mitigation measures. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.293 Construction and Operational Noise Impacts on Wildlife Are Not Adequately Addressed. The EIS/EIR describes a three-year period of noise disturbance as being temporary and therefore not significant. However, according to the Noise Pollution Clearinghouse FACT SHEET on Noise Effects on Wildlife, "the study of animal response to noise is a function of many variables including characteristics of the noise and duration, life history characteristics of the species, habitat type, season and current activity of the animal, sex and age, previous exposure and whether other physical stressors (e.g. drought) are present (Manci, et al., 1988)." The FACT SHEET further states that "behavioral and physiological responses have the potential to cause injury, energy loss (from movement away from noise source), decrease in food intake, habitat avoidance and abandonment, and reproductive losses (National Park Service, 1994). Studies have shown that when certain bird species are flushed from nests in response to noise, eggs are broken and young are exposed to injury and predation (Bunnell et. al., 1981; Gladwin, 1987)." Some of the animals impacted in the Project area have short life spans and are only active in the summer and fall months when the noise would occur. For these species, three years is not temporary. The EIS/EIR should fully evaluate noise impacts on these species.

The mitigation for noise impacts on wildlife is too vague. More details about noise reduction measures should be added. Also, since operational noise could affect wildlife throughout the life of the project, nest surveys for birds of concern should be carried out each year in operational noise impact areas.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

DI.5 The noise and vibration caused by 24 hour a day drilling for 45-90 days (for each well!) would profoundly disrupt the wildlife in the area. In addition, the high voltage transmission lines, roads and steam pipeline would disturb the pristine ecosystem. *(Ana Holub and Richard Lucas)*

Response—Wildlife Exposure to Noise

The potential effect of construction and well-testing noise on wildlife is addressed in Section 4.8, Wildlife. Several mitigation measures identified in this section are designed to mitigate the potential effects of project-related noise on special-status wildlife. For example, Mitigation Measure 4.8.3c and 4.8.3g restrict construction activities to specific time periods in order to minimize the potential for disturbance to nesting northern goshawks and Swainson's hawks.

The potential effects on recreation from noise generated by construction and well-testing have been considered in the EIS/EIR. These potential effects are discussed in Section 4.14, Noise, as well as in Section 4.11, Land Use and Recreation. Appropriate mitigation measures to minimize the noise effects of the project on recreation have been identified in these sections of the EIS/EIR.

Comment AG.264 expresses concern about the potential impacts of increased vibration from the proposed project to some wildlife, including snakes, salamanders, frogs, toads,

and many insects. It is unknown what types and amounts of vibrations the proposed project is likely to generate and what impacts these vibrations might have on wildlife. However, as discussed in Section 4.8 of the Draft EIS/EIR, there are no special-status snakes, salamanders, frogs, toads, or insects that occur or may occur in the project area. Thus, project-generated vibrations, if they occur, would not adversely affect special-status species and would not result in significant impacts.

In response to comment AG.284, the text of the Draft EIS/EIR on page 4-112 (paragraph 2) has been clarified:

> "~~During the construction phase, wildlife (including bats) would not experience adverse physiological effects from high noise levels because the temporary human activity and moving machinery in a given area would cause wildlife to avoid construction sites during these periods. However,~~ T~~t~~he combination of human activity, moving machinery, and associated noise would ~~also serve to~~ temporarily displace wildlife (especially birds, bats, and other mammals) from the habitat immediately adjacent to construction. Effects to wildlife from noise and disturbance would be temporary, because it would be concentrated in the summer and fall months over a three-year period. During drilling operations and construction of well pads and the power plant, about 50 to 60 acres of habitat at most would be impacted by noise and disturbance that could cause temporary displacement of wildlife. While the effects of construction noise on wildlife could be adverse, ~~Since~~ impacts would be temporary and restricted to a relatively small area. Thus, ~~,~~ the effects upon wildlife are not expected to be significant."

Comments—Effects of New Roads on Wildlife

D.6 In addition, we wish to reiterate our concerns for increased road densities in the project area. The project proposes to construct two miles of new roads. Excessive roads (>1.5 miles of open road/mile') are considered detrimental to wildlife. The DFG recommends that an equal number of miles of nonessential roads within the project area be closed permanently or gated to reduce the impact of the new road construction. *(Richard L. Elliott, California Department of Fish and Game)*

X.10 The MSAAS is also concerned with the issue of roads as mentioned in the EIS/EIR. A plethora of roadways already exist on or near the proposed site. To build more would be redundant. *(Michael Hauptman, Mount Shasta Area Audubon Society Board of Directors)*

AG.73 The California Department of Fish and Game had recommended a thorough analysis of the impacts from the creation of year-round access to the area, but the EIS/EIR fails to provide sufficient information regarding the impact of new roads on wildlife. (Ex. G, p. 2, July 9, 1996 Letter from Richard Elliot, Cal. Dept. of Fish & Game; Ex. B, § 4.8.) The EIS/EIR acknowledges that new roads associated with the transmission line could provide the public with access to portions of the project area that were previously inaccessible. (EIS/EIR, p. 4-109.) Nonetheless, the EIS/EIR find this impact to be insignificant because any disturbance of wildlife would be temporary and sporadic. (*Ibid.*)

Again, the EIS/EIR fails to provide any factual basis supporting its conclusion. In fact, it is likely that new roads will increase the Project's impacts by opening previously inaccessible areas to the public. The EIS/EIR should discuss where the new roads will be located, what areas will be newly accessible, the types of public activities allowed, and the effects of increased access on wildlife. (Ex. B, § 4.8.) Mitigation measures may be required to reduce the associated impacts. These measures may include gating the new roads or closing them to the public. (Ex. B, § 4.8.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.290 Page 4-109 of the EIS/EIR states that "new roads associated with the transmission line could provide the public with access to portions of the project area that were previously inaccessible. If the public were to access these areas, any disturbance of wildlife would be expected to be temporary and sporadic, and would not be expected to significantly affect any wildlife species in the area." This impact assessment is totally inadequate. Some public activities can be very damaging to the environment and can cause significant impacts to wildlife. These must be discussed in the EIS/EIR. There should be a discussion of where the new roads will be located, what areas the roads will allow access to, and what type of activities the public will conduct on these new roads (i.e. four-wheel driving, camping, hunting, etc.) After an adequate description of the potential impacts is provided, then appropriate mitigation measures

can be recommended. For example, maybe the new roads should be gated and closed to public access. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

DB.7 After construction, all roads not reclaimed should be closed to public use. Roads fragment habitat, and encourage litter, vandalism, and poaching. The less roads, the better. *(Stan Haye)*

PH4.49 What would be the effects of road construction on wildlife? *(Mount Shasta Public Hearing)*

Response—Effects of New Roads on Wildlife

The USFS and BLM acknowledge the CDFG policy to recommend that there be no net increase in accessible roads in areas where accessible road density is already greater than 1.5 miles per square mile. Because the density of accessible roads within the proposed power plant and wellfield area exceeds 1.5 miles per square mile, this policy would apply to the proposed project. This policy is based on research that found that increased road densities with public vehicular access reduced mule deer usage of adjacent habitat (Payton 1979). This research concluded that mule deer are affected by the increase in human presence associated with the road and not the road itself.

Most of the existing roads within the proposed power plant and wellfield area (see Figure 2.2-3 on page 2-9) are already closed to public access. There are only three roads within the power plant and wellfield area that are open to the public:

- Forest Service Road 44N64 (unpaved)
- Forest Service Road 44N54 (unpaved)
- Forest Service Route 49 (paved)

All other existing roads within the proposed power plant and wellfield area are either gated or blocked by an earthen berm. All new roads proposed for the power plant and wellfield area (see Figure 2.2-3) would also be closed to the public. Likewise, all roads proposed to be improved would remain closed to the public. Because most existing and all new roads within the project area are closed to public access, no new road closures would be necessary to comply with the CDFG policy.

Public access to access road for the transmission line would depend on the location of the roads. On the Klamath National Forest, roads that are not already designated to be permanently closed (see discussion above) would by managed under the current road management plan. Under this plan, all but designated roads are closed between August 15 and March 31. On the Modoc National Forest, most access roads would be closed except those needed for regular maintenance of the transmission line or for other critical management activities. Once the final alignment of the transmission line is selected and access roads are sites, the Modoc National Forest would designated which access roads would remain open and which roads would be closed to public use.

Comments AG.73 and AG.290 present concern that the construction of new roads would increase the recreational use of the area which would, in turn, adversely affect wildlife. As stated above, all new and improved roads in the power plant and wellfield area would be closed or remain closed to public access. New access roads constructed along the transmission line route would be open to public use. Because these access roads would be relatively short in length (typically less than 0.5 mile) and most would be closed to the public (see above), they would not substantially alter the recreational use of the area around the transmission line.

As discussed in response to "Comment—Effects to Hunters" in the Land Use and Recreation Section, the only place where hunting would be limited is within an approximately 200-acre area in the power plant and wellfield area. In this area, shooting would be prohibited, but other forms of hunting would be allowed. This restriction would not substantially change the hunting patterns in the area.

In addition, the transmission line corridor itself is not expected to substantially alter recreational use of the area. Due to the vegetation that would be established in the transmission line corridor, hunting may actually decline along the transmission line corridor, reducing the pressure on wildlife. As described in Section 3.7 of the Draft EIS/EIR, vegetation in the majority of the transmission line corridor would be maintained in a relatively dense stand of native shrubs. Once this vegetation reaches maturity (i.e., after establishment), it would provide excellent cover for the two game species in the region, mule deer and bear. The increase in understory cover and height would also reduce the visibility of hunters. The combination of high and dense cover for game species and low visibility would probably reduce the attractiveness of this habitat to hunters, thus reducing hunting along the corridor.

See also responses to "Comment—Recreational Use in the Immediate Wellfield Vicinity" and "Comment—Recreational Use in the Vicinity of the Transmission Line" in the Land Use and Recreation Section for more discussion of the effects of the project on recreational uses that might affect wildlife. See also response to "Comment—Effects of Hunting and Habitat Fragmentation on Wildlife" below.

Reference:

Payton, R. 1979. *Wildlife Habitats in Managed Forests.* USDA Forest Service, Agriculture Handbook No. 553.

Comments—Effects of Transmission Lines on Birds

B.11 The Service is concerned about the statement on page 4-125, that bird collisions with large diameter conductors are relatively unlikely to occur. What diameter are the large conductors? The document does not cite any scientific literature or data that supports this claim. Potential mitigation measures are proposed for small diameter (3/8 inch) overhead ground wires and conductors. However, the Service is concerned that over most of the 24-mile transmission route, birds, including bald eagles, may not be protected from possible injury or death as a result of collision with conductors.

(Ronald A. Iverson, U.S. Fish and Wildlife Service)

N.29 Wildlife Electrocution and Collision Hazards as a Result of the Transmission Lines for the Fourmile Hill Geothermal Project, Telephone Flat Geothermal Project, and the Malin-Warner Transmission Lines

Construction and operation of the proposed project has the potential to adversely kill or injure threatened and endangered species, special-status bird species, and birds in general as a result electrocution and collision with the transmission lines.

The DEIS/EIR included mitigation measures to reduce the level of significance to less than significant, however the "taking" of threatened and endangered species, special-status bird species, and bird species in general would still occur. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

AG.93 The EIS/EIR also acknowledges that ospreys and bald eagles are likely victims of collisions with the transmission line segments. (EIS/EIR, p. 4-125.) The letter from Thomas Reid Associates indicates that the selection of transmission line segment B1 would reduce this impact. (Ex. B, § 4.8.) This alternative, however, is not included as a mitigation measure. This alternative should be discussed.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.283 Transmission Line Collisions Will Significantly Affect Birds. The most significant effects on wildlife may be those of introducing an industrial use into a relatively undisturbed wildlife area, not the mere removal of habitat. For example, the transmission line will likely result in a significant effect from bird collision with wires. Mitigation Measure 4.8.4a, p. 4-126, regarding balls and markers, has been shown to

be of limited effectiveness in reducing impact because the balls and markers are not visible during nighttime hours or under cloudy and inclement weather conditions when many birds could be flying across the area (James and Haak, 1979). The imposition of 24 miles of high voltage transmission line across any part of this area creates an unavoidable increase in avian mortality (including deaths of listed and sensitive species) and would be a significant, unmitigable impact.

Page 4-125 of the EIS/EIR states: "The highest potential for bird collisions exists along the portion of segment A1 located near Medicine Lake. The species most likely to be affected would be bald eagles and ospreys, both of which frequently engage in flight activity in the vicinity of this transmission line segment." Alternative transmission line segment B1 reduces impacts on birds (from collisions), but the use of this alternative is not included as a mitigation measure. This measure should be discussed.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

BQ.15 On page 4-125, bird collision/electrocution has been identified as a possible problem. The species most likely to be affected are Bald Eagles and Osprey. Bald Eagles and Osprey are special-status species and would be exposed to collision/electrocution if segment A1 is developed along Medicine Lake. We do not agree that this is a less than significant finding because the effectiveness of the mitigation measures (4.8.4a) has not been demonstrated. In addition, there is no reference in the draft EIS/EIR to any further mitigation measures if 4.8.4a is ineffective. The draft EIS/EIR did not determine at what level the mitigation measure would be considered ineffective, what is the trigger point in the number of dead or injured Bald Eagles or Osprey that would require improved mitigation measures? The draft EIS/EIR does not require any monitoring of the populations of Bald Eagles or Osprey in the Medicine Lake area. Without monitoring the changes in numbers of these birds it is impossible to determine the effect of this project on the species. We would like a written response to these concerns.

(S. Peder and Suzanna S. Cuneo, et al.)

HF.14 I note, for example, that this is the category used to describe the effects to general wildlife and special status species. How do you arrive at this conclusion? For at least the past 20 years we have enjoyed a nesting pair of bald eagles each summer at Medicine Lake, and in the past decade there have also been ospreys on the lake. I am very well aware of what happens to these large, threatened birds of prey when they tangle with transmission lines, as is very likely to happen, particularly if these lines are run near the lake where these birds regularly roost. How many dead and electrocuted eagles and osprey would it take to move this effect from "adverse" to "significant"? Clearly given the population levels of these and other birds at Medicine Lake, the loss of even one bird would be significant, yet this is not acknowledged in the report.

(Daniel T. Spencer)

Response—Effects of Transmission Lines on Birds

In response to comment B.11, 1.4-inch diameter conductors and 3/8-inch groundwires (called "shield wires" in the EIS/EIR) would be used for the proposed transmission line. A number of studies have identified overhead groundwires, not conductors, as the primary cause of bird collisions with power lines (Scott et al. 1972; Willard et al 1977; Brown et al. 1987; Faanes 1987). Overhead groundwires, which deflect lightning from striking the conductor, are typically narrower than conductors and placed above them. Because of their placement and narrower diameter, they are more difficult for birds to see and avoid.

The standard reference in this field, written by the Avian Power Line Interaction Committee (APLIC), states that overhead groundwires are the wires most often struck by birds (APLIC 1994). To minimize the hazard to birds, the APLIC recommends keeping the vertical distribution of transmission wires (i.e., conductors and groundwires) to a minimum, which reduces the potential collision zone.

As discussed in the Draft EIS/EIR, Calpine would primarily use wood, H-frame support structures for the transmission line. As shown in Figure 2.2-9, transmission conductors would be placed side-by-side in a horizontal plane. This design meets the recommendation of the APLIC because the vertical spacing of the conductors is minimized. This design would minimize the chance of bird collisions with the conductors.

Unlike conductors, groundwires cannot be placed in the same horizontal plane as the conductors because of the groundwire's purpose: to deflect lightning from striking the conductors. In order for a groundwire to be effective, there must be 16 to 18 feet separating the groundwire from the conductors.

In response to comments N.29, AG.93, and AG.283, the chance of birds colliding with transmission power lines (and possibly being killed as a result) depends on many factors, including:

- The species of bird
- Bird flying patterns in the area (both local and migratory)
- The surrounding vegetation and terrain
- The design of the transmission line

Studies conducted throughout the world indicate that power lines may or may not cause increases in bird mortality (see references in APLIC 1994). Furthermore, if mortality does occur, the increase in mortality may or may not be considered significant, depending on the factors listed above. For example, if a local bird population is large and/or growing, increases in mortality from power lines may not affect the ability of that population to sustain itself. In this example, impacts from transmission line collisions might not be considered significant. Before making a determination of significance, all of the factors listed above must be taken into account.

The comments suggest that impacts to birds, particularly to osprey and bald eagle, would be adverse and significant. However, the comments provide no support for making a determination of significance. The analysis in the EIS/EIR states that effects to birds from collisions with the proposed transmission line would be very infrequent and not significant. Furthermore, there would not be any take of bald eagles, a Federally listed species, because the chance of collision would be extremely low. Further justification (beyond what was already presented in the Draft EIS/EIR) for these determinations is provided below.

The transmission line within the Klamath National Forest and the western section of the Modoc National Forest would not significantly increase bird mortality because the tallest lines (the shield wires) would not substantially exceed the height of the tree canopy. The proposed transmission line would pass through forest habitats within the Klamath National Forest and the western section of the Modoc National Forest. Within this area, the forest canopy is tall enough in most locations to overtop the proposed transmission line. As described on page 2-41 of the Draft EIS/EIR, the transmission poles would also vary in height: H-frame and three-pole structures would be 60 to 80 feet tall; single steel poles would be 65 to 95 feet tall.

Mitigation Measure 4.8.4a on page 4-126 of the Draft EIS/EIR states that overhead groundwires would be placed at or below the tree canopy level wherever possible. In places where the canopy is lower than about 50 feet (for example, in stands dominated by lodgepole pine), groundwires in the center of each span (where bird collisions are most likely) would exceed the canopy height. (This assumes that the groundwires would sag about 10 feet in the middle of each span.) As stated in Mitigation Measure 4.8.4a (as revised below), markers of some kind would be placed along the wire in

certain areas. These areas are those in which bird collisions are most likely along the entire transmission line corridor. These markers would make the wires more visible to passing birds and would reduce the chance of bird collisions.

Comment AG.283 notes that balls and other markers have limited effectiveness in reducing bird collisions. This comment is supported by a single reference (James and Haak 1979). However, there is substantial evidence that marking devices, particularly bird flight diverters, can be very effective in reducing collisions by birds of some species (references cited in APLIC 1994 include: Koops 1987; Morkill and Anderson 1991; Ledger et al. 1993; Lawson and Wyndam 1993; Brown and Brewien 1995). In all of these studies, the presence of a marking device reduced the number of bird collisions substantially (by 40 to 89%, depending on the method used and the conditions of the tests).

The comment further suggests that marking devices would not be effective because they are less visible at night or during inclement weather. It is true that marking devices would be less visible at night and during inclement weather. During these times, marking devices would probably be less effective at reducing the chance of bird collisions. However, there are also fewer birds in flight during the night or during inclement weather. For example, bald eagles and osprey are not active at night. Moreover, in winter, when inclement weather is most common, they are restricted to winter roost sites, none of which are near the proposed or alternative transmission lines. Thus, the actual number of bird collisions at night or during inclement weather would likely be much less than that seen during the day.

Species most commonly killed by collisions with transmission wires are large birds such as cranes, pelicans, and vultures that have low maneuverability in flight (Willard et al. 1977; Brown et al. 1987; APLIC 1994). In some cases, waterfowl can be killed by transmission lines because of their fast flight at low altitudes. Birds that are very agile in flight are only rarely reported killed by collisions with transmission wires (APLIC 1994). Agile birds include large hawks, owls, and eagles (including bald eagle and osprey).

The only special-status birds that would be considered particularly at risk to transmission line collisions (i.e., large birds with low maneuverability or birds that fly low in large flocks) and that are known to occur in the project area are the greater sandhill crane (*Grus canadensis tabida*) and the American white pelican (*Pelecanus erythrorhynchos*).

The greater sandhill crane is listed by the state as a threatened species and a USFS Region 5 sensitive species. Approximately 300 pairs are known to breed in northeastern California (Thelander and Crabtree 1994); some of these individuals may occur in the project area, particularly near State Highway 139. Greater sandhill cranes would most likely be moving through this area along two routes: (1) from potential breeding sites near the Oregon border (e.g., Lower Klamath Lake and Tule Lake) and sites to the south of the project site, during the breeding season, and (2) between potential breeding sites to the northeast of the project site (e.g., Clear Lake) and their wintering grounds in California's Central Valley (Zeiner et al. 1990). No potential breeding habitat for the

greater sandhill crane is found within the project area. Thus, no impacts to greater sandhill cranes are expected to occur as a result of this project.

As a result of their long-distance movement, the greater sandhill crane may cross the proposed and alternative transmission line segments C1 or C2. Greater sandhill cranes that winter in the central valley of California have been killed by collisions with powerlines (Thelander and Crabtree 1994). Those collisions were likely due to dense fog combined with low flight, neither of which would occur near the project area. First, dense fog is not common along State Highway 139. Second, sandhill cranes that might occur along State Highway 139 would be flying relatively long distances (e.g., 30 to 100+ miles). Cranes that fly long distances, particularly in migration, fly at altitudes well above that of the proposed transmission line. In the unlikely event that sandhill cranes flew near the transmission lines, marking devices (Mitigation Measure 4.8.4a) would alert the birds to the presence of the wires.

The American white pelican is listed by the state as a species of special concern. American white pelicans nest in the summer north of the project site in the Clear Lake and Tule Lake National Wildlife Refuges (Zeiner et al. 1990). American white pelicans may travel through the project area to forage for fish during the breeding season (pelicans have been known to travel up to 184 miles to forage while breeding). Pelicans may also travel through the project area from their breeding grounds to their wintering grounds along the central California coast and in California's Central Valley (Zeiner et al. 1990). However, like the sandhill crane, white pelicans tend to fly at relatively high altitudes, well above the level of the proposed transmission line. In the unlikely event that American white pelicans flew near the transmission lines, marking devices (see Mitigation Measure 4.8.4a) would alert the birds to the presence of the wires. Thus, no impacts to American white pelicans are expected to occur as a result of this project.

In summary, no significant impacts to listed birds are expected to occur as a result of the proposed or alternative transmission lines. In addition, there would be no significant effect to migratory birds under the Migratory Bird Treaty Act.

Mitigation Measure 4.8.4a has been revised to clarify its intent:

"**Mitigation Measures**

~~The potential for b~~Bird ~~electrocution and~~ collisions ~~hazards~~ could be considered significant~~,~~ if special status species are involved. Therefore, the following mitigation measure is included to reduce this potential impact to a less-than-significant level:

4.8.4a Overhead ground wires and conductors should be placed at or below the surrounding forest canopy wherever possible. ~~If ground wires and conductors cannot be placed at or below the surrounding forest canopy a marking system should be installed on the overhead ground wires, as directed by the USFS~~. As directed by the USFS, marking devices will be installed along segment C1 or C2 (where greater sandhill cranes may be active). ~~Possible M~~marking devices could include aerial marker spheres, spiral vibration dampers, or bird flight~~-~~diverters ~~to reduce collision hazards~~. (C) "

See also responses below to "Comments—Bald Eagle" and "Comment—Osprey" regarding the potential for project impacts that are specific to these species.

Comment AG.283 further suggests that the selection of an alternative that includes segment B1 would reduce the chance of bird collisions. This recommendation is noted. However, the selection of a particular alternative cannot be included as mitigation for another alternative. The purpose of the alternatives is to provide scenarios that can be evaluated independently. While impacts to birds may be reduced by the selection of segment B1, other environmental effects may be increased by the selection of segment B1. Thus, each alternative must stand alone to allow for decision-makers to clearly evaluate the differences.

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Comments—Effects of Hunting and Habitat Fragmentation on Wildlife

T.20 The DEIS/EIR's treatment of transmission line impacts on forest ecosystems and wildlife habitats is also fatally flawed in that it has no spatial consideration of effects. It is not enough to report the number of acres of each forest type that will be removed; the fragmentation and edge effects on the surrounding forest ecosystems must also be analyzed and disclosed. How and where habitat blocks will be set aside to provide compensation for the number of disturbed American marten territories, goshawk territories, etc., must be determined in a Forest Plan/NEPA process. The EIS/EIR process hasn't addressed these issues yet. *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

AG.295 In addition to loss of habitat, the EIS/EIR should also discuss other impacts associated with the transmission line corridors. The corridor may provide a migration corridor for some animals, but the existence of the corridor also creates more forest "edge" and fragments the habitat. The creation of this opening could increase predation on some species (e.g. raptor predation on small mammals). Also, hunting is allowed in these national forest areas. If hunting is allowed within the transmission line corridor, it could increase hunting pressure on game species or encourage illegal hunting. These effects should be discussed and mitigation measures should be proposed.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effects of Hunting and Habitat Fragmentation on Wildlife

The comment suggests that the creation of the transmission line corridor will fragment forest habitat and create more forest "edge", which may cause increased predation. Habitat fragmentation has two important components: (1) reduction in total habitat area, and (2) creation of smaller and/or more disjunct habitat patches (Wilcove et al. 1986). The Draft EIS/EIR analyzed the potential effects of the project on the reduction in total habitat area (see Table 4.8-2). An analysis of the effects of the project on the spatial arrangement of habitat is presented below.

In the Medicine Lake Highlands and in the transitional area between the Medicine Lake Highlands and the Modoc Plateau, construction of the transmission line corridor would remove or disturb Forested habitat in a band 50 to 125-feet wide (see detailed discussion of the transmission line corridor design on pages 2-42 through 2-46 of the Draft EIS/EIR). This corridor would pass through and near forest that is largely continuous. Exceptions to this include existing roads and utility corridors, large areas of bare, volcanic rock (e.g., Medicine Lake Lava Flow, Glass Mountain), and areas that have been clearcut for timber. Areas that have been clearcut for timber are in various stages of regrowth; only those areas that have been clearcut recently would still be relatively open (and be considered "non-forest" habitat).

Because the proposed transmission line would pass through an area of mostly continuous and intact forest, the forest habitat would not be "fragmented" in the usual fashion. As it is typically defined, fragmentation results when animals and plants become confined to "islands" of habitat in a "sea" of open, or otherwise unsuitable, habitat (Wilcove et. al. 1986; Meffe and Carroll 1997). This pattern is created by human activities such as agricultural development or urbanization. The pattern of disturbance created by linear features such as roads and utility corridors is much different than that created by agriculture or urbanization.

Adverse effects on forest species have been documented as a result of habitat fragmentation. Included among these effects are a suite of adverse effects called "edge effects." Forest "edge" is a sharp transition between a patch of forest habitat and a patch of unForested or open habitat. The sharp transition between these habitats often results in edge effects. Edge effects are adverse effects on populations of forest-interior species (i.e. species that require continuous patches of forest) due to changes resulting from the

sharp boundary with the non-forest habitat. These changes include increases in temperature, wind (and subsequent blow-downs), predation, or nest parasitism (Wilcove 1985; Saunder et al. 1991; Meffe and Carroll 1997). Edge effects of large magnitude generally occur along the perimeter of a forest habitat that is adjacent to large, continuous areas of non-forest habitat. Edge effects may or may not be associated with habitat fragmentation.

Some researchers have speculated that edge effects may also occur as a result of linear openings in otherwise continuous forest (e.g., Askins 1994). Some evidence supports this hypothesis. For example, Rich et al. (1994) examined the abundance of forest birds and the abundance of avian predators (e.g., jays and crows) and a nest parasite (the brown-headed cowbird) in forest interiors and along forest edges that were adjacent to one of three linear disturbances: (1) unpaved roads, (2) paved roads, or (3) utility corridors. As a control, they also examined the abundance of birds within undisturbed forest. Rich et al. (1994) found that forest interior birds were equally abundant in the forest interior and adjacent to any of the three linear disturbances. This result suggests that forest interior birds do not perceive such narrow corridors (the widest corridors, utility corridors, had an average width of 23 meters). However, they also found that the abundance of cowbirds increase in forest edges that were adjacent to paved roads. In addition, the abundance of nest predators in forest edges increased adjacent to powerlines. In summary, these results suggest that, while bird abundance may not change next to linear corridors, bird mortality may increase or bird reproduction may decrease as a result of increased avian predation and nest parasitism, respectively.

The results of the Rich et al. (1994) study suggest that birds that occupy the forest edge along the proposed transmission corridor or along the proposed access roads would experience higher mortality and lower reproduction than the same birds away from the corridor. Although adverse, such an effect would not be significant because none of the species that might be affected are state or Federally listed. Avian predators such as jays and crows and nest parasites such as the brown-headed cowbird prey upon small songbirds. No forest songbirds that occur in the project area have special-status (see Table 3.8-1 on page 3-102 of the Draft EIS/EIR). Thus, no significant effects are expected to occur to birds from edge effects of the transmission line corridor or from the access roads. See also response to "Comment—Northern Spotted Owl" regarding the potential for habitat fragmentation effects on the northern spotted owl.

Indeed, some species may benefit from the creation of the transmission line corridor, as suggested in some of the comments. Species that prefer forest edges such as mule deer and elk may be attracted to the transmission line corridor. Some small mammals such as rodents and rabbits also prefer this type of habitat. Increases in their numbers could benefit special-status species such as American martin, several owls, and other raptors.

Comment AG.295 also presents concern that construction of the transmission line would increase hunting in the area which would adversely affect wildlife. Hunting is regulated by the CDFG throughout California, including on USFS land. CDFG regulations restrict hunting to specific times of the year for particular species and limit hunting to designated areas. The restrictions on hunting in the project area would not change as a result of the proposed project. However, as described in the response to "Comment—Effects to Hunters" in the Land Use and Recreation Section, shooting

would be prohibited in the power plant and wellfield area. This restriction would limit hunting to forms that do not use firearms.

Due to the vegetation that would be established in the transmission line corridor, hunting may actually decline along the transmission line corridor. As described in Section 3.7 of the Draft EIS/EIR, vegetation in the majority of the transmission line corridor would be maintained in a relatively dense stand of native shrubs. Once this vegetation reaches maturity (i.e., after establishment), it would provide good cover for the two game species in the region, mule deer and bear. The increase in understory cover and height would also reduce the visibility of hunters. The combination of high and dense cover for game species and low visibility would probably reduce the attractiveness of this habitat to hunters, not increase it.

See also responses to "Comment—Recreational Use in the Immediate Wellfield Vicinity" and "Comment—Recreational Use in the Vicinity of the Transmission Line" in the Land Use and Recreation Section for more discussion of the effects of the project on recreational uses.

References:

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IMPACTS TO SPECIFIC SPECIAL-STATUS WILDLIFE

Comments—Bald Eagle

O.14 The bald eagle is a federal threatened species and a California endangered species. Modoc National Forest seeks to "develop a bald eagle nest territory management plan" (LRMP, 4-212). According to the EIS, Bald Eagle nesting sites have been reported along the area proposed to house the transmission line and in segment C1 of the preferred alternative, where three roosting sites have been located (EIS, 3-101). Despite this, the EIS states that foraging and nesting habitat would not be lost during the construction of the geothermal plant, but that there would be some impacts on the birds. The Land and Resource Management Plan (LRMP) states that the Forest Service will assist in the recovery of the species by both surveying and managing potential sites in addition to those currently occupied (4-26). Thus, the management of this bird should follow the LRMP to manage for bald eagle nesting and foraging sites. In addition, management should continue to follow the Bald and Golden Eagle Protection Act and the Endangered Species Act. It is urgent that the Fourmile Hill Geothermal Project be implemented in a way to protect Bald Eagle nest territories. *(Katherine Kowatch, Friends of the River)*

X.7 Issues of particular concern to the MSAAS include 5. The close passage of the line to three Bald eagle winter roosting sites as well as Osprey habitat and nest sites.
(Michael Hauptman, Mount Shasta Area Audubon Society Board of Directors)

AG.78 The EIS/EIR states that the bald eagle (*Haliaeetus leucocephalus*) has been observed in the Project's vicinity in both summer and winter. (EIS/EIR, p. 3-101.) The bald eagle is listed as a federally threatened and California endangered species. (*Ibid.*) Bald eagle activity occurs on the south side of Medicine Lake, about 3.5 miles southeast of the wellfield and power plant. Bald eagles have been observed at Modoc Lake, about 1.3 miles to the east. (*Ibid.*) Additionally, bald eagles have been observed along transmission line segment A1 and three winter roosting sites are located in the vicinity. (*Ibid.*) The EIS/EIR acknowledges that bald eagles are among the species most likely to be affected by collisions with transmission lines. (*Id.* at p. 4-125.)

Nonetheless, the EIS/EIR finds that the Project will not significantly affect the bald eagle because no foraging or nesting habitat would be lost. (*Id.* at p. 4-114.) Additionally, the EIS/EIR presumes that noise, human disturbance, and construction impacts would not adversely or significantly affect the bald eagle. (*Ibid.*) The EIS/EIR, however, offers no basis for its conclusions. There is no discussion of the Project's effects on the winter roosting sites. Indeed, the EIS/EIR's conclusions are inconsistent with the EIS/EIR's own information regarding the bald eagle's use of the Project area.

The EIS/EIR does not discuss the Project's consistency with the U.S. Fish & Wildlife Service's Pacific Bald Eagle Recovery Plan (1986), portions of which are attached as Exhibit H. (CEQA Guidelines, App. G(a) (consistency); (43 USC § 1712(c)(9) (requiring coordination with federal, state, and local land use planning and management programs).) The Klamath National Forest LRMP Standard 8-7 requires bald eagle management according to the Recovery Plan. The Recovery Plan specifies goals such as maintaining and improving forested habitat in both the breeding and wintering range. (Recovery Plan, § 1.32) This may be accomplished through prohibiting logging of known nest trees, perch trees, and winter roost trees, and through preserving snags. (*Id.* at §§ 1.3211, 1.3215.) Further, the Recovery Plan restricts power line construction within 1 mile of communal roosts and requires corrective measures where repeated collisions (more than 1) are documented. (*Id.* at § 4.132.) The EIS/EIR should evaluate whether the Project is consistent with these measures and others identified in the Recovery Plan.

Absent this information, there is no basis for concluding that the Project will not have a significant impact on the bald eagle. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

PH2.1 I've spent enough time over the years to know that the Route A1 will disturb eagles. I'm more interested in eagles than I am goshawks and the rest of these. Less than fifteen years ago there wasn't a forest service employee that knew there were any eagles at Medicine Lake. We had—we had officials from the Tulelake station come up there and sit in my camper drinking coffee, and he finally spotted an eagle. But ninety-nine percent of the people that have been with the forest service had never seen an eagle, and these eagles have been flying around up there at the lake for well over fifty years.

(Klamath Falls Public Hearing)

Response—Bald Eagle

No bald eagle foraging habitat, nest territory, or winter roost sites would be impacted by the proposed project. Bald eagles forage primarily in bodies of water to catch fish and water birds. Within the project area, bald eagles are known to forage in and near Medicine Lake, particularly on the south side of the lake. Two juvenile bald eagles were sighted in September of 1995 at Modoc Lake, east of Mt. Hoffman (Galea Wildlife Consulting 1995). This lake may be used as occasional foraging habitat for bald eagles (other surveys of this lake did not find bald eagles). Bald eagles nest in the summer in tall, mature trees that are close to their foraging habitat (usually less than one mile away). This habitat is present in the project vicinity only on the south side of Medicine Lake. Thus, in the project vicinity, nesting habitat for the bald eagle is restricted to the south side of Medicine Lake.

Bald eagles also require sites for communal roosting in the winter. Unlike nesting sites, winter roost sites may not be found close to foraging sites. In the project vicinity, there are two large winter roosting areas. One roosting area occurs near Caldwell Butte and Cougar Butte in the Medicine Lake Highlands. The southern extent of this area is approximately two miles north of segment B1 of the proposed transmission line. The second large bald eagle roosting area is found near Bonita Butte (approximately five miles west of Lava Beds National Monument) and extends to the Three Sisters (west of Forest Road 15). This site is approximately six miles northwest of segment A3 of the

proposed transmission line. Several smaller roosting sites occur in the project vicinity, none of which would be affected by the proposed project. These include:

- On Timber Mountain (approximately two miles south of transmission line segment C1 (Biosystems Analysis, Inc. 1996)
- Along State Highway 139, south of Newell and north of Timber Mountain. Trees or power poles along Highway 139 are used temporarily (one to several nights at a time) by individual bald eagles that feed on deer carcasses along Highway 139. These individuals probably originate from Caldwell Butte or Timber Mountain (Brad Reed, Modoc National Forest, personal communication, 1998).
- Approximately five miles north of segment A3 in the Klamath National Forest (called the "Lava Roost" area).

Bald eagles fly over the project site (at various locations), but they do not utilize any portion of the project site for nesting, foraging, or winter roosting. Bald eagles have been known to use the south shore of Medicine Lake to nest (Galea Wildlife Consulting 1995). Segment A1 of the proposed transmission line crosses the north shore of Medicine Lake. However, this area is not suitable bald eagle nesting habitat. The north shore of Medicine Lake contains Forest primarily of lodgepole pine. This species is too short and does not have large enough branches to support bald eagle nests.

Comment AG.78 also questions whether the Draft EIS/EIR is consistent with the *Bald Eagle Recovery Plan.* The Draft EIS/EIR is consistent with the *Bald Eagle Recovery Plan* primarily because no nesting territory, foraging habitat, or winter roosting sites would be affected by the project. Furthermore, most of the provisions of the plan that are cited in the comment do not apply to development projects (including the Fourmile Hill project). The sections of the *Bald Eagle Recovery Plan* that are referenced in Exhibit H of the comment contain guidelines to:

- Maintain and improve quantity, quality, and availability of [bald eagle] food supplies (Section 1.31)
- Maintain and improve forested habitat in both the [bald eagle] breeding and wintering range (Section 1.32)
- Restrict human disturbance at [bald] eagle use areas (Section 1.33)
- Reduce bald eagle mortality associated with shooting and trapping (Section 4.11)
- Reduce exposure of bald eagles to contaminants (Section 4.12)
- Reduce [bald eagle] impact and electrocution mortality associated with power lines (Section 4.13)
- Rehabilitate sick, injured, and orphan bald eagles for release into the wild (Section 4.14)
- Enhance productivity of [bald eagle] pairs nesting in the wild (Section 4.21)
- Establish new breeding populations [of bald eagles] in suitable habitat by translocation (Section 4.22)
- Develop captive breeding programs to supplement natural populations [of bald eagles] when needed (Section 4.23)

The Draft EIS/EIR is consistent with Sections 1.31 and 1.32 of the *Bald Eagle Recovery Plan* because bald eagle habitat would be maintained in the project area. Sections 1.33 and 4.11 do not apply to this project because the project would not impact bald eagle

use areas (i.e., foraging, nesting, or winter roosting sites) and the project would not change the recreational use of hunters that might hunt in bald eagle use areas (see response to "Comment—Effects of Hunting and Habitat Fragmentation on Wildlife" for further discussion of the effects on hunting).

The Draft EIS/EIR is consistent with Section 4.12 of the *Bald Eagle Recovery Plan* because of the proposed mitigation measure to eliminate bird exposure to potential contaminants in wellfield sumps (see response to "Comment—Wildlife Exposure to Sump Contents" for more details). Because of the design of the transmission line, birds can not be electrocuted (see page 4-125 of the Draft EIS/EIR); the Draft EIS/EIR is therefore consistent with Section 4.13 of the *Bald Eagle Recovery Plan*. The remaining sections of the *Bald Eagle Recovery Plan* do not apply to development projects: Sections 4.14, 4.21, 4.22, and 4.23 provide management direction to state and Federal resource management agencies such as the USFWS and the CDFG.

The potential impact of the transmission line on bald eagles is considered less-than-significant. However, the last paragraph on page 4-125 of the Draft EIS/EIR has been changed to clarify the discussion of the potential impacts to the bald eagle:

> "**Operation:** Bird collisions with transmission line wires would be a potential hazard, especially under conditions of low visibility or high levels of bird flight activity. While collisions with the large diameter conductors are relatively unlikely because of their visibility, the small diameter (3/8 inch) overhead ground wires are less visible and birds may strike them while avoiding conductors. Birds that collide with wires may be crippled or killed; this would be considered a significant adverse impact if it involved listed or other special-status species. The highest potential for bird collisions exists along the portion of segment A1 located near Medicine Lake. The special-status species most active in this area are~~likely to be affected would be~~ bald eagles and ospreys. However, raptors such as the bald eagle and osprey are unlikely to be affected by transmission lines because of their high maneuverability in flight (Avian Power Line Interaction Committee 1994)~~, both of which frequently engage in flight activity in the vicinity of this transmission line segment.~~"

See also response to "Comment—Effects of Transmission Lines on Birds" for a discussion of the potential for the transmission line to cause impacts to birds in general. See response to "Comment—Osprey" for a discussion of potential impacts to osprey.

References:

BioSystems Analysis, Inc. and JRP Historical Consulting Services. 1996. *Biological and Cultural Resource Assessments for the Calpine Transmission Line Project, Volume 1—Report*. February.

Galea Wildlife Consulting. 1995. *Biological Survey Report, Fourmile Hill Assessment Area*. October .

Comments—Mule Deer and Animal Migration Routes

AG.82 A project may have a significant impact on the environment if it will substantially interfere with the movement of any resident or migratory fish or wildlife species. (CEQA Guidelines, App. G(d).) The EIS/EIR, however, does not provide sufficient information about migratory species to adequately assess the Project's impacts on these species. The EIS/EIR does not even identify whether the wellfield and power plant areas or transmission lines segments are on any migration routes. (Ex. B, § 4.8.) Thomas Reid Associates addresses the Project's interference with migration routes in more detail. (Ex. B, § 4.8.) Without this basic information about migration routes, the EIS/EIR cannot determine whether the Project will affect animal migration.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.83 More specifically, the EIS/EIR does not provide a sufficient analysis of the Project's effects on mule deer migration. A map in the USDA Forest Service's Environmental Assessment for Geothermal Leasing (1981) shows a major mule deer migration corridor that appears to run through the power plant and well pad area. The EIS/EIR, however, concludes that the Project facilities and roads will not interfere with animal migration routes. (EIS/EIR, p. 4-122.)

The EIS/EIR's conclusion is unsupported by any factual data. Accordingly, the EIS/EIR should describe the effect that 18 to 36 months of construction will have on the migrating deer herd since the herd will be expected to avoid the construction are during this time, or perhaps permanently. (Ex. B, § 4.8.) Without this information, there is no basis to determine that Project will not have a significant impact on the environment.

Further, the EIS/EIR's proposed mitigation that would reduce the Project's impacts on mule deer is inadequate. Mitigation measure 4.8.3m prohibits construction or decommissioning activities on mule deer winter range between December 1 and March 1. (EIS/EIR, p. 4-125.) However, the critical period for mule deer winter range is from November 1 though May 1. (USDA Forest Service Environmental Assessment for Geothermal Leasing (1981); Ex. B, § 4.8.) This mitigation measure should be revised to encompass the critical period for mule deer winter range. (Ex. B, § 4.8.) Without adequate mitigation, there is no basis for the lead agency to conclude that the Project's impacts on migratory species and mule deer have been mitigated to insignificance.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.285 The EIS/EIR states that "wildlife would be expected to temporarily avoid sites at which construction and well drilling are in active progress, maintaining distances of 200 to 400 feet from these sources of noise and disturbance." (p. 4-112.) However, the EIS/EIR also states (p. 4-122) that "the existence of project facilities would not interfere with migration routes for special status wildlife species...Adequate space would exist under the transmission line for the free movement of wildlife species...Production pipelines would be elevated approximately 3 to 6 feet above ground on stansions, and wildlife would be able to move freely underneath." These two statements appear contradictory. If wildlife are avoiding the project area during construction due to noise, physical activity and disturbance, why would wildlife be expected to move freely through the area during operations, when they would still be subjected to noise, and activities of personnel? The EIS/EIR needs to resolve this contradiction.

In addition, the EIS/EIR does not address the real issue of whether the area occupied by the project site is actually on any important migration routes for wildlife species. The power plant and well field area contain over a mile of production and injection pipelines in the east-west direction and two sets of pipelines, about one-half to one mile in length, in the north-south direction. The EIS/EIR must determine whether the project site is on any migration routes before an assessment of impacts to animal migration can be made. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.286 The EIS/EIR discusses the issue of interference with animal migration routes on p. 4-122. The EIS/EIR states that the roads used for project operation would not pose barriers to movement of species such as mule deer and pronghorn. The EIS/EIR, however, does not discuss the impact of construction of project facilities on mule deer migration. The Deer Habitat Map from the USDA Forest Service *Environmental Assessment for Geothermal Leasing* (1981) shows a major deer migration corridor which appears to go right through the proposed power plant and well pad area. The EIS/EIR should describe the effect that 18 to 36 months of construction will have on the migrating deer herd since the herd will be expected to avoid the construction area during this time, or perhaps permanently.

The EIS/EIR includes mitigation 4.8.3m (p. 4-125), which prohibits construction or decommissioning activities between December 1 and March 31, for impacts to the mule deer winter range. Based on the information in the USDA Forest Service *Environmental Assessment for Geothermal Leasing* (1981), the critical period of use is from November 1 through May 1, so the period of prohibition should be extended to encompass this larger period.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

PH3.15 So these pipes are going to be anywhere from six inches to six feet above the ground and you don't think that that's going to have an impact on the wildlife in the area, the migration patterns of deer, cougars, black bear? *(Yreka Public Hearing)*

PH4.16 Concerned about disturbance of migratory routes. *(Mount Shasta Public Hearing)*

PH4.17 The EIS/EIR should address the elk herd. *(Mount Shasta Public Hearing)*

Response—Mule Deer and Animal Migration Routes

These comments suggest the need to clarify project impacts to animal migration. The mule deer is the only species of wildlife that engages in regular and seasonal movements through the region in which the wellfield and power plant would be located. Other species such as birds may migrate through the region incidentally.

However, the project is not expected to pose a barrier to bird migration. Thus, there would be no significant effect of the project on migrating birds.

Mule deer travel through the region on a broad front, rather than in a narrow path. During the three-year period of well drilling and power plant construction, human activity (that could affect mule deer) would be concentrated at two or three sites within the wellfield at any one time. These sites would range from about 300 to 800 feet in maximum width. Assuming that deer maintained a distance of 200 to 400 feet from these sites to avoid noise and human activity, they would still have ample opportunity to pass through the project area without encountering any barriers. As an alternative, they could readily shift their movements a few thousand feet to the east or west and avoid the wellfield/power plant area completely.

Appendix G of the CEQA Guidelines states that a project may have a significant effect on the environment if it would "interfere substantially with the movement of any resident or migratory fish or wildlife species." As described above, the project would not interfere substantially with the migration of mule deer. The effect on mule deer would therefore not be significant.

During the operational phase of the project, human activity would be confined to the power plant, with occasional maintenance visits by personnel to well pads and drilling of infill wells (at two year intervals). Extensive research conducted at The Geysers geothermal field showed that deer and other wildlife readily move through geothermal development areas. At The Geysers, wildlife were found crossing roads and moving under elevated pipelines (Miller et al. 1986). This research demonstrated no adverse effects on the distribution and abundance of a wide diversity of wildlife species. These studies concluded that deer co-existed with geothermal development and were regularly seen feeding immediately adjacent to power plants, well pads, and pipelines.

Thus, the best available data and experience indicate that while wildlife may avoid the immediate vicinity of construction and well drilling activities, there would be no "substantial" impact to wildlife movements, and thus no significant impact under CEQA. During the operational phase of the project, wildlife would be able to move through the project area and utilize undisturbed habitat there.

As noted in Mitigation Measure 4.8.3m, the seasonal timing of construction and decommissioning activities may be adjusted by the USFS. If it is required, this adjustment could be based on the timing of mule deer activity within the project area. Comment AG.83 cites data from 1981 to support the assertion that the conclusions in the Draft EIS/EIR regarding mule deer migration are unsupported. The conclusions reached in the Draft EIS/EIR are based on the professional judgment and experience of USFS staff who are familiar with current patterns and timing of mule deer migration in the project area. Data from 1981 are no longer relevant to mule deer migration patterns because these patterns have changed since 1981.

Reference:

Miller, M. R., Zitney, G. R., Schlorff, R. W., Leitner, P. and J. F. Hurley. 1986. *The Geysers Wildlife Study: The Distribution and Abundance of Wildlife Populations in Relation to Geothermal Development.* Pacific Gas & Electric Company, Dept. of Engineering Research, San Ramon, CA. November. 243 pp.

Comments—Northern Goshawk

O.13 Northern goshawk live in the Medicine Lake Highlands, where mature forest provide for goshawk and marten habitat (LRMP, 4-211). The goshawk is a federal and state species of concern and a U.S.F.S. Sensitive Species. The Modoc LRMP management strategies are to inventory and protect active Goshawk territories needed to meet population targets (4-212). Yet, the EIS concedes that 154 acres of goshawk foraging and nesting sites will lost as a result of the proposed alternative. As a result, the EIS states that mitigation will be used to reduce the adverse impacts from construction. Goshawk management should continue to follow the LRMP raptor Management Prescription. *(Katherine Kowatch, Friends of the River)*

AG.79 The Northern goshawk (*Accipiter gentilis*) is a federal and state species of concern and a USFS sensitive species. (EIS/EIR, p. 3-105.) The EIS/EIR acknowledges that there have been widespread sightings of the goshawk in the region and that the goshawk is resident in the Medicine Lake Highlands. (*Ibid.*) Nesting and foraging sites have been identified throughout the Project area. (*Id.* at pp. 3-105 to 3-106.)

The Project would destroy about 154 acres of foraging habitat. (*Id.* at p. 4-116.) Additionally, the transmission line would affect approximately 27 acres of potential nesting habitat in red fir forest. (*Ibid.*) Goshawks nesting in the west-central portion of the wellfield and power plant area could be affected by noise and disturbance from construction and well drilling activities although the well pad locations were moved away from existing nest sites to reduce noise effects. (*Id.* at p. 4-117.) Nonetheless, the EIS/EIR states that noise and disturbance effects on the goshawk will not be significant. (*Id.* at p. 4-121.)

The EIS/EIR, however, fails to provide adequate data or analysis supporting its conclusion. Absent more information, there is no basis to determine that the Project will not significantly affect the goshawk.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Northern Goshawk

As discussed on pages 4-116 and 4-117 of the Draft EIS/EIR, the proposed project would not have a significant impact on the northern goshawk. This conclusion is based on the information presented in the Draft EIS/EIR. Impacts from project operation and construction on northern goshawk have the potential to be significant only within the wellfield area. Impacts to northern goshawk may be significant only in this area because a northern goshawk territory was found only near this area. Impacts to northern goshawk after mitigation are considered not significant because:

- No active goshawk nests or territories would be lost (contrary to the statement in comment O.13)
- The site of the proposed wellpads have been moved away from the goshawk territory nearby (see page 4-117 of the Draft EIS/EIR). This action reduces potential noise impacts to goshawk nests within the well field site.
- Mitigation Measure 4.8.3c (as revised below) limits the period of construction and restricts certain activities within 0.5 miles of the northern goshawk territory within the species' nesting period (between March 1 and August 31). This action reduces potential impacts to nesting goshawks around the power plant and well field sites.
- Mitigation Measure 4.8.3d requires preconstruction surveys for northern goshawk territories within the chosen transmission line alignment. If any territories are identified within the alignment, appropriate restrictions on activity near the territory would be implemented.
- Mitigation Measures 4.8.1c, 4.8.1d, 4.8.1e, and 4.8.3a reduce the effects of the proposed project to general wildlife habitat. These mitigation measures (plus those outlined in Section 4.7) reduce the level of impact to northern goshawk foraging habitat.
- Even without mitigation, loss of foraging habitat for the northern goshawk is not considered significant because of the abundance of this habitat in the project vicinity. The removal of foraging and nesting habitat for the northern goshawk would be spread over a large area that probably overlaps with several goshawk territories. Because the impacts would be spread over a large area, no one territory would likely be affected in a substantial way. Thus, individual birds could easily

adjust their territory size to compensate for the small loss in foraging and nesting habitat.

Comment AG.79 states that on page 3-105 to 3-106, the Draft EIS/EIR states the "Nesting and foraging sites [for the northern goshawk] have been identified throughout the project area." It is true that foraging habitat is present throughout the project area (e.g., within the power plant and wellfield area, and within segments A1, A2, and B1 of the proposed transmission line). However, it is not true that northern goshawk nests have been identified throughout the project area.

There is only one known northern goshawk territory in the vicinity of the project, which contains several nests. As stated on pages 3-105 to 3-106 of the Draft EIS/EIR, a northern goshawk territory (called the "Grouse Hill Goshawk Territory") is known from approximately 0.5 miles west of the power plant (despite the name, the Grouse Hill territory is not located on Grouse Hill). One other northern goshawks territory is known within the vicinity of the proposed project: approximately two miles south of segment A1 of the proposed transmission line, near Payne Springs.

Mitigation Measure 4.8.3c has been revised so that it is more consistent with the mitigation for the northern goshawk proposed in the Biological Assessment for the exploration phase of this project (Galea and Oberlag 1996). The mitigation measure has been revised as follows:

"4.8.3c **Northern goshawk:** A limited construction and operating period shall be in effect to protect the goshawk nest site in the west-central portion of the wellfield and power plant area. This limitation will prohibit certain activities (depending on distance from nest site) between March 1 and August 31 of each calendar year. This limitation includes no noise disturbance or habitat modifying activities within 0.25 mile of the nest site during this period (this includes limiting truck traffic on Forest Road 44N54 between March 1 and August 31 by designating an alternate route away from the goshawk nest site). This limitation also includes no habitat~~-~~modifying activities within 0.25 to 0.5 mile of the goshawk nest site during this period, but allows noise disturbance within this distance. Therefore, the following activities would be prohibited during this period within 0.25 and 0.5 mile of the goshawk nest site: (1) Construction of ~~the four well pads within this distance from the nest site (i.e.,~~ well pads P-4, P-5, I-2, and ~~I-3~~), (2) road construction, and (3) well drilling. ~~would therefore be prohibited between March 1 and August 31, but~~ T~~t~~he testing and operation of wells at these pads would not be restricted within 0.25 and 0.5 mile of the goshawk nest site. Beyond 0.5 mile from the g~~G~~oshawk nest site, no restrictions on operation and construction activities will apply. In addition, all Calpine employees and contract personnel working at the site will be notified of the importance of isolating the goshawk nest site from noise and unnecessary human activity. Personnel will be prohibited from conducting field activities within 0.25 mile of the goshawk nest site unless authorized by the USFS. (C, O, D)"

Reference:

Galea, F. and D. Oberlag. 1996. *Fourmile Hill Geothermal Exploration Project, Biological Evaluation/Assessment: Threatened, Endangered, Proposed, and Forest Service Sensitive Species*. March 1996.

Comments—Northern Spotted Owl

B.6 The Draft EIS/EIR does not discuss the effect of the proposed action on the ability of northern spotted owls to disperse in a north/south direction through the project area. In addition there is little discussion of the importance of the Medicine Lake Highlands Managed Late-Successional Area (MLSA) to the reserve network established in the Northwest Forest Plan for this and other late-successional forest species. We recommend that the Draft EIS/EIR be revised to include an analysis of the effects to northern spotted owls of additional fragmentation of suitable habitat.

(Ronald A. Iverson, U.S. Fish and Wildlife Service)

X.8 Issues of particular concern to the MMAS include 6. The passage of the lines through Northern spotted and California spotted owl habitat, roosting and nest sites.

(Michael Hauptman, Mount Shasta Area Audubon Society Board of Directors)

AG.80 The northern spotted owl (*Strix occidentalis caurina*) is listed as a federal threatened species and a California species of concern. (*Id.* at p. 3-106.) A spotted owl activity center is located 3.5 miles west of the wellfield and power plant area. (*Ibid.*) Possible foraging habitat is scattered throughout the wellfield and power plant area, although its fragmented condition may reduce spotted owl use. (*Ibid.*) Suitable nesting and foraging habitat exists within 0.25 miles of the freshwater pipeline route. (*Ibid.*) Such habitat also traverses, or is adjacent to, certain transmission line segments. (*Id.* at pp. 3-107, 4-117.)

The Project would remove 106.4 acres of late seral forest, which is spotted owl habitat. (EIS/EIR, Table 4.7.1, p. 4-85; Ex. B, § 4.8.) The EIS/EIR notes that construction of the transmission line alone could affect up to 77 acres of potential spotted owl habitat. (EIS/EIR, p. 4-117.) Transmission line maintenance activities also could potentially result in the disturbance of northern spotted owl in adjacent habitat. (*Id.* at p. 4-121.)

Nonetheless, the EIS/EIR does not indicate whether the Project will have a significant effect on the northern spotted owl. It fails to identify the consequences of wellfield development on the owl's foraging capabilities. The EIS/EIR should also consider the disproportionate impact that removal of late seral forest will have on the spotted owl. (Ex. B, § 4.8.)

Absent adequate data and a reasoned analysis of the Project's impact on the owl, the EIS/EIR fails as an informational document. Additionally, given the sparse data available, there is no basis to determine that the Project will not significantly affect the owl.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.282 The EIS/EIR finds that habitat impacts may not be significant, but it does not demonstrate why this may be true. Figure 3.7-1 does not show the continuation of the habitat types into the areas adjacent to the project. The EIS/EIR does not discuss the relative value of the habitats. We do not know the regional context of how many acres of contiguous red fir forest there are locally or in the sub-region, or how important this particular patch of relatively undisturbed red fir forest is to wildlife species, or if it is one of the few areas providing "late seral values." Since the late seral forest is the habitat of the northern spotted owl, a federally listed threatened species, the EIS/EIR needs to also consider the disproportionate impact removal of late seral forest (e.g. 21.7 acres of red fir forest and 84.7 acres of upper montane mixed conifer forest (Table 4.7-1, p. 4-85)) will have on the northern spotted owl. Without more information about habitat, we don't know what the Project's true impact would be on wildlife.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

CT.2 It is also important to the northern spotted owl as well as the California spotted owl. *(Sylvia M. Gregory)*

Response—Northern Spotted Owl

The comments state concern about the loss of late-seral Forest and the potential impacts of this loss to northern spotted owls. These impacts include the direct loss of late-seral forest as well as the indirect effects of habitat fragmentation.

A complete analysis of the potential effects to the northern spotted owl from the proposed project will be presented in the Biological Assessment for the project. This Biological Assessment is being prepared in compliance with Section 7 of the Endangered Species Act and will be submitted to the USFWS for their review. A copy of this Assessment will be available for review at the USFS Modoc National Forest Headquarters in Alturas, California.

Any type of habitat modification within the range of the northern spotted owl could affect that species in a variety of ways, depending on the environmental conditions and

the type of impacts that occur. The types of general effects that are possible are summarized and described in detail below:

- Effects on habitat within northern spotted owl territories:
  - Removal of or disturbance to occupied nests
  - Removal of or disturbance to occupied roosts
  - Removal of or disturbance to foraging habitat
- Effects on habitat outside of northern spotted owl territories but within suitable northern spotted owl habitat:
  - Removal of or disturbance to suitable nesting, roosting, or foraging habitat
  - Removal of or disturbance to suitable dispersal habitat

Effects on Northern Spotted Owl Territories. The proposed project would not affect any habitat within known northern spotted owl territories. As described in the Draft EIS/EIR on pages 3-106 and 3-107, multiple surveys over several years have not detected any northern spotted owls within the proposed project area (within either the power plant area, wellfield area, or along the proposed transmission line alignments). The nearest northern spotted owl activity center is approximately 3.5 miles west of the wellfield area. These conclusions are based on:

- Surveys conducted for this project (Galea Wildlife Consulting 1995, 1998)
- Surveys conducted for other projects within or near the project area (Gutierrez and Dames & Moore 1993; BLM et al. 1995; BioSystems Analysis 1996; Galea Wildlife Consulting 1996)
- USFS records of all northern spotted owl sightings in the Klamath and Modoc National Forests and negative results of surveys conducted in the project area (J. Villegas, personal communications, 1997)

To determine if northern spotted owls have moved into or near the project area since the above surveys were conducted, preconstruction surveys would be conducted to map suitable nesting or roosting habitat within 0.25 miles of the proposed freshwater pipeline and transmission line (see Mitigation Measure 4.8.3e, as revised below). If such habitat is found, construction in those areas would be restricted to a time outside of the activity period of the northern spotted owl. This would ensure that no spotted owl nests or roosts would be disturbed by construction activities.

Mitigation Measure 4.8.3e, on page 4-123 of the Draft EIS/EIR, has been revised as follows:

"4.8.3e **Northern Spotted Owl:** Conduct appropriate surveys for northern spotted owl roosting~~foraging~~ or nesting habitat prior to construction of the transmission line and installation of the temporary freshwater pipeline in a corridor extending 0.25 mile from the centerline of transmission line segments in the Medicine Lake Highlands, and along the freshwater pipeline route. If there is suitable northern spotted owl roosting~~foraging~~ or nesting habitat within 0.25 mile of the freshwater pipeline and transmission line right-of-way, then no construction activity shall occur in these areas between February 1 and July 31. During annual spring maintenance, transmission line helicopter maintenance within 0.25 mile of suitable roosting~~foraging~~ or nesting habitat shall not be used. Instead, snowmobiles or sno-cats may be used to access

these portions of the transmission line for annual spring maintenance. (C, O, D)"[1]

Effects on Suitable Northern Spotted Owl Habitat. Although no northern spotted owls are known to nest the project area, suitable nesting and foraging habitat may be present within some areas of the proposed project. The areas in which suitable nesting and foraging habitat may be present are:

- Within the power plant and wellfield area. Because this habitat is already highly fragmented (due to natural conditions and past logging activities), small, and it is not preferred habitat (Galea Wildlife Consulting 1996), it is unlikely that this habitat would be used by northern spotted owls for nesting. However, this habitat may be used by dispersing northern spotted owls for foraging.
- Forested habitat 0.25 miles from the proposed temporary freshwater pipeline route. This habitat fits the definition of suitable nesting and foraging habitat.
- According to maps prepared by the USFS Doublehead Ranger District, portions of segments A1, A2, A3[2], and B1 may contain suitable nesting or foraging habitat for the northern spotted owl.

The removal of potentially suitable northern spotted owl foraging habitat (for dispersing owls) in the power plant and wellfield area would not be considered significant. The removal would not be significant because that habitat is of low quality and there have been no records of its use by northern spotted owls.

Some disturbance may occur to potential foraging habitat for northern spotted owls near the proposed temporary freshwater pipeline. However, disturbance to this habitat would be minimal because the pipeline would be hand-laid. Because this disturbance would be temporary and of low magnitude, it is not considered significant.

As described in the Draft EIS/EIR, construction of the proposed transmission line could affect up to 77 acres of suitable northern spotted owl foraging habitat. This affect would include removal of habitat, conversion of habitat to other vegetation types, and disturbance to the habitat in the form of tree topping. Mitigation Measure 4.8.1d directs Calpine to compensate for the loss of all stands of late-seral Forests. This includes potential habitat for the northern spotted owl. Implementation of this mitigation measure would reduce the impact of the transmission line to a level below significance.

It should be noted that the Northwest Forest Plan sets standards and guidelines for activities on National Forests within the entire range of the northern spotted owl (see Section 3.10 of the Draft EIS/EIR for more details on this plan). As described in the Draft EIS/EIR on page 3-106, most of the lands within the proposed project are designated by the Northwest Forest Plan as "Matrix" land. (The remaining lands are within lands designated as either a Managed Late Successional Area or an Adaptive Management Area). The matrix designation represents the lowest priority for

[1] In August 1998 (at press time), Calpine conducted a field survey on the Modoc National Forest within 0.5 mile of transmission line segment A3 (the segment in the lead agencies' preferred alternative that is within the range of the northern spotted owl). No habitat was found in this area that meets the Modoc National Forest's definition of suitable nesting or roosting habitat for the northern spotted owl. See the Biological Assessment, available for review by the public at the USFS office in Alturas, California, prepared for this project for more details of this survey and its results.

[2] See footnote 1 above.

preservation of northern spotted owl habitat. See responses to comments in the Plans and Policies Section for further discussion of this issue.

Effects on Northern Spotted Owl Dispersal Ability. The comments also state that the forest clearing associated with the proposed project would result in habitat fragmentation which could adversely affect the ability of northern spotted owl to disperse between patches of suitable habitat. The project may remove some habitat that could be used by northern spotted owls for dispersal (the amount depends on which alternative transmission line route is selected). The removal of this habitat may also slightly increase the fragmentation of remaining dispersal habitat. However, because of the amount and configuration of the habitat loss, an adverse effect on the dispersal ability of the northern spotted owl is not expected to occur. An explanation for this conclusion is presented below.

In studies of the dispersal patterns of juvenile owls, owls have been either fitted with radio-transmitters and tracked or banded and recaptured elsewhere. In five studies that tracked or banded a total of 50 individuals throughout the Pacific Northwest (including northern California), juvenile northern spotted owls dispersed an average of 18 miles. Their maximum dispersal distance was over 50 miles (data summary and citations in Thomas et al. 1990).

Northern spotted owls tend to prefer certain types of habitat for dispersal. Dispersing northern spotted owls prefer Forests with larger trees and in denser stands (i.e., late-seral or mature Forests) (e.g., Forsman et al. 1984; Carey et al. 1990; Miller et al. 1997). However, northern spotted owls also regularly disperse through forest with moderate density and tree sizes (i.e., mid-seral Forests) (Thomas et al. 1990; Miller et al. 1997).

According to the Fourmile Hill Geothermal Exploration Project BE/BA (Galea and Oberlag 1996), dispersal habitat for the northern spotted owl is generally described as timber stands having canopy closure of 40% or greater and an average tree diameter (at breast height) of 11 inches or greater. The Doublehead Ranger District uses a similar definition for northern spotted owl dispersal habitat. There is habitat that fits this definition in the wellfield and power plant area and on the various transmission line alternatives. Some loss of this habitat would occur as a result of project development. On the transmission line, right-of-way clearance would result in removal of trees from a long corridor that is at most 125 feet wide.

Although it is unknown what actually constitutes a barrier to owl dispersal, it is reasonable to assume that a transmission line corridor 50 to 125-feet wide would not constitute a barrier to a northern spotted owl that is dispersing an average of 18 miles away (and up to 50 miles away).

Within the wellfield and power plant area, clearing would take place for seven well pads (2.5 acres each) and a power plant (10.4 acres). Because of their small size, project facilities would not form continuous barriers that could result in substantial or unacceptable habitat fragmentation. The road and pipeline corridors within the wellfield and power plant area would be no wider than 40 feet. Likewise, dispersing northern spotted owls should be able to readily cross these disturbances.

Habitat fragmentation is thought to be partly responsible for the decline of the northern spotted owl through its effects on suitable nesting habitat (Thomas et al. 1990). The effects of habitat fragmentation on dispersal habitat are much less well known. Part of the difficulty in determining the effect of fragmentation on dispersing northern spotted owls is that northern spotted owls use many different habitat types for dispersal.

Comment B.6 includes a request for discussion of the potential project impacts within the Medicine Lake Highlands Managed Late-Successional Area (MLSA). This MLSA is one of a series of reserves designated to protect and enhance late-successional forest ecosystems that serve as habitat for late-successional and old-growth forest related species, including the northern spotted owl. MLSAs are identified in drier locations where fire is more frequent. As a result, certain silvicultural treatments and fire hazard reduction treatments are allowed to help prevent catastrophic destruction by high intensity fires, disease, or insect epidemics. If a project alternative that includes a transmission line routed through the Medicine Lake Highlands MLSA were to be chosen, the cleared corridor would not exceed 125 feet in width. As discussed above, dispersing northern spotted owls should have no difficulty traversing this narrow corridor. Such a narrow corridor would not result in a substantial or unacceptable level of habitat fragmentation.

Comment X.8 also presents concern about potential impacts to the California spotted owl from the proposed project. The California spotted owl (*Strix occidentalis occidentalis*) is a subspecies that is closely related to the northern spotted owl (*Strix occidentalis caurina*). According to some scientists, there are essentially no genetic differences between the two subspecies. Despite this assertion, the Committee on Classification and Nomenclature of the American Ornithologists' Union retained the two subspecies in 1989 (Thomas et al. 1990). As of 1998, this ruling still stands. The Committee also retained the original geographic boundary between the two subspecies. In northeastern California, this boundary approximately coincides with the Pit River and State Highway 299 (until Redding). Based on this boundary, no California spotted owls occur near the proposed project; the Medicine Lake Highlands area is only within the range of the northern spotted owl. Thus, no impacts to California spotted owls would occur as a result of the proposed project.

Comment AG.80 expresses concerns over potential impacts to northern spotted owl from habitat loss and transmission line maintenance activities and states that the project would remove 106.4 acres of late seral forest, all of which is considered to be habitat for the northern spotted owl. However, the Draft EIS/EIR does not state that 106.4 acres of late seral forest would be lost as a result of the proposed project. The commentor appears to have obtained this value by adding together the total of removed, removed-converted, and disturbed red fir forest and upper montane mixed conifer forest in Table 4.7-1. However, it cannot be assumed that all of these forest types are in a late seral stage. Some of the forest included in these two habitat types has been logged recently and is still in an early- or mid-successional stage. Other portions of these Forests, due to environmental constraints such as soil type or topography, are not in a late-successional stage and will likely never reach such a stage. Other portions of these vegetation types have burned recently; as a result, those Forests are also in an early- or mid-successional

stage. Indeed, it is likely that substantially less than 106.4 acres of late-seral forest habitat would be disturbed or removed by the project.

A complete analysis of the amount and types of habitat suitable for the northern spotted owl that would be removed or disturbed by the proposed project will be presented in the Biological Assessment for the project. This document is in preparation and will be submitted to the USFWS (see response to "Comment—Consultation with Regulatory Agencies" for more information).

Mitigation Measures 4.8.1a through 4.8.1e on page 4-110 of the Draft EIS/EIR have been specifically designed to minimize the impacts to late seral forest and to reduce the potential loss of late seral stage forest to a level that is less than significant. Furthermore, Mitigation Measure 4.8.3e is designed to reduce potential construction and maintenance impacts to northern spotted owl below the level of significance. Taken together, these mitigation measures reduce the level of impact to the northern spotted owl to below significance. See also response to "Comment—General Impacts to Late Seral Forests" in the Vegetation Section.

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Comment—Osprey

AG.81 The osprey (*Pandion haliaetus*), which is a USFS management indicator species and a California species of special concern, forages in the Medicine Lake and Bullseye Lake areas. (EIS/EIR, p. 3-107.) The osprey perches in trees along transmission line segment A1 and one active nest was observed 0.5 miles south of segment A1. Suitable habitat also exists near segment A2. (*Ibid.*) The EIS/EIR acknowledges that the osprey is among the species most likely to collide with transmission line segment A1. (*Id.* at p. 4-125; Ex. B, § 4.8.) Nonetheless, the EIS/EIR concludes that the Project would not reduce osprey foraging or nesting habitat would be lost and it would not significantly affect the osprey. (EIS/EIR, p. 4-118.)

The available information, however, indicates that transmission line collisions will significantly affect the osprey population and other bird species. The letter from Thomas Reid Associates states the placing 24 miles of transmission line in the area creates an unavoidable increase in avian mortality, and would be a significant, unmitigable impact. (Ex. B, § 4.8.) Further, proposed mitigation measure 4.8.4a is inadequate to reduce bird collisions because the ball and marker system is ineffective at night or under inclement weather conditions. (EIS/EIR, p. 4-126; Ex. B, § 4.8.) Hence, this impact would not be mitigated to insignificance.

In sum, the EIS/EIR's finding the Project will not have a significant impact on the osprey is based on unsupported conclusions and not on facts. Given the available information, there is no basis to determine that the Project will not significantly affect the osprey and adequate mitigation measure should be proposed. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Osprey

See response to "Comment—Effects of Transmission Lines on Birds" for a general discussion of the potential for the transmission line to cause impacts to birds. The potential impact of the transmission line on ospreys is considered less than significant with the implementation of Mitigation Measure 4.8.4a on page 4-126. However, the text on page 4-125 of the Draft EIS/EIR has been changed to clarify the discussion of potential impacts to the osprey (see response to "Comment—Bald Eagle" for the text of this change).

Comments—Pine Marten and Pacific Fisher

O.12 The LRMP for Modoc National Forest states that marten habitat must be managed in the forest. Specifically, management must "maintain habitat for marten during geothermal exploration and development." (4-212) The EIS does not clearly discuss specific management activities to protect marten habitat. Before further planning has passed, it is crucial that a management plan for the pine marten be established or the proposed project will be in violation of the Modoc LRMP.
(Katherine Kowatch, Friends of the River)

Q.3 The EIS/EIR discloses effects on a myriad of species. We are concerned about the negative effects on all species, but are particularly concerned with martens, fishers, and goshawks. Martens and fishers are forest carnivores whose numbers have been declining steadily. Fishers and goshawks are species of special concern at both the state and federal level, and the marten is a USFS Region 5 sensitive species. Any negative effects to these species could drive them further towards listing as threatened or endangered species under the federal Endangered Species Act. *(Lori J. Cooper, Klamath Forest Alliance)*

Response—Pine Marten and Pacific Fisher

As discussed in Mitigation Measures 4.8.3k and 4.8.3l on pages 4-124 and 4-125 of the Draft EIS/EIR, management activities are proposed to protect and minimize the impacts to American marten habitat that may occur within the proposed project. These measures are consistent with the Modoc National Forest Land and Resource Management Plan.

Comment Q.3 expresses concern for protection of marten, fisher, and goshawk. Mitigation Measures 4.8.3c, 4.8.3d, 4.8.3k, and 4.8.3l on pages 4-123 through 4-125 of the Draft EIS/EIR specifically address the protection of northern goshawk and American marten and their habitat, both within the wellfield and power plant area and along the transmission route. As stated in the Draft EIS/EIR on page 3-111, there is no evidence of a resident population of the Pacific fisher in the project area. Thus, no significant impact

on this species would be expected to occur from project activities. See response to "Comment—Northern Goshawk" above for further information on potential impacts to northern goshawk.

Comments—Special-Status Bats

X.9 Issues of particular concern to the MMAS include 7. The passage of the line through the habitat, roosting and reproductive sites of seven bat species, four of which are listed as Federal Species of Concern.

(Michael Hauptman, Mount Shasta Area Audubon Society Board of Directors)

GB.1 The purpose of this letter is to comment on the assessment of impacts to bat species as outlined in the DEIS/EIR for the Fourmile Hill Geothermal Development Project (State Clearinghouse No. 96062042), and to provide relevant information that has emerged from a recent radiotracking study of Townsend's big-eared bats at Lava Beds National Monument.

The document implies that suitable habitat for the pallid bat is confined to the "lower elevations from the eastern slopes of the Medicine Lake Highlands down onto the Modoc Plateau " (p. 3-109). Pallid bats occur up to 10,000 feet in the central Sierra Nevada's (D. Graber, Sequoia National Park, pers. comm.), and are one of the species most frequently encountered at 6,500 in giant sequoia/red fir forest (per. obs). While pallid bats are best known from lower elevation forested habitats, I have found them to occur in the 4,000-8,000 foot elevation range, and in that elevation range would make no distinction between their broad habitat associations and those for some of the other species (e.g., *Myotis volans* or *Lasionycteris noctivagans*).

(Elizabeth D. Pierson)

GB.2 This document makes the statement that neither construction nor operating noise would adversely affect a number of the bat species (i.e., pallid bats, silver-haired bats and special status Myotis species), and bases this conclusion on data collected by W. Rainey and myself in the upper Sacramento River drainage, This misinterprets our data and makes unsupported assumptions.

On p. 4-119, the document states: "Based on recent studies in northern California of bat behavior by D. Pierson and W. Rainey, pallid bats are known to use both diurnal and night roosts in areas exposed to high levels of highway and railroad noise." This statement is not accurate. While we identified one regularly occupied bridge night roost, it was located on a rarely used access road, and was at least 100 m.(and in a location somewhat buffered) from an active railroad line. All diurnal pallid bat roosts located during the course of this project were in trees located at least 1 km. from a highway or railroad. In this study, and in another study I conducted in the Carmel Valley, the relatively light noise generated by investigators locating tree roosts on foot (by radiotracking) was sufficient to cause animals to temporarily abandon these sites. While pallid bat nursery colonies occur in human-occupied structures, I know of no data evaluating the tolerance of this species for specific noise levels, nor for unexpected, unfamiliar noise.

(Elizabeth D. Pierson)

GB.3 On pp. 4-119 and 4-120 , the document states: "Recent studies of tree-dwelling bats such as Myotis sp. and silver-haired bats have been conducted by D. Pierson and W. Rainey in the vicinity of the upper Sacramento River. Based on these studies, tree-dwelling bats are known to use both diurnal and night roosts in areas exposed to high levels of highway and railroad noise."

Again, this statement is not accurate. We located over 20 tree roosts for silver-haired bats. All but one were located more than a Km from the highway/railroad corridor. The roost closest to the highway (ca. 200 m) was located in a forested draw and was buffered from highway noise. The available evidence suggests that there are significant differences among *Myotis* species in their response to human disturbance and thus lumping them together is inappropriate. While our studies identified diurnal tree roosts for *Myotis yumanensis* close to the railroad line (closest roost was ca, 50 m), this study was conducted late in the reproductive season. Thus we have no evidence that these roosts were being used when females had dependent young. Additionally, this species, which does not have special status, is generally recognized as tolerant of some classes of human disturbance. In contrast, no diurnal roosts for any of the special-status *Myotis* species were located during the reproductive season within 1 km, of the highway or railroad corridor in our study. Bridge night roosts were used by some of the special-status *Myotis* species, but no active bridges were used as diurnal roosts. While some special status *Myotis* species are known to occur in human-occupied buildings in other settings, I know of no data evaluating their tolerance for specific noise levels, their tolerance for unexpected, unfamiliar noise, nor their ability to adapt to long term changes in local noise levels. I do know from my own experience that human incursion into a *Myotis thysanolles* or *Myotis evotis* roost area can cause the animals to abandon the roost.

(Elizabeth D. Pierson)

GB.4 The document states on p. 4-1 12 that: "If noise levels of 70 to 75 dBA were present on a long- term basis without the accompanying activity of humans or machines, wildlife (including bats) would gradually adapt to the noise, and the avoidance response would subside." I know of no data to substantiate this conclusion for bats. Use of dBA as a measure of noise (and disturbance) to bats ignores the fact that

frequencies used by bats for prey detection and communication are largely above the range of human hearing. *(Elizabeth D. Pierson)*

GB.5 In summary, this document is misleading in several ways regarding bats. First, it fails to distinguish among roost types. Whereas a number of bat species will night roost in areas with relatively high noise levels (e.g., under active highway bridges), most are far more sensitive to acoustic disturbance at their diurnal roosts, particularly if these are maternity roosts. This document also assumes that because species may have adapted to noise levels in one setting (e.g., roosting in human-occupied structures), they will tolerate construction and operation noise associated with the geothermal project. This overlooks the fact that bats may make distinctions regarding noises they will tolerate, and that factors other than perceived intensity (e.g., predictability) may be important. It also overlooks the fact that the location of the noise source may make a difference (e.g., bats will night roost under -- but apparently never over --- active highway bridges [C-. Erickson, Cal Trans]). The document also does not adequately address the spectral distribution of noise -- and the potential for ultrasonic noise, potentially disturbing to the bats, to be generated by the geothermal operation (e.g., venting of high pressure gas or vapor. *(Elizabeth D. Pierson)*

GB.6 The document states (p. 4-1 12) that during the construction phase wildlife (including bats) would be expected to avoid construction sites, and that these animals would be displaced during the summer and fall for a three-year period. It then concludes that because this displacement is temporary the effects "are not expected to be significant." This overlooks the fact that bats have an extremely low reproductive rate (typically one young per year), and generally exhibit great loyalty to roosts or roosting areas. Displacement could mean failed reproduction for bats within the impact area. Without knowing the distribution of roosts in and around the construction zone, there is no basis for concluding that impacts would not be significant. *(Elizabeth D. Pierson)*

GB.7 The proposed mitigation measures are also inadequate. The document states for pallid bats, silver-haired bats, and *Myotis* species that: "All loss of snags with dbh of 18 inches or more shall be mitigated for off-site at a distance of 250 feet or more from the edge of areas cleared for project facilities." Such a measure would only serve as mitigation if these off-site trees were not already occupied by other bats. I see no logic by which it can be argued that removal of snags does not result in a net loss of roosting habitat unless an equal number of snags are generated in equivalent habitat and future snag recruitment is taken into account. *(Elizabeth D. Pierson)*

GB.9 It was also determined by this radiotracking study that individual *C. townsendii* roosting in the Cave Loop system of Lava Beds National Monument traveled up to 7 miles to forage, and were foraging in the forested habitat within the project area. The impacts of this project on the foraging habitat of this species needs to be addressed. *(Elizabeth D. Pierson)*

Response—Special-Status Bats

The information in comment GB.1 on elevational range of the pallid bat is noted. The text of the Draft EIS/EIR on pages 3-108 and 3-109 has been changed to incorporate this information:

> "**Pallid Bat:** The pallid bat (*Antrozous pallidus*), a California Species of Special Concern and a Northwest Forest Plan Protection Buffer species, is found in a wide variety of habitats in California, from deserts to coniferous forests. This species uses a variety of diurnal roosts, including caves, rock outcrops, and trees with cavities or exfoliating bark. ~~The pallid bat is expected to occur within the project area at the lower elevations from the eastern slopes of the Medicine Lake Highlands down onto the Modoc Plateau. The wellfield and power plant area, the freshwater pipeline, and transmission route segments A1 and A2 do not provide suitable habitat for the pallid bat and this species is probably not present in these areas. Transmission line segments B1 and C1 provide suitable habitat for the pallid bat, and this species is very likely to be present in the vicinity of these segments.~~ The pallid bat is very likely to occur throughout the project area, and all portions of the proposed project area provide suitable habitat for this bat."

The information in comment GB.2 on pallid bat roost locations and their response to noise is also noted. The text of the Draft EIS/EIR on page 4-119 (first paragraph) has been changed to incorporate this information:

> "~~Based on recent studies in northern California of bat behavior by D. Pierson and W. Rainey, pallid bats are known to use both diurnal and night roosts in areas exposed to high levels of highway and railroad noise. Construction noise from the project would be expected to be comparable to (and possible less than) this type of noise. This noise would therefore not be expected to adversely affect the use of nearby tree and snag roosts by this species.~~ Pallid bats are known to use tree roosts remote from human disturbance, but will also use both night and diurnal roosts in human-occupied structures, farm buildings, and highway bridges. Their exact level of tolerance for human activity and noise has not been systematically studied. However, a conservative approach can be taken to evaluating the potential impact to these species. If trees or snags used by pallid bats are located in areas adjacent to construction activity, these animals could be displaced to alternative roosts. Because pallid bats would be able to return following construction, no significant impacts to this species are expected to occur as a result of the proposed project."

The information in comment GB.3 on the roost locations of silver-haired bats and special-status *Myotis* species and their response to noise is also noted. The text of the Draft EIS/EIR on page 4-119 (last paragraph) has been changed to incorporate this information:

> "~~Recent studies of tree-dwelling bats such as *Myotis sp.* and silver-haired bats have been conducted by D. Pierson and W. Rainey in the vicinity of the upper Sacramento River. Based on these studies, tree-dwelling bats are known to use both diurnal and night roosts in areas exposed to high levels of highway and railroad noise. Construction noise from the project would be expected to be comparable to (and possible less than) this type of noise. This noise would therefore not be expected to adversely affect the use of nearby tree and snag roosts by these special-status bat species.~~ Silver-haired bats and the special-status *Myotis* species are known to roost in trees and snags remote from human disturbance and may be sensitive to the kinds of human activity and noise that would be associated with the construction phase of the proposed project. Their exact level of tolerance for human activity and noise has not been systematically studied. However, a conservative approach can be taken to evaluating the potential impact to these species. If trees or snags used by these bat species are located in areas adjacent to construction activity, these animals could be displaced to alternative roosts. Because these special-status bat species would be able to return following construction, no significant impacts are expected to occur to these species as a result of the proposed project."

Comment GB.4 questions whether bats would adapt over time to noise levels of 70-75 dBA and also questions the use of dBA as a measure of noise and disturbance to bats. In fact, in this case dBA is a very conservative measure of noise level because it emphasizes lower frequencies. As described on page 4-111 of the Draft EIS/EIR, noise emissions from project sources would be dominated by lower frequencies, with minimal sound emissions in the high frequency and ultrasonic portion of the sound spectrum. The perception of project-related noise at ultrasonic levels would be even lower than suggested by the Draft EIS/EIR because noise at these high frequencies is absorbed very quickly with distance. This conclusion is supported by field data collected at The Geysers geothermal field. According to this study, there were no differences in sound pressure levels in the ultrasonic frequencies (22-45 kHz) between developed and undeveloped habitat areas even though developed areas had sound pressure levels between 40 and 62 dBA and undeveloped areas had levels of 30 to 40 dBA (Miller et al. 1986).

Thus, the available data on noise levels in a developed geothermal field indicates that sound pressure levels during the project operational phase are likely to be well below the conservative estimate of 70-75 dBA. Furthermore, noise levels in the high and ultrasonic frequency range are likely to be at or only slightly above current background noise levels during any of the project phases.

Comment GB.5 makes a number of suggestions of factors that may affect the reactions of bats to noise disturbance. These factors are noted. However, because there have been no systematic studies of the effects of noise disturbance on bats, the Draft and Final EIS/EIR takes the most conservative approach in its analysis of noise-related effects on bats from the proposed project (described above).

Comment GB.6 expresses concern for the displacement of bats from roosts in the vicinity of construction sites. Recent studies on roost-site selection by forest-dwelling bats emphasize the critical importance of adequate numbers of large defective or dead trees with cavities, crevices, or exfoliating bark that provide suitable roosting habitat (Barclay and Brigham 1996; Brigham et al. 1997). However, a very common observation is that bats (as individuals or as groups) switch diurnal roosts frequently and appear to demonstrate fidelity to a general area rather than to specific roosts. The distances between successive occupied roost trees or snags often range from several hundred meters to several kilometers. This suggests that the appropriate conservation strategy should be to maintain adequate regional abundance of large snags and defective trees. It also suggests that tree-roosting bats may have considerable flexibility in roost choice. Moreover, shifting roosts is part of normal behavior and indeed may be an adaptive strategy.

Research has not yet identified the number or density of roosting sites required to support desired levels of tree-dwelling bat populations (Brigham et al. 1997). In the absence of standards, it seems reasonable to replace all losses of snags with dbh of 18 inches or more. Mitigation Measures 4.8.1e, 4.8.3h, and 4.8.3j proposed in the Draft EIS/EIR address the need to compensate for loss of snags in order to maintain an adequate regional abundance of this important habitat component.

Comment GB.7 expresses concern that the proposed mitigation for snag losses is inadequate. Mitigation Measure 4.8.1e on page 4-110 of the Draft EIS/EIR proposed the replacement of snags with dbh of 18 inches or more. This mitigation measure is in accordance with the standards and guidelines of the Northwest Forest Plan, which requires compensation for the loss of snags. See also response to "Comment—Retention of Snags and Woody Debris" in the Plans and Policies Section for a discussion of maintaining these habitat components.

The suggestion, that trees selected for snag creation should be surveyed to determine that they are not already occupied by bats, is noted. Mitigation Measure 4.8.1e on page 4-110 of the Draft EIS/EIR has been modified to incorporate this suggestion:

> "4.8.1e For trees and snags with dbh greater than or equal to 18 inches that are removed during construction, compensation shall be provided by Calpine in accordance with the standards and guidelines of the Northwest Forest Plan (USFS and BLM 1994a). Per these guidelines, all loss of snags with dbh of 18 inches or more shall be mitigated for at an off-site location that is a distance of 250 feet or more from any edge of an area~~the edge of areas~~ cleared for project facilities. The trees selected for snag creation shall be inspected by a qualified

wildlife biologist to ensure that they are not occupied by bats or other special-status wildlife. Snag creation (or other compensatory measures) could include killing live trees or accelerating the development of stands to increase tree senescence. (C)"

It should be noted that Mitigation Measures 4.8.3h and 4.8.3j require pre-construction surveys to identify potential bat roosting sites that could be impacted and avoidance of such sites to the greatest extent possible.

Regarding comment GB.9, the Draft EIS/EIR on page 4-119 discusses the potential effects of the project on foraging habitat for the Townsend's big-eared bat. This discussion has been revised to clarify the nature of the potential impacts to this species:

> *"Townsend's big-eared bat (Corynorhinus townsendii):* About 175 acres of foraging habitat suitable for Townsend's big-eared bats would be lost due to construction of the project, including transmission line and wellfield/power plant facilities~~construction on segment C1~~. This habitat loss would not have a significant impact on the species, since the area affected would be only a small fraction of the total habitat available. Project avoidance of high quality roosting habitat in the form of caves would prevent further impacts to this species."

This discussion applies to foraging habitat of individuals that originate either inside or outside the project area, including from within Lava Beds National Monument.

References:

Barclay, R. M. R., and R. M. Brigham (eds.). 1996. *Bats and Forests Symposium*. Victoria, B.C., Canada, October 19-21, 1995. Research Brief Working Paper 23/1996. British Columbia Ministry of Forestry, Victoria, B.C.

Brigham, R. M., M. J. Vonhof, R. M. R. Barclay, and J. C. Gwilliam. 1997. Roosting behavior and roost-site preferences of forest-dwelling California bats (*Myotis californicus*). *Journal of Mammalogy* **78**:1231-1239.

Miller, M. R., G. R. Zitney, R. W. Schlorff, P. Leitner, and J. F. Hurley. 1986. *The Geysers Wildlife Study: The Distribution and Abundance of Wildlife Populations in Relation to Geothermal Development*. Pacific Gas & Electric Company, Dept. of Engineering Research, San Ramon, CA. November.

Comments—Swainson's Hawk

AG.90 For example, CDFG has prepared guidelines for mitigating impacts to the Swainson's Hawk. (Ex. B, § 4.8.) The EIS/EIR, however, does not adopt these mitigation measures. This deficiency is addressed in detail in the letter from Thomas Reid Associates. (Ex. B, § 4.8.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.91 Similarly, the EIS/EIR does not propose measures mitigating the loss of foraging habitat for many of the birds. Thomas Reid Associates recommends mitigation similar to that found in the Swainson's hawk guidelines. (Ex. B, § 4.8.) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.292 The EIS/EIR does not discuss specific species guidelines where they exist. For example, there are specific guidelines pertaining to mitigation for impacts to the Swainson's hawk, a California threatened species. The "Guidelines" are contained in the "Staff Report regarding Mitigation for Impacts to Swainson's Hawks in the Central Valley in California," which was prepared by the California Dept. of Fish and Game, dated November 1, 1994. However, these guidelines are not mentioned (page 4-120) even though the site contains suitable foraging habitat and potential nesting habitat for the hawk.

The Swainson's hawk mitigation listed on page 4-124 of the EIS/EIR is not consistent with that recommended in the "Guidelines." The EIS/EIR states that if any Swainson's hawks nests are found within 0.25 miles of the transmission line corridor, then disturbance should be avoided from March 1 to July 31 (measure 4.8.3.g). The "Guidelines" recommends a nest avoidance period of March 1 to

September 15, or August 15 if a Management Authorization of Biological Opinion is obtained for the project.

In addition, the "Guidelines" include mitigation for loss of foraging habitat, which the EIS/EIR does not include even though the EIS/EIR states that "about 20 acres of foraging habitat suitable for the Swainson's hawk would be lost along segment C1 due to transmission line construction." (Page 4-118.) Mitigation for foraging habitat is specified on pages 11 and 12 of the "Guidelines" document.

There is no mitigation for loss of foraging habitat for many of the other sensitive bird species (p. 4-122). Mitigation similar to that recommended in the Swainson's hawk Guidelines should be recommended for other sensitive bird species where there is a loss of foraging habitat.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Swainson's Hawk

These comments state that mitigation for impacts to Swainson's hawk should follow recommendations contained in a CDFG staff report dated Nov. 1, 1994. The cited CDFG Staff Report applies specifically to mitigation for impacts to Swainson's hawk in the Central Valley of California. In the Central Valley, Swainson's hawk is found in agricultural lands and forages in habitats used for crop production, which are being converted to urban development. In contrast, in Modoc County, Swainson's hawk forages in the extensive juniper woodlands and open shrublands. In these habitats there has been essentially no habitat loss due to development activities. As a result, there is approximately 30,000 acres of suitable foraging habitat available within 3 miles on either side of segment C1 or C2 of the proposed transmission corridors. The loss of 20 acres of foraging habitat within this large contiguous area of available habitat would not constitute a significant impact. Moreover, the cited guidelines do not apply in this region of California. Mitigation Measure 4.8.3g on page 4-124 of the Draft EIS/EIR provides adequate and appropriate protection for this species.

Comment AG.91 also suggests that measures similar to the ones outlined by the CDFG be applied to mitigation for the loss of foraging habitat for other special-status birds. Mitigation measures are already proposed in the Draft EIS/EIR that reduce the level of impact to special-status birds to below significance (see page 4-123). Furthermore, available habitat for these special-status birds (e.g., Cooper's hawk, northern goshawk, sage grouse) is similarly abundant throughout the project area (see response to "Comment—Provide Species' Range Information" for more details). Thus, no further mitigation measures are required.

Comments—Wolverine and Sierra Nevada Red Fox

AG.70 The California wolverine and Sierra Nevada red fox are listed species that exist in Siskiyou County and whose range overlaps with the Project area. [Ex. B, § 4.8; Ex. B, Attachment; see also Ex. F, pp. 4-8.) The golden eagle is a fully protected species in the area. (Ex. B, § 4.8.) The lead agency should describe these animals and their habitat requirements. The lead agency should also conduct surveys if the Project has the potential to affect these species. (Ex. B, § 4.8.) This information is necessary to assure the public and the decisionmakers that the Project's impacts on these species have been considered. However, none of this information has been provided in the EIS/EIR.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.288 The EIS/EIR does not address two state listed animal species which have known ranges in or near the project site. These were included in the California Dept. Fish and Game Internet site (www.dfg.ca.gov/Endangered/SIS.html). These are the California Wolverine (California threatened and fully protected) and the Sierra Nevada red fox (California threatened) (species accounts attached). The EIS/EIR should include a description of these animals, their habitat requirements, and surveys of the animals if they have the potential to be impacted by the project.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Wolverine and Sierra Nevada Red Fox

See pages 3-104 and 4-116 of the Draft EIS/EIR for a discussion of the golden eagle and the potential for the project to impact this species. The following discussions for the wolverine have been added to Section 3.8 of the Draft EIS/EIR. In addition, this species has been added to Tables 3.8-1 through 3.8-3 of the Final EIS/EIR.

> "**California wolverine:** The California wolverine (*Gulo gulo luteus*) is listed as threatened by the CDFG, as a species of concern by the USFWS, and as a USFS Sensitive species. This subspecies is found in remote areas of the North Coast, Cascade, and Sierra mountain ranges of California and Oregon (Thelander and Crabtree 1994). It is apparently extremely wary of humans. As a result, the wolverine has rarely been seen in this century in California. Indeed, there has been no specimen or photograph taken of this subspecies in California in over 50 years. However, there have been several reliable sightings of this species in California during that time, including one from the late 1980's about 30 miles west of the project area. The California wolverine is thought to have never been common , but may be declining more recently due to loss of remote coniferous forest habitat that is free of human disturbance.
>
> This hypothesized historic and current range of the California wolverine includes the project site within Siskiyou County and the extreme western edge of Modoc County (Zeiner et al. 1990; Thelander and Crabtree 1994). The proposed transmission line corridors C1 and C2 are in lower elevation woodland and scrubland habitat that is likely outside of the range of the California wolverine.
>
> The California wolverine's apparent sensitivity to human activity probably restricts most of its range to regions that are already free of such activity. These areas might include designated wilderness and other roadless areas where humans seldom travel. However, there have been sightings of wolverine near campgrounds and recreational areas in California, indicating that wolverines do venture into more disturbed areas. The proposed project would cross habitat that contains roads and supports human activities that may already exclude the California wolverine. Marginally-suitable habitat for this species may exist in the forested habitats in the project area, including the wellfield and power plant area, and transmission line segments A1, A2, and B1.
>
> **Segment B2: California wolverine.** Suitable habitat for the California wolverine may be present in the forested areas of the project, particularly in the vicinity of Red Shale Butte and Lyons Peak.
>
> **Segment A3: California wolverine.** Marginally-suitable habitat for the California wolverine may exist along segment A3 due to this species' very large home range and the level of human use in and near the Medicine Lake Highlands. Marginally-suitable habitat for this species may also be present south of segment A3 on the north-facing slopes of Mount Hoffman."

The following discussion of potential impacts to the California wolverine has been added to Section 4.8 of the Draft EIS/EIR.

> "*California wolverine (Gulo gulo luteus):* Up to 250 acres of marginal habitat may be available for the California wolverine in the project area. There is no evidence that this species is present in the area. Due to the rarity of the wolverine in California, the species' requirements for a large home range, and the existing level of human

disturbance in area, this species is not expected to use the marginal habitat in the project area. Most of the habitat that would be lost is found in areas that already experience some human disturbance (e.g., along or near existing roadways). This loss of potential marginal habitat would not have a significant impact on the species. Along segment A2 of the proposed transmission line, some habitat would be lost within the Mount Hoffman released roadless area. Because this area is largely undisturbed, it may be better-quality habitat for the wolverine. Habitat removal along segment A2 would occur along the margins of the forested portion of the roadless area and would not substantially fragment that habitat. Therefore, no significant effects on the wolverine are expected to occur as a result of the proposed project."

The following discussions for the Sierra Nevada red fox have been added to Section 3.8 of the Draft EIS/EIR. In addition, this species has been added to Tables 3.8-1 through 3.8-3 of the Final EIS/EIR.

"**Sierra Nevada Red Fox:** The Sierra Nevada red fox is listed as threatened by the CDFG, as a species of concern by the USFWS, and a USFS Sensitive species. The Sierra Nevada red fox (*Vulpes vulpes necator*) is an extremely rare species that was once found in the Cascade Range from Siskiyou County south along the crest of the Sierra Nevada Range as far south as Tulare County. Its current range is assumed to be similar to its historic range. This species occurs in mid to high elevations of these mountain ranges but is seldom seen there (Zeiner et al. 1990; Thelander and Crabtree 1994).

The Sierra Nevada red fox was historically found in the Mt. Lassen area, and at one time was found in the Medicine Lake Highlands. However, there has been no record of this species occurring in the project area since 1934, when an individual was trapped at Medicine Lake (Galea Wildlife Consulting 1995). This species occurs in several forest types, including red fir, lodgepole pine, and mixed conifer stands (Zeiner et al. 1990), all of which are present in the power plant and wellfield area and along transmission line segment A1. The species is currently not known to occur in Modoc County, although suitable habitat may be present for this species along segments A2 and B1.

Segment B2: Sierra Nevada red fox. Although this species is not currently known to occur in Modoc County, suitable habitat may exist in the lodgepole pine and mixed conifer forest in the western portion of segment B2.

Segment A3: Sierra Nevada red fox. Suitable habitat for this species is present along segment A3 in lodgepole pine and mixed conifer forest."

The following discussion of potential impacts to the Sierra Nevada red fox has been added to Section 4.8 of the Draft EIS/EIR.

"*Sierra Nevada red fox (Vulpes vulpes necator):* Approximately 250 acres of potentially-suitable habitat for the Sierra Nevada red fox exists in the wellfield and power plant area and along transmission line segments A1, A2, and B1. The specific habitat requirements of this species are not well known, so the analysis for this project assumed that all forest in red fir, lodgepole pine, and mixed conifer stands is suitable for this species. Because of the abundance of these forest types in the project area, the loss of up to 250 acres of potentially-suitable habitat is not considered significant."

References:

Galea Wildlife Consulting. 1995. *Biological Survey Report, Fourmile Hill Assessment Area.* October 1995.

Thelander, C. G., and M. Crabtree, editors. 1994. *Life on the edge: a guide to California's endangered natural resources: Wildlife.* BioSystems Books, Santa Cruz, CA.

Zeiner, D. C., W. F. Laudenslayer, Jr., K. E. Mayer, and M. White (eds.). 1990. *California's wildlife. Vol. III. Mammals.* California Department of Fish and Game, Sacramento, CA. 407 pp.

Comments—Wildlife at Fall River Springs

B.2 The Draft EIS/EIR does not consider the effects of the proposed action on the federally listed endangered Shasta crayfish (*Pacifastacus fortis*). This species is found in isolated populations in the middle reaches of the Pit River and its tributaries in Shasta County, including the Fall River. Because of the extremely limited range of this species and a number of other environmental factors that threaten its tenuous persistence, loss of only one of these populations may jeopardize the continued existence of the species.
(Ronald A. Iverson, U.S. Fish and Wildlife Service)

N.9 The DEIS/EIR failed to disclose and evaluate the potential direct, indirect, and cumulative impacts to water quality and the effects to wild trout species and their habitat (all life stages) and aquatic species and their habitat (all life stages) of Fall River as a result of the proposed Fourmile Hill Geothermal Project and the Telephone Flat Geothermal Project. Consequently, the DEIS/EIR is deficient for failing to disclose and evaluate the potential direct, indirect, and cumulative impacts to water quality and the effects to the wild trout species and their habitat (all life stages) and aquatic species and their habitat in Fall River as a result of the proposed projects.

The failure of the DEIS/EIR to disclose and evaluate the direct, indirect, and cumulative impacts to water quality of Fall River resulting from the proposed projects because of potential adverse water quality alterations and impacts also failed to disclose and evaluate the potential direct, indirect, and cumulative impacts to Shasta Crayfish species and their habitat (all life stages) in Fall River. The Shasta Crayfish is protected under the federal Endangered Species Act. The DEIS/EIR is deficient for failing to disclose and evaluate the direct, indirect, and cumulative impacts to Shasta Crayfish species and their habitat of the Fall River as a result of affecting Fall River springs as a result of the proposed project and future geothermal projects.

The cumulative impacts to several other unique and rare species and their habitat in Fall River resulting from the proposed Fourmile Hill Geothermal Project and the Telephone Flat Geothermal Project were not disclosed and evaluated in the DEIS/EIR. Those species and their habitat are: rough sculpin (federal species of concern and state-listed threatened species), bigeye marbled sculpin (California species of special concern), California floater mussel (federal species of concern) and montane peaclam (federal species of concern). *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

O.10 There are a number of rare and protected aquatic species whose habitat is threatened by the construction of a geothermal plant. The headwater springs of the Fall River support the greatest concentration and largest extant populations of Shasta crayfish, a federal and state listed endangered species. The Shasta crayfish populations are very fragmented and small. If geothermal development of the Medicine Lake Highlands contaminates the groundwater source for the headwater springs, the Shasta crayfish would probably not recover.

A number of other aquatic species are at risk as a result of groundwater contamination in the Fall River headwater springs. These include: rough sculpin, a federal species of concern and a state listed threatened species; bigeye marbled sculpin, a California species of special concern; California floater mussel and montane peaclam, both of which are federal species of concern. Groundwater contamination would pose a serious and irreversible threat to the survival and existence of these rare and protected species.

The quality of the Fall River wild trout fishery is world renown but is currently threatened from sediment impacts. New impacts from a decline in water quality could have devastating effects on this premiere biological and recreational resource. *(Katherine Kowatch, Friends of the River)*

Response—Wildlife at Fall River Springs

The comments express concern over potential impacts to special-status wildlife that occurs in the springs that feed into the Fall River. In particular, many comments are concerned about potential impacts to the Shasta crayfish, a state and Federal endangered species. The Shasta crayfish (*Pacifastacus fortis*) is found in seven

populations within the midreaches of the Pit River drainage in northeastern Shasta County, California. These seven populations are found in sections of three rivers: Fall River, Hat Creek, and Sucker Springs Creek (Thelander and Crabtree 1994; Light et al. 1995). The Shasta crayfish is most abundant at the headwaters to the Fall River springs and at springs downstream from Spring Creek (Light et at. 1995).

Within these areas, the Shasta crayfish primarily inhabits waters that are cool, spring-fed, and have properties that are relatively constant, both daily and seasonally (e.g., temperature, rate of flow, turbidity) (Eng and Daniels 1982; Light et al. 1995). However, portions of some populations, particularly at Big Lake, are known to inhabit waters that experience large fluctuations in water temperature and turbidity. In addition, Shasta crayfish appear to prefer areas with abundant rocky cover (Light et al. 1995).

Some populations of the Shasta crayfish have become isolated from one another as a result of dam construction. It is not known whether their total numbers have declined as a result of this disturbance, but this is likely. The isolation among population that was caused by the dams reduces the chance that one population will be replenished by individuals migrating from other populations. As a result, the isolated populations have a greater chance of going locally extinct from either natural or anthropogenic causes.

Another cause for concern for the populations of Shasta crayfish is the introduction into the Pit River drainage of two exotic crayfish, the signal crayfish (*Pacifastacus leniusculus*) and *Orconectes virilis* (Eng and Daniels 1982). The signal crayfish, which is native to Lake Tahoe, is not native to northeastern California. *O. virilis* is native to waters east of the continental divide. Both crayfish are larger, faster growing, and more aggressive than the Shasta crayfish. Because both crayfish now co-occur with most of the Shasta crayfish populations, and because the three species share similar prey, the signal crayfish and *O. virilis* may cause declines in Shasta crayfish numbers by depleting the prey eaten by the Shasta crayfish.

Because of the Shasta crayfish's apparent reliance on the springs in the area, the species is probably very sensitive to changes in water quality. To a lesser degree, the Shasta crayfish is probably sensitive to changes in water quantity from the springs, because the amount of water coming from the springs indirectly affects water quality in the rivers and creeks. Because of a lack of data on this species' specific habitat requirements, and a lack of data on its tolerance of variation in water quality, it is difficult to predict what effect an activity may have on this species.

As discussed on page 3-26 of the Draft EIS/EIR, no effects on water quality or quantity are expected to occur at the Fall River springs area, 35 miles south of the project. Even if a direct connection existed, the daily groundwater extraction predicted for the project would represent 0.17 percent of the daily flow from the Fall River springs (see page 4-24 and response to "Comment—Potential Effect to Fall River Springs" in the Hydrology Section). Because no adverse effects to the quantity or quality of the water at the Fall River springs area would be expected, there would be no impact to any aquatic species within the Fall River springs system, including the Shasta crayfish, rough sculpin, bigeye marbled sculpin, California floater mussel, montane peaclam, or wild trout.

References:

Eng, L. L., and R. A. Daniels. 1982. Life history, distribution, and status of *Pacifastacus fortis* (Decapoda: Astacidae). *California Fish and Game* 68:197-212.

Erman, D. C., T. Light, and C. Myrick. 1992. *Survey of the Status of the Shasta Crayfish* (Pacifasticus fortis) *in Northeastern California*. California Department of Fish and Game, Inland Fisheries Division, Endangered Species Program, Sacramento, CA.

Light, T., D. C. Erman, C. Myrick, and J. Clarke. 1995. Decline of the Shasta crayfish (*Pacifasticus fortis* Faxon) of northeastern California. *Conservation Biology* 9:1567-1577.

Thelander, C. G., and M. Crabtree, editors. 1994. *Life on the edge: a guide to California's endangered natural resources: Wildlife*. BioSystems Books, Santa Cruz, CA.

Comments—Effects of Water Quality on Fish and Other Aquatic Organisms

B.22 How will water quality of surrounding lakes, marshes, and streams be affected? How will this relate to fish health and potential reduction of fish prey base for eagles and other fish eating birds?
(Ronald A. Iverson, U.S. Fish and Wildlife Service)

N.13 The DEIS/EIR is deficient because it failed to disclose and evaluate the direct, indirect, and cumulative impacts to fishery resources, riparian habitat, and water quality as a result of the stream crossing associated with the construction of the transmission corridor. The DEIS/EIR did not disclose the names of the streams where the stream crossings will be made nor did the DEIS/EIR disclose the present conditions of fishery resources, riparian habitat, and water quality in the streams to be affected by the stream crossing for the proposed transmission corridor. The DEIS/EIR simply stated that the applicant will obtain a streambed alteration agreement from the California Department of Fish and Game. Streambed alteration agreements are not subject to CEQA and is an agreement between the DFG and applicants without any public notification and input. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

U.11 Another issue brought to light in the 1984 Supplemental Environmental Assessment (pg. 36) is the following: "Any contamination of the water could eliminate or reduce the fishery in the lakes, thereby reducing their recreational value." What will lake water contamination do to the endangered Bald Eagles, Osprey and other animals eating contaminated fish? Please address these issues in writing.
(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

Y.30 The impact on fisheries was addressed in the 1984 Supplemental EA (p. 36) but seems to be omitted in the draft EIS/EIR. The 84 EA states "Any contamination of the water could eliminate or reduce the fishery in the lakes, thereby reducing their recreational value." The effects on endangered bald eagles, osprey or other animals eating contaminated fish are also not addressed.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AG.234 Acid rain can eliminate aquatic organisms and result in major shifts in species composition by lowering the lake pH. The DEIR fails to discuss the aquatic organisms in the lakes in the Project area or provide any baseline data even though all are classified as fish habitat except Blanche Lake, which is too shallow to support a fishery. (USFS and BLM 1984, Table 6.) These lakes are stocked annually with arctic greyling and brook and rainbow trout (USFS and BLM 1984, p. 18; Reed 1997), which are very sensitive to pH.[3] Acid rain also solubilizes some metal ions, particularly aluminum, copper, iron, lead, mercury and zinc, some of which are highly toxic to plants (aluminum) or aquatic organisms (aluminum, lead, mercury).[4]

The literature indicates that sulfate deposition rates in excess of 8 to 12 lbs/ac-yr are high enough to adversely affect the biota in sensitive freshwaters.[5] For example, the gills of the fathead minnow Pimephales promelas were shown to suffer damage in a lake that was experimentally acidified with 10 to 11 lbs/ac-yr of sulfate.[6] *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

HD.14 The mitigation measures for water quality from these emissions considers only criteria that are protective of human health, not the environment, as required by California and federal law. Water quality criteria for aquatic organisms should be considered and included in monitoring evaluations. *(Amanda Spencer)*

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[3] A.G. Heath, Water Pollution and Fish Physiology, 2nd Ed., Lewis Publishers, Boca Raton, FL, 1995, Chapter 10.

[4] O.L. Loucks and R.W. Usher, Watershed Sensitivity Measurement Strategy for Identifying Resources at Risk from Acid Deposition, U.S. EPA Report EPA-600/3-84-011, January 1984.

[5] D.W. Schindler, Effects of Acid Rain on Freshwater Ecosystems, Science, v. 239, January 1988, pp. 149-157.

[6] R.L. Leino, P. Wilkinson, J.G. Anderson, Histopathological Changes in the Gills of Pearl Dace, Semotilus margarita, and Fathead Minnows, Pimephales promelas, from Experimentally Acidified Canadian Lakes, Canadian Journal of Fishery and Aquatic Science Supplement., v. 126, no. 44, 1987

HY.8 In your Table 3.3-3: Surface Water Uses on page 3-28, Medicine Lake, Crystal Springs Creek, Little Medicine Lake, Bullseye Lake, Paynes Creek, Blanche Lake, and Schonchin Spring are listed as Fish Habitat, yet there is no mention of the species of fish found in these habitats. If I was to go to 5: Mitigation Monitoring and Reporting Program, again no names of the species of fish found in these habitats are listed, how do you suppose mitigation can be measured without knowing which species of fish are being mitigated for? I urgently request that the list of fish inhabiting these waterbodies to be included and studied in the DEIR. Without it, the DEIR cannot be considered half-way complete, and we have a right to know!!! Endangered Species Act!!!! *(Alice Tseng)*

PH1.2 It's my understanding that when Orr Lake was dammed up, Butte Creek went dry and the native fish population was destroyed. Has anything of this nature been looked into for the—any possibility of anything like that occurring on up out there once this is done? *(Dorris Public Hearing)*

Response—Effects of Water Quality on Fish and Other Aquatic Organisms

As discussed in the Draft EIS/EIR, there are very few surface water bodies located in the project area. There are no perennial streams or lakes located within several miles downslope of the proposed power plant and wellfield. Due to the high permeability of soils in the project area, contaminants that are accidentally released to the surface would percolate into the ground before reaching any surface water. Soils would act as a filter to partially remove contaminants before they reach the shallow groundwater aquifer.

The proposed transmission line would cross anywhere from zero to three small perennial streams (as mapped by the USGS on 7.5-minute topographic quadrangles), depending on which alternative route was chosen. The proposed transmission line route and Alternative 3 (which includes segments A1, B2, and C1) would not cross any perennial or intermittent streams that are marked on USGS maps. Alternative transmission line segment A3 would cross up to two perennial streams:

- An unnamed stream that runs parallel to Forest Road 49; the stream drains a small unnamed lake that is approximately 1 mile north of the Medicine Lake Glass Flow
- An unnamed stream that drains north immediately adjacent to Aspen Crater; segment A3 comes close to the head of this stream and it is not clear if segment A3 would cross or avoid the stream

Alternative transmission line segment C2 would cross an unnamed stream only if Alternative substation 1 (the one farthest east) was chosen. Alternative segment C2 would cross this stream less than 0.25 miles north of where the stream disappears into the soil. It should be noted that none of these three streams qualify for protection within Riparian Reserves under the Northwest Forest Plan. (See response to "Comment—Riparian Reserves" in the Plans and Policies Section for more discussion of Riparian Reserves.)

As stated in Mitigation Measure 4.3.5a on page 4-31 of the Draft EIS/EIR, Calpine would not site transmission line structures or access roads (except road crossings) within 100 feet of intermittent streams. Two of the three streams that might be crossed by the transmission line are too small and too short to support substantial fish populations. Thus, no impacts to fish would occur in those streams. The stream along Forest Road 49 may support fish. However, because a paved road exists adjacent to the stream that has numerous stream crossings, there would be no need to build any additional road crossings in that area. Thus, no impacts to fish within that stream would occur as a result of project construction.

Effects to surface water quality from the proposed project could occur from deposition of airborne emissions. Deposition effects on water quality are discussed on pages 4-34 through 4-38 of the Draft EIS/EIR. Airborne emissions would not cause water quality to exceed any water quality standard in the project area over the life of the project. Thus, effects on water quality would be less than significant. It is also expected that effects on fish health and the prey base for eagles and other fish-eating birds would be less than significant. See also response to "Comment—Effects on Medicine Lake" in the Hydrology Section.

Comment HD.14 suggests including in the EIS/EIR water quality criteria that protect aquatic organisms. The proposed project would not significantly impact aquatic organisms from deposition of emissions from the power plant and wellfield. This conclusion is based on EPA guidelines for water quality monitoring for aquatic organisms. Table 4.3-4 below presents the EPA criteria for aquatic organisms for four constituents: arsenic, boron, mercury, and ammonia. These four constituents were selected because (1) they would be present in the emissions of the proposed power plant in relatively high concentrations, (2) the constituents are biologically active and have the potential to adversely effect aquatic organisms, particularly through bioaccumulation (Webster and Timperley 1995) and (3) the EPA has developed water quality standards for aquatic organisms for these constituents.

The EPA water quality standards for aquatic organisms are quite robust because they have been developed for a wide variety of aquatic organisms, including insects, crustaceans, and fish. The EPA standards are also based on experimental evidence (unlike criteria for human health), so they are a reliable measure of potentially toxic or chronic effects. These values represent the lowest levels of these constituents at which toxic or chronic effects were observed in any of the organisms that were tested.

As seen in Table 4.3-4, the current levels of these constituents in three surface water bodies near the project site (Medicine Lake, Little Medicine Lake, and Bullseye Lake) are well below the criteria at either maximum concentrations (CMC) or chronic concentrations (CCC). Data from the EIS/EIR is also presented which show the estimated levels of arsenic, boron, and mercury in Medicine Lake after the 45-year life of the project. As described in the Draft EIS/EIR on page 4-36, very conservative (and often unrealistic) assumptions were made to generate these values. These estimated concentrations are also well below the EPA water quality criteria for aquatic organisms. Thus, significant effects to aquatic organisms are not expected to occur as a result of emissions and deposition of these emissions from the proposed project.

Comment HY.8 also requests the names of the fish present in various water bodies in the Medicine Lake Highlands. This information is beyond the scope of this EIS/EIR. As stated in the Draft EIS/EIR, there are no special-status fish in the Medicine Lake Highlands that could be affected by the proposed project. Moreover, the data in the table above indicate that the proposed project would not affect the water quality of lakes in which these common fish are found.

Table 4.3-4: EPA Water Quality Criteria for the Protection of Aquatic Life[1]

	EPA Water Quality Criteria		Pre-Project Water Quality[2]			Post-Project Water Quality[3]
Compound	**CMC[4]**	**CCC[4]**	**Medicine Lake**	**Little Medicine Lake**	**Bullseye Lake**	**Medicine Lake**
Arsenic	0.34	0.15	< 0.005	< 0.005	< 0.005	0.00026
Boron	—	0.75[5]	< 0.10	< 0.10	< 0.10	0.00087
Mercury	0.0014	0.00077	< 0.0002	< 0.0002	< 0.0002	0.0001
Ammonia	0.58-33[6]	0.11-2.5[6]	0.13	< 0.050	< 0.050	—

Notes:

1 All values are in mg/l, which is equivalent to ppm

2 SOURCE: Calpine surface water quality monitoring program; Data collected in November, 1997; values at Medicine Lake are averages of three samples taken at a depth of 1 foot. See response to "Comment—Hydrologic Monitoring Plan" in the Hydrology Section for the methodology.

3 Estimated values taken from Fourmile Hill EIS/EIR Table 4.3-3. See Section 4.3.7 in the EIS/EIR for a an explanation of the derivation of these values.

4 SOURCES: EPA 1986, 1992, and 1997. EPA set two criteria for each contaminant: (1) CMC = criteria maximum concentration; CMC is a one hour average, not to be exceeded more than once in three years, and (2) CCC = criteria chronic concentration; CCC is a four day average concentration, not to be exceeded more than once in three years.

5 A limit set mainly to protect crops

6 Ammonia toxicity is dependent on temperature and pH; a range of toxicity values is given; the lower bound is at pH = 9 and 86°F; the upper bound is at pH = 6.5 and 32°F. The pH and temperature for Medicine Lake at the surface = 45°F and pH = 6.9; Little Medicine Lake pH = 6.8; Bullseye Lake pH = 6.9; temperature was not measured at Little Medicine Lake or at Bullseye Lake.

References:

EPA (Environmental Protection Agency. 1997. Water quality standards; establishment of numeric criteria for priority toxic pollutants for the state of California; proposed rule. *Federal Register* **62**:42159-42208.

———. 1992. Revised tables for determining average freshwater ammonia concentrations. Internal memorandum, Office of Water, Washington, DC. July 30.

———. 1986. *Quality Criteria for Water*. Report 440/5-86-001. Washington, DC.

Webster, J. G., and M. H. Timperley. 1995. Biological impacts of geothermal development. Pp. 97-117 *In:* Environmental Aspects of Geothermal Development, Proceedings of the International Geothermal Association Congress, Pisa, Italy, May 18-20, 1995.

WILDLIFE MITIGATION

Comments—Wildlife Mitigation

B.15 In addition, we recommend that the project proponent, in consultation with this office and the California Department of Fish and Game, develop a more complete plan that mitigates for the project's direct and indirect impacts to federally listed species, migratory birds, and Federal species of concern and compensates for project-related loss of habitat. The mitigation plan should be included in a revised draft environmental document.

(Ronald A. Iverson, U.S. Fish and Wildlife Service)

N.25 The DEIS/EIR states that special-status habitat would be lost from construction of project facilities at the wellfield and power plant area, and the clearing of vegetation along the transmission line corridor. The DEIS/EIS further states that for some species the loss of habitat for northern spotted owl, hairy woodpecker and pileated woodpecker would be considered a loss of habitat. Further, the DEIS/EIR states that the proposed project "could" also affect special-status species through noise and human disturbance during construction, which "could" result in abandonment of a territory or reproductive failure.

The DEIS/EIR alleges that based on the proposed mitigation measures (4.8.3a to 4.8.3n) the levels of significance would be less than significant. This seat-of-the pants finding that the levels of significance would be less than significant is misleading and grossly deficient.

Based on the data (Table 4.8-2) included in the DEIS/EIR, the document shows that 1,230 acres will be lost to bird species habitat, 946 acres will be lost to bat species habitat, and 625 acres will be lost to mammal species habitat as a result of the proposed project. And that the total loss is 2,801 acres to bird, bat, and mammal species habitat.

The information contained in the DEIS/EIR regarding the potential impacts to specific special-status species and their habitat is very limited, and in some cases misleading information.

The mitigation measures cited in the DEIS/EIR for specific special-status species and their habitat provides surveys and studies which should have been conducted and included in the DEIS/EIR. The DEIS/EIR is deficient without including the results of the special special-status species surveys and studies.

(Robert J. Baiocci, Fall River Wild Trout Foundation)

AG.89 The EIR/EIS fails to provide an adequate discussion of mitigation measures that would minimize the Project's significant impacts to wildlife. (Cal. Pub. Res. Code §21100(b)(3); 14 CCR § 15126(c); Robertson, 490 U.S. at pp. 352-52.) One flaw is that the EIS/EIR does not discuss specific guidelines for mitigating impacts to sensitive species.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.95 Absent adequate mitigation measures, there is no basis for the lead agency to determine that the Project's impacts on the environment have been mitigated to insignificance.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

HF.19 What guarantees are there that the anticipated significant adverse effects on wildlife and vegetation (4.7 & 4.8) can actually be successfully mitigated to "less than significant," and again, by whose criteria and according to whose values and assumptions are these effects deemed less than significant?

(Daniel T. Spencer)

Response—Wildlife Mitigation

These comments address the adequacy of the mitigation measures to reduce or avoid impacts to special-status wildlife and to their habitat. Twenty-one mitigation measures are proposed in Section 4.8 of the Draft EIS/EIR to avoid or minimize impacts to wildlife. Many of these mitigation measures are designed to reduce potential impacts to specific special-status species; other measures are designed to reduce impacts to habitat that is used by a variety of wildlife (e.g., late-seral Forests). Some of these mitigation measures have been modified in response to comments outlined in this section, and several new mitigation measures have been added. These revisions and additions serve to further reduce effects. Furthermore, many of these mitigation measures contain a requirement for Calpine to develop a specific plan in consultation with USFS. These plans would outline the steps that Calpine would take to reduce environmental impacts even further. Plans that are related to biological issues include:

- Hydrologic Monitoring Plan
- Power Plant Deposition Monitoring Plan

- Reclamation and Revegetation Plan
- Soil Conservation and Erosion Plan
- Weed Control Plan

These plans were developed to verify expected impacts, many of which would be less than significant prior to monitoring. The mitigation measures outlined above, as modified, adequately comply with state and Federal laws by reducing the level of impact below significance. Justification for the determination that impacts to wildlife are reduced below significance is presented in the Draft EIS/EIR and in responses to comments above. The data gathered for this EIS/EIR and the data already available from previous studies were adequate to conduct impact analysis. Furthermore, these data and the impact analysis that they supported were adequate to define mitigation measures to avoid impacts to wildlife or reduce impacts to wildlife to a level below significance.

An extensive Mitigation Monitoring and Reporting Program (MMRP) is described in Section 5 of the Draft EIS/EIR (pages 5-1 through 5-42). As required by NEPA and CEQA, this MMRP would include all of the plans that are proposed as individual mitigation measures (see partial list above). See response to "Comment—General Vegetation Mitigation" in the Vegetation Section for a discussion of the adequacy of the mitigation for potential impacts to vegetation resources.

Table 2 in Appendix C of the Final EIS/EIR: Summary of Methodology of Botanical and Wildlife Studies Referenced in EIS/EIR

Surveyor(s)	Area Surveyed	Date(s) Surveyed	Target Species	Survey Technique(s)	Reference
Dr. R. Gutierrez and Dames & Moore	8,700 acres within Glass Mountain Federal Unit	1992: 18 days btwn May 30 and July 19	Northern spotted owl	stationary call points and repeat visits	Gutierrez and Dames & Moore 1993
BioSystems Analysis, Santa Cruz, CA	Transmission line segments A3, B1, C1 (21,760 acres)	1995: July 1-4, Aug. 25-24, Sept. 8-17,	all potential special status plants	literature search; visual assessment	BioSystems Analysis 1996a
BioSystems Analysis, Santa Cruz, CA	13, 440 acres within previous study site	1995: Oct. 9-12	all potential special status animals	literature search; habitat assessment	BioSystems Analysis 1996a
Galea Wildlife Consulting, Crescent City, CA	Calpine geothermal exploration site: approx. 8,000 acres centered on proposed power plant and wellfield	1994, 1995: spring and summer (number of days unknown)	N. spotted owl, N. goshawk, osprey, bald eagle, Amer. marten, Sierra Nev. red fox, Townsend's big-eared bat, 5 other bat species of special concern	Literature search, habitat suitability assessment, snow tracking	Galea Wildlife Consulting 1995
Peter Figura and Marilyn Renner for Galea Wildlife Consulting	Pipeline corridors and drilling pad sites near Fourmile Hill	1995: July 28-29, Sept. 2-5	all potential special status plants	visual survey	Galea Wildlife Consulting 1995
Galea Wildlife Consulting, Crescent City, CA	Calpine's Mt. Hoffman Assessment Area (approx. 20,500 acres)	1994: June 12-15, 24-26, Aug. 15-17 1995: June 13-15, 25-26, July 19-21, Aug. 16-17, 21-23	Peregrine falcon, N. spotted owl, bald eagle, Amer. marten, Pacific fisher, N. goshawk, great gray owl, Townsend's big-eared bat, Sierra Nev. red fox	stationary call points, call playback, snow tracking, habitat suitability assessment, visual surveys	Galea Wildlife Consulting 1996a

Table C-2: Methodology of Wildlife Studies Within or Near Project Area (continued)

Surveyor(s)	Area Surveyed	Date(s) Surveyed	Target Species	Survey Technique(s)	Reference
Galea Wildlife Consulting, Crescent City, CA	Fourmile Hill Geothermal Project Pad #88-28 and vicinity	1995: April 22, May 3, July 18, 29	American marten	snow tracking, visual surveys for den sites	Galea Wildlife Consulting 1996b
Dr. Phillip Leitner, Orinda, CA	29 12-acre sampling units along all Fourmile Hill Geothermal Development Project transmission line alternatives (= 348 acres)	dates unknown	nine special status bat species	Developed habitat suitability model for diurnal roosts; verified model with field sampling	P. Leitner 1997
Barbara Leitner, Orinda, CA	Entire Fourmile Hill Geothermal Development Project area	1996: July 14-18, Aug. 12-16; 1997: June 2-6, August 15	all potentially occurring species status plants	literature search, visual survey, habitat assessment	B. Leitner 1996, 1997

3.10 Visual Quality

INTRODUCTION

This section provides responses to comments on visual quality issues. The comments and responses are grouped under the following headings:

- General
- Methodology
- General Impacts of Project Facilities
- Impacts from Specific KOPs
- Consistency with VQOs
- Mitigation Measures

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

GENERAL

Comments—Figure Edits

AJ.4 3.) Figure 3.9-1 and -2. The scales are incorrect. *(Larry Hearne, et al., Tionesta Residents)*

AJ.5 4.) Figure 4.9-4. Caption for the bottom view gives wrong location. It should be Route 97, not Schochin Butte. *(Larry Hearne, et al., Tionesta Residents)*

Response—Figure Edits

Comment noted. Figure 3.9-1 on page 3-123 of the Draft EIS/EIR and Figure 3.9-2 on page 3-126 of the Draft EIS/EIR have been corrected to show the appropriate scale. In addition, the caption for the bottom photograph in Figure 4.9-4 on page 4-167 of the Draft EIS/EIR has been corrected.

METHODOLOGY

Comment—VQO Determinations

AD.40 Visual Quality Objectives were determined before any evaluation of the eligibility of cultural properties to the National Register of Historic Places. For eligible properties, criteria such as integrity of location, setting, feeling, and association have to also be considered, not only 'preservation, 'retention,' 'partial retention,' 'modification', etc. *(Floyd J. Buckskin, Pit River Tribe)*

Response—VQO Determinations

Visual Quality Objectives (VQOs) were determined for the Klamath and Modoc National Forests by the USFS as part of the development of the Klamath National Forest Land and Resource Management Plan (LRMP) (USFS 1995) and Modoc National Forest LRMP (USFS 1991), respectively. The eligibility criteria mentioned in comment AD.40 are not part of the VQO analysis, and are therefore not relevant to this analysis. However, these criteria were used in the evaluation of potential effects (including potential visual effects) to sites identified as important to tribal members (see page 4-61 in Section 4.6, Traditional Cultural Values of the Draft EIS/EIR). Table 4.6-1 summarizes probable impacts to the views from 26 traditional cultural sites identified. The criteria cited were considered in the evaluation of the sites for eligibility for listing on the National Register of Historic Places (NRHP). For more information on the evaluation of impacts to traditional cultural values, see

the responses to comments in the Traditional Cultural Values Section of this document.

Comments—VQO Analysis

AG.97 As the analysis of Thomas Reid Associates indicates, the EIS/EIR used an improper methodology for assessing visual impacts. (Ex. B, § 4.9.) This "Key Observation Point" methodology does not provide a sufficient basis for understanding or evaluating the significance of the Project's impacts. (Ibid.)

The general approach of the EIS/EIR's visibility analysis is to list all of the ways in which the Project will significantly impact views, and then to dismiss these impacts as insignificant without any credible basis. These conclusions of insignificance leave the reader baffled, because they are in stark contradiction to the EIS/EIR's own description of the impacts and to common sense.

This section of the EIS/EIR should be completely revised and recirculated for public comment. (Ex. B, § 4.9.) The EIS/EIR should also be revised to analyze measures that will actually mitigate these visual impacts. The BLM has a statutory mandate to place the protection of scenic values on equal footing with other resources. (FLPMA, 43 U.S.C. §§ 1701(a)(8), 1711(a).)

The following are merely examples of the flawed analyses contained in the EIS/EIR's visual quality impact section. As Thomas Reid Associates concluded, "[a]ll project components will conflict with the [Visual Quality Objectives] VQO's." (Ex. B, § 4.9.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.297 The Draft EIS/EIR uses an incorrect, and essentially meaningless methodology to assess visual impacts. The Draft EIS/EIR states that the analysis was conducted in compliance with the USFS Visual Management System (VMS) and updated to reflect the concepts of the USFS Scenery Management System. The Draft EIS/EIR also states that the terminology used in this analysis is consistent with that used in the VMS and SMS. The Draft EIS/EIR goes on to say (P. 4-135) that "this evaluation is based on an assessment of visible project elements from surrounding Key Observation Points (KOPs) in the region."

Page 3-120 states that "the term 'Key Observation Point' is a designator used in the field of visual resource assessment to identify view points of public significance within a given region. This term, however, is not a formal designation that is defined or regulated by Federal or state agencies." These two statements just quoted are contradictory. How can the term (or use of KOPs) be consistent with that used in VMS and SMS if the term is not a formal designation of either of these agencies? Is the KOP methodology one that was invented by the consultant? If so, this should be stated.

In any case, the KOP methodology appears inappropriate for understanding the visual impacts of the project. In the first place, Table 3.9-1 which lists the KOPs, their view characteristics and direction, appears to bear no relationship to the distance of these view points from components of the proposed project. The table does not even list the distance of each of these KOPs from the relevant project components. Table 4.9-1 of the Visual impact section lists whether the project components would be visible or not visible from the 21 KOPs but conveys no real information of the actual visual impact (e.g. the distance from the KOP to the component, how dominant the project component would be in the view).

The analysis should be re-done the other way around — that is, the zone of impact should be defined by the zone of visibility of the project components, not pre-selecting the view points first and evaluating these in relation to the project. The restructured analysis would then show what land uses, including KOPs were located within the visibility zones at increasing distances from the project facilities.

A meaningful visual impact methodology for transmission lines would define a series of visibility zones. For example, the following methodology was used in a prior EIS/EIR on a 500 kv transmission line in southern California.[1] In the closest zone (0-300 feet) transmission line structures will be visible in almost any foreground, and could be higher than nearby trees. The structures and the line itself would be dominant in the viewer's foreground view. From 300 to 800 feet, towers diminish in relative height so that they can be obscured by trees (30 to 40 feet tall). From 800 to 1500 feet, towers are highly noticeable, but only in longer views afforded in open vistas along roads, above scrub or between sparsely spaced trees. From 1500 to 2500 feet, the tower takes on the scale of a passing automobile or pedestrian (if features such as this could be seen). At 2500 feet, the structures may still be visible but would no longer dominate the landscape, being smaller than other objects close by. Beyond 5000 feet (i.e. 1 mile), the visual impact is essentially nil. Even though transmission line structures and roads can sometimes be seen, they are so faint they can not be thought to meaningfully detract even from a pristine landscape. This zone methodology should have been used to delineate project impact.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

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[1] USDA Forest Service and California Public Utilities Commission (1982-1986). *Devers-Valley 500 KV, Serrano-Valley 500 KV and Serrano-Villa Park 220 KV Transmission Line Project EIS/EIR.*

HD.16 The Key Observation Points (KOP) were not discussed with the general public, nor, does it appear was input sought from homeowners at Medicine Lake. *(Amanda Spencer)*

Response—VQO Analysis

The assessment of the potential visual effects of the proposed action was conducted by a third-party consultant with special expertise in performing visual analyses, under the guidance of the USFS (including USFS visual resource specialists). The assessment was conducted in accordance with applicable USFS guidelines for visual resource analyses, and supplemented by the third-party expert's professional judgment and experience. Potential visual effects are evaluated at an equal level of detail as other resource evaluations in the Draft EIS/EIR, and appropriate and effective mitigation measures for visual effects are identified.

The purpose of using Key Observation Points (KOPs) was to provide decision-makers and the public with a reasonably thorough discussion of the potential aesthetic impacts of the proposed project. KOPs were used to supplement the analysis in compliance with USFS VQOs. KOPs are representative sites, sensitive routes of travel, special places, and other areas where levels of sensitivity to visual resources could be expected to be high. The use of KOPs allows for the identification of "on-the-ground impacts" of the project on views from sensitive vantage points. The KOP analysis, in conjunction with the VQO consistency analysis, provides a full understanding of the visual impacts of the project.

VQOs contained in the Klamath and Modoc Forest LRMPs are intended to be achieved by views from inventoried points and routes of public visual sensitivity. VQO achievement from other non-inventoried locations is not required by the Forests (Mosier 1998). Furthermore, although the term "KOP" is not a formal USFS designation, the use of KOPs is not contradictory to either the USFS Visual Management System (VMS), VMS guidelines, or the Scenery Management System (SMS). The KOPs that were used included USFS-inventoried points of public visual sensitivity.

As discussed on page 3-120 of the Draft EIS/EIR, KOPs were selected on the basis of:

- Discussions with representative of the National Park Service (NPS), Lava Beds National Monument, and the Modoc and Klamath National Forests
- Preliminary environmental work performed in the Fourmile Hill Exploration EA (BLM et. al. 1995)
- Travel routes of public visual sensitivity (Sensitivity Levels I and II) inventoried by the Modoc and Klamath National Forests
- The public scoping process conducted for this project
- Consultation with local American Indian tribes

During public scoping for the project, input on KOPs was sought from the general public, including homeowners at Medicine Lake.

The Draft EIS/EIR does identify the relationship of the KOPs to the proposed project. Figure 3.9-1 on page 3-123 of the Draft EIS/EIR identifies the KOPs locations, and their distance to various project features. Table 3.9-1 describes the type of views (foreground, middleground, and background) available from each KOP. These

relationships to the proposed project features from KOP locations are described in the impact analysis in Section 4.9, Visual Quality of the Draft EIS/EIR. This impact analysis includes information on how dominant views of project components would be from each KOP.

The alternative methodology for visual analysis identified in comment AG.297 is noted. However, the methodology used in the Draft EIS/EIR is more appropriate than the methodology suggested in the comment. The suggested methodology was used for a transmission line project in the southern California and Arizona deserts where there are predominantly long-range views. The Medicine Lake Highlands are a forested area where the suggested methodology would not be effective. In addition, visibility zones (as well as sensitivity levels, and the variety of the characteristic landscape) are considered and evaluated by the USFS as part of establishing the VQO designations that provide a baseline set of criteria for evaluating management/development proposals. The KOP and VQO consistency analyses were the most appropriate methodologies to use for the visual analyses of the proposed project, given the setting and type of potential impacts.

Comment—Visual Simulation from Tionesta

AJ.9 2.) Computer simulations of the visual impact of the transmission line were made for several KOPs (key observation points). A Tionesta point was not selected, in spite of the fact that visual impact on Tionesta was known to be of concern and in spite of the fact that the visual impact at Tionesta is on the foreground (closeup) view, not the middleground or background view as for other locations simulated.

(Larry Hearne, et al., Tionesta Residents)

Response—Visual Simulation from Tionesta

As noted in comment AJ.9, visual simulations were prepared for certain KOPs. These KOPs were selected by the USFS to provide a representative sample of potential changes in project area views due to project facilities. The KOPs from which simulations were made are those that had the greatest potential for the general public to have open views of project facilities. Neither NEPA nor CEQA require the preparation of visual simulations for a proposed project. Although visual simulations were not prepared for all KOPs, potential impacts to views from all KOPs (including KOP 14 at Tionesta) were addressed in the text of Section 4.9, Visual Quality of the Draft EIS/EIR. Effects to views from the KOP 14 area are addressed under Impact 4.9.8 on pages 4-165 to 4-169 of the Draft EIS/EIR, and a visual simulation from KOP 13 (in the vicinity of Tionesta) is provided on page 4-167 of the Draft EIS/EIR. In addition, as shown in Table 3.9-1, existing views from KOP 14 are limited to the foreground by Forest cover. Views of the transmission line from Tionesta would therefore be limited and mitigated to a less-than-significant level.

GENERAL IMPACTS OF PROJECT FACILITIES

Comments—Visual Impacts of Power Plant and Wellfield

J.14 Finally, plant enthusiasts visiting the Medicine Lake Highlands find that the views from Glass Mountain, Little Mt. Hoffman, and Mt. Hoffman are breathtaking, and this is primarily because these views are unobstructed by powerlines, power plants, and other aspects of industrial development. Implementation of this proposed geothermal project will result in the irreplaceable loss of a spiritually uplifting experience for many lovers of nature who come to this area because of its pristine beauty. There is no solution which can possibly mitigate this fundamental problem with the proposal.

(Vivian Parker, California Native Plant Society)

DU.3 ...pipes will snake through the forest over bare ground, *(Charles B. Jones)*

IC.2 You cannot tell me there is going to be safely controlled atmosphere up there and scenic view free of the plant. *(Sharon Villarruel)*

PH4.18 Concerned about visual effects. *(Mount Shasta Public Hearing)*

Response—Visual Impacts of Power Plant and Wellfield

Potential views of wellfield facilities (including pipelines) from wellfield-vicinity vantage points are discussed under Impacts 4.9.2 and 4.9.3 on pages 4-144 to 4-149 of the Draft EIS/EIR. These visual effects would be considered adverse but not significant prior to mitigation, and mitigation identified to further reduce these less-than-significant impacts.

As discussed in the Draft EIS/EIR, a "line-of-sight analysis" was conducted from viewpoints throughout the study area. Because of topography and Forest cover, the power plant facility will not be readily seen from most locations, including KOPs at Little Mt. Hoffman, and in the vicinity of Glass Mountain and Mt. Hoffman. Although the transmission line and steam plumes would likely be visible from these viewpoints, this visual effect would be less than significant after mitigation. A summary of project components that would be visible from the KOPs for the project is presented in Table 4.9-1 on pages 4-142 and 4-143 of the Draft EIS/EIR. For a discussion of the project's effects from air emissions to the atmosphere, see the response to comments in the Air Quality Section of this document.

Comments—Visual Impacts from Lighting at Night

H.25 Medicine Lake is an outstanding location for stargazing due to the clean air and lack of nearby significant light sources. If adequately mitigated, it is not likely that the Fourmile Hill Project will have a significant adverse impact on existing conditions. Every effort should be made to limit light emissions into the night sky, particularly from the powerplant site and well drilling activities. *(Bill Dart, American Motorcyclist Association)*

H.27 One area that needs more mitigation involves transmission line construction within the Medicine Lake Caldera, should segments A1, A2, or B2 be constructed. The document allows construction activity from 7 AM to 10 PM. This should be changed to no later than 7 PM, which would eliminate the need for any lighting throughout the construction season. *(Bill Dart, American Motorcyclist Association)*

Y.36 The analysis ignores the fact that the area presently has virtually no visual impacts, and that the night sky is totally dark except for the moon, planets and stars. The effects of visual impacts must be measured against a standard of pristine quality, not against urban standards. Places where a total night sky can still be experienced are becoming very rare in our world. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AD.33 Areas in the west portion of the Medicine Lake Highlands would have a visible glow of indirect light, and in some instances visible direct light from the Fourmile Hill power plant and towers. Direct visible light would be seen from such areas as Redcap Mountain, Pumice Stone Mountain, Little Mount Hoffman and Medicine Mountain due to the elevation and line of sight of these peaks to the Fourmile Hill Project.

Fourmile Hill, Lookout Butte and Badger Peak would have the most significant visual effects during construction and operation periods both during daytime and nighttime visibility periods. *(Floyd J. Buckskin, Pit River Tribe)*

AD.35 During winter periods, night visibility will be an obvious effect from refracted light as far away as the Fall River Valley. An example of this type of refracted lighting is visible from Mount Shasta Ski Park at present, and is seen as an orange glow on overcast and cloudy nights. *(Floyd J. Buckskin, Pit River Tribe)*

AG.99 The EIS/EIR also mischaracterizes visual impacts caused by illumination of Project components. (Ex. B, § 4.9.) The EIS/EIR fails to analyze the visual impacts associated with the cooling tower, turbine building, or the "brilliant switchyard lighting." (Ibid.) As to the drill rig mast lighting, which will entail 24-hour illumination of a 145-foot tall tower, Thomas Reid Associates concluded that there is simply no way the proposed mitigation measure (4.9.2c) will mitigate impacts to insignificance. (Ibid.) The forest canopy is approximately 40 feet tall. Thus, this lighting will extend more than 100 feet above the canopy. The glow

from these lights will be seen for miles. This certainly is not the "pristine night sky" expected by the Lava Beds visitors. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.301 Lighting. Page 4-139 (5th paragraph), states that "the turbine building would extend approximately 45 feet above the forest canopy". There is no mention here how high the cooling tower would be. According to another section of the EIS/EIR, the cooling tower would be 70 feet tall (p. 2-28). The turbine building would be 92 feet tall (p. 4-148). Thus, the cooling tower should also extend above the forest canopy. The EIS/EIR did not discuss impact of cooling tower or turbine building lights our what view zones would be impacted. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.302 The Impact of Switchyard Lighting is not Analyzed. The last sentence of Page 4-139, 5th paragraph states that "brilliant switchyard lighting" will be "positioned at the upper levels of the forest canopy" How high above the canopy will this lighting extend? There is no mention of the types of "brilliant switchyard lighting", nor how brilliant these lights will be. There is no discussion of the zone of impact from this switchyard lighting. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.303 The EIS/EIR Mis-states the Impact of Drill Rig Mast Lighting. The Draft EIS/EIR (p. 4-145) discusses the visibility of drill mast lighting. Page 4-139 (4th paragraph), states that Drill Rig Mast Lighting "would be along the full length of drill rig masts...140- to 145-feet tall" and "operated on a 24-hour basis when in use." Page 4-145 (4th paragraph, 3rd line), states that "this impact would not be significant as the visibility of well field operations would be consistent with the VQO of Modification." How can drill rig masts, which are up to 145 feet tall and lighted on a 24-hour basis, be consistent with the VQO of Modification, especially when this VQO is defined as "activities of vegetative and landform modification must borrow from the naturally established form, line, color and texture so completely and at such a scale that their visual characteristics are those of natural occurrences within the surrounding area or character type". (p.3-125) A 145-foot tall drill rig mast cannot be considered consistent with the surrounding area or character type when the surrounding area or character is undisturbed forest canopy approximately 40 feet tall.

The Draft EIS/EIR concludes erroneously that "While the duration of views of this lighting would be short, lighting would likely draw visual attention as it would create a strong visual contrast with nighttime conditions in the immediate surrounding area". This statement is exemplary of the overall failure of the Draft EIS/EIR to identify: (1) project characteristics producing impact, (2) zones of impact, and (3) receptors within the zones. The Draft EIS/EIR needs to state the number, type and intensity of the lights to be used on the masts, and how many drill rigs would be in use simultaneously. The EIS/EIR preparer needs to do a field test or simulation of the actual night lighting to determine the zone of impact. How far from the project site is the "immediate surrounding area"? The lights from the drill rigs, well fields and power plant facility lighting would still be significant in an otherwise uninhabited area after implementation of Mitigation Measure 4.9.2c. The glow from these lights could be seen for miles, and would be reflected into the sky on cloudy nights (and on some dark cloudy days). To properly assess impact, the Draft EIS/EIR needs to identify the receptors in the zones who would get either direct glare or an enhanced sky glow from the project lighting.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

DU.5 ...and lights from noisy plants will brighten the night sky and so dim the starlight which is so spectacular up here. *(Charles B. Jones)*

HT.19 The permanent new source of night lighting will create a strong visual contrast with night time conditions in the area and have a significant visual impact. *(Louise Thompson)*

IQ.16 Reflected light from the power plant will become a large, dispersed glow in the moisture laden area of the steam plume. This glow will be visible for many miles away as a diffuse but easily identifiable source on the mountain. Again such phenomena is common around other cooling towers such as those in the Burney area and at the Wheelabrator Facility in Anderson. *(Phil Woodward)*

PH3.85 I am concerned right now, Medicine Lake is pitch black at night. There isn't anything to be seen except the stars and such. You are going to have this plant lit up 24 hours a day. And, you know, the light is going to travel. The noise is going to travel up there. It is going to be like this big glow over there. It is going to look like an industrial park at night, you know. It is not going to be a natural area anymore. It will look like an industrial park with a lake next to it. *(Yreka Public Hearing)*

PH3.86 I wonder how many watts of outside lighting you will have at the plant once it is operating. *(Yreka Public Hearing)*

PH3.87 So in your little pictures you drew us where the power line was, you didn't do one for nighttime to show us. *(Yreka Public Hearing)*

PH5.20 The permanent new source of night lighting will create a strong visual contrast with nighttime conditions in the area and have a significant visual impact. *(Medicine Lake Public Hearing)*

Response—Visual Impacts from Lighting at Night

The existing lack of nighttime light sources in the Medicine Lake Highlands is acknowledged. In response to this nighttime sensitivity and public concerns about the project, the effect of nighttime project lighting was evaluated in the Draft EIS/EIR. The night-lighting evaluation took into account the current nighttime conditions in the area. This evaluation also included all potential project-related light sources, including drill rig, cooling tower, turbine building, and switchyard lighting. See the responses to comments in the Noise Section for a discussion of noise impacts and analysis of the proposed project.

The visual effect of lighting at the wellfield and power plant area is described and evaluated under Impact 4.9.2 on pages 4-144 to 4-147 of the Draft EIS/EIR. Mitigation Measure 4.9.2c, identified on page 4-146 of the Draft EIS/EIR, ensures that visual effects from night lighting would be less than significant. This measure identifies proven techniques that would be used to reduce the visual effect of wellfield and power plant lighting, such as shrouding of lights, directing lights downward, and using timers and motion activators to turn lights on only when needed.

The potential night-lighting visual effect is also discussed in Section 4.9, Visual Quality, for specific KOPs from which this effect could be visible. As discussed in the Draft EIS/EIR, implementation of Mitigation Measure 4.9.2c would ensure that night-lighting visual effects from KOPs and vantage points throughout the region would be less than significant. The specific lighting-control techniques outlined in this mitigation measure would ensure that night lighting does not cause a reflected glow that would have a significant effect on visual quality. The exact wattage of outdoor lighting would be determined through the exterior Lighting Design and Management Plan discussed in this measure.

Based on comment H.27, the following mitigation measure has been added to the Final EIS/EIR:

> "4.9.5c Within the designated Medicine Lake Recreation Area, construction activities will be limited from sunrise to sunset in order to limit the need for lighting during the construction phase of the project."

In response to comment Y.36, the discussion of significance criteria on page 4-135 of the Draft EIS/EIR identifies the standard of "creat[ing] significant new sources of light and glare in the vicinity." Standards used to determine impacts of the proposed project include those for rural areas.

In response to comment AD.33, direct lighting would not be expected to be visible from any KOPs, including Little Mt. Hoffman. However, direct light from the project may be visible at the other locations mentioned in the comment. The source of this lighting would be the exterior lights associated with stair access to the cooling towers, which would project above the Forest canopy. In order to address the concern in comment AD. 33, Mitigation Measure 4.9.2c (bulleted items 1, 4 and 6) on page 4-146 of the Draft EIS/EIR has been revised as follows:

> "• Use lights that may be within view of Primary Forest Route 49 <u>and other identified sensitive viewpoints</u> only when necessary, such as for emergency purposes or when conducting routine night-time maintenance activities.

- Area lighting, cooling tower exterior lighting, and security lighting should be controlled by the use of timed switches and/or motion-detector activation control so lights are only on when necessary.
- All light fixtures should include shrouds (either fixed or adjustable), other shielding, or be directed in such a way as to block direct light from Forest Road 49, from identified sites located in the west portion of the Medicine Lake Highlands that are significant to traditional cultural values, and from other identified sensitive viewpoints."

Lighting of the cooling tower and turbine building are specifically discussed on page 4-139 of the Draft EIS/EIR. As discussed, the turbine building would extend approximately 45 feet above the Forest canopy, but would not require exterior lighting except at the lower levels for ground access. The cooling tower, which would include exterior lights for stairway access to the facility, would project above the Forest canopy. As discussed on page 4-145 of the Draft EIS/EIR, the power plant facility and perimeter lighting (in conjunction with drill rig mast lighting) would be considered a significant visual impact prior to mitigation. This impact would be reduced to less-than-significant levels with implementation of Mitigation Measure 4.9.2c.

Switchyard lighting is also expressly analyzed in the Draft EIS/EIR. As discussed on page 4-139, perimeter and area lights and switchyard lighting would be positioned at the upper levels of the Forest canopy where branching density and associated screening potential are reduced. This lighting is included in the analysis of wellfield and power plant lighting on pages 4-144 to 4-147 of the Draft EIS/EIR. The quote of "brilliant switchyard lighting" mentioned in comment AG.302 is taken out of context. The quoted sentence of the Draft EIS/EIR merely explains that the switchyard lighting would be brighter than perimeter and area lights. In addition, these lights would not extend above the Forest canopy. For the Draft EIS/EIR evaluation, a worst-case assumption was made about the types of lighting that might be used. Mitigation Measure 4.9.2c provides guidance for selecting and installing lighting to ensure that no significant visual effects occur from this lighting.

In response to comment AG.303, drill rig mast lighting would be a temporary visual effect that would only occur during initial and infill drilling. As discussed on pages 4-145 and 4-148 of the Draft EIS/EIR, drill rig mast lighting would be a short-term adverse visual impact that would not result in long-term inconsistency with VQOs for the wellfield area. This lighting would therefore not be considered a significant impact. It should also be noted the VQO designation for modification (which occurs at all of the wellpads except production pad P-1, located adjacent to the proposed power plant) allows for activities that visually dominate the original characteristic landscape (see page D-3 of the Draft EIS/EIR). This designation of modification is the most permissive of landscape alterations of the four USFS VQO designations in the project area. It is "permissive" because it was found to not be visible from USFS Inventoried Sensitive viewpoints (Mosier, 1998).

The alternative-lighting assessment methodology suggested in comment AG.303 is noted. However, the methodology used for assessing night-lighting effects in the Draft EIS/EIR provides a fair and representative projection of potential visual effects due to night lighting.

Comments—Visual Impacts of Steam Plumes

N.18 "The EIS/EIR states from the cooling towers will be seen as a cloud. This may be true from several hundred miles away; however, for anywhere within 50 miles, it will be identified as what it is, an industrial discharge in the middle of a forest environment. On clear calm days, common in the fall and spring months, the steam plumes will be visible for may miles. This visibility will be enhanced due to the slow dispersion of the plumes under such conditions, resulting in plumes over 500 feet high and visible for fifty miles or more." *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

Y.34 The DEIS/EIR minimizes the impacts of industrial discharges that would likely result in plumes over 500 feet high and visible for 50 miles or more, lit at night by all-night lighting. Figures given do not reflect that discharges would be produced 24 hours a day and would accumulate and spread out.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AD.39 The Pit River Tribe was never consulted during the steam venting simulation for the Fourmile Hill project, to determine their visual effects to traditional cultural properties important to the Tribe. Neither was the Tribe consulted about visual impacts resulting from the various transmission line alternatives.
(Floyd J. Buckskin, Pit River Tribe)

AG.98 One example of the EIS/EIR's flawed analysis approach is its treatment of steam plumes from the cooling towers and well venting. The EIS/EIR finds that well venting plumes and cooling tower plumes would be visible from several Forest roads including Route 49, which is a scenic byway (pp. 4-144, 4-148, 4-149), from Medicine Lake (p. 4-155), and from Little Mount Hoffman (p. 4-152).

The EIS/EIR concludes that the cooling tower steam plumes will not result in long-term inconsistencies with the power plant's "Retention" Visual Quality Objectives ("VQOs") because they may not always be visible, may quickly disperse under certain weather conditions, and Forest visitors may not be able to distinguish them from clouds or other features (?) in the sky. (EIS/EIR, p. 4-138.) This conclusion is simply not believable, and is not supported by factual data. (Ex. B, § 4.9.)

The cooling tower plumes will rise from a stack protruding approximately 23 feet above the forest canopy. In summer, the plumes will rise 110 feet above the cooling tower and reach 375 feet in length. In winter, the plumes will rise 250 above the tower, and reach 930 feet in length. (EIS/EIR, p. 4-139.) The EIS/EIR also acknowledges that these plumes may be visible year-round. (EIS/EIR, p. 4-139.) These plumes will be clearly visible during the nighttime, when viewsheds are particularly sensitive, even in the summer due to the low nighttime temperatures in the area. (Ex. B, § 4.9.) The plumes would be such a dominant visual feature that their visual impacts would be unmitigable. (Ibid.)

According to a representative of the National Park Service, the geothermal plant "has the potential to negatively impact two known contributors to [Lava Beds National Monument] park visitor's experience-natural quiet and pristine night sky." (Ex. I, Scoping Comments of George Turnbull, Superintendent, NPS (July 12, 1996) (emphasis added).) The Lava Beds Monument receives 8,000 visitors per month during the summer. Given the current annual growth rate of 3-5% per year, the number of visitors could more than triple over the Project's 50-year life. (EIS/EIR, p. 3-162.)

Dr. Fox suggests mitigation measures that could reduce or eliminate the cooling tower plumes. (Ex. A, Comment 7.b.) These are not, however, the mitigation measures recommended in the EIS/EIR. These mitigation measures should be incorporated in a revised EIS/EIR as conditions of project approval. Otherwise, there is no basis to support the EIS/EIR's conclusion that these steam plumes will not cause significant environmental impacts to Lava Beds users, residents and other Forest visitors.

In the absence of more information, there is no basis for concluding that the proposed measures can or will reduce the potentially significant impacts to visual quality.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

BQ.17 Steam Plume Assumptions (page 4-138): "As a result of periodic presence and ephemeral nature of steam plumes, the visual analysis assumes that the visibility of steam plumes ... could not result in potential long-term inconsistencies with USFS VQO's. Additionally, the fact that many forest visitors and residents may not readily distinguish steam plumes from other clouds or features in the sky further supports this assumption." We cannot understand how a steam plume that will extend 250 feet above a 70 foot high cooling tower will not have an impact on the VQO, particularly from Medicine Lake KOP's. The draft EIS/EIR on page 4-139 states that "cooling tower steam plumes could be visible year round." In addition well venting steam plumes will be visible for up to six weeks and reach a height of 285 feet because of well flow testing (page 4-138). We believe that any visitor to Medicine Lake would find this visually offensive and would not confuse a steam plume with a cloud. The VQO for cabin residences and campground users,

at Medicine Lake, would definitely be impacted because of the constant presence of these plumes. *(S. Peder and Suzanna S. Cuneo)*

DU.2 ...clear air will be clouded with steam plumes from blocky cooling towers, *(Charles B. Jones)*

HT.17 Lighting will be along the full length of drill rig masts, 140 to 145 feet tall, operated on a 24 hour basis. Steam plumes will be more visible on cold days as they are related to ambient temperature. Dry days have high evaporation rates. Cold day plumes are more dense and this more visible. During the 1st 2 Years of construction, well venting will occur for 2 plant operation extending from 110' in height & 375' in length, visible year round. In winter 250' high, 930' long. *(Louise Thompson)*

IQ.11 The EIS/EIR states steam from the cooling towers will be seen as a cloud. This may be true from several hundred miles away; however, for anywhere within 50 miles, it will be identified as what it is, an industrial discharge in the middle of a forest environment. On clear calm days, common in the fall and spring months, the steam plumes will be visible for many miles. This visibility will be enhanced due to the slow dispersion of the plumes under such conditions, resulting in plumes over 500 feet high and visible for fifty miles or more. *(Phil Woodward)*

PH3.69 Going to be small, though? How big is it going to be in the winter? Going to look like up in Klamath Falls and settles down on the whole area, looks like hell. *(Yreka Public Hearing)*

PH3.74 You were saying you thought there were 15 leases given out. I happen to know you came to the homeowners meetings, told us 19 leases were given. I happened to drive over there to the first one that was drilled. I have pictures of it, pictures of all of this stuff. And that first well, there is a cloud visible from about eight miles away. It wasn't anything like your little—cute, little thing you have on your picture. If you want a correct picture, I can send you a picture of that immense cloud that goes up from that well that was being drilled. I think when you put these things out, you ought to be accurate about it. *(Yreka Public Hearing)*

PH5.18 Visual quality, section 4.9. "Lighting will be along the full length of the drill rig masts, 140 to 145 feet high, operated on a 24-hour basis. "Steam plumes will be more visible on cold days, as they were related to ambient temperature. Dry days have high evaporation rates; cold day plumes are more dense and thus more visible. "During the first two years of construction, well venting will occur for two to six weeks; plumes range between 40 to 285 feet. Cooling tower plumes will occur during plant operation, extending from 110 feet in height to 375 feet in length, visible year-round; in winter, 250 feet high, 930 feet long. *(Medicine Lake Public Hearing)*

PH5.45 You haven't proven to me I'm not going to sit here and see this thing in the winter or at any other time. *(Medicine Lake Public Hearing)*

Response—Visual Impacts of Steam Plumes

The assumed average winter and summer plume sizes were based on determinations made for the Newberry Geothermal Pilot Project. This project is located near the Newberry National Volcanic Monument in Oregon. The setting for this geothermal project is comparable to the Medicine Lake Highlands. No steam-venting simulation for the project was conducted. All potentially-affected American Indian tribes have been consulted regarding potential visual effects of project operations, as well as the transmission line alternatives (see the responses to comments in the Traditional Cultural Values Section of this document, the summary of tribal consultations (MHA 1998), and the *Medicine Lake Highland and Timber Mountain Ethnographic Report, For The Fourmile Hill Geothermal Development Project, Siskiyou and Modoc Counties, California* (Theodoratus, et. al. 1998)).

The Draft EIS/EIR recognizes that these average steam plumes may be seen in the background of views over great distances such as from Timber Mountain Lookout (KOP #15), which is more than 17 miles away from the power plant site. The Draft EIS/EIR states that cooling tower steam plumes could be visible year round, depending on atmospheric conditions. The commentor is correct in assuming that when the steam plume is higher, it could be seen from more locations and over greater distances. It should be recognized that the plume would represent an ever-diminishing element of the background view the further one moves away

from the Highlands. There will also be periods when the cooling tower plume is not visible, such as dry, warm days.

It is acknowledged that some Forest visitors and local residents who see the steam plumes may consider the project to be "an industrial discharge" into a Forest environment where the principal use is perceived as open space and recreation. These individuals therefore may feel that the steam plumes are an unavoidable adverse effect. This is recognized on pages 4-193 and 4-333 in the Draft EIS/EIR. Steam plumes may also be perceived as a visual reminder that the National Forest is managed for a variety of purposes that include harvesting natural resources for human use. In that sense, recognizing the presence of the geothermal project, as evidenced by steam plumes, would be akin to being reminded that timber-harvest activities also take place in the Forest, as evidenced by the visible contrast of recent timber-harvest areas readily seen from Primary Forest Route 49.

However the steam plumes are interpreted, they would appear as only one thing: similar to a cloud. The plume would be white and billowy when it is visible. Depending on atmospheric conditions, location of the observer, and other factors, the plume may be readily evident to an observer. At other times, the plume would be indistinguishable from clouds in the sky. Either way, the mere presence of this plume would not be a significant effect of the project on visual resources. As stated earlier, the cooling tower would not be visible from most vantage points, due to the location of the plant between Fourmile Hill and Grouse Hill (neither of which are typical public view points).

In response to comment AG.98, as stated on page 3-125 of the Draft EIS/EIR, the designation of Primary Forest Route 49 as a Scenic Byway does not include with it any specific regulatory restrictions. Use of the term "other features" on page 4-138 of the Draft EIS/EIR is intended to include other atmospheric features such as fog emanating from the lake, regional fog and low cloud cover, rain squalls and storms, and snow storms. To reflect this information, the last sentence of the sixth paragraph on page 4-138, of the Draft EIS/EIR has been revised as follows:

> "~~Additionally, the fact that m~~Many Forest visitors and residents may not readily distinguish steam plumes from ~~other~~ clouds or other atmospheric features ~~in the sky further supports this assumption~~ that may be experienced in the Medicine Lake area. These include clouds, fog emanating from the lake, regional fog and low cloud cover, rain squalls and storms, and snow storms."

The visibility, contrast, scale, and duration of steam plumes were evaluated in the Draft EIS/EIR both relative to USFS VQOs and all KOPs. As seen from Medicine Lake, which also has a VQO designation of Retention, the Draft EIS/EIR states that the presence of the proposed transmission line in combination with the visibility of the steam plumes would result in a significant unavoidable impact (see page 4-162 of the Draft EIS/EIR). This unavoidable impact is due almost exclusively to the presence of the transmission line near Medicine Lake. As discussed on pages 4-178 to 4-179 of the Draft EIS/EIR, implementation of an alternative transmission line route that would not pass by Medicine Lake (i.e., Alternative 5 or 6) would

eliminate this significant unavoidable effect from Medicine Lake KOPs, even though the steam plume would still be intermittently visible. Alternative 6 has been identified in this Final EIS/EIR as the lead agencies' preferred alternative; implementation of Alternative 6 would avoid the significant unavoidable visual impact of transmission line segment A1 at Medicine Lake.

The Draft EIS/EIR stated that, in accordance with the NPS visual resource policies, if any visual intrusion related to the proposed project would be perceived by visitors in the Lava Beds National Monument's two wilderness areas, the quality of the wilderness would be considered to be adversely affected (see last paragraph on page 4-135 of the Draft EIS/EIR). As discussed on page 4-169 through 4-179 and shown in Figure 4.9-5 of the Draft EIS/EIR, the project would not significantly affect views from the Lava Beds National Monument. The KOPs at the Lava Beds National Monument are located about 10 miles from the proposed power plant and wellfield. The maximum estimated plume (250 feet high by 930 feet long) would be extremely small at this distance. While these effects may be adverse, they would not be considered significant. It should also be noted that no comment letter was received about the Draft EIS/EIR from the National Park Service.

Based on knowledge of steam plume visibility, there is sufficient information to conclude that the steam plumes would not (by themselves) represent a significant effect, and therefore no mitigation is required. Measures identified by the comment to reduce steam plume size (see the response to "Comments—Cooling Tower Mitigation" in the Air Quality Section) have been reviewed by the USFS, third-party consultant, and project applicant, and have been found to be either inapplicable or infeasible.

Regarding the discrepancy between the number of leases issued and the number stated in previous meetings, some of the leases had been relinquished since the issue date. Some energy companies originally interested in development of the leases decided not to pursue it and have relinquished them. These leases have never been re-issued.

Comments—Visual Impact of Transmission Line Segment A1

H.6 Al is the most offensive, since it is visible from the beach, the entire lake, the residences on the southeast corner of the lake, the residences on Little Medicine Lake, most of the campgrounds, roads 49, 97, 43N47, 43N48, 44N50, 43N99, & 43N21, Schonchin Springs, Little Mt. Hoffman Lookout, The old ski hill, the hiking trail to the Medicine Lake Lava Flow, and Little Medicine Lake, Arnica Sink, Glass Mountain, and all surrounding peaks or high points. Apparently Al was selected primarily due to the tie-into the Telephone Flat project, but this is not made clear in the document. Telephone Flat could be serviced without the Al segment though, using segment A2. In any case, segment Al is absolutely unmitigable and accordingly unacceptable. *(Bill Dart, American Motorcyclist Association)*

GP.2 The visual effects of the transmission lines on Medicine Lake and the surrounding countryside are appalling, brutalizing the landscape viewshed for miles. *(Fred L. Rinne)*

HD. 18 Additionally, the EIR/EIS states that segment Al is in retention, partial retention, or modification VQO areas; however, Figure 3.9-2 indicates this segment intersects a preservation zone. *(Amanda Spencer)*

Response—Visual Impact of Transmission Line Segment A1

The opinions regarding the impacts of transmission lines in the Medicine Lake area and acceptability of segment A1 are noted. As discussed in the Draft EIS/EIR, the use of segment A1 for the proposed action would result in a significant unavoidable visual effect. However, implementation of Alternative 5 or 6 (which both use

segment A3) would not involve development of segment A1, and would avoid significant visual impacts to the Medicine Lake area, including the specific location mentioned in comment H.6. Alternative 6 has been identified in this Final EIS/EIR as the lead agencies' preferred alternative.

The Telephone Flat project is not linked to the Fourmile Hill Geothermal Development Project, and is undergoing a separate environmental review process. Transmission line segments were chosen based on many factors. These factors primarily included environmental issues, input from the lead and responsible agencies, and community concerns raised during public scoping meetings. See Section 2.1, of the Draft EIS/EIR for a discussion of the alternatives development process.

In response to comment HD.18, Figure 3.9-2 on page 3-126 of the Draft EIS/EIR shows that segment A1 passes through Retention, Partial Retention, and Modification VQO designations. The commentor may have misinterpreted the symbol identifying Forest Road 49 as a sensitive travel route as being a Preservation VQO area. As shown in the legend in Figure 3.9-2, this symbol identifies Forest Road 49 as a Sensitivity Level I Travel Route. Segment A1 does not intersect any Preservation VQO areas.

Comment—Visual Impact of Transmission Line Segment A2

H.7 Segment A2 is also unacceptable even though it will not be visible from many of the previously mentioned sites. The proposed alignment crosses directly over the only surface geothermal feature in the area, the Hot Spot. This is a major destination for snowmobilers in the winter, and is the destination of many hikers as well. It is likely to hold significance for Native Americans. This segment would call for removal of a significant amount of Red Fir forest, which is not wide-spread in the area. This Red Fir habitat is favored by winter fur bearers generally and should be protected. Without the Telephone Flat Project, there is no need to use A2 or A1, as A3 would serve the same purpose, be similar in distance, and has less overall negative impacts.

(Bill Dart, American Motorcyclist Association)

Response—Visual Impact of Transmission Line Segment A2

The opinion regarding the acceptability of segment A2 is noted. Segment A2 would not pass directly over the Hot Spot, and would not affect this feature (see the responses to comments in the Geothermal Resources Section). Also, see the responses to comments in the Land Use and Recreation, Traditional Cultural Values, Vegetation, and Wildlife Sections of this document. As discussed in response to "Comments—Visual Impact of Transmission Line Segment A1," Alternative 6 (which uses segment A3) has been identified as the lead agencies' preferred alternative.

Comment—Visual Impact of Transmission Line Segment B2

H.8 Segment B-2 is also unacceptable due to visual impacts, even though it is not visible from many of the previously mentioned sites. This alignment would cross 43N53 and the road circling Lyons peak and Red Shale Butte. Lyons Peak is a popular vista point, whose viewshed would be dominated and degraded by segment B2. B2 is also unnecessary without the Telephone Flat Project.

(Bill Dart, American Motorcyclist Association)

Response—Visual Impact of Transmission Line Segment B2

Segment B2 would be used by Alternatives 3 and 4. The opinion regarding the acceptability of segment B2 is noted. Segment B2 is not part of the proposed project (Alternative 1) or the lead agencies' preferred alternative (Alternative 6).

IMPACTS FROM SPECIFIC KOPS

Comments—Effects on Views from KOPs 1-5 (Medicine Lake)

BQ.16 The draft EIS/EIR has an excellent description of the Medicine Lake Caldera, page 3-124. "Medicine Lake is located at the visual and topographic center of the Caldera. There are no telephone or electricity service lines serving the basin. Combined, these characteristic create a strong sense of place and remoteness to the lake... With the exceptions of a few private cabins and the public boat launch that visually encroach on the lake and the shoreline, there is an overall sense of intactness to the lake's character." We contend this project does have a significant impact under CEQA and USFS visual assessment practices. In the draft EIR/EIS there are assessments made of the project's visual characteristics using certain assumptions. We are challenging the accuracy of some of these assumptions: *(S. Peder and Suzanna S. Cuneo)*

BQ.18 Lighting Assumptions: The draft EIR/EIS describes lighting for drilling rigs as being the full length of a 145 foot tall rig, and that drilling rigs would be in operation 24 hours a day. We do not believe that the draft EIS/EIR is accurate in stating that this lighting would not affect KOP's in the Medicine Lake area. Because this has the potential of having such a devastating effect on the visual quality of Medicine Lake we would ask that the lighting assumptions be reexamined and that an effective model be developed so that residents of Medicine Lake and campground users can have a better assessment of the effect of drilling rig lighting and the effect of operational lighting used by the power plant. The draft EIS/EIR does not accurately address the effect of night lighting on KOPs 2,3 and 5. It is impossible to determine from the draft EIS/EIR how the determination was made that the lights would not be visible from Medicine Lake. The draft EIS/EIR did say (page. 4-145) that; "This impact (drill rig and power plant lighting) would be significant as this lighting would create a long-term inconsistency with the VQO of Retention which covers the power plant site." The draft EIS/EIR goes on to say " ...lighting would likely draw visual attention as it would create a strong visual contrast with nighttime conditions." We are concerned that these visual contrasts would not be limited to the plant area and would have a negative impact on VQOs in the Medicine Lake area. We are concerned that a wilderness lake will have the nighttime appearance of a football stadium. Please respond, in writing, to these concerns. *(S. Peder and Suzanna S. Cuneo)*

BQ.19 The draft EIS/EIR states on page 4-162 "The visual impacts from the Medicine Lake shoreline (KOP's 2,3,5) would be considered significant and unavoidable... Mitigation Measures 4.92a and 4.9.2b would not eliminate the visibility of well venting and cooling tower steam plumes from these KOPs. Therefore, with mitigation, the visibility of segment Al of the transmission line would result in a significant unavoidable impact as the visibility of both transmission line and steam plumes would impact the overall visual characteristics of the Medicine Lake area." If the final EIS/EIR supports any alternative except #7 (no action), then there must be written documentation of how these documented effects, found in the draft EIS/EIR, have been rectified with CEQA and USFS VQOs. The draft EIS/EIR is very clear on the unique visual qualities found in and around Medicine Lake, it is also very clear from the draft EIS/EIR this project will have a substantial negative impact on those qualities. *(S. Peder and Suzanna S. Cuneo)*

CY.1 My wife and her family own a cabin at Medicine Lake and I was very upset to find out that they are trying to pass this geothermal project at Medicine Lake. We look forward to spending our summers with her family at the lake. I enjoy fishing and reading by the lake. The beauty and peacefulness is why we keep going back each year. This type of project will destroy everything we keep going back for each summer. It will definitely be an eye-sore and take away from the natural beauty of the area. *(Dave Harris)*

DK.2 The first several alternates for the power lines for this project show the power lines to come up from outside the Medicine Lake basin, over the summit and down through the middle of the basin. To me, this is absolutely unacceptable as it would totally change the nature and appearance of the basin area from a unique recreational area to an industrial looking basin. *(Roger G. Hyytinen, Hyytinen Engineering)*

FP.14 The Medicine Lake Highlands is a remote area with relatively few man-made changes to the natural scenery. The majority of the users of the area come here because of this reason. There are no telephone lines or TV antennas to block the views. The Draft EIS/EIR is correct when it states in Section 3-124 that "there is a strong sense of place and remoteness to the lake... With the exceptions to of a few private cabins and the public boat launch that visually encroach on the lake and the shoreline, there is an overall sense of intactness to the lake's character".

Section 2-28 details the construction of a cooling tower that will be 70 feet high and 355 feet long (greater than the length of a football field!). This structure will be lit up at night. Drilling rigs over 145 feet high in operation 24 hours per day will also be lit at night. Please be aware that there currently are no lighting structures within the Medicine Lake calderas. These lights will be visible for miles around. We do not agree that this lighting will have no effect on the KOP's of the Medicine Lake area. Please re-evaluate this section on lighting and visual quality. *(Eric T. Nelson)*

FP.15 Section 4-138 outlines the potential effects of steam plumes on the Medicine Lake area. These steam plumes will be present year-round and extend 250 feet above the 70 foot cooling tower. In addition, well venting will reach 285 feet for a six week period. The steam plumes will significantly effect the visual quality of

the area. Please include justification as to the no impact designation for steam plumes on the VQO from the Medicine Lake KOP. *(Eric T. Nelson)*

HF.20 And of course, even the ES acknowledges that no mitigation efforts will significantly reduce the adverse effects on Medicine Lake Views (4.9.5), effectively ruining what the EIS/EIR itself describes as the "sense of intactness to the lake's character." (p. 3-124) *(Daniel T. Spencer)*

HT.16 Table 4.61, of 26 sites listed by tribal members, 11 sites list visibility of steam plumes from the power plant, 3 listed visibility of power plant lights. If visible on tribal sites, it stands to reason that they will be visible from campgrounds & cabin sites. The Project would introduce industrial elements into the forest landscape thus disturbing the pristine quality of the environment. The defined mitigation may not fully mitigate the effect; the impact would therefore be considered a significant unavoidable impact. *(Louise Thompson)*

HT.18 Visual quality impacts that can not be mitigated involve changes of landscape made by transmission line as seen from the Lake, campgrounds & private residences. Heavy equipment & construction vehicles as well as helicopters will operate for the 3 years of construction. After decommissioning, it will take 50 to 75 years to restore forest conditions. *(Louise Thompson)*

PH5.17 Table 4.61, of the twenty-six sites listed by tribal members, eleven sites list visibility of steam plumes from the power plant; three list visibility of power plant lights. If visible from the tribal sites, it stands to reason that they will be visible from the campgrounds and the cabin sites. The project will introduce industrial elements into the forest landscape, thus disturbing the pristine quality of the environment. The defined mitigation may not fully mitigate the effect; the impact would therefore be considered a significant unavoidable impact. *(Medicine Lake Public Hearing)*

PH5.19 The visual quality impacts that cannot be mitigated involve changes of landscape made by transmission line as seen from the lake, campgrounds and private residences. "Heavy equipment and construction vehicles, as well as helicopters, will operate for the three weeks of construction—three years of construction. "After decommissioning it will take fifty to seventy-five years to restore forest conditions. *(Medicine Lake Public Hearing)*

Response—Effects on Views from KOPs 1-5 (Medicine Lake)

Comments on the description of the existing setting at Medicine Lake are noted. Contrary to the assertion made in several of the comments, the Draft EIS/EIR does state that the project would have a significant visual impact at Medicine Lake under CEQA and USFS visual assessment practices. As discussed on pages 4-155 to 4-162 of the Draft EIS/EIR, the proposed project (Alternative 1) would have an unavoidable significant effect on views from Medicine Lake KOPs 2-5, even after mitigation. There would be no significant visual effect to views from the campgrounds at Medicine Lake (KOP 1), since views from this KOP are to the south and away from the proposed project. This unavoidable significant effect at KOPs 2-5 would be due to the presence of transmission line segment A1 as a dominant visual feature from Medicine Lake KOPs. Alternatives 5 and 6 would use segment A3 instead of A1, and would therefore avoid the unavoidable significant visual effect of Alternative 1 on Medicine Lake KOPs. Alternative 6 has been identified in this Final EIS/EIR as the lead agencies' preferred alternative.

The assumptions used in the Draft EIS/EIR are considered to be valid and legitimate, and provide a reasonable basis for the analysis of potential visual effects. Regarding lighting assumptions, the determination that permanent lighting would not be directly visible from Medicine Lake (including KOPs 2, 3 and 5) was made on a visual observation (or "line-of-sight") analysis. Site specific field research and analyses were conducted from each of the identified KOPs. Additionally, line-of-site map evaluations were made from traditional cultural sites not listed as KOPs (see Section 4.6, Traditional Cultural Values, of the Draft EIS/EIR). Sites identified by tribal members are dispersed throughout the region; it is therefore not valid to suggest that components of the project would be visible from campgrounds and cabins at Medicine Lake because they are visible from cultural sites.

Regarding views from Medicine Lake KOPs, Medicine Lake is located at an elevation of 6,676 feet. The Lake is visually screened by a broad ridgeline from the power plant site, which is located at an elevation of approximately 6,920 feet. This ridgeline ranges in elevation from approximately 7,000 feet to 7,040 feet, and is further enhanced by Forest cover. The remainder of the wellfield is located at lower elevations than the power plant site, and is therefore even more visually screened. The wellfield is also visually blocked from Medicine Lake by Grouse Hill, which is located at an elevation of approximately 7,120 feet.

It should be noted that Medicine Lake is not a "wilderness lake" (one that exists amidst complete darkness), and that private recreation residences around Medicine Lake do have lights. In addition, it is not anticipated that any indirect-glow effects would dominate the night sky or result in a significant impact. The concern that potential lighting impacts identified in the Draft EIS/EIR for those areas immediately surrounding the power plant site will not be limited to the plant area is noted. Mitigation Measure 4.9.2c cites a number of specific lighting-design parameters to avoid the stated concern. These include a number of measures to:

- Limit lighting to only those areas necessary
- Use light-activation mechanisms to assure that lights are on only when needed
- Use shrouds, low-brightness fixtures with optical controls, and other methods of shielding to control direct and stray lighting effects

See the response to "Comment—Visual Impacts from Lighting at Night" for more information on project-related night-lighting effects.

Regarding the visibility of the steam plume from Medicine Lake KOPs, it is acknowledged in the Draft EIS/EIR that the plume would be visible from these KOPs. The plume would also contribute to an unavoidable significant effect of the proposed action (Alternative 1) on views from these KOPs. As discussed in the response to "Comments—Visual Impacts of Steam Plumes," this effect would be due to the visual presence of transmission line segment A1. The steam plume itself would not constitute a significant effect due to its ephemeral nature, appearance, and relatively small size when viewed from a distance. Implementation of either Alternative 5 or 6 would avoid the unavoidable significant visual effect of Alternative 1 on Medicine Lake KOPs. For more information on the visual effect of the steam plume, see pages 4-144 through 4-145, and 4-155 through 4-157 of the Draft EIS/EIR and the response to "Comments—Visual Impacts of Steam Plumes."

Comments—Effects on Views from KOP 6 (Little Mount Hoffman)

H.9 I didn't see any reference to visual impacts to visitors to the Little Mt. Hoffman Lookout, a very popular destination for sightseers. Two years ago the old lookout was renovated and is now available on a reservation basis for campers, which has made it an even more popular destination. The Final EIS/EIR must analyze the impact of the project on visitors to Little Mt. Hoffman.
(Bill Dart, American Motorcyclist Association)

H.10 Most snowmobilers travel to the top of all local ridges and peaks to experience the views. From any higher observation point, the transmission lines and their 125 wide strip that has been cleared of all trees over 12′ will be painfully evident. The final EIS/EIR must analyze and adequately mitigate the impact on the proposed project as well as the cumulative impact of this project and the Telephone Flat project to visitors to Little Mt. Hoffman and all of the peaks and vista points around and within the Medicine Lake Caldera available to snowmobilers and hikers. *(Bill Dart, American Motorcyclist Association)*

Response—Effects on Views from KOP 6 (Little Mount Hoffman)

The Draft EIS/EIR analyzes the potential effect of the project on views from Little Mt. Hoffman. This location is identified in the Draft EIS/EIR as KOP 6. As shown in Table 3.11-1 on page 3-157 and discussed on page 3-158 of the Draft EIS/EIR, the Little Mt. Hoffman Lookout is available as an overnight-rental unit for campers. Potenti al impacts to views from KOP 6 are evaluated under Impact 4.9.6 on pages 4-162 and 4-163 of the Draft EIS/EIR.

It is acknowledged that the proposed transmission line corridor may be visible from higher vantage points at the Medicine Lake caldera. The analysis of visual impacts in the Draft EIS/EIR utilized KOPs to provide a representative sample of the potential effects of the proposed action. These KOPs were chosen by the USFS on the basis of public and agency input, as well as USFS knowledge of key vantage points from which the project might be seen in the project vicinity. Specific analysis of potential visual impacts from all dispersed routes of travel and destination points is not practical.

While the transmission line corridor may be visible from some of the higher vantage points at the Medicine Lake caldera, these views would not be considered a significant effect of the project due to planned vegetation management. Vegetation-clearance methods for the transmission line are described on pages 2-42 to 2-46 and 4-139 to 4-140 of the Draft EIS/EIR. In the Medicine Lake Highlands, a 100-foot-wide (not 125-foot-wide) corridor would be cleared for the transmission line. Trees under 12 feet in height would not be removed. In addition, the corridor would be replanted with shrub and grass seed mixes, and the edges of the corridor would be scalloped, which would reduce the visual contrast of the corridor with surrounding Forested areas.

Mitigation Measures 4.9.4a through 4.9.4c are identified on page 4-154 of the Draft EIS/EIR to reduce the visual effect of the transmission line. Except for the view from the Medicine Lake overlook (which would directly overlook transmission line segment A1), these measures would ensure that the project would have a less-than-significant visual effect. For a discussion of potential cumulative visual effects, see the response to "Comment—Cumulative Visual Effects" in the Cumulative Effects Section.

Comments—Effects on Views from KOPs 7-10 (Project Vicinity Roads)

PH1.1 In what way will this project impact the Modoc Volcanic Scenic Byway, the proposed byway? This has been supported by Dorris city and the people, by the Chamber of—Butte Valley Chamber of Commerce, as well as service agencies and organizations in this community. *(Dorris Public Hearing)*

PH2.8 And also, same thing, still got this Modoc Volcanic Scenic Byway, as far as I know is still hanging also somewhere along—I'd like to know where it stands. *(Klamath Falls Public Hearing)*

Response—Effects on Views from KOPs 7-10 (Project Vicinity Roads)

Potential effects of the proposed project on views from roads in the project vicinity (including the portion of Primary Forest Route 49 that is designated as the Modoc Volcanic Scenic Byway) are evaluated in Section 4.9, Visual Quality, of the Draft EIS/EIR. Potential effects on views from Primary Forest Route 49 near the proposed power plant site (KOP 7) are addressed under Impact 4.9.3 on pages 4-147 to 4-149 of

the Draft EIS/EIR, and effects on views from other project vicinity roads (KOPs 8-10) are addressed under Impact 4.9.4 on pages 4-149 to 4-155 of the Draft EIS/EIR.

As discussed on these pages, the project's effect on views from KOPs 7, 9, and 10 would be less than significant after mitigation. The project's effect on views from KOP 8 (the Medicine Lake overlook along Primary Forest Route 49) would remain significant even after mitigation due to prominent views of transmission line segment A1. This effect would be considered a significant unavoidable effect of those alternatives that would use segment A1 (i.e., the proposed action and Alternatives 2 through 4). Alternatives 5 and 6 would use transmission line segment A3 instead of segment A1, and would therefore avoid the unavoidable significant visual effect of the proposed action and the other alternatives on KOP 8. Alternative 6 has been identified in this Final EIS/EIR as the lead agencies' preferred alternative.

Comment—Effects on Views from KOPs 11-12 (Arnica Sink and Glass Mountain)

AD.51 Also, it is highly misleading to say that Alternative 6 will avoid the Al segment since the freshwater pipeline will run from Arnica Sink to the power plant. The freshwater pipeline would have visual impacts on the Roadless areas which it would traverse. *(Floyd J. Buckskin, Pit River Tribe)*

Response—Effects on Views from KOPs 11-12 (Arnica Sink and Glass Mountain)

Alternative 6 would use segment A3 instead of A1 (see Figure 2.3-1 on page 2-61 and Table 2.3-2 on page 2-63 of the Draft EIS/EIR). Segment A1 is in no way connected to, or associated with, the proposed temporary freshwater pipeline. In addition, this pipeline would not cross any roadless (or released roadless) areas. As discussed on pages 2-21 and 2-22 of the Draft EIS/EIR, the pipeline would generally parallel Forest Road 49, which does not pass through any roadless areas (see Figure 3.10-1 on page 3-139 of the Draft EIS/EIR). The pipeline would be a four-inch-diameter, hand-placed, surface-water pipeline that would be routed around trees, large rocks, and other surface obstacles. The pipeline would be in place for only the first season of construction, at the end of which the pipeline would be removed. The presence of this temporary pipeline would not be considered a significant impact to visual quality in the area.

Comments—Effects on Views from KOPs 13-17 (Tionesta)

AJ.6 5.) table 3.9-2. It states for segment C1 that Existing Scenic Integrity ,is moderate to low due to ranch development, numerous roads, railroad tracks, and existing transmission lines that dominate the otherwise undisturbed landscape. This statement is incorrect in part and far too broad. First, we are not aware of such ranch development in the sense of what would normally be understood as a ranch. Second, many of the residents of Tionesta consider the existing scenic integrity from their viewpoints to be excellent. Most see no roads other than the road to their residence (County Road 97A). None of the residents can see railroad tracks. Some see no transmission lines and the remainder see only the tops of one. In fact, most of us chose to live here because of the pastoral setting, the natural beauty of the immediate area and the abundant wildlife. *(Larry Hearne, et al., Tionesta Residents)*

AJ.8 7.) Table D3 states that the transmission line would be "viewed through sparse pines against land and sky backdrop". While this may be true at select locations along this length of line, it incorrectly describes the situation for other points along this segment. *(Larry Hearne, et al., Tionesta Residents)*

AJ.10 It is explicitly and unequivocally stated or implied in several places in the EIR that transmission lines significantly degrade the scenic view. For example:

".....the overall sense of intactness is moderate to low. This is caused by evident land uses that include... transmission line corridors..." (Pg. 3 - 124)

"Existing Scenic Integrity is moderate to low due to... and existing transmission lines that are scattered throughout the otherwise undisturbed landscape." (Table 3.9-2)

It is later stated in direct contradiction that the presence of a visible transmission line would not degrade the view.

"because of the presence of the moderate forest cover of ponderosa pine and junipers, the presence of the proposed line would not substantially alter the intactness of the landscape character as perceived from Tionesta or in the greater Modoc Plateau." (Pg 4-69) (Table 4.9-1 lists the transmission line as visible from Tionesta.) "At Tionesta, a portion of segment C1 of the transmission line would be visible. .... The proposed transmission line would not be expected to be visually prominent in the landscape around Tionesta and would not significantly affect views from Tionesta. (Pg 4-302)

The best explanation of this apparent contradiction might be that the presence of several transmission lines in the background has significant adverse affect, but the addition of just one in the foreground doesn't. We can't buy such an argument! *(Larry Hearne, et al., Tionesta Residents)*

AJ.13 The view to the North is principally brush land in the foreground with juniper trees in the background. The proposed transmission line would lie across Road 97 and would be well in front of the juniper background. Very little screening would be afforded by the intervening vegetation. Thus the poles and conductors would be in virtually full view and would be visually very prominent. *(Larry Hearne, et al., Tionesta Residents)*

AJ.15 Along the center and at the east end of Tionesta, there are varying amounts of pines. These trees will afford some screening of the transmission line, but this screening will not be complete. While the transmission line will not be as apparent from this part of Tionesta, the impact will still be significant. This is because the present view is considered excellent. The views from this area are not presently spoiled by a host of objectionable features, as listed in the EIR. *(Larry Hearne, et al., Tionesta Residents)*

AJ.16 The proposed transmission line would have some additional adverse effects in this area. The extent of the forest is thin along parts of this zone. The proposed transmission line will lie between the homes and the road (FS 97). Thus, clearing of trees and other vegetation for the line may result in views of road traffic and increased noise from road traffic. *(Larry Hearne, et al., Tionesta Residents)*

Response—Effects on Views from KOPs 13-17 (Tionesta)

The description of the existing characteristic landscape in Table 3.9-2 on page 3-130 of the Draft EIS/EIR is not limited to specific views, but rather presents a cumulative view of the area through which the transmission line corridor crosses. As used in this table, the term "integrity" is intended to refer to the cohesiveness of views and integrity is adversely affected by the presence of human development, such as homes, roads, and transmission lines. While views from individual residences may be considered by individual homeowners as "excellent" relative to scenic integrity, individual residences and associated fence lines, outdoor parking areas, signs, and outdoor storage also contribute to the overall character of the landscape. The statements regarding scenic integrity in Table 3.9-2 included consideration of all of these visible elements.

The description of transmission line segment C1 provided in Table 3.9-2 is based on KOPs 13-16, and does not include specific locations such as views from residences. In addition, the general landscape of the length of segment C1 does not include dense vegetation that can screen the indications of rural development (such as transmission lines). In response to comment AJ.6, the discussion of scenic integrity for segment C1 in Table 3.9-2 on page 3-130 of the Draft EIS/EIR has been revised as follows:

> "Foreground and background views from KOPs 13-16. Views from Primary Forest Route 10 and other northern locations. Existing Scenic Integrity is moderate to low due to rural residences and other ~~ranch~~ development, numerous roads, railroad tracks, and existing transmission lines that are scattered throughout the otherwise undisturbed landscape."

Comment AJ.8 is apparently referring to the discussion of views from KOP 14 in Table D-3 in Appendix D of the Draft EIS/EIR. This KOP was chosen as a reasonable

representative location at the community of Tionesta for assessing the visual effects of the proposed project. The description of views for KOP 14 in Table D-3 is specific to this KOP and is not intended to generalize all views along transmission line segment C1. The possible existence of more open views at other locations along segment C1 is acknowledged.

The portions of the Draft EIS/EIR quoted in comment AJ.10 are not contradictory. This comment selectively quotes portions of the description of the visual setting from the Draft EIS/EIR. As discussed above, the low to moderate scenic integrity and intactness of the Tionesta area is due to a combination of existing conditions, not just the existing transmission lines. These conditions including the presence of roads, rural residences, railroads, and other human development in addition to the existing transmission lines. While the presence of these conditions may detract from the scenic integrity and intactness of the Tionesta area, this presence does not mean that there is currently a significant effect to views from Tionesta, and the Draft EIS/EIR makes no such determination.

It is acknowledged that the proposed transmission line could be visible from some locations in the Tionesta area. However, the addition of the proposed transmission line to the area would not substantially affect existing views from Tionesta, and would not result in a significant effect to the visual quality of the area. Screening vegetation (such as juniper tress and mature shrubs) does exist between most vantage points at Tionesta (including KOP 14 and the center and eastern portions of Tionesta), and the proposed transmission line route. This vegetation would further limit views of the transmission line from vantage points at Tionesta. It should be noted that there are no plans to clear trees or other screening vegetation for the portion of transmission line segment C1 near Tionesta. This vegetation lies to the south of segment C1, between the proposed transmission line route and Tionesta. There would therefore be no potential for increased views of road traffic or increased noise from road traffic due to implementation of the proposed project.

The ability to see the transmission line from Tionesta would be even further reduced (and possibly eliminated) by the implementation of Alternative 6, which has been identified in this Final EIS/EIR as the lead agencies' preferred alternative. Alternative 6 would use transmission line segment C2 instead of segment C1. Segment C2 would be located approximately two miles further north from Tionesta than segment C1. Due to distance and intervening vegetation, views of the transmission line from Tionesta under Alternative 6 would affect a very slight proportion of the viewshed.

Comment—Effects on Views from KOPs 18-21 (Lava Beds National Monument)

BH.7 The Calpine project will adversely effect views of Lava National Monument. *(Richard S. Cimino)*

Response—Effects on Views from KOPs 18-21 (Lava Beds National Monument)

Potential effects on Lava Beds National Monument views are discussed under Impact 4.9.9 on pages 4-169 to 4-174 of the Draft EIS/EIR. With implementation of mitigation measures identified in Section 4.9, Visual Quality, of the Draft EIS/EIR, the adverse visual effects to Lava Beds National Monument views would be considered less than significant. See also the responses to "Comments—Visual

Impacts of Power Plant and Wellfield" and "Comments—Visual Impacts from Lighting at Night."

CONSISTENCY WITH VQOS

Comment—General Comment Regarding VQO Consistency

AG.298 Figure 3.9-2 presents VQO designations along alternative transmission line routes, but the EIS/EIR presents no quantitative comparison of the difference between alternatives with respect to the categories of VQO sensitivity. The EIS/EIR should quantify the acreage of land that would be in conflict with each VQO designation for the power plant/well field area, and the extent (miles) along each alternative transmission line route that would affect each category of VQO designation.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—General Comment Regarding VQO Consistency

Figure 3.9-3 on page 3-127 of the Draft EIS/EIR illustrates VQO designations surrounding the power plant, wellfield, and portions of the alternative transmission line routes. Figure 3.9-2 on page 3-126 illustrates VQO designations surrounding the alternative transmission line routes. Table D-2 in Appendix D of the Draft EIS/EIR provides a summary of the extent of each VQO designation that would be affected by the proposed and alternative transmission line segments. Acreages of each VQO designation around the power plant, wellfield, and portions of the alternative transmission line routes were not quantified in the Draft EIS/EIR since this information is not relevant to the determination of potential visual effects. Furthermore, quantification would not necessarily assist in characterizing the effect of the project on VQO designations, nor would it assist in determining mitigation measures.

Comments—Consistency with VQO Designations at the Power Plant and Wellfield

N.17 17. As stated by Phil Woodward, "The visual impacts of the project, including steam plumes, buildings, lighting, and aluminum clad pipelines on the scenic beauty of the area, including designated Unique Geologic Areas, are serious and significant. The Visual Quality Objective in the area of Fourmile Hill is "retain". This requirement cannot be met with implementation of the proposed project and is, in itself, reason enough to deny the project" *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

Y.37 The Visual Quality Objective in the Forest Plan is "retain," and the effects are being greatly minimized to make it appear that this objective is being met. Visual Quality Objectives for potentially eligible areas to the National Register of Historic Places are not even being considered.

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AG.300 Steam Plumes. Page 4-139 (3rd paragraph, 5th line), and page 4-145 (4th paragraph, 2nd line) both state that the "visibility of ...steam plumes ... would be considered an adverse visual impact". However, Page 4-145 (4th paragraph, 3rd sentence) states that "this impact would not be significant, as the visibility of steam plumes would not result in a long-term inconsistency with the VQO of Retention which covers the power plant site, due to periodic visibility and ephemeral nature of such plumes."

However, page 3-125, 4th paragraph, states that the Retention visual quality objective "provides for management activities which are not visually evident. Activities may only repeat form, line, color or texture common to the characteristic landscape, but must remain visually subordinate to the characteristic landscape".

The visual simulation methodology depicted on page 4-137, last paragraph, 6th line states that the cooling tower steam plumes would extend "approximately 110 feet in height above the cooling tower and 375 feet in length" and took into account topographic elevation of the power plant site and the height of the cooling tower.

Page 4-139, 2nd paragraph, 3rd line, states that "during winter, the average plume height could ...extend 250 feet above the cooling tower, with a length of 930 feet.", and "cooling tower steam plumes could be visible year round, depending upon atmospheric conditions".

Further, the last sentence in the 2nd paragraph on Page 4-139 states that "plume visibility is typically ephemeral, due to dispersion". Because the Medicine Lake Highlands is a heavily wooded mountainous area, above 4000 feet in elevation, (page S-11, 5th paragraph, 2nd line) it can be expected that the nighttime

temperatures even in summer dip to between 30-40 degrees (f), and daytime temperatures in the summer may not rise until midday, when the sun is high in the sky. Steam plumes would be visible in the sky at these temperatures.

The steam plumes, which originate approximately only 2 miles away from Medicine Lake, and which may be 250 feet high and 930 feet long would be "significant", per the significance criteria, especially in an area with a *Retention* VQO. The mitigation proposed for the steam plume (4.9.2b) is to design cooling towers to minimize the size of the steam plume. Table S-5 finds that the only visual impact that would remain significant after mitigation is the effect on Medicine Lake views. There is no analysis in the EIS/EIR to support this conclusion. The steam plume would have a significant visual impact on more than just Medicine Lake, and there is no analysis in the EIS/EIR showing how it would be feasible to design cooling towers to reduce the steam plume, or how this would reduce its visual impact to less-than-significant. Furthermore, the steam plume would be such a pervasive visual feature in the sky over a wide area that the impact would remain significant after mitigation.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

HD.17 The power plant is in a "retention" area for Visual Quality Objectives (VQO); therefore, construction of the plant would appear to be inconsistent with upholding this objective. *(Amanda Spencer)*

IQ.10 The visual impacts of the project, including steam plumes, buildings, lighting, and aluminum clad pipelines on the scenic beauty of the area, including designated Unique Geologic Areas, are serious and significant. The Visual Quality Objective in the area of Fourmile Hill is "retain". This requirement cannot be met with implementation of the proposed project and is, in itself, reason enough to deny the project.

(Phil Woodward)

Response—Consistency with VQO Designations at the Power Plant and Wellfield

The majority of areas in and around the wellfield and power plant site have VQO designations of Retention or Partial Retention. Retention is the more restrictive of the two designations.

The VQO designation of Retention requires that a project not be visually evident. USFS guidelines define evident as "that which is apparent to the casual Forest visitor" (Department of Agriculture, USFS. *National Forest Landscape Management, Volume 2 - Chapter 1. The Visual Management System.* Washington D.C. 1974.). VQOs of the Klamath and Modoc Forest LRMPs were intended to be achieved by views from inventoried points and routes of public visual sensitivity. VQO achievement from other non-inventoried locations is desirable but not required by the Forest (Mosier 1998).

The power plant site and Primary Forest Road 49 (KOP 7) are both located in areas with a VQO designation of Retention. Mitigation Measures 4.9.2a through 4.9.2f would reduce the visibility of project features from Primary Forest Route 49. Figure 3.9-3 illustrates VQO designations surrounding the power plant and wellfield. These designations are Retention around the power plant site and Partial Retention elsewhere. The steam plumes from the project, though visible at times, would not dominate the Highlands landscape and would not result in long-term inconsistencies with VQO designations (see also the response to "Comment—Visual Impacts to Steam Plumes"). Mitigation Measure 4.9.2f requires that all project facilities, including buildings and pipelines, use paint or integrated material coloring that is uniform, non-contrasting and non-reflective, except where safety colors are required by code. Mitigation Measure 4.9.2c requires a detailed Exterior Lighting Design and Management Plan (see the response to "Comment—Visual Impacts from Lighting at Night").

In response to comment Y.37, consistency with VQOs is not a criteria in determining NRHP eligibility. Criteria from the National Historic Preservation Act (NHPA) were used to evaluate sites on or eligible for listing in the NRHP (see page 4-61 of the

Draft EIS/EIR). Table 4.6-1 on page 4-73 of the Draft EIS/EIR summarizes potential impacts from traditional cultural use sites.

Comments—Consistency with VQO Designations in the Medicine Lake Vicinity

H.12 In summary, the visual impacts of any power line segments through the Medicine lake caldera are unacceptable. The proposed mitigation measures for the proposed project alternative do not eliminate significant adverse impacts on the visual environment in the Medicine Lake Caldera. Forest Visual Quality Objectives are not achieved. This area is too important to the general public for its unspoiled visual characteristics to allow something as degrading as a power line to be constructed through it.
(Bill Dart, American Motorcyclist Association)

O.9 The visual quality objectives of the Mount Hoffman roadless area are listed in the EIS. Part of the transmission line for the geothermal project would be placed along Forest Service road 77, which is an area with a Visual Quality Objective of preservation (3-126). According to the EIS, a VQO of preservation allows for ecological changes only and management activities are prohibited (3-125). The area surrounding the geothermal plant is an area classified under Retention (3-126). Retention requires that the management activity not be visually evident (EIS, 3-125), yet a 50 foot corridor would be cleared for the transmission line (4-84). The Medicine Lake Highlands support early to mid-seral size trees and 100 feet of vegetation would be cleared (4-85 - 4-86). Such alterations to the landscape will be visible, as this area has remained undeveloped. Again, Modoc will be in direct violation of their forest plan, if the path for the transmission line is not rerouted. *(Katherine Kowatch, Friends of the River)*

Response—Consistency with VQO Designations in the Medicine Lake Vicinity

Mitigation Measure 4.9.7a would require the transmission line along segment A2 (between mileposts 7.0 and 8.0) be re-routed to the north, and a minimum of 0.25 miles away from the Glass Mountain Lava Flow to avoid the area with a VQO designation of Preservation. Mitigation Measures 4.9.4a, 4.9.4b, 4.9.5a, and 4.9.5b would reduce the visual effects of the transmission line corridor in areas of Retention and ensure consistency with this VQO. As stated previously, Alternative 6 has been identified in this Final EIS/EIR as the lead agencies' preferred alternative. Alternative 6 would use transmission line segment A3 instead of A1 and A2, which would avoid the Mt. Hoffman released roadless area.

Comment—Consistency with VQO Designations in the Tionesta Vicinity

AJ.14 The VQO (visual quality objective) listed for this segment of the line is "Partial Retention"(See Figure 3.9-2). With this objective, activities "must remain visually subordinate to the characteristic landscape". It hardly seems that this objective is satisfied when the transmission line would be the focus of attention in the foreground. On the contrary, it seems that this objective would not be met. Furthermore, it would seem that it must be concluded that the transmission line has a significant adverse effect on visual quality in this area of Tionesta! *(Larry Hearne, et al., Tionesta Residents)*

Response—Consistency with VQO Designations in the Tionesta Vicinity

As noted in the comment, the portion of transmission line segment C1 near Tionesta is located in an area with a VQO designation of Partial Retention. As discussed on pages 4-169 of the Draft EIS/EIR, potential inconsistencies of the segment C1 with this VQO designation would be eliminated with implementation of Mitigation Measure 4.9.4a. Overall, this portion of the transmission line would not visually dominate the characteristic landscape, and would not introduce visual elements not already present in the area. The project would therefore be consistent with the VQO designation of Partial Retention near Tionesta after mitigation, and the visual effect at Tionesta would be less than significant.

MITIGATION MEASURES

Comment—Adequacy of Measures

H.5 The visual impacts of the proposed power line segments Al, A2, and B2 are not adequately mitigated, cause a significant adverse impact, are inconsistent with Forest Visual Quality Objectives, and are totally unacceptable. These segments are all within the Medicine Lake caldera, and would be a visual blight upon an otherwise near-natural appearing landscape. The proposed project calls for clearing of vegetation within the 125′ right of way, with all 50 to 75′ mature trees typical of the proposed alignment being cut; creating a very visible scar that will never have a natural appearance during the life of the project.
(Bill Dart, American Motorcyclist Association)

Y.35 Evaluations and mitigation measures for the visual impacts of acres of buildings and asphalt, 24-hour lighting, miles of transmission lines and 36″ above-ground pipelines are grossly inadequate given the present character of the area. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AG.299 The height of structures, according to the Draft EIS/EIR (p. 2-39 through 2-41) would be 60 to 80 feet for wood pole H-frame structures, 60 to 80 feet for guyed three-pole structures used at angle points, and 65 to 95 feet for single-pole structures. The spacing between poles on the multiple-pole structures would be 19.5 feet.

The Draft EIS/EIR claims that alternative transmission line routes will mitigate these impacts, but fails to substantiate that conclusion. Page S-12, (4th paragraph--Unavoidable Adverse Effects, last sentence), states that "The visual effect would be avoided by alternatives". Which alternative(s)? In addition, page 4-162 (2nd and 3rd paragraphs), states that the level of significance from visual impacts after mitigation from the Medicine Lake shoreline and from the Medicine Lake Lava Flow Trail would remain significant and avoidable. Please reconcile.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Adequacy of Measures

As discussed in the Draft EIS/EIR, the visual effects of transmission line segments A1 and A2 would be less than significant and consistent with VQOs after mitigation, except for the effect on views from Medicine Lake (KOPs 2-5). The effect on these views would be significant and unavoidable due to the development of segment A1 for the proposed action (Alternative 1). Alternatives 5 and 6 would mitigate and avoid this otherwise unavoidable significant effect by using segment A3 (which would avoid the Medicine Lake area) instead of A1 and A2. Alternative 6 has been identified in this Final EIS/EIR as the lead agencies' preferred alternative.

Transmission line segment B2 would be used by only Alternatives 3 and 4, and would not be a part of the proposed action (Alternative 1) or the lead agencies' preferred alternative (Alternative 6). Mitigation measures were identified in the Draft EIS/EIR to reduce the visual effect of segment B2 to less-than-significant levels and ensure VQO consistency. The statement in comment H.5 regarding the acceptability of this segment (as well as segments A1 and A2) is noted.

Comment AG.299 mentions the proposed height and spacing of transmission line structures, and erroneously states that the Draft EIS/EIR claims that alternative transmission line routes would mitigate transmission line height and spacing. No mitigation is necessary or recommended for transmission line height and spacing. The alternative transmission line routes have been identified to mitigate or avoid a variety of potential environmental impacts of the proposed action (Alternative 1), such as visual effects and recreational conflicts at Medicine Lake, the Mt. Hoffman released roadless area, and areas of concern to American Indian tribes.

Comment AG.299 mis-states and misinterprets the conclusion for the proposed action regarding the level of significance of visual impacts from Medicine Lake KOPs (KOPs 2-5) after mitigation. These impacts would be significant and

unavoidable after mitigation (not "avoidable" as stated in the comment). In addition, this conclusion applies to only the proposed action (Alternative 1). Since Alternatives 5 and 6 would use segment A3 instead of segments A1 and A2, these alternatives would eliminate views of the transmission line from Medicine Lake KOPs. These alternatives would not have a significant effect on views from Medicine Lake KOPs, and would therefore avoid this unavoidable significant effect of Alternative 1.

Comment—Feasibility of Drill Mast Lighting Mitigation

AG.304 Mitigation Measure 4.9.2c. regarding drill mast lighting states that:

> "Drill mast night lighting shall also be shrouded and directed down the drill mast, not out from it. (This mitigation does not apply to any lighting of masts to meet Federal Aviation Administration requirements)."

The parenthetical in this mitigation measure casts doubt on whether the mitigation will be feasible, because it implies that, due to the height of the drill rigs, the FAA will require the masts to be up-lighted so that they may be visible to aircraft. If that is the case, then the mitigation measure, as stated, could not be implemented and is of little or no value.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Feasibility of Drill Mast Lighting Mitigation

As stated in Mitigation Measure 4.9.2c, all drill mast lighting necessary for drilling operations would be shrouded and directed down the drill mast. It is therefore not implied by the parenthetical statement in Mitigation Measure 4.9.2c that shrouding and down-directing of operational lighting would be infeasible.

At the time of Draft EIS/EIR distribution, it was unknown whether the Federal Aviation Administrative (FAA) would require lights for the drill mast. It has subsequently been clarified that FAA lighting is only required for structures that are 200 feet (or more) in height, as measured from ground level (FAA Advisory Circulars 70/7460-1J and 70/7460-2J). As discussed on page 4-139 of the Draft EIS/EIR, the drill masts used for the proposed project would be approximately 140 to 145 feet tall. FAA lighting would therefore not be required for the drill rig masts, and the only lighting on these masts would be the shrouded and down-directed operational lighting.

Comments—Helicopter Use as Mitigation

AG.100 The EIS/EIR failed to evaluate a potential mitigation measure for visual impacts caused by transmission line and access road construction. (Ex. B, § 4.9.) According to Thomas Reid Associates, helicopter-aided construction is often used in remote areas to eliminate the need for access roads. Such a mitigation measure could eliminate up to 90 acres of land disturbance, and the visual impacts associated with that disturbance. (Ibid.) The EIS/EIR should analyze the feasibility of this mitigation measure.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.306 Helicopter Construction would Provide Substantial Mitigation. The Draft EIS/EIR failed to mention a major mitigation measure that would be effective in mitigating visual, as well as vegetation and wildlife impacts. The Draft EIS/EIR discusses helicopter construction in the noise section (p. 4-263), but fails to make the connection between helicopter construction and the elimination of access roads. Helicopter construction in mountainous terrain or roadless areas is used specifically to eliminate the need to build access roads. Helicopter construction is used extensively by some utility companies such as Southern California Edison, who do substantial construction in mountainous areas (*Devers-Serrano EIS/EIR (see Footnote), Devers-Palo Verde EIR, 1986*). The use of helicopter construction could eliminate land disturbance on up to 90 acres (per Table 2.2-1) and reduce public trespass into areas not now served by any roads. The Draft EIS/EIR should have analyzed the potential short- and long-term advantages (e.g. visual, vegetation disturbance) and disadvantages (e.g. noise) of this potential mitigation measure.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Helicopter Use as Mitigation

As discussed in the Draft EIS/EIR, helicopters may be used for construction of the transmission line, except in the vicinity of Medicine Lake due to noise concerns. Helicopter use was not identified as mitigation in the Draft EIS/EIR for visual (or other) effects of the transmission line since helicopter use would not effectively or substantially mitigate any project impacts. The existing network of roads in the Medicine Lake Highlands reduces the amount of new road construction for the proposed project.

The primary effect of the transmission line would be clearing the right-of-way for safety purposes (i.e., to prevent fire hazards resulting from lightning strikes and contact between vegetation and transmission lines), not for road construction. The additional effects to wildlife (noise effects to bald eagle, northern goshawk, osprey, etc.) and vegetation clearing for helicopter landing and laydown or staging sites would be greater than that required under the proposed action. Construction with helicopters was therefore not considered as mitigation as it would not reduce environmental effects.

Comments—Suggested Mitigation for Transmission Line Visual Effects

H.11 The document discusses possible power line construction methods, with either two or three wood pole structures being used in most areas, with a single steel pole used as a mitigation measure as A1 crosses some forest roads. The single steel pole requires less right of way width, and should be specified in the final EIS/EIR for any transmission line that is built in forested areas so that tree removal is minimized, and subsequently, the size of the visual scar is minimized. Additionally, a single steel pole painted to blend with the local forest, is less obvious than three wooden poles in a straight line.

(Bill Dart, American Motorcyclist Association)

AG.305 The Proposed Mitigation for Visual Impact would Largely be Ineffective, And Could Be Counterproductive. The Draft EIS/EIR states as mitigation for visual impacts to the Medicine Lake area (Measures 4.9.5a, p. 4-161) that the towers could be lower if they were spaced more closely together. Since a major part of the visual impact is the number and the mass of towers in view from any given viewpoint, rather than the height of towers, this measure could be counterproductive.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Suggested Mitigation for Transmission Line Visual Effects

Comment AG.305 is incorrect in stating that a major part of the potential visual impact of the proposed transmission line in the Medicine Lake area would be the number and mass of support structures in view from any given viewpoint. Views of the proposed transmission line and its support structures from vantage points in the Medicine Lake area would primarily be shielded by vegetation, lava flows, and other intervening features. The most visible aspect of the line would be the tops of the support structures and portions of the line itself (see Figure 4.9-1 on page 4-151, Figure 4.9-2 on page 4-157, and Figure 4.9-2 on page 4-159 of the Draft EIS/EIR). The visual impact of the transmission line at Medicine Lake would therefore be related to the height of the support structures, not the number or mass of support structures.

Mitigation Measure 4.9.5a on page 4-161 of the Draft EIS/EIR is identified as a possible method to reduce the height of the support structures, and thereby reduce (or possibly eliminate) the visibility of the tops of the support structures and the transmission line. This measure would reduce visual effects due to the presence of the proposed transmission line in the Medicine Lake area.

Contrary to comment H.11, single steel poles would not require substantially less right-of-way width or vegetation clearance than two- or three-pole wooden support structures. The width of the right-of-way and required vegetation clearance is based almost exclusively on the height of the transmission line conductors, and the associated adjacent vegetation clearance necessary to prevent vegetation from coming into contact with the conductors. The height of the conductor would be approximately the same regardless of the type of support structure that is used.

Whether natural wooden poles or single steel poles painted to blend with the Forest (as suggested in comment H.11) would be more obvious is debatable. It is not expected that either type of support structure would necessarily be more advantageous from a visual quality standpoint in forested areas. The use of only single steel poles in forested areas would therefore not lessen the visual effect of the transmission line corridor, and is not identified as mitigation for visual effects of the project.

3.11 Plans and Policies

INTRODUCTION

This section provides responses to comments on issues related to plans and policies of the USFS. The comments and responses are grouped under the following headings:

- General
- Land and Resource Management Plans
- Northwest Forest Plan
- Released Roadless Areas

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

GENERAL

Comments—National Monument Designation

BK.3 The Medicine Lake Highlands deserves national monument status to protect its wild character. *(John Copoulos)*

GL.4 We would like to see Medicine Lake Highlands become a national monument. In the meantime, its wild nature needs to be protected. *(Deirdre and Randy Rand)*

Response—National Monument Designation

National Monuments are administered by the U.S. Department of the Interior and the National Park Service (NPS). The land in the Medicine Lake Highlands is under the jurisdiction of the U.S. Department of Agriculture and the U.S. Forest Service (USFS). A transfer of jurisdiction from the USFS to the NPS would require a decision by the legislative or executive branch of the United States government. There are currently no proposals to make such a transfer. Furthermore, this action is not within the scope of the NEPA or CEQA process for this project (or the Draft EIS/EIR).

LAND AND RESOURCE MANAGEMENT PLANS

Comments—Consistency with National Forest Land and Resource Management Plans

T.15 Forest management direction for hundreds of square miles of the Modoc National Forest has not yet been adequately re-evaluated and the potential resource conflicts have not been resolved or mitigated in any meaningful way. The DEIS/EIR misses the main points of conflict between the existing Forest Plans and the proposed project, and furthermore neglects to provide for Forest Plan revisions and amendments to both accommodate and compensate for the Fourmile Hill project and its transmission line. Federal regulations implementing the National Forest Management Act (36 CFR Part 219 et seq.) require that all actions, permits, contracts, etc. on national forest lands be consistent with the applicable Forest Plan (36 CFR 219.10(e)). Prior to approving the proposed project, the Modoc National Forest must amend and revise its Forest Plan. *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

Y.40 Forest Plans are equivalent to zoning on public lands. They define what can and cannot be done and are presumably arrived at through a public process. The National Forest Management Act requires that undertakings be consistent with Forest Plans. Proposed developments must be compatible with other uses (see 1984 EA, page 4).

Forest Plans have to be revised or amended if the situation, conditions and assumptions that have been used in the development of the Plan have changed so as to require significant changes in management emphasis. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

Y.42 In addition, a proposal for a transmission line corridor and the building of power plants, well fields, sumps, above-ground pipeline carrying temperatures of 500-600 degrees, etc. are impacts that exceed the current management prescriptions in both the Klamath and Modoc Forest Plans which stress recreational

use and management for old growth species.

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

Y.46 There is an absence of any NEPA process to amend the Modoc and Klamath National Forest Plans. When impacts are as significant as they are here, the Forest Plans should be amended or revised through a full public participation process before doing a DEIS/EIR on a project.

The present DEIS/EIR seems to propose amending the Forest Plans simultaneously with the analysis of impacts of the proposed project. However, there has been no specific public input on the Forest Plans changes. We believe that this violates the National Forest Management Act and its implementing regulations (36 CFR 219), the NEPA process, as well as Forest Service Manual 1909.15 on Environmental Policy and 1909.12 on National Forest Planning. A Forest Plan amendment needs to be prepared on each issue, with appropriate public involvement. At no public meeting in our area was amending or revising the Forest Plans brought up or input sought on these issues. The Modoc Forest Plan (and presumably the Klamath Forest Plan contains a similar provision) states:

> If the Forest Plan requires amending, the Forest Supervisor determines whether a proposed amendment would result in a significant change to the Plan. If the change is significant, the Forest Supervisor shall follow the same procedure required to develop and approve a Forest Plan. The Regional Forester approves significant amendments. If the change is not significant for the purposes of the planning process, the Forest Supervisor may approve and implement an amendment after the public is notified and NEPA procedures are completed (Modoc Forest Plan at 1-3)

[[1]Note: a request to the Klamath National Forest for their management plan made 10 days ago has still not been received as of this writing.] *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AJ.11 The management plan for utility corridors states "Minimize proliferation of separate utility corridors by confining future needs to existing corridors, if possible". (See page 3-144.) The proposed line (Alternative 1) ignores this standard. This raises the question of why management plans are developed if they are not going to be followed. While the EIR does not appear to address this issue, it is stated on page 4-181 that the "transmission line would not conflict with any management objectives. " This conclusion appears unjustified!

(Larry Hearne, et al., Tionesta Residents)

Response—Consistency with National Forest Land and Resource Management Plans

As discussed on pages 4-180 through 4-186 of the Draft EIS/EIR, with mitigation the Fourmile Hill Geothermal Project is consistent with the Klamath and Modoc National Forest Land and Resource Management Plans (LRMPs) as amended. Several mitigation measures (which are an integral part of the project) are proposed in the Draft EIS/EIR to bring the proposed project into compliance with the LRMPs. The first mitigation measure is designed to bring the project into compliance with Visual Quality Objectives (VQOs). This mitigation measure proposes to move segment A1 of the transmission line out of a Retention VQO in order to comply with the Klamath and Modoc LRMP (see Section 4.9 of the Draft EIS/EIR for further discussion). Alternative 6, the agencies preferred alternative, would not use segment A1.

As discussed on page 1-8 of the Draft EIS/EIR, the proposed project also includes as mitigation an amendment to standard and guideline #24-25 of the Klamath LRMP that brings the project into compliance with this LRMP. This mitigation ensures that the project would be consistent with a standard in the LRMP for the protection of Native American sacred sites in accordance with the American Indian Religious Freedom Act of 1978. (Note that the proposed project already complies with the intent of the LRMP standard). The proposed amendment corrects an unenforceable USFS policy. As described on pages 4-182 through 4-184 of the Draft EIS/EIR and in response to "Comments—Consistency with Klamath National Forest Land and Resource Management Plan" below, the language in the policy in the LRMP would be revised so that it meets its intent to comply with the American Indian Religious Freedom Act of 1978. This mitigation measure would apply to all of the action alternatives.

Comment Y.42 suggests that the proposed project would result in impacts that exceed the current management prescriptions in the Klamath and Modoc LRMPs. As described in Section 4.10, the proposed project (with mitigation) would not violate any standards or guidelines within the Klamath or Modoc LRMP. Geothermal development, including the construction of a geothermal power plant, wellfield, sumps, pipelines, and power transmission, are included in the management prescriptions for the Klamath and Modoc National Forest LRMPs. Amendments to the LRMPs would establish and designate a utility corridor for the transmission line as described on page 1-7 of the Draft EIS/EIR. These amendments would be part of all action alternatives.

Comment Y.46 requests public participation in amending the LRMPs.

The public has been given a meaningful opportunity to comment on the proposed changes to the LRMPs through the public review process for this project (i.e., four scoping meetings, one interested parties meeting, five public hearings on the Draft EIS/EIR, and the written comment period for the Draft EIS/EIR). None of the proposed changes to the LRMPs have been deemed significant by the Supervisors of two National Forests. The effects of the proposed changes to the LRMPs are addressed in this EIS/EIR, which was prepared in compliance with NEPA. No additional public involvement is required under the National Forest Management Act or NEPA to approve these changes to the LRMP.

The quotation from the Modoc LRMP in comment Y.46 is a paraphrase from the National Forest Management Act of the requirements for amending a LRMP. The Klamath LRMP includes similar language. The Forest Service Planning Handbook states that:

> "In the case of a change to the forest plan that is determined not to be significant, the Forest Supervisor documents the decision in the appropriate document at the same time, if the activity is approved, amends the forest plan and implements the project or activity following appropriate public notification." (1909.12, 5.4, 2)

According to this policy, the LRMP amendments would be documented in the Record of Decision for the project and the public duly notified.

Comment AJ.11 states that the Draft EIS/EIR ignores the standards and guidelines in the Modoc LRMP for utility corridors. As stated on page 3-144, the following standards in the Modoc LRMP apply to utility corridors:

- Limit allocations of single-purpose transmission and transportation corridors. Place new transportation and utility facilities within or contiguous to existing corridors. Encourage the use of private lands, where appropriate, for new corridors. Appropriateness is determined at the site-specific project level.
- Minimize proliferation of separate utility corridors by confining future needs to existing corridors, if possible. However, consider construction of new corridors outside existing utility rights-of-way if technology, safety, national and state practices, engineering, or environmental quality precludes coexisting uses.
- When establishing utility corridors, avoid the following areas:
  - Critical habitat for threatened and endangered species
  - Designated Wilderness
  - Research Natural Areas

- Semi-primitive recreation areas
- Special Interest Areas
- Areas used in the practice of Native American religions

As stated on page 4-185 of the Draft EIS/EIR, due to constraints on the location of the geothermal power plant (e.g., because of the location of the resource and Calpine's geothermal lease), it would not be feasible to locate the transmission line for the proposed project wholly within existing utility corridors or on private lands, according to the first standard outlined above. Therefore, a new utility corridor would be designated for this project. The location of the new, designated utility corridor would be consistent with the remaining Modoc LRMP standards and guidelines for utility corridors.

The proposed transmission line would be sited to avoid critical habitat for special-status species (see Sections 4.7 Vegetation and 4.8 Wildlife), semi-primitive recreation areas (see Section 4.11 Land Use and Recreation), Special Interest Areas (see Section 4.2, Geology and Soils), and Native American religious areas (see Section 4.6, Traditional Cultural Values). Since there are no designated wilderness areas or Research Natural Areas in the project vicinity, the proposed action would not affect these areas, and would not conflict with standards and guidelines for these areas.

Comment AJ.11 specifically cites the second policy outlined above. The proposed project is consistent with this policy. As stated on page 4-185 of the Draft EIS/EIR, the proposed 230-kV transmission line could transmit up to 145 MW of electricity, which is approximately 95 MW more than would be required for the proposed project. Thus, future geothermal development within the Glass Mountain KGRA (including the proposed Telephone Flat project) could utilize the same transmission line and/or utility corridor. The use of this single utility corridor would reduce the future proliferation of utility corridors in accordance with the Modoc LRMP policy cited in comment AJ.11.

See also responses below to "Comments—Consistency with Modoc National Forest Land and Resource Management Plan" and "Comments—Consistency with Klamath National Forest Land and Resource Management Plan" for further discussion of these issues.

Comments—Consistency with Modoc National Forest Land and Resource Management Plan

T.17 The Medicine Lake area is supposed to "feature outdoor recreation use" (Modoc National Forest Land and Resource Management Plan, p.4-213) and to provide habitats for specialized, mature- and old-growth-dependent wildlife species. These resources, and the Geologic Special Interest Areas that would also be affected visually, cannot be managed in the manner prescribed in the Forest Plan if the proposed geothermal plant and transmission line are built. Management direction for Modoc National Forest Management Areas 61, 62, and 63 must to be revised.

(Linda L. Blum, Medicine Lake Citizens for Quality Environment)

Y.43 The Modoc Forest Plan states that:

Leasees may not conduct activities in the following areas at any time:

- bald eagle winter roosts and nesting habitat;
- bald eagle feeding sites in high concentration areas;
- goshawk nesting territories;
- peregrine falcon nesting territories;

- sage grouse strutting grounds;
- old-growth forest (marten habitat);
- streamside management zones. (Modoc Forest Plan at 1-2)

We do not believe that avoidance of these, and also the seasonal areas listed for osprey, golden eagles, winter deer and pronghorn range and kidding, deer fawning, Swainson's hawk, has been adequately demonstrated in the DEIS/EIR to meet the stipulations in the Forest Plan. There is a lack of on-the-ground observation regarding both wildlife and plant habitats, and most of the information given in the DEIS/EIR appears to be speculative and incomplete. The impacts of noise, as stated earlier, are inadequately addressed. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

Y.44 Similarly, 'Protection of Highly Scenic and Sensitive Visual Areas' (Modoc Forest Plan at 1-2) is not conclusively demonstrated in the DEIS/EIR. We believe that visual impacts, particularly those associated with the steam plume, lighting, the transmission line, and above ground pipelines are being underestimated. The cumulative effects of the steam plume and lighting, combined with certain weather conditions, would create a marked change in the night time visual quality of the Medicine Lake Highlands and for at least 50 miles away. (Please see further discussion under visual quality above.) *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

Y.45 In addition, we believe that the DEIS/EIR does not sufficiently meet the additional stipulations in the Modoc Forest Plan regarding geothermal development, particularly those having to do with areas potentially eligible to the National Register of Historic Places, Protection of Wetlands and Watersheds. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AG.37 Also, all instruments for the occupancy and use of forest lands must be consistent with the forest plans. (16 USC § 1604(i); 36 CFR 219.10(e).) The EIS/EIR does not discuss the Project's consistency with the Modoc National Forest Land Resource Management Plan's Cultural Resources Guideline 6, which calls for the protection of cultural resources largely by directing activities away from sensitive areas. The lead agency should evaluate the Project's consistency with this Guideline.

The lead agency must fully evaluate these areas before it can find that the Project will not have a significant impact on cultural resources. Without this information, the public and the decisionmakers cannot make an informed evaluation about the Project's impacts and whether the impacts can and will be mitigated. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.52 All instruments for the occupancy and use of forest lands must be consistent with the forest plans. (16 USC § 1604(i); 36 CFR 219.10(e).) The EIS/EIR does not discuss the Project's consistency with the Modoc National Forest Land Resource Management Plan's (LRMP) Sensitive Plants Guideline 6, which calls for the management and conservation of sensitive plant species and habitat. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.74 All instruments for the occupancy and use of forest lands must be consistent with the forest plans. (16 USC § 1604(i); 36 CFR 219.10(e).) The EIS/EIR also does not identify whether sensitive species such as the bald eagle, Swainson's hawk, goshawk, osprey and mule deer are within designated habitat as defined by the Modoc National Forest LRMP and would be subject to the standards and guidelines therein. (Modoc National Forest LRMP, pp. 4-25 to 4-29.) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.94 The Modoc National Forest LRMP includes stipulations for the protection of wildlife that may be imposed on projects on a case-by-case basis. (Modoc National Forest LRMP, p. 4-18.) Special Stipulation 5 includes prohibitions on conducting activities at any time near bald eagle winter roosts and nesting habitat, goshawk nesting territories. (*Id.* at p. I-2.) It also prohibits activities during critical periods. (*Ibid.*) This stipulation should be considered as a mitigation measure. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

Response—Consistency with Modoc National Forest Land and Resource Management Plan

The Draft EIS/EIR describes the Forest Service policies that apply to the project on pages 3-136 through 3-150 and pages 4-180 through 4-189. There is an extensive discussion in these sections about the compliance of the Draft EIS/EIR with the Modoc National Forest LRMP.

Comment T.17 references the Modoc LRMP on page 4-213. It is assumed that the comment refers to page 4-212 of the Modoc LRMP. On this page, the following standard and guideline is identified for the Medicine Lake Management Area: "Feature outdoor recreation use in the Medicine Lake caldera." The proposed power

plant and wellfield would not be located in the Medicine Lake caldera. The proposed transmission line would be located in the caldera, unless the lead agencies select Alternative 5 or 6. The transmission line would not be located in the caldera under Alternative 5 or 6.

As stated in the EIS/EIR in the Land Use and Recreation Section (e.g., see page 4-193 of the Draft EIS/EIR), the proposed project would not have a significant effect on the quality of recreational opportunities in the area. This determination was made based on the significance criteria outlined on page 4-190 of the Draft EIS/EIR. Although the effects of the project on recreation would not qualify as significant under CEQA, it is acknowledged that some visitors may consider the effects of the project to be adverse. See below (and the other comments referenced below) for a discussion of impacts to wildlife and compliance with the wildlife provisions of the Modoc LRMP.

Comment T.17 also references Geologic Special Interest Areas and suggests that the project would adversely affect the visual quality of these areas. Geologic Special Interest Areas are discussed in the Draft EIS/EIR on pages 3-4 and 4-4. The proposed project would have no direct effect on any of the three Geologic Special Interest Areas located in the area. The potential visual effects of the proposed project are discussed in Section 4.9 of the EIS/EIR. Effects of the proposed project on the visual quality from the Geologic Special Interest Areas (i.e., views of visitors who are standing in the Geologic Special Interest Areas) were not analyzed in the Draft EIS/EIR because these areas are not used regularly by visitors.

Comment Y.43 suggests that the proposed project would not comply with the Modoc LRMP for the avoidance of various types of wildlife and their habitats. The proposed project complies with the Modoc LRMP in the sections cited in the comment because:

- No bald eagle winter roost sites or nesting habitat are present in or near the project area. As stated on page 3-101 of the Draft EIS/EIR, the closest bald eagle winter roost site or nesting habitat is 3.5 miles southeast of the power plant and wellfield area, south of Medicine Lake.
- No bald eagle feeding sites in high concentration areas are present within the area of the proposed project. Bald eagles forage in Medicine Lake, approximately 0.25 south of segment A1 of the proposed transmission line.
- As described on page 3-105 of the Draft EIS/EIR, there is only one goshawk nesting territory near the project site: the "Grouse Hill" territory, which is 0.25 miles west of the wellfield, on the Klamath National Forest. Facilities were sited to avoid the nesting area. Mitigation measure 4.8.3c has been included to reduce potential impacts to the goshawks in this territory. This mitigation measure complies with the Klamath LRMP because it defines a limited operating period for the construction of project facilities that is based on the Klamath LRMP.
- Peregrine falcons do not nest or forage in or near the project area. Thus, no impacts to this species would occur.
- As described on page 4-118 of the Draft EIS/EIR, the loss of sage grouse strutting grounds would be considered significant under CEQA. In addition, the loss of such habitat would be inconsistent with the Modoc LRMP. Mitigation measure 4.8.3f is proposed to ensure that no transmission line structures are built within 0.5 miles of an active sage grouse strutting ground. Thus, with the implementation of mitigation measure 4.8.3f, the proposed project complies with the Modoc LRMP for sage grouse.

- Pine martens (called "American marten" in the Draft EIS/EIR) have been observed foraging in the project area (see page 3-110 of the Draft EIS/EIR). As stated in the Draft EIS/EIR on page 4-120, approximately 128 acres of foraging habitat for American marten would be lost as a result of the proposed action. Although no den sites have been identified within the wellfield and power plant area, project facilities would be sited to avoid preferred denning habitat.

  In addition, mitigation is proposed to avoid direct impacts to pine marten dens. Mitigation measure 4.8.3k states that all facility locations shall be surveyed by a qualified biologist for suitable denning structures once during the summer and once during the winter prior to construction. If marten are detected, activity shall cease to allow the animal to escape safely. The log piles, hollow logs, or other structures shall be reassembled at the periphery of the facility location to allow for future use as dens.

  Mitigation measure 4.8.3l states that along the transmission route, trees that are removed within marten habitat (above 5,000 feet) during clearance of the transmission line corridor shall be retained for use as future den structures. With the implementation of mitigation measures 4.8.3k and 4.8.3l, impacts to this species would be minimized and the project would comply with the Modoc LRMP.
- Streamside Management Zones have been replaced by Riparian Reserves in the Northwest Forest Plan. As discussed in response to "Comments—Riparian Reserves" below, the proposed project would not cross any designated Riparian Reserves. Thus, the project would be consistent with this policy in the Modoc LRMP, as amended by the Northwest Forest Plan.

The wildlife analysis is based on field studies and literature review conducted for the project. These studies are described in the biological reports that were prepared for or consulted for this project. For further discussion, see responses to comments in the Wildlife Section under the following topics (in the order in which they appear):

- Adequacy of Wildlife Surveys
- Wildlife Survey Methodology
- General Impacts to Special-Status Wildlife
- Wildlife Exposure to Noise
- Effects of Transmission Lines on Birds
- Bald eagle
- Northern Goshawk
- Pine Marten and Pacific Fisher

See the Noise Section of this document for responses to comments on noise impacts.

Comment Y.44 states that the visual impacts of the proposed project are underestimated and that the proposed project would not comply with the Modoc LRMP for visual resources. The comment references Special Stipulation 4A and 4B in Appendix I of the Modoc LRMP. Appendix I of the Modoc LRMP includes Special Stipulations for geothermal, oil, and gas leases on the Modoc National Forest.

Special Stipulation 4A and 4B protect Visual Quality Objectives as Retention. The potential visual impacts of the proposed project are extensively discussed in Section 4.9 of the EIS/EIR. Potential impacts from the steam plume, lighting, the transmission line, and the above-ground pipelines are specifically addressed in this section (e.g.,

see Table 4.9-1). The conclusion of the analysis in the EIS/EIR states that the project would not have a significant effect on the visual quality of the region as long as mitigation measures are adopted. With mitigation, Visual Quality Objectives of Retention or Partial Retention would be maintained. These mitigation measures are identified on pages 4-146 through 4-161 of the Draft EIS/EIR. See responses to comments in the Visual Quality Section for further discussion of these issues.

It is assumed that comment Y.45 refers to Appendix I of the Modoc LRMP, Special Stipulations for Geothermal, Oil and Gas Leasing. Special Stipulation 1 identifies several areas that should be protected and preserved in "as nearly natural condition as possible:"

- National Register cultural resource sites
- Developed recreation sites
- Devil's Garden Research Natural Area
- Glass Mountain Glass Flow, Burnt Lava Flow, and Medicine Lake Glass Flow Geologic Special Interest Area

None of these areas would be adversely or significantly affected by the proposed project. Thus, the proposed project is in compliance with Special Stipulation 1 of the Modoc LRMP.

Comment AG.37 questions whether the proposed project is consistent with the Modoc LRMP Cultural Resources Guideline 6. Cultural Resource Guideline 6 states: "Protect cultural resources largely by directing activities or use away from sensitive areas, by maintaining confidentiality, and by informing Forest users of cultural resource protection requirements." As stated on page 4-185 of the Draft EIS/EIR, the proposed project would be consistent with Modoc Forest policies for protection of cultural resources. Mitigation Measures 4.5.1a through 4.5.1j on pages 4-55 through 4-57 of the Draft EIS/EIR describe in detail the procedures that would be used to survey for and, if possible, avoid sensitive cultural resources. Where avoidance would not be possible, these mitigation measures describe the procedures that would be used to preserve the information contained in the cultural resource sites according to Federal and state laws. These mitigation measures would ensure that the project complies with the policies of the Modoc National Forest described in the Modoc LRMP.

Comment AG.37 also states that the lead agency must fully evaluate these areas before it can find that the project would not have a significant impact on cultural resources. The effect of the proposed project on Cultural Resources is fully evaluated in Section 4.5 of the EIS/EIR. The lead agencies will follow the requirements of Section 106 of the National Historic Preservation Act (and other laws) to evaluate and protect cultural resources. See responses to "Comments—Adequacy of Surveys at the Power Plant/Wellfield Site" and "Comments—Adequacy of Surveys along the Transmission Line" in the Cultural Resources Section for more information.

Comment AG.52 appears to be referring to Modoc National Forest Forest-wide Guideline 16 in the Modoc LRMP, not Guideline 6 (Guideline 6 refers to firewood). Guideline 16 states that the Forest will "Manage and conserve sensitive plant species

and their habitats to ensure that viable populations are maintained." The Draft EIS/EIR for the proposed project is consistent with Guideline 16.

Guideline 16(B) states that the Forest shall "Prior to project implementation, conduct inventories if potential habitat or known population locations are identified." The project would comply with the guideline. The Draft EIS/EIR includes the requirement to conduct a botanical survey of the project site and to conduct detailed summer and preconstruction surveys in the chosen transmission line corridor (i.e., Mitigation Measure 4.7.3a).

Comment AG.74 suggests that the Draft EIS/EIR does not identify whether sensitive species such as the bald eagle, Swainson's hawk, goshawk, osprey, and mule deer are within designated habitat as defined in the Modoc National Forest LRMP. The Modoc LRMP on page 4-26 defines "designated habitat" as "lands which are presently identified, or which may be identified as displaying the proper habitat attributes for supporting viable populations of a given species." The LRMP further states that "Field investigation, manual map overlays, and computer searches of the Forest data base are means of designating these areas."

As described in the EIS/EIR in Section 3.8, some habitat within the project area is suitable for sensitive wildlife species, including the bald eagle, Swainson's hawk, northern goshawk, osprey, and mule deer. In addition, as described in Section 4.8, some habitat for these species would be removed or disturbed by project construction. However, mitigation measures are defined to avoid or minimize these impacts so that they are not significant. See responses to comments in the Wildlife Section for more discussion of the potential project impacts to general wildlife habitat and to specific wildlife species, including the ones mentioned in comment AG.74.

Comment AG.94 states that Special Stipulation 5 in the Modoc LRMP should be considered as a mitigation measure to reduce impacts to bald eagles and northern goshawks. As stated in Section 4.8 of the EIS/EIR, no activity is proposed within one mile of any known bald eagle nest or winter roost site. Thus, the Draft EIS/EIR is consistent with Special Stipulation 5 for Geothermal, Oil, and Gas Leasing of the Modoc LRMP. Furthermore, the Draft EIS/EIR does not propose any activity within 0.25 miles of any known northern goshawk nesting territory. Activities within 0.5 miles of a known northern goshawk nesting territory are restricted to times outside of the goshawk breeding period (see Mitigation Measure 4.8.3c). See Section 4.8 of the EIS/EIR and the responses to "Comments—Bald Eagle" and "Comments—Northern Goshawk" in the Wildlife Section for further discussion of potential impacts to bald eagle and northern goshawk.

Comment AG.94 also suggests that other restrictions on project activities within Special Stipulation 5 should be followed. However, the other restrictions on activities within Special Stipulation 5 apply only to the following biological resources:

- Osprey nesting territories
- Golden eagle nesting territories
- Winter deer and pronghorn range
- Deer fawning areas

- Pronghorn kidding areas
- Swainson's' hawk areas

Because none of these resources occur in the project area, mitigation measures to reduce impacts to these resources are not required.

Comments—Consistency with Klamath National Forest Land and Resource Management Plan

AG.53 Also, the Klamath National Forest LRMP's Guidelines 7-1 and 7-4 for Sensitive Plants provide that the Forest Service should enhance sensitive plant species populations and habitat and avoid disturbances during critical growth periods. The lead agency should evaluate the Project's consistency with these forest plans.

Without this information, the public and the decisionmakers cannot assess the Project's impacts on vegetation and propose appropriate mitigation measures.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.75 Also, the Klamath National Forest LRMP requires the Forest Service to avoid or minimize impacts to sensitive species where possible. (Klamath National Forest LRMP Standard 8-18.) The Project's consistency with these forest plans should be discussed.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

CV.3 I question this statement that the requirement in the Klamath National Forest LRMP #25-25 was written in error. I believe that if there is a desire to amend this section, a public comment period should be established and public meetings held to address this issue and solicit comments from the tribe and interested members of the public. *(Kyle Haines)*

Response—Consistency with Klamath National Forest Land and Resource Management Plan

Comment AG.53 questions whether the Draft EIS/EIR is consistent with the Klamath National Forest Land and Resource Management Plan Guideline 7-1 and 7-4. The text of these guidelines is presented below:

- Guideline 7-1: Enhance Sensitive plant species populations and habitat to maintain reproducing, self-sustaining populations. Conduct an assessment to determine which Sensitive species are at a higher risk. Develop management strategies for higher risk Sensitive plant species first, with the intent of preventing the need for the species to become listed as T & E [threatened and endangered] species.
- Guideline 7-4: Disturbances to plant populations and occupied habitat should be avoided during critical periods of plant growth. Individual projects shall develop project-level mitigations [sic] measures to avoid adverse impacts to Sensitive species.

Guideline 7-1 applies to the planning process and management practices of the Klamath National Forest. This guideline does not apply to individual, site-specific projects such as the Fourmile Hill Geothermal Development Project.

The proposed project would avoid disturbing populations of sensitive species (using the Forest Service's definition of sensitive species) wherever possible. Mitigation measures to avoid significant adverse impacts to these species are proposed in the Draft EIS/EIR on page 4-94. Thus, the Draft EIS/EIR is consistent with Guideline 7-4.

The Draft EIS/EIR is also consistent with the Klamath National Forest LRMP. Comment AG.75 references Klamath LRMP Standard 8-18, which requires the Forest Service to minimize or avoid impacts to sensitive species where possible. The Draft EIS/EIR is consistent with this standard because mitigation measures are proposed to avoid or reduce impacts to all sensitive wildlife and plants (see Sections 4.7 and 4.8

for a discussion of these mitigation measures). With these mitigation measures, the impact to sensitive species would be reduced to a level below significance. Implementation of these mitigation measures avoids or minimizes the impacts to sensitive species wherever possible.

Comment CV.3 questions the need to revise Forest-wide standard #24-25 of the Klamath LRMP (comment CV.3 cites "#25-25" but the assumption is that the commentor meant "#24-25" instead). An explanation of this Forest-wide standard and the rationale for changing it is presented on pages 4-78 and 4-79, and 4-182 through 4-184 of the Draft EIS/EIR. As currently written, Forest-wide standard #24-25 sets forth an unenforceable policy, namely "to assure that [Native American] use will continue to occur and will not be impaired." The Klamath National Forest cannot force Native Americans to use any sites to "assure that use will continue to occur."

As stated in the Draft EIS/EIR, the intent of Forest-wide standard #24-25 was to comply with the American Indian Religious Freedom Act of 1978. This law describes the same policy as Forest-wide standard #24-25, except that the law does not require the continued use of Native American sites by Native Americans. Instead, the law protects the right of Native Americans to use traditional sites if they so desire. In contrast to Forest-wide standard #24-25, the Federal law is enforceable.

Comment CV.3 also recommends giving the public and the tribes an opportunity to comment on this proposal. The public and the tribes were given an opportunity to comment on this issue through the public comment period for the Draft EIS/EIR (which included public meetings and the opportunity to submit written comments). Public meetings were held in Klamath Falls, Yreka, Mt. Shasta City, Medicine Lake, and Dorris to obtain comments on the Draft EIS/EIR. Meetings with the Klamath and the Pit River Tribes have also been held to solicit comments on the Draft EIS/EIR.

Comment—Cumulative Watershed Analysis for Medicine Lake

O.3 Our largest concern lay with the protection of water quality in Medicine Lake. Medicine Lake lies within an enclosed hydrologic basin and is therefore extremely sensitive to potential water quality impacts. The Modoc LRMP states that Medicine Lake is the largest lake on the District - and the most popular recreation area (4-211). This lake also serves the spiritual and sacred ceremonies of the Shasta, Modoc, Klamath and Pitt River tribes and is highly valued within their cultures. The Fourmile Hill Geothermal Project is located within 3 miles of Medicine Lake (EIS, 3-20).

Through conversations with Forest Service representatives, it has become clear that a Cumulative Watershed Analysis has not been done for Medicine Lake in the wake of this geothermal project proposal. Not only is this a obvious violation of the Clean Water Act but is also a blatant disregard for the management guidelines found in the Modoc LRMP, which mandates the maintenance of water quality in Medicine Lake (4-212). Specifically, management for Medicine Lake must evaluate the potential of each project to degrade the lake's water quality (4-212). In the absence of a cumulative watershed analysis, this Fourmile Hill Geothermal Project is not in compliance with this direction.

(Katherine Kowatch, Friends of the River)

Response—Cumulative Watershed Analysis for Medicine Lake

The potential depositional effects of the proposed project on Medicine Lake are discussed on pages 4-34 through 4-38 of the Draft EIS/EIR. Based on the analysis presented in this section, the Draft EIS/EIR concludes that the project would not significantly affect the water quality of Medicine Lake. Based on comments received during the public comment period, this depositional analysis was redone in order to include more realistic assumptions in the model. Details of this new analysis are presented in the Final EIS/EIR and in responses to comments under "Surface Waters

and Effects from Deposition" in the Hydrology Section. This new analysis reached the same conclusion as the Draft EIS/EIR, that depositional effects to Medicine Lake would not be significant.

Additional baseline hydrology data has been collected by Calpine at Medicine Lake and at nearby water bodies. These data have been included in the Final EIS/EIR. These data are also discussed in the response to "Comments—Hydrologic Monitoring Plan" in the Hydrology Section.

The comment also states that a cumulative watershed analysis should be performed for Medicine Lake. According to Forest Service policy, cumulative watershed analyses are required only for areas that have one or more surface drainage channels. The Medicine Lake basin does not support any substantial surface drainage channels. Therefore, no cumulative watershed analysis is required for the Medicine Lake basin.

NORTHWEST FOREST PLAN

Comment—Medicine Lake Managed Late Successional Area

B.7 Alternatives number three and four to the proposed action, incorporate transmission line segment B2, which crosses the Medicine Lake Highlands MLSA. According to the Record of Decision (ROD) for *Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl* and *Standard and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Species within the Range of the Northern Spotted Owl*, the purpose of protecting MLSAs is similar to that of Late-Successional Reserves (LSR). The ROD specifies however, that certain silvicultural treatments and fire hazard reduction treatments may be permitted to help prevent complete stand destruction from large catastrophic events, such as fire. Alternatives three and four would remove habitat along a half mile of white fir-dominated forest and one-quarter mile of late seral stage forest in the MLSA. Since development of geothermal power is not one of the objectives of MLSAs, these alternatives are inconsistent with the ROD and should not be considered further. The Service recommends that the Draft EIS/EIR be revised to include other transmission line route alternatives that would be consistent with the ROD. *(Ronald A. Iverson, U.S. Fish and Wildlife Service)*

Response—Medicine Lake Managed Late Successional Area

The comment is correct in stating that geothermal energy production and its associated activities (e.g., road construction and transmission line construction) are not stated goals of the Northwest Forest Plan. However, as discussed on p. 3-149 of the Draft EIS/EIR, such activities within MLSAs are not prohibited by the Northwest Forest Plan as long as these activities do not violate other laws and they are consistent with other provisions of Forest Management Plans. The Northwest Forest Plan simply "discourages" rather than prohibits geothermal activities within MLSAs. Alternatives 3 and 4 are therefore not inconsistent with the goals of the Northwest Forest Plan for MLSAs.

The comment also states that the purpose of protecting MLSAs is similar to that of Late-Successional Reserves. The Northwest Forest Plan Standards and Guidelines for non-silvicultural activities within MLSAs defers to the Standards and Guidelines for Late-Successional Reserves. On page C-17 of the Plan, the following Standard and Guideline is given for development within Late-Successional Reserves (and, by reference, within MLSAs):

> "Development of new facilities that may adversely affect Late-Successional Reserves should not be permitted. New development proposals that address public needs or provide significant public benefits, such as powerlines, pipelines, reservoirs, recreation sites, or other public works projects will be reviewed on a

case-by-case basis and may be approved when adverse effects can be minimized and mitigated. Developments will be located to avoid degradation of habitat and adverse effect on identified late-successional species."

As described in Section 1.2 of the EIS/EIR, Purpose and Need, the proposed project addresses the public need for alternative energy sources. Furthermore, the proposed project could provide a significant public benefit by providing power to the northwest power grid that is generated from geothermal energy. Because the proposed project would meet a public need and may provide a significant public benefit, Alternatives that contain segment B2 of the transmission line (which passes through the Medicine Lake MLSA) will be evaluated by the USFS.

Regarding non-silvicultural activities within Late-Successional Reserves or MLSAs, the *Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* states that "While most existing uses and development are intended to remain, it may be necessary to modify or eliminate some current activities in Late-Successional Reserves that pose adverse impacts." The Modoc National Forest is currently mapping the distribution of habitat types within the Medicine Lake Highlands MLSA. Their preliminary map (dated October 24, 1996) indicates that transmission line alignment B2 may cross through mixed conifer, red fir, or white fir forest of relatively high-quality (tree crowns 24-40 feet in diameter, with greater than 70% crown cover). Immediately to the north of the B2 alignment is an area within the MLSA that is largely free of late-successional forest that could support the northern spotted owl. Mitigation measures have been added to Alternatives 3 and 4 to re-align segment B2 so that impacts to potential northern spotted owl habitat within the Medicine Lake MLSA are avoided.

The seven alternatives evaluated in detail in the Draft EIS/EIR represent a range of reasonable and feasible alternatives for the proposed action, consistent with NEPA and CEQA. Other transmission line alternatives were considered, but would not be feasible or would not avoid or reduce environmental impacts (see Section 2.5 of the EIS/EIR). Additional transmission line alternatives will therefore not be considered in the Final EIS/EIR.

Comments—Riparian Reserves

K.10 Riparian reserves must be defined as "any nonpermanent flowing drainage feature having a definable channel and evidence of annual scour or deposition" (p. C-31). Seeps and springs must be classified as streams if they have sufficient flow in a channel, or if they qualify as seasonal or perennial wetlands under the criteria defined in the 1987 Corps of Engineers Wetlands Manual (p. B-16).

All unstable and potentially unstable areas must be included in riparian reserves (p. C-31). This includes all areas characterized by steep slopes and soft, underlying bedrock (pp. B-23-B-26).

Riparian reserve widths must be measured according to the height of sight-potential trees (p. C-31).

Riparian reserves must contain adequate dispersal habitat for terrestrial species such as the northern spotted owl (p. B-31).

(Ryan Henson, California Wilderness Coalition)

AG.289 Riparian Reserve Areas Should be Mapped. In the description of regional overview in the wildlife section (p. 3-98 to 3-99) the EIS/EIR states that there is "little surface water, few permanent streams or riparian habitats, and few springs, meadows, or wetlands." However, in Section 5 of the document, on page 5-6, mitigation measure 4.3.5a states "Calpine shall not site transmission line structures and access roads (except road crossings) within Riparian Reserve areas as delineated by the USFS". There is no discussion in the vegetation or wildlife sections of these Riparian Preserve areas.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Riparian Reserves

Riparian Reserves are areas designated in the Northwest Forest Plan to preserve aquatic ecosystems and the geomorphic processes associated with these ecosystems. Riparian Reserves are often designated as portions of watersheds in which riparian-dependent resources receive the primary management emphasis. Riparian Reserves include areas that generally parallel the stream network but also include other areas necessary for maintaining hydrologic, geomorphic, and ecological processes in aquatic systems. These other areas may include lakes, ponds, or wetlands.

Riparian Reserves are designated based on guidelines and criteria described in the Northwest Forest Plan. The Plan specifies that Riparian Reserves shall have a minimum width, which will depend on the type of habitat within them. This minimum width provides a buffer zone around the perimeter of the habitat. Riparian habitat types are divided into five general categories, which are listed in order of Reserve width (from widest to narrowest):

- Fish-bearing streams
- Permanently flowing non-fish-bearing streams
- Constructed ponds and reservoirs, and wetlands greater than 1 acre
- Lakes and natural ponds
- Seasonally flowing or intermittent streams

No Riparian Reserves are present on the Klamath National Forest in or near the project sites. On the Modoc National Forest, the majority of the Riparian Reserves have been designated around seasonal wetlands or permanent lakes (e.g., Medicine Lake, Little Medicine Lake). The only portion of the proposed project that might affect a Riparian Reserve is segment A1 of the proposed transmission line. Depending on its final alignment, segment A1 may be nearby the following Riparian Reserves:

- Medicine Lake, which has a buffer zone of approximately 300 feet surrounding it.
- A large seasonal wetland between Medicine Lake and the Medicine Lake Glass Flow, which has a buffer zone of approximately 150 feet (see Figure 3.7-2 of the EIS/EIR for the location of this wetland and page 3-85 of the Draft EIS/EIR for a description of this wetland).
- A small seasonal wetland (less than one acre) on the southern edge of the Medicine Lake Glass Flow (see Figure 3.7-2 of the EIS/EIR for the location of this wetland). Because of its small size, there is no buffer zone surrounding this wetland.

Segment A1 would not come within 300 feet of Medicine Lake, so it would not enter the Medicine Lake Riparian Reserve. As shown on Figure 3.7-2 of the EIS/EIR, segment A1 would not cross the small seasonal wetland adjacent to the Medicine Lake Glass Flow. As it is currently aligned, segment A1 passes through the large seasonal wetland north of Medicine Lake. However, Mitigation Measure 4.7.4a on page 4-95 of the Draft EIS/EIR has been proposed to reroute the transmission line to the north of the meadow, adjacent to the Medicine Lake Glass Flow. Implementation of this mitigation measure would ensure that this meadow would be avoided, and would allow an adequate buffer to protect the glass flow (See also response to "Comments—Effects on Wetlands" in the Vegetation Section for more information.) Mitigation Measure 4.7.4a has been revised to

ensure that the buffer zone around the Riparian Reserve will also be avoided during transmission line and road construction:

> "4.7.4a In order to avoid the meadow north of Medicine Lake, the portion of segment A1 of the transmission line corridor near the meadow shall be relocated to be routed north of this meadow, between the meadow and the Medicine Lake Glass Flow. The transmission line at this location shall be constructed to avoid the meadow and its 150-foot Riparian Reserve buffer zone by ensuring that the transmission line poles are located such that the transmission line spans any portion of the meadow or its buffer zone underneath the line. Access roads shall not be located in the meadow area or in its buffer zone, and construction activities shall avoid this meadow and its buffer zone~~to the greatest extent possible~~. (C)"

Special management standards and guidelines apply to Riparian Reserves in order to preserve their important ecosystem functions. These standards and guidelines are divided into eleven categories based on the type of management activity:

- Timber management
- Roads management
- Grazing management
- Recreation management
- Minerals management
- Fire/Fuels management
- Lands
- General riparian area management
- Watershed and habitat restoration
- Fish and wildlife management
- Research

With the implementation of Mitigation Measure 4.7.4a (as revised above), no activity is proposed for this project within any Riparian Reserve. However, even without mitigation, only the standards and guidelines pertaining to "roads management" (pages C-32 and C-33 of the Northwest Forest Plan Standards and Guidelines) apply to this project. The impacts of roads on water quality (the maintenance of which is a key goal of Riparian Reserves) is discussed on pages 4-30 and 4-31 of the Draft EIS/EIR. Mitigation Measure 4.3.5a and 4.3.5b are proposed on page 4-31 to reduce the potential impacts of road construction. Mitigation Measure 4.3.5a has been revised to state that roads will not be built in any Riparian Reserve. (See response to "Comments—Surface Water Impacts from Road Construction and Maintenance" in the Hydrology Section for a discussion of this mitigation measure.) This and other mitigation measures proposed in Section 4.3, Hydrology, are consistent with the Standards and Guidelines for roads management described in the Northwest Forest Plan.

Comment K.10 cites the criteria by which Riparian Reserves are delineated. This delineation has already been conducted by the USFS for the Klamath and Modoc National Forest.

Comment AG.289 suggests that Riparian Reserves be discussed in the Vegetation or Wildlife Section of the Draft EIS/EIR. Because Riparian Reserves are a designation in the Northwest Forest Plan, they are discussed in Section 3.10, Plans and Policies, rather than in Vegetation or Wildlife. As stated above, Riparian Reserves include a variety of vegetation types and habitats, including coniferous forests, meadows, aquatic systems (e.g., streams, lakes, ponds), and riparian woodland. No Riparian Reserves are present on the Klamath National Forest in or near the project site. Three Riparian Reserves are present on the Modoc National Forest (wetlands and open water habitats only), none of which would be affected by the proposed project with the implementation of proposed mitigation measures.

Comments—Retention of Snags and Woody Debris

K.13 Green tree and snag retention guidelines must be met (p. C-41- C-42).

Any coarse woody debris on the ground must be retained and protected to the greatest extent possible (p. C-40).
(Ryan Henson, California Wilderness Coalition)

AG.57 Also, standards for retention of dead and down woody debris and snags should be discussed. (Ex. D.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Retention of Snags and Woody Debris

Maintaining many of the sensitive species in the Forest requires the maintenance of unique features within the habitat that provide additional habitat structure. These features include the presence of dead trees (i.e., snags) and coarse woody debris on the ground and in aquatic habitats. The retention of these features has been identified in the Northwest Forest Plan as a guideline for the management of Matrix lands (page C-40 of the Northwest Forest Plan).

As stated on page 4-109 of the Draft EIS/EIR, the proposed project has the potential to remove or disturb (1) isolated stands of late-seral forest and (2) individual trees and snags with dbh greater than or equal to 18 inches. The actual number of snags that would be removed by the project depends on the final transmission line alignment. Mitigation Measure 4.8.1e on page 4-110 of the Draft EIS/EIR is proposed to compensate for snags removed during project construction. According to this mitigation measure, Calpine would replace lost snags with dbh greater than or equal to 18 inches in accordance with USFS policy and in accordance with the standards and guidelines of the Northwest Forest Plan. Incorporation of this mitigation measure ensures that the project meets the standards for the retention of snags in the Northwest Forest Plan.

The retention of downed, woody debris is also a goal of the Northwest Forest Plan. The project may remove and disturb late-successional forest that contains downed woody debris that is important for some wildlife. Mitigation Measure 4.8.1d on page 4-110 of the Draft EIS/EIR directs Calpine to replace lost stands of late-successional forest. Techniques that could be used (upon approval of the USFS) to replace these lost stands include the creation of woody debris on the forest floor. The use of this management technique would meet the objectives of the Northwest Forest Plan for the retention of downed woody debris.

Comment K.13 references a guideline for the retention of "green trees." The retention of green trees is a guideline for the management of timber harvests within Matrix lands. This guideline (Northwest Forest Plan, page C-41) states that patches of green

trees (i.e., uncut trees) at least 2.5 acres in size should be left within harvested areas. Some wildlife species may also benefit from the retention of single trees within these harvested areas. Because the proposed project does not include tree harvesting of large patches (within which smaller patches or single trees might be left), this guideline does not apply. Furthermore, the retention of green trees within the transmission line corridor would pose a serious safety risk. As discussed on pages 2-42 through 2-46 of the Draft EIS/EIR, live and dead trees would be removed from the transmission line corridor in order to minimize the risk of fires caused by trees contacting the transmission lines.

Comments—Watershed Analysis

K.9 The Medicine Lake Highlands are the only portion of the Modoc National Forest covered by President Clinton's Northwest Forest Plan (hereafter referred to as Option 9). Unfortunately, we suspect that most of Option 9's standards and guidelines have not even been considered as part of this project given their scant coverage in the EIS/EIR.

We request that the final EIS specifically explain how each of the following requirements of Option 9 will be met (all citations are from the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, USDA USFS, USDI BLM, April, 1994):

A watershed analysis must be completed before any management activities are carried out in roadless areas (p. B-19).

A watershed analysis must be performed before interim riparian reserves may be entered for management activities, regardless of the type of activity proposed (pp. C-31-C-321.)

(Ryan Henson, California Wilderness Coalition)

Y.47 There are also Northwest Forest Plan Option 9 requirements to do a watershed analysis before proposing major projects. To our knowledge this has not been done. All action alternatives in the DEIS/EIR have significant impacts on old growth forests and some of the wildlife species protected under the Northwest Forest Plan, as well as other species of concern. The DEIS/EIR fails to meet the requirement of an action alternative without significant impacts on old growth forests.

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

Response—Watershed Analysis

The comments state that a watershed analysis must be prepared before any management activities are conducted in roadless areas or before proposing major projects. As stated in the Northwest Forest Plan on page A-7 and B-20 of the Standards and Guidelines watershed analysis is required before projects can be approved in the following areas:

- Key Watersheds designated in the Northwest Forest Plan
- Riparian Reserves
- Inventoried roadless areas

First, as stated in the Draft EIS/EIR on page 3-137, the proposed project is not within a Key Watershed, as designated in the Northwest Forest Plan. Second, as described in the response to "Comments—Riparian Reserves" above, the project would not cross any Riparian Reserve. Finally, the proposed project is not within an inventoried roadless area, as defined in the Northwest Forest Plan (see below). Thus, a watershed analysis is not required prior to the approval of the proposed project because the project is not within any of the three areas listed above.

Comment K.9 cites page B-19 of the Northwest Forest Plan Standards and Guidelines as support for the need to perform a watershed analysis. As stated on page B-19 of the Northwest Forest Plan, in order for the policy to apply to areas within a roadless

area (e.g., the Mt. Hoffman released roadless area), the "roadless area" must still qualify as roadless under the criteria used in the Forest Service's second Roadless Area Review and Evaluation (RARE II). The Modoc National Forest does consider the Mt. Hoffman released roadless area as a "roadless area" under the Northwest Forest Plan.

If an alternative is selected for the project that goes through the Mt. Hoffman released roadless area, a watershed analysis would be performed prior to the Record of Decision. However, at this time, the lead agencies have identified Alternative 6 as the lead agencies' preferred alternative. This alternative would use segment A3 instead of segments A1 and A2, and would not pass through the Mt. Hoffman released roadless area. Thus a watershed analysis for Mt. Hoffman released roadless area would not be required for Alternative 6.

Comment K.9 also states that a watershed analysis must be performed before interim Riparian Reserves may be entered for management activities. As stated above and in the response to "Comments—Riparian Reserves" above, the proposed project would not enter or pass through any Riparian Reserves. Therefore, no watershed analysis would be required. Note that the USFS has already completed an analysis similar to that of a watershed analysis for the Goosenest Adaptive Management Area (USFS 1996), which includes the portion of the proposed project located on the Klamath National Forest.

Comment Y.47 expresses concern over potential impacts to old-growth forests and their associated wildlife species. For a discussion of this issue, see response to "Comments—General Effects on Old-Growth (Late-Seral) Forests" in the Vegetation Section, and responses to "Comments—General Impacts to Special-Status Wildlife" and "Comments—Northern Spotted Owl," both in the Wildlife Section.

Reference:

USFS. 1996. *Goosenest Adaptive Management Area Ecosystem Analysis*. U. S. Forest Service, Pacific Southwest Division. April.

Comments—Designation as Old-Growth Reserve

AC.3 A presidential order declared this area an old-growth reserve as part of the Northwest Forest plan. Disturbance of this region will DISRUPT and DAMAGE those trees and the entire area. *(Tim McKay, North Coast Environmental Center)*

AS.3 As you are undoubtedly aware President Clinton has designated an old growth reserve in this area as part of his north west Forest Plan. Please send a map or written description of the boundaries of this old growth reserve, with an overlay of proposed energy developments and associated facilities. *(Brian B. Beard)*

AV.2 This proposed project will substantially degrade a pristine area with significant old-growth forests and endangered species, including both the northern and California spotted owl. This area has been designated an old-growth reserve as part of President Clinton's Northwest Forest Plan. *(Dave and Laurie Bish)*

AY.2 As you know, President Clinton designated this area as an old growth reserve as part of this Northwest Forest Plan. This was because of its extensive forest and biodiversity. The Highlands are home to the Bald Eagle, Osprey, American Marten, Goshawk, Peregrine Falcon, Pileated Woodpecker, and Northern Spotted Owl and California Spotted Owl. *(Theresa Brady)*

BK.2 These spectacular wildlands contain extensive ancient forest and biodiversity values and were designated an old-growth reserve by President Clinton's Northwest Forest Plan. *(John Copoulos)*

BU.3 I question the legality of such a project where it would impact an endangered species such as the spotted owl. The importance of this habitat has been recognized by the Clinton administration as an old-growth reserve. *(Bob DeNike)*

BZ.3 The President even designated it an old-growth reserve; and after 95% of ancient forests being cut on public lands (which is neither equitable, fair, economical nor "multiple-use), it seems logical to protect what little wilderness is left. *(Dean H. duVernet)*

CE.3 So great are its extensive ancient forest and biodiversity values it has been designated by President Clinton as part of his Northwest Forest Plan with the eventual prospect of national monument status. *(Paul Emery)*

CT.3 President Clinton designated the area an old-growth reserve as part of his Northwest Forest Plan because of the ancient forests and the many other species to be found in the area. *(Sylvia M. Gregory)*

DP.1 I would like to call your attention to the proposed geothermal project in Medicine Lake Highlands of Modoc National Forest in Siskiyou County.

The Medicine Lake Highlands is an area containing ancient forest, rare wildlife, and biodiversity values not likely to be found elsewhere. It is my understanding that the Clinton administration designated it as an "old growth reserve". *(DelMar Janson)*

DV.2 The project is proposed in an LSR with old growth forest that I have personally vowed to try to protect for future generations since we have destroyed so much of our precious old growth already. We must protect all that is left which isn't much. *(Marilee Jordan)*

DV.3 I don't have to tell you that LSR's are set aside for the protection of wildlife habitat. I am particularly concerned for the species dependent on old growth forest and corridors linking them to other roadless areas; i.e., martens, fishers, goshawks and spotted owls. Transmission lines, noise from construction, motorized vehicles and the resultant plant are not compatible with the purpose and intent of an LSR. *(Marilee Jordan)*

GD.2 This area, the Medicine Lake Highlands, has been designated by President Clinton as part of the Northwest Forest Plan as an old-growth reserve, because of its rich diversity and biodiversity values. It is home to Northern and California Spotted Owls as well as many other rare birds. *(Dolores Plumb)*

GR.3 A presidential order declared this are an old-growth reserve as part of the Northwest Forest Plan. Disturbance of this region will DISRUPT and DAMAGE those trees and entire area. *(Marylee Patricia Rohde)*

Response—Designation as Old-Growth Reserve

As described on page 3-136 of the Draft EIS/EIR, the Northwest Forest Plan (otherwise known as the "President's Plan") designated areas within the range of the northern spotted owl as one of seven types of land:

- Congressionally Reserved Areas (e.g., Designated Wilderness, National Parks, National Monuments)
- Late-Successional Reserves
- Managed Late-Successional Areas
- Riparian Reserves
- Adaptive Management Areas
- Administratively Withdrawn Areas
- Matrix (includes those Federal lands not designated as one of the other six categories)

Two of these land designations, Late-Successional Reserves (LSRs) and Managed Late-Successional Areas (MLSAs), may be the designations to which all of the comments refer. The primary goal of LSRs and MLSAs is to preserve and enhance late-successional, or "old-growth" forest. However, only a portion of the Medicine Lake Highlands has been designated as either an LSR or an MLSA. The proposed project would not occur within or near any Late-Successional Reserve; the nearest Late-Successional Reserve to the proposed project is approximately six miles south of

Medicine Lake. Thus, no impacts to Late-Successional Reserves would occur as a result of the proposed project.

The proposed project would cross an MLSA, the Medicine Lake MLSA (see Figure 3.10-2 on page 3-142 of the Draft EIS/EIR). However, the lead agencies' preferred alternative is Alternative 6, which would not cross the Medicine Lake MLSA. Adoption of this preferred alternative would avoid impacts to the Medicine Lake MLSA. For further discussion, see response to "Comments—Medicine Lake Managed Late-Successional Area" above.

For a discussion of potential impacts to old-growth Forest, see response to "Comments—General Effects on Old-Growth (Late-Seral) Forests" in the Vegetation Section. For a discussion of the potential impacts to the sensitive wildlife species mentioned in the comments, see the following responses to comments in the Wildlife Section (listed in the order in which they appear):

- Bald Eagle
- Northern Goshawk
- Northern Spotted Owl
- Osprey
- Pine Marten and Pacific Fisher

Comments AV.2, AY.2, and GD.2 cite other sensitive wildlife species including the peregrine falcon, pileated woodpecker, and California spotted owl. As discussed in Section 3.8 of the EIS/EIR, Wildlife, the peregrine falcon and California spotted owl do not occur in the project area. A discussion of the pileated woodpecker is found on page 3-107 of the Draft EIS/EIR. As discussed on page 4-118 of the Draft EIS/EIR, the proposed project would not have a significant effect on the pileated woodpecker.

Comment CE.3 references national monument status. See response to "Comments—National Monument Designation" at the beginning of this section.

Comment—Potential Effects to Late-Successional Forests

K.11 No cutting of late-successional forest is allowed in watersheds where 15 percent or less of the federal forest land is late- successional forest (p. C-44-C-45). *(Ryan Henson, California Wilderness Coalition)*

Response—Potential Effects to Late-Successional Forests

The Northwest Forest Plan provides for the retention of late-successional forest patches in areas where little acreage of this forest type currently remains. Special standards apply to fifth-field watersheds in which less than 15% of the watershed area is covered by late-successional forest. Fifth-field watersheds are defined by the U.S. Geological Survey as watersheds 20 to 200 square miles (12,800 to 128,000 acres) in size. Some of the project area is within fifth-field watersheds. Therefore, the standard outlined above applies to the proposed power plant and wellfield area and to segment A1 and a portion of segment A2 of the proposed transmission line.

As stated in the Northwest Forest Plan, "Landscape areas where little late-successional forest persists should be managed to retain late-successional patches." (Standards and Guidelines page C-44). The Northwest Forest Plan defines late-successional stands as those greater than 80 years old. On the Modoc National Forest, only segment A1 and a

portion of segment A2 are within the range of the northern spotted owl (see Figure 3.10-2 in the EIS/EIR) and subject to the standards and guidelines of the Northwest Forest Plan. Within this area, more than 15% of the forest is late-successional, as defined by the Northwest Forest Plan. Clearing of forest associated with this project would not reduce the proportion of late-successional forest in the watershed below 15%.

On the Klamath National Forest, the proposed project is within the Goosenest Adaptive Management area. According to the Standards and Guidelines of the Northwest Forest Plan, in the Goosenest Adaptive Management Area, the 15% "should be considered as a threshold for analysis rather than a strict guideline" (Northwest Forest Plan Standards and Guidelines page D-11). The vegetation around the proposed power plant and wellfield does not meet the criteria for late-successional vegetation based on the analysis in the Goosenest Adaptive Management Area Ecosystem Analysis (USFS 1996).

For more discussion of impacts to late-successional forests and their associated special-status species, see the following responses to comments (the section in which each response is found is listed in parentheses at the end of the response name):

- General Effects on Old-Growth (Late-Seral) Forests (Vegetation)
- Mitigation for Impacts to Late-Seral Forest and General Wildlife Habitat (Vegetation)
- Northern Spotted Owl (Wildlife)
- Pine Marten and Pacific Fisher (Wildlife)
- Wildlife Mitigation (Wildlife)

RELEASED ROADLESS AREAS

Comments—Wilderness Designation for Released Roadless Areas

AS.1 I support wilderness designation for both the Mount Hoffman and Burnt Lava Flow Roadless Areas. *(Brian B. Beard)*

CV.2 The Mt. Hoffman Roadless Release Area along transmission line Section A2 is worthy of wilderness status. This is an important biological corridor for sensitive species, and is adjacent to the Glass Mountain 51A area. The soils are also very fine and steep in this area, which would lead to a greater erosion potential. There is also a recreation possibility near the hot spot, due to the existence of fumeroles and high quality obsidian and foam blocks adjacent to the roadless area. *(Kyle Haines)*

HP.3 Good to designate the Mt. Hoffman/Glass Mountain Wilderness of 16,000 acres. *(John R. Swanson)*

Response—Wilderness Designation for Released Roadless Areas

Wilderness designation is outside the scope of this EIS/EIR. The recommendations for Wilderness designations are considered in the development and revisions of the LRMPs. The Mt. Hoffman released roadless area was not proposed for Wilderness status in the LRMPs. The California Wilderness Act of 1984 designated five areas on the Modoc National Forest for incorporation into the National Wilderness Preservation System. No other wilderness planning areas exist on the Modoc National Forest. The opinions stated in the comments are referred to USFS staff for their consideration when the status of the Mt. Hoffman roadless release area is reviewed in the future for possible Wilderness designation.

Comments—Potential Impacts to Released Roadless Areas

T.16 It is not just the Mount Hoffman roadless area that would be affected in a manner inconsistent with the Modoc Forest Plan (a management prescription of Semi- Primitive Non-Motorized applies to the released roadless area). *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

Y.49 Three roadless areas—Mount Hoffman Roadless Area, Glass Mountain and the area north of Dry Lake—were identified in the 1970's as potential wilderness, released as roadless areas. No impacts on wilderness or on non-motorized primitive recreation are analyzed in the DEIS/EIR. We understand that impacts of first entries into Roadless Areas require a NEPA process of their own. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

BR.4 Also, the remaining roadless areas in northeastern California are few and small in size and mostly unprotected. These areas should be left in a natural condition with only existing low-intensity uses allowed. Alternative 5 meets this condition. *(Bill DeJager)*

CW.5 Roadless areas are so rare and this designation is becoming more meaningless all the time. These areas are essential habitat for many predators who roam over a wider space. *(Barbara Hannelore)*

PH4.50 What is a roadless release area? *(Mount Shasta Public Hearing)*

Response—Potential Impacts to Released Roadless Areas

Released roadless areas are described in the Draft EIS/EIR on page 3-138 (note that they were called "roadless release areas" in the Draft EIS/EIR in error). Three released roadless areas could be affected by the proposed project (depending on the alternative selected): Mt. Hoffman, Lava, or Dobie Flat. If a transmission alignment is chosen that includes segment A2, the project would cross the Mt. Hoffman released roadless area. If the lead agencies' preferred alternative (Alternative 6) is chosen, the project would cross approximately 1.5 miles of the Lava released roadless area in its southeast corner, and approximately 2 miles of the Dobie Flat released roadless area in its southern portion (see Figure 3.10-1 on page 3-139 of the Draft EIS/EIR).

As discussed in the Draft EIS/EIR on page 4-184, construction of a transmission line is not inconsistent with the management guidelines that apply to released roadless areas. These areas have been "released" from consideration as Wilderness and are subject to the same management guidelines as National Forest lands in other areas. See response to "Comments—Mt. Hoffman Released Roadless Area" below for further discussion of the policies governing the management of released roadless areas and a discussion of the requirement for separate preparation of an EIS for penetration into a roadless area (comment Y.49).

Comments—Mt. Hoffman Released Roadless Area

K.3 The Mount Hoffman Roadless Area is consistently referred to as a "roadless release area" in the EIS/EIR. We have been following roadless area development issues since the 1970s when the Forest Service first identified roadless areas through the first and second Roadless Area Review and Evaluation studies. In all that time, we have never encountered the term "roadless release area." The closest is the term "released roadless area" which is simply a way for the Forest Service to point out the fact that such roadless areas were "released" from wilderness consideration by the California Wilderness Act of 1984 until the next forest planning cycle. We have always considered this term somewhat insulting since it is designed to make roadless areas seem inconsequential, Thus, "roadless release area" is not only insulting to conservationists, but confusing as well since it has never, at least to our knowledge, been used before. The Modoc National Forest should know that the "release" clause of the California Wilderness Act of 1984 does not free the Forest Service from its obligation under the National Environmental Policy Act (NEPA) to consider the site-specific impacts of developing roadless areas and diminishing their primitive character (Smith v. U.S. Forest Service, F.3d, 9th Circuit Number 93-36187). *(Ryan Henson, California Wilderness Coalition)*

K.4 As we informed the Forest Service in 1995 during the scoping process for the Glass Mountain Unit Geothermal Exploration Project EA/IS, much of this proposed powerline construction will occur in the Mount Hoffman Roadless Area. We further informed the Forest Service that the impacts of the proposed action on the roadless area must be assessed in an EIS. Unfortunately, our concerns were ignored in the EIS/EIR since the description of the Mount Hoffman Roadless Area contained in the EIS/EIR on pages 3-

140-3-141, as well as the discussion of the project's impacts on the roadless area on pages 4-198-4-200, fail to discuss the Forest Service's roadless area evaluation criteria, namely natural integrity, apparent naturalness, remoteness, solitude, special features, manageability, logical boundaries, and special places or values. We are surprised that these issues were ignored since the Modoc National Forest has complied with the laws and policies covering roadless areas in the past by considering the impacts of projects on these values. See, for example, the Mount Vida Planning Area Final Environmental Impact Statement, Modoc National Forest, July, 1991. *(Ryan Henson, California Wilderness Coalition)*

K.6 On the same page, the EIS/EIR mentions that off-road vehicles may be allowed to use the powerline corridor without even bothering to assess the ecological, cultural, recreational, and other impacts of allowing such motorized use in a roadless area. Apparently, the Modoc National Forest is oblivious to the fact that off-road vehicle use in roadless areas is terribly controversial and has itself been the subject of numerous environmental impact statements, appeals, and court battles in Forest Service Region 5. *(Ryan Henson, California Wilderness Coalition)*

K.7 Lastly, page 4-200 offers an analysis that is both myopic and misleading. For example, the EIS/EIR ignores the fact that the Mount Hoffman Roadless Area will be cut in half by the powerline and road project, and simply asserts that only 24 acres (0.2 percent of the roadless area) will be affected. This analogous to asserting that a gunshot victim is not seriously injured since the hole in his body is only quarter-inch wide and occupies only a small percentage of his body as a whole. *(Ryan Henson, California Wilderness Coalition)*

K.8 It is important to note that, in the past, the Modoc National Forest (as well as other national forests) have prepared far more defensible and thorough environmental impact statements for projects destroying similar amounts of roadless acreage. For example, the Mount Vida EIS referenced above provided an extensive discussion of roadless area values for a proposal to construct one mile of road through the Mount Vida Roadless Area. Like the Fourmile Hill project, the Mount Vida road project would have cut the roadless area in half and affected "only" 55 acres (0.6 percent of the Mount Vida Roadless Area). Despite this, the Forest Service made an effort to assess the impacts of the proposed road on the Mount Vida Roadless Area's natural integrity, apparent naturalness, remoteness, solitude, special features, manageability, logical boundaries, and special places or values. It seems that the Modoc has decided to give NEPA short shrift for the Fourmile Hill project.

As a result, the EIS/EIR violates 42 U.S.C. subsection 4321-4370 (NEPA) which requires that environmental impact statements examine the impact of major federal actions that may significantly affect the quality of our environment. More specifically, "The decision to develop a previously undeveloped area is an irreversible and irretrievable decision, the impacts of which must be analyzed in an EIS" (California v. Block, 690 F.2d 753, Ninth Circuit. 1982). The Forest Service has an obligation under NEPA to consider the site- specific impacts of developing roadless areas and diminishing their primitive character (Smith v. U.S. Forest Service, F.3d, 9th Circuit Number 93-36187).

The Mount Hoffman Roadless Area is over 5,000 acres in size and remains primitive in character. Thus, it qualifies as a future addition to the National Wilderness Preservation System according to the criteria established by the Wilderness Act of 1964. As the courts have affirmed, "[t]he possibility of future wilderness classification triggers, at the very least, an obligation on the part of the agency to disclose the fact that development will effect a 5,000 acre roadless area" (Smith v. U.S. Forest Service, supra. slip op. at 9489). In addition, the Forest Service Handbook states that if a "substantial alteration" of a roadless area's primitive character is proposed, an EIS must be prepared and impact of the proposed action on the roadless area must be considered (1909.15 Section 20.6 WO Amendment 1909.15-92-1). This direction is no mere paperwork exercise--it recognizes the ecological importance of these areas and the inherently controversial nature of development projects proposed in them.

The arguments mentioned above regarding NEPA and proper roadless area analyses have been affirmed numerous times by both the Forest Service through the administrative appeals process, as well as by the courts (see Appeal to the Regional Forester for Region 4 of the United States Forest Service of the DN for the Woodfords Timber Sale in the Toiyabe National Forest by the California Wilderness Coalition, the Wilderness Society, and Sorensen's Resort, August 25, 1994).

As the foregoing discussion demonstrates, the effect of the proposed action on the wild character of the Mount Hoffman Roadless Area was improperly studied in the EIS/EIR (or more precisely, not studied at all). Thus, the EIS/EIR does not satisfy the detailed analysis requirements set forth in 36 C.F.R. 219.17. *(Ryan Henson, California Wilderness Coalition)*

O.8 It is imperative that the wilderness and roadless character of the Mount Hoffman Roadless Area be retained. The Mount Hoffman roadless Area has two distinct regions. The first part of this roadless area contains a lush mix of over 5,000 acres of pines and firs which cover the landscape in an unbroken pattern. Bald eagles are found in this area near No Name Lake. From the slopes of Mount Hoffman, one can view scenic Mount Shasta and Lassen Peak. The east side of the roadless area is home to Glass Mountain, which was formed from three independent lava flows. Glass Mountain is classified as a Geological Area by the Pacific Southwest Regional Forester. Such a classification requires that the area remain as close to its natural condition as possible. Do not jeopardize the wilderness characters of the

Mount Hoffman Roadless Area by allowing a geothermal transmission line to be placed in this area and disrupt this pristine area. Any human development will disturb the unbroken pattern of the landscape and will violate the requirements of the Pacific Southwest Regional Forester.
(Katherine Kowatch, Friends of the River)

Q.6 The Mount Hoffman Roadless Area will be significantly affected by the proposed project. The EIS/EIR evaluates some of the effects of the proposed action on the Roadless Area and concludes that they are less than significant. However, the EIS/EIR does not evaluate the effects of the proposed project on the Roadless Area in relation to its importance to wildlife and humans. Roads, rights-of-way, and transmission lines into the Roadless Area will disturb wildlife by the noise of motorized vehicles, as well as increase the chances of poaching and collisions between wildlife and motorized vehicles.

It is important to consider that forested roadless areas are rare in the Medicine Lake Highlands and provide values that, once eliminated, are not easily replaced The EIS/EIR for this proposed project does not adequately consider and disclose these effects, and as a result, does not fully inform the public of the consequences if the project goes forward *(Lori J. Cooper, Klamath Forest Alliance)*

AD.61 The EIS/EIR at 3-140 states that an Environmental Impact Statement is needed for entry into Roadless Release Areas. Not only segment A2 of the transmission line would cross the Mount Hoffman Roadless Area, but also the freshwater pipeline from Arnica Sink to the Power Plant at Fourmile Hill. The EIS/EIR does not make it clear how the impacts to Roadless Areas will be treated and how the scoping, public input and decision process will be carried out. As with amendments to the Forest Plans, entries into Roadless Areas should be evaluated in a separate EIS process where the impacts are disclosed and input solicited specifically for this action. *(Floyd J. Buckskin, Pit River Tribe)*

BR.2 Dissecting or otherwise developing the Mt. Hoffman roadless area. *(Bill DeJager)*

GP.3 The project will chip away the Mount Hoffman roadless area. *(Fred L. Rinne)*

Response—Mt. Hoffman Released Roadless Area

As stated in comment K.3, the proper term is "released roadless areas," not "roadless release area" as stated in the Draft EIS/EIR. The Final EIS/EIR has been corrected.

It should be noted that, at this time, the lead agencies have identified Alternative 6 as the lead agencies' preferred alternative. This alternative would use segment A3 instead of segments A1 and A2, and would not pass through the Mt. Hoffman released roadless area. However, in case an alternative is selected that includes segment A2 of the transmission line corridor (the segment that passes through the Mt. Hoffman released roadless area), the following response is provided to the comments above regarding potential impacts to the Mt. Hoffman released roadless area.

The National Forests are aware of their obligation under NEPA to consider the site-specific impacts of developing roadless areas. The agencies' preferred alternative is Alternative 6, which would avoid the Mt. Hoffman released roadless area but would affect the Lava and Dobie Flat released roadless area. However, if another alternative is selected that includes segment A2, the proposed transmission line would not substantially alter the character of the Mt. Hoffman released roadless area. This conclusion is based on the evaluation of potential impacts to the Mt. Hoffman released roadless area that are discussed in the Draft EIS/EIR in the following sections:

- Section 4.9 (Visual Quality)
- Section 4.10 (Plans and Policies)
- Section 4.11 (Land Use and Recreation)

The discussions in these sections adequately address the potential impacts of the proposed project on the Mt. Hoffman released roadless area. These impacts are

determined to be not significant for the following reasons, each of which is described in detail below:

- Construction of roads or transmission line corridors is not prohibited within released roadless areas on the Modoc National Forest.
- The recreational opportunities within the Mt. Hoffman released roadless area will be largely preserved because of the proposed placement of transmission line segment A2 adjacent to the Glass Mountain lava flow.
- An access road and well pad are already present in the Mt. Hoffman released roadless area in the same area as segment A2.
- The central portion of the Mt. Hoffman release roadless area (through which segment A2 would pass) has a Recreation Opportunity Spectrum designation of "roaded natural." This designation is the least restrictive category for recreational use. Construction of a transmission line is consistent with this recreational policy.

Transmission Lines Are Not Prohibited Within Released Roadless Areas: Federal land suitable for wilderness designation by Congress was chosen through a long process that began in 1971 and essentially ended in California in 1984 with the passage of the California Wilderness Act. As a result of a lawsuit brought by the State of California in 1980, all roadless areas that had been selected as candidates for wilderness designation had to be managed as if they were wilderness. After the passage of the California Wilderness Act in 1984, most of these roadless areas were "released" from consideration as wilderness. The remaining roadless areas were designated by Congress as wilderness. The California Wilderness Act also states that the released roadless areas need not be managed for the purpose of protecting their suitability for wilderness designation (Section 111). In other words, the released roadless areas could be managed just like the surrounding multiple-use lands.

Since the passage of the California Wilderness Act, some development (including road construction) has occurred within many of the released roadless areas. In an effort to update their planning process, many National Forests reassess the status of the released roadless areas within their boundaries each time they amend their Land and Resources Management Plan (LRMP). For example, the Klamath National Forest reassessed the status of all of their released roadless areas in their development of the USFS LRMP (1995). The purpose of this reassessment was not to designate additional wilderness but to determine which released roadless areas (and portions of them) could still support primitive recreational uses. The Alternatives presented in the Klamath National Forest LRMP included varying degrees of use designations within each released roadless area. These designations include a wide variety of uses including timber harvesting, off-road vehicle use, and backcountry uses. This further illustrates the point that a wide variety of uses, including transmission line construction, are permitted within released roadless areas.

Recreational Opportunities Would Be Preserved: The comments state several times that the Mt. Hoffman released roadless area would be "cut in half" or "bisected" by segment A2 of the proposed transmission line corridor (e.g., comment K.7). This is true if one considers the boundaries of the Mt. Hoffman released roadless areas on a map and one assumes that the character of the released roadless area is similar throughout.

In fact, the Mt. Hoffman released roadless area is composed of two distinct areas. The first area surrounds Mt. Hoffman. This western half of the Mt. Hoffman released roadless area is characterized by relatively dense and continuous mixed conifer and red fir forest. The eastern half of the Mt. Hoffman released roadless area is composed entirely of the Glass Mountain Glass Flow Geologic Area (see Figure 3.2-2). This area contains rugged lava formations that are almost devoid of vegetation. Recreational opportunities in the eastern portion of the Mt. Hoffman released roadless area are extremely limited due to the rough and jagged rocks, lack of trails, and lack of water and vegetation cover.

The proposed transmission line corridor would be located near the edge of the western half of the released roadless area (i.e., near the boundary between the western and eastern portions of the released roadless area). The integrity and continuity of the western half of the Mt. Hoffman released roadless area would be largely preserved because only the perimeter of the continuous Forest would be impacted. Thus, although the proposed transmission line would "bisect" the released roadless area on a map, the recreational value of the released roadless area would be largely preserved.

Disturbance Is Already Present: A gated road is already present within the Mt. Hoffman released roadless area along a portion of segment A2. This road, approximately 1.5-miles long, connects an unimproved dirt road with an abandoned geothermal well (wellpad 28-32) that is approximately 0.5-miles southeast of Mt. Hoffman. This road extends over most of segment A2 within the released roadless area (approximately 1.5 out of 2 miles). As stated in Mitigation Measure 4.7.1a, the transmission line corridor and its associated access roads would utilize existing disturbed areas as much as possible. Thus, new disturbance within the released roadless area would actually be less than that stated in the Draft EIS/EIR.

Proposed Use Is Consistent with Recreational Opportunity Designations: As described in Section 4.11 of the Draft EIS/EIR, the USFS has designated three types of recreational opportunities (out of four types possible) within the Mt. Hoffman released roadless area. These designations are listed below with their approximate location given in parentheses:

- Roaded Natural (east of and including Mt. Hoffman to the Glass Mountain lava flow)
- Semi-Primitive Non-Motorized (west of Mt. Hoffman)
- Semi-Primitive Wilderness (all of Glass Mountain lava flow)

An explanation of these designations is found on pages 3-153 and 3-154 of the Draft EIS/EIR. According to USFS policy, motorized vehicles are not permitted in areas designated as Primitive (i.e., designated Wilderness) or Semi-Primitive areas. The proposed route of segment A2 is through an area designated as Roaded Natural, where motorized vehicle use is already allowed. Thus, the proposed project would not result in any change in off-road vehicle use in the Mt. Hoffman released roadless area.

Recreational Opportunity System designations also indicate the degree of resource modification that is typically allowed. A designation of Roaded Natural indicates that

more resource modification is generally allowed than in areas with any other designation.

Comment K.4 also refers to the failure of the Draft EIS/EIR to discuss the Forest Service's roadless area evaluation criteria. These criteria were used in the Roadless Area Review and Evaluation (RARE) process initiated in 1971 (RARE I) and again in 1977 (RARE II). These criteria were useful for evaluating the merits of lands throughout the National Forest system for wilderness designation. The use of these criteria in the EIS/EIR would not be appropriate because wilderness designation is outside the scope of this EIS/EIR. Recommendations to Congress for wilderness designation are considered in the development of and revisions to LRMPs. Note that the USFS still retains the use of RARE II designations for some released roadless areas (e.g., Mt. Hoffman released roadless area).

The sentence in the Draft EIS/EIR to which comment K.6 refers (page 4-198, second-to-last sentence) notes possible uses of the transmission line corridor. The actual allowed recreational use of the transmission line corridor would be determined by the National Forests according to their policies and guidelines. According to the Modoc National Forest Land and Resource Management Plan, unrestricted off-highway vehicle use is already allowed on a majority of the Mt. Hoffman released roadless area through which the proposed segment A2 would pass. The proper forum in which to address the issue of off-highway vehicle use on the Modoc National Forest is the environmental review process for the Modoc National Forest Land and Resource Management Plan. It is beyond the scope of the EIS/EIR for this project to address the policy of off-highway vehicle use in released roadless areas. The Draft EIS/EIR on page 4-198 has been revised to clarify its intent.

Comment O.8 expresses concern that the proposed project would degrade the roadless character of the Mt. Hoffman released roadless and the Glass Mountain Geological Area. No activities from this project are proposed within the Glass Mountain Geological Area. Therefore, no impacts to this area would occur. A discussion of the potential impacts to the roadless character of the Mt. Hoffman released roadless area is presented above.

Comment O.8 states incorrectly that the placement of segment A1 of the transmission line corridor along Forest Road 77 would violate the designated Visual Quality Objective (VQO) of Preservation. As shown on Figure 3.9-2 and 3.9-3 of the Draft EIS/EIR, segment A1 of the proposed transmission line corridor would cross Forest Road 77 (not be aligned "along" it) within a VQO Retention area (not Prevention). Mitigation Measure 4.9.4c on page 4-194 of the Draft EIS/EIR further reduces the impact of this crossing by moving segment A1 west so that it crosses Forest Road 77 within a Partial Retention area.

As discussed on pages 4-144 through 4-147 of the Draft EIS/EIR, the effects of the proposed power plant and wellfields on the visual quality of the area will be reduced to a level below significance after mitigation. Mitigation Measures 4.9.2a through 4.9.2f detail the steps that would be taken to reduce the level of impact of the project to the visual quality of the area surrounding the proposed power plant and wellfields.

Comment Q.6 expresses concern about the importance of the Roadless Area in relation to wildlife and humans. The comment also expresses concern about the potential impacts within the Roadless Area from noise and poaching. For a discussion of these potential effects, see responses to comments in the Wildlife and Land Use and Recreation Sections.

Comment AD.61 notes that the freshwater pipeline from Arnica Sink to the power plant would cross the Mt. Hoffman released roadless area. This statement is correct. However, as stated on pages 2-21 and 2-22 of the Draft EIS/EIR, this pipeline would be temporary (less than one year) and would result in little ground disturbance. The pipeline would be laid by hand on the surface with four-inch diameter pipes that would be carried by hand from Forest Road 49, immediately adjacent to the proposed route. No vegetation clearing or grading would be required for the temporary pipeline. A corridor of up to five feet wide could be affected by the proposed pipeline. Due to the narrow width of the disturbance and the low level of the disturbance, vegetation could recover quickly. Because the impacts of the proposed freshwater pipeline are temporary and minor, there would be no substantial change in the roadless character of the Mt. Hoffman released roadless area.

Comment AD.61 also suggests that a separate EIS be prepared to evaluate the effects on the Mt. Hoffman released roadless area. As stated on page 3-140 of the Draft EIS/EIR, Section 20.6.3 of the USFS *Environmental Policy and Procedures Handbook* (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 EIS. The potential impacts of the proposed project on the Mt. Hoffman released roadless area have been addressed in this EIS/EIR. The policy in the Handbook does not state that a "separate" EIS must be prepared.

3.12 Land Use and Recreation

INTRODUCTION

This section provides responses to comments on issues related to land use and recreation. The comments and responses are grouped under the following headings:

- General
- Effects on the Overall Recreation Experience
- Effects on Dispersed Recreation
- Effects on Developed Recreation Use Areas
- Effects on Residential Areas

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

GENERAL

Comments—Adequacy of Analysis

AG.101 To the extent the EIS/EIR fails to accurately assess and mitigate Project impacts, it also fails to properly assess impacts to land use and recreation. The following examples demonstrate how the EIS/EIR fails to provide sufficient information to assess impacts to recreational users, and disregards the severity of these impacts. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.103 According to CEQA, a project may have a significant impact on the environment if it will conflict with established recreational uses of an area. (CEQA Guidelines, App. G(w).) Nearly all of the Project components will be located on public land within the Klamath and Modoc National Forests. (EIS/EIR, p. 3-151.) The scenic, geologic, biologic, and historic resources of these Forests provide diverse year-round recreational opportunities. (*Id.* at p. 3-153.)

The available recreational activities encompass both intensive and dispersed recreational uses. Approximately 40,000 recreationalists visit the Medicine Lake area every year and this use has increased by 8% to 10% over the past three years. (*Id.* at p. 3-157.) Activities include camping, fishing, picnicking, boating, swimming, and hiking. (*Id.* at p. 3-156.) Approximately 80% of the recreational activities in the Modoc and Klamath National Forests relate to dispersed recreation uses such as camping, nature study, hiking, snowmobiling, and cross-country skiing. (*Id.* at pp. 3-158 to 3-159.) The Doublehead Ranger District in the Modoc National Forest receives over 200,000 such visits per year. There are no plans to develop these dispersed recreational lands for intense recreational use. (*Id.* at p. 3-158.)

The Project will adversely alter the overall character of the area by affecting sights, sounds, and air quality. (*Id.* at p. 4-191.) The EIS/EIR, however, repeatedly takes the position that any recreational users who are bothered by Project views, noise, dust, or odors can "move out of the vicinity or make a decision not to hunt or hike in proximity" to the Project. (*Id.* at pp. 4-192, 4-193,) "The visitor's ability to modify plans to avoid activities that may be perceived as bothersome or annoying would minimize the negative effects of the project on the overall recreation experience." (*Id.* at pp. 4-192, 4-193.) Thus, the EIS/EIR places the burden on innocent third parties to avoid the Project's effects. It is ridiculous to expect forest users who seek a wilderness experience to modify their plans and leave the area. This is inappropriate and conflicts with established recreational uses of the area. The EIS/EIR should discuss this conflict and propose mitigation measures to reduce the Project's impacts on recreational users.

The EIS/EIR's approach to the impacts to these users - that they can simply move if they are disturbed by the Project, misses the point. The fact that these visitors can move to another part of the Forest does not mean they are not impacted by the Project. On the contrary, forcing visitors to move demonstrates that the Project has a significant impact on these visitors. These users visit the Forests to experience a pristine natural setting. Thus, they are likely to be particularly disgruntled to discover that their wilderness experience has been disrupted by loud noises, ground-shaking, foul odors, and acute health effects.

The EIS/EIR should be revised to include a more realistic and considerate assessment of the impacts to recreational users. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

HF.21 Under Section 4.11: Land Use and Recreation, how in the world can the authors of the EIS/EIR conceivably conclude that effects on the overall recreation experience, effects on developed recreation use areas, and effects on Medicine Lake residences would be "less than significant"?? Again, by whose

criteria and according to whose values and assumptions are these effects deemed less than significant? Have you consulted those of us who have been visiting Medicine Lake for the past 30-40 years to see whether or not viewing power lines across the lake, listening to year-round construction and operational noises, having the pristine star-gazing from the lake now impaired by lights from the plant, a developed industrial infrastructure in a formerly pristine natural environment, construction and operation emissions into the incredibly pure and thin mountain air, etc., etc., etc.-whether we view these cumulative effects as "less than significant" to our recreational and residential experience? Any one of these effects, let alone their cumulative impact, will forever and irreparably damage precisely what we regularly I return to Medicine Lake for (in my case a one-way trip of 2000 miles that I make each summer): a pristine natural environmental and geological/ecological/cultural wonder, unique in North America, where recreational and ecological needs have been maintained in a careful balance. Developing the geothermal power project is not simply one more "multiple use" added to this careful balance; it is fundamentally incompatible with the other recreational and ecological interests and irrevocably damaging to them. *(Daniel T. Spencer)*

HG.1 I wish to comment specifically about paragraph 4. 11.1 -Effect on overall recreational experience--page 4-191. I believe the paragraph should be changed to read as follows :

"Construction, operation and decommissioning of the proposed project will affect the general recreational experience in the vicinity by affecting the overall character of the area as defined by its sights, sounds and air quality. This would be considered an significant adverse impact as the project would substantially detract from the overall recreation experience. Decommissioning cannot possibly return the area to its predevelopment conditions." *(Lorin C. Spencer)*

IQ.15 Other impacts from the project are clearly understated. The EIS/EIR fails to evaluate the combined effects of various disturbances at the site but instead analyses each disturbance, such a noise, steam plumes, and lighting, in an isolated manner. The combined effects of the steam plumes and lighting will cause a synergistic effect well beyond the descriptions stated for each individual effect. *(Phil Woodward)*

Response—Adequacy of Analysis

The comments question the conclusions in the Draft EIS/EIR regarding the significance of impacts to recreation. As discussed in Section 4.11 of the EIS/EIR, Land Use and Recreation, all potential impacts of the proposed project or all alternatives on recreation would be less than significant, even before mitigation. The determination that the project would not significantly affect the recreation of the Medicine Lake recreation area was based on the significance criteria listed on pages 4-190 and 4-191 of the Draft EIS/EIR. These criteria were taken from the CEQA Guidelines and were developed based on accepted professional standards.

As stated on page 4-191 of the Draft EIS/EIR, the proposed project may affect the general recreation experience in the vicinity by affecting the overall character of the area as defined by its sights, sounds, and air quality. The analysis therefore does evaluate the combined effect of various potential impacts of the project. These effects would be considered adverse but not significant because the project would not substantially detract from the overall recreation experience.

The opinions expressed in the comments regarding potential recreation effects are noted. The existing conditions and recreational opportunities at Medicine Lake and throughout the Forests were carefully considered in the Draft EIS/EIR evaluation of potential recreation effects. In response to comment HF.21, extensive public scoping was conducted to solicit public input on potential environment effects of the project, including potential effects to recreation. In addition, several public hearings on the Draft EIS/EIR were held, and the Draft EIS/EIR was widely distributed and made available at various locations. For more information on public participation efforts for the Draft EIS/EIR, please refer to Section 1.3 of this document.

It is acknowledged that a visitor's recreation experience is subjective and based on individual perceptions. For example, some visitors to the Medicine Lake Highlands

may consider the construction or presence of the transmission line adjacent to the Medicine Lake Glass Flow to have an adverse effect on their recreation experience. While this impact may be considered adverse by some visitors, the overall recreation experience would not be adversely and significantly affected by the proposed project.

Comment AG.103 also references the discussion in the Draft EIS/EIR on pages 4-192 and 4-193 about the effects of the project on recreationists. This discussion was intended to explain one potential impact of the project on recreationists. It is acknowledged that the decision by recreationists in the project area to go elsewhere because they are bothered or annoyed by project facilities or activities would be considered an adverse effect. Although adverse, this effect would not be considered significant.

Despite the conclusion that effects to recreation would be less than significant, several mitigation measures are proposed in the Draft EIS/EIR to reduce effects even further. For example, Mitigation Measures 4.9.2a and 4.9.2b on page 4-146 of the Draft EIS/EIR would minimize the size and height of the steam plume from the cooling towers, minimizing its visual impact. Mitigation Measure 4.9.4a on page 4-154 of the Draft EIS/EIR would reduce the clearing necessary for erection of the transmission line. By retaining more trees along the line, more of the wires and poles would be shielded from view.

Mitigation measures are also proposed to reduce the risk to human health and safety, which would reduce the effects to recreationists. For example, Calpine proposes to post notices in the vicinity about the geothermal facilities, activities within these facilities, and the potential risks to which recreationists could be exposed (see Mitigation Measure 4.15.8a on page 4-292 of the Draft EIS/EIR). In addition, mitigation measures are proposed in Sections 4.13 and 4.14, Air Quality and Noise, respectively, that would reduce the potential impacts of the project on recreationists.

For further discussion of the issues raised in the comments, see the following responses to comments in this section:

- Compatibility with Forest Service Multiple-Use
- Effects on the Overall Recreation Experience within the Region
- Effects on Recreation in and near Medicine Lake
- Effects to Dispersed Snowmobile Use
- Effects on Medicine Lake Residences

Comment AG.103 also suggests that the project would create adverse and significant effects to visitor's "wilderness experience" through effects due to noise, ground-shaking, foul odors, and acute health effects. As described in the EIS/EIR, there would not be adverse or significant effects from any of these impacts. (It should be noted that there are no designated Wilderness Areas in the proposed project area or vicinity that are subject to special restrictions.) For a discussion of the basis for this conclusion, see the following sections in Chapter 4 of the EIS/EIR, or responses to comments under these headings:

- Noise
- Geology and Soils

- Air Quality
- Human Health and Safety

It should be noted that Alternative 6 has been identified in this Final EIS/EIR as the lead agencies' preferred alternative. Alternative 6 would use transmission line segment A3 instead of segments A1 and A2. This alternative would avoid placement of the transmission line in the immediate vicinity of Medicine Lake, and the transmission line would not be visible from Medicine Lake vantage points. Implementation of Alternative 6 would therefore be likely to further reduce the less-than-significant effects to recreation at Medicine Lake in comparison to Alternative 1.

Comments—Background Data

AG.102 The EIS/EIR provides some general information about recreational users in the area. However, according to Thomas Reid Associates, the type of information provided does not allow a proper assessment of the Project's impacts to these users. (Ex. B, § 4.11.) For example, the EIS/EIR does not provide information about where hikers and other users are located, so a proper analysis can be conducted based on how many users will be in the zones of impact. (*Ibid.*)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.307 The EIS/EIR discusses, in general terms, land use and recreation in the Medicine Lake recreation area and within the Modoc and Klamath National Forests. Yet these discussions are not directly relevant to the impact of the project on recreation and residential land uses. For example, the EIS/EIR states (p. 3-157) that "an estimated 40,000 recreationalists visit the Medicine Lake recreation area each year, and the use of this area has increased by 8 to 10% over the past three years... The majority of users visit the recreation area between Memorial Day (in late May) and Labor Day (in early September). During the months of July and August 1996, the campgrounds were observed to operate an average 65% occupancy during the week..." and at capacity on weekends. Table 3.11-1 indicates that there are a total of 75 camp sites at Medicine Lake in 4 campgrounds. There is no indication of the average length of stay or how many people are occupying the campgrounds at full or 65% occupancy. Similarly, p. 3-158 under "Dispersed Recreation Areas," states: "Use levels on the Doublehead Ranger District of the Modoc National Forest are currently at just over 200,000 visits per year." This data gives no indication of where the 200,000 visitors are in relation to the areas impacted by any portion of the project.

The EIS/EIR needs to present information on how many hikers, fisherman, and snowmobilers are within the project's impact zones during project construction and operations. For example, how many recreationists, on the average, would be within 1 mile of the power plant site or well pads and could hear the sounds of well drilling or generators/compressors? How many permanent residents and recreational users are located in zones where they would view any one of the transmission line alternatives as part of their foreground or middleground view? This information in necessary to assess the project's impacts on recreation and land use. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.315 There is no attempt to describe present use patterns (other than snowmobile use) in the portion of the USFS lands which potentially could be impacted by noise. Vague terms such as hunter or hiker are used to describe potentially affected user groups and it is not possible to determine if 10 or 1000 visitors would be affected by project noise and where the established uses are in relation to the project. Traditional recreational uses within the impact area need to be mapped. An estimate of the levels of each usage for the impact area needs to be obtained from USFS sources.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

BE.8 There also, needs to be an extensive study on the recreational value of the Medicine Lake area. I feel it has more value to the State of California and Siskiyou County than the proposed geothermal project's, and is much safer for the environment. Any consideration you give my comments will be appreciated. Thank you. *(Paul Carter, Jr.)*

Response—Background Data

As stated on page 3-151 of the Draft EIS/EIR, data on recreation uses of the project area were collected from a variety of sources, including:

- Current Klamath and Modoc National Forest Land and Resource Management Plans
- Staff from the USFS, Lava Beds National Monument, and California Department of Parks and Recreation

- Site visits and random interviews of recreationists at Medicine Lake during July through October, 1996.

These data are directly relevant to the impact of the project on recreation and residential land use because these data describe the general recreation use in the region. There are only a few key recreational sites in the Medicine Lake Highlands and western Modoc Plateau, namely Medicine Lake (summer and winter use), Lava Beds National Monument (summer use), and several snowmobile parks (winter use). The majority of the visitors to the Medicine Lake Highlands are concentrated in these three key areas. The remaining recreation uses in the Medicine Lake Highlands and western Modoc Plateau are by dispersed users such as hunters, recreational drivers, hikers, and snowmobilers (away from the snowmobile parks).

Comment AG.307 suggests including data on the average length of stay of campground users at Medicine Lake or data on the number of people occupying the campgrounds at full or 65% occupancy. These data would not improve the analysis presented in the Draft EIS/EIR. Segment A1 of the proposed project would pass within less than a mile of Medicine Lake. This is the only project facility that has the potential to affect campers or other visitors to Medicine Lake (with the possible exception of the steam plume from the power plant, as described in response to "Comments—Effects on the Recreation experience in and near Medicine Lake").

As described on page 4-194 of the Draft EIS/EIR, the Medicine Lake Lava Flow Trail would need to be closed for approximately one week during transmission line construction in this area. This is the only impact that would occur from the proposed project to visitors to the Medicine Lake campgrounds. This impact is not significant, regardless of the duration of stay of campers or of the number of occupants during full or 65% capacity at the campgrounds.

Comments AG.307 and AG.315 suggest that more data should be collected on the number of recreationists in the immediate vicinity of the proposed project. As stated in the Draft EIS/EIR, the proposed project facilities, with the exception of a portion of segment A1, occur in areas that receive dispersed recreation use. Because of the nature of this use, it is difficult to accurately estimate the amount of use that a particular area receives, for two reasons. First, the majority of users to the region are concentrated in the developed recreation sites (e.g., Medicine Lake) and along the Forest road system. The remaining visitors are dispersed over a very large area. As a result, their density is low.

Second, there is likely a high variation in the use of one particular site. Dispersed recreation users often move throughout a wide region in the Forest, and do not stay in one location for an extended period. Because of the low number of users away from developed recreational sites and the high variation in the use of single sites, it is very difficult to estimate the precise use of a single site (e.g., the power plant and wellfield area or locations along the transmission line). In order to collect such data, many observations (to detect a useful number of visitors) over long time periods (to "offset" the high variation in use patterns) would be required. Such an investigation may not even achieve useful or sound results due to the large area that would need to be observed, the duration of monitoring necessary, and the likely inability to detect

dispersed recreationists. The collection of such data is therefore neither practical nor desirable, and is not relevant or necessary to understand the potential for impacts to dispersed recreation. Any attempt to quantify the number of users within a certain zone of the project would be highly speculative, and is not discussed further in this document.

The only permanent residences with views of the proposed transmission line or any of the alternative lines are located at Tionesta. As discussed on page 3-163 of the Draft EIS/EIR, there are 12 to 15 homes located in this community. Any views of the transmission line from these homes would not be considered a significant effect on land use. Two large transmission lines (500 kV) already pass through or near Tionesta. The addition of the proposed transmission line would not result in a substantial alteration of the present land use of the area or disrupt or divide the physical arrangement of this established community.

The significance criteria used in the EIS/EIR to evaluate the impacts of the proposed project do not rely on the amount of visitor use in the project area (see page 4-190 of the Draft EIS/EIR). The significance criteria are independent from the amount of use in any one area. For example, the last criterion states that the project would have a significant impact if "the sights, sounds, or odors emanating from the project would be sufficient, individually or combined, to detract substantially from the Forest visitor's recreation experience." This significance criteria makes no mention of the number of visitors to an area that would be required to reach a significant impact. Likewise, the other significance criterion make no mention of the amount of visitor-use required to reach significance. Thus, detailed visitor use data are not necessary to adequately address the potential project impacts to recreation uses.

Comments—Compatibility with Forest Service Multiple-Use

BP.9 Mr. Sharp, at the public hearing you justified the proposed geothermal project in terms of the Forest Service's mandate for "multiple use of public lands." Please provide me with the specific policy (and law if one exists) that states that mission. As far as multiple use near Medicine Lake, logging has never been allowed in or near the caldera. How can geothermal development in the same area have less impact? *(S. Peder and Suzanna S. Cuneo, et al.)*

CH.4 These lands are under the stewardship of the United States Forest Service. This means that these lands are to be protected and preserved in their natural conditions. Building geothermal power plants does not seem to be compatible with this idea of protection and preservation. In fact, I would say that the development of such plants would be the exact opposite of this mandate. *(Elizabeth V. Farioletti)*

Response—Compatibility with Forest Service Multiple-Use

The Multiple-Use Sustained-Yield Act of 1960 states:

> "The Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the National Forests for multiple use and sustained yield of the several products and services obtained therefrom. In the administration of the National Forests due consideration shall be given to the relative values of the various resources in particular areas... 'Multiple use' means the management of all the various renewable surface resources of the National Forests so that they are utilized in the combination that will best meet the needs of the American people..."

In addition, the Mission of the USFS includes the provision to "...administer the nonrenewable resources of the National Forest System to help meet the Nation's needs

for energy and mineral resources..." Comment CH.4 inaccurately characterizes the mission of the USFS as "preservation" and "protection." A more accurate characterization of the USFS's mission would be "conservation" and "wise-use."

As stated on page 1-3 of the Draft EIS/EIR, the purpose of the Fourmile Hill Geothermal Project is to develop the geothermal resource on Calpine's Federal geothermal leases to economically produce and deliver electrical power. The need for the project was stated by the U.S. Geothermal Steam Act of 1970, the Federal Land Policy and Management Act of 1976, and the Energy Policy Act of 1992. The proposed project is consistent with these acts, which direct the Federal government to foster and encourage private enterprise in the development of alternative energy resources, within appropriate environmental constraints.

Pursuant to the Geothermal Steam Act of 1970 (30 U.S.C. 1001-1025), Calpine's Federal geothermal leases grant the right to develop and utilize the geothermal steam and associated geothermal resources (30 U.S.C. 1003). The standard stipulations for Federal geothermal leases issued under the Geothermal Steam Act of 1970 convey the "exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources...in or under" the leased lands.

The proposed project is also consistent with USFS policies and mandates, including the Klamath and Modoc National Forest Land and Resource Management Plans (see response to "Comments—Consistency with National Forest Land and Resource Management Plans" in the Plans and Policies Section for a discussion of this issue). The development of geothermal resources is identified in the Klamath and Modoc National Forest LRMPs as part of their "multiple-use" mandate.

Comment BP.9 states that logging has never been allowed in the Medicine Lake Caldera and that geothermal development cannot have less of an impact than logging. As stated in the EIS/EIR, the proposed power plant and wellfield would be built outside of the caldera. Furthermore, the analysis in the EIS/EIR does not compare the impacts of the proposed project to any other potential use, such as logging. The impacts are analyzed based on their magnitude relative to the existing environment.

EFFECTS ON THE OVERALL RECREATION EXPERIENCE

Comments—Effects on the Overall Recreation Experience within the Region

AV.4 The area serves an attractive location for wilderness travelers which will be blighted by the electrical towers.
(Dave and Laurie Bish)

BG.1 While I am not opposed to growth in this county, and certainly do want to see it prosper economically, I believe that we sometimes have a tendency to throw the baby out with the bath water!

By virtue of our natural beauty and recreational activities our area attracts tourists who ultimately leave their dollars on our doorstep. We are almost totally dependent upon tourism to maintain a health economy.

What is proposed at Medicine Lake is contrary to everything that makes us attractive to the outside world. Geothermal plants, pollution and health hazards are what they are running away from. We do not want this type of development in our recreation areas, nor in any other area where adjoining property values will be adversely affected.
(Colleen Cena)

CS.2 As one who has paid many visits to the area over a 25-year period, I can say without hesitation that the projects would be disruptive to recreation use, damaging to the ecosystem and destructive to the some of the most dramatic vistas in California.
(G.S. Green)

EZ.3 And there has always been the freedom for fishing, hunting, hiking, camping, for everyone.
(Joan McDermos)

HU.1 I would like to call your attention to the Geothermal development planned for the Medicine Lake highlands area of Northern California. It is being protected by many of the residents of Siskiyou County as being detrimental to the recreational use in this area. This pristine area provides a stark contrast to many of the other recreational areas in California, overrun by tourists and development. *(Louise Thompson)*

IA.1 I have reviewed the Fourmile Hill Geothermal Development Project EIS draft. I find no proposed alternatives that will not interfere with the recreation values my family enjoys in the Medicine Lake Highlands.
(Susan Turney)

IW.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses.
(D. Ano)

Response—Effects on the Overall Recreation Experience within the Region

As stated on page 4-191 of the Draft EIS/EIR, the proposed project may affect the general recreation experience in the vicinity by affecting the overall character of the area as defined by its sights, sounds, and air quality. These effects would be considered adverse, but not significant because the project would not substantially detract from the overall recreation experience.

The determination that the project would not significantly affect the overall recreation experience of Forest visitors was based on the significance criteria listed on pages 4-190 and 4-191 of the Draft EIS/EIR. These criteria were taken from the CEQA Guidelines and were developed based on accepted professional standards. It is acknowledged that a visitor's recreation experience is subjective and based on individual perceptions. Thus, some visitors may consider project activities to have an adverse effect on their recreation experience. While this impact may be considered adverse by some visitors, the overall recreation experience would not be adversely and significantly affected by the proposed project.

See also Section 4.9 of the EIS/EIR, Visual Quality, for a discussion of the potential visual impacts of the proposed project. See also responses to comments in the Visual Quality Section of this document for further discussion of this issue. Comment BG.1 expresses concern over the potential impacts of the project to tourism at Medicine Lake. See response to "Comment—Effects to Tourism" in the Socioeconomics Section for an analysis of the potential impacts of the project on the tourism of the region.

Comments—Effects on Recreation in and near Medicine Lake

Q.10 The Medicine Lake area has outstanding recreational opportunities which are being enjoyed by increasing numbers of visitors. The proposed project will degrade the recreational experience for visitors, despite the conclusions of the EIS that none of the impacts will be significant. The EIS callously suggests that visitors who are bothered or annoyed by the sights and sounds of the project "can readily move out of the area or make a decision not to recreate in proximity" to the project sites!

The problem is that more and more public land is being adversely impacted by timber cutting, grazing, and developments like the proposed project, leaving less and less places for an undisturbed recreation experience. For these reasons, the effects of the proposed project on recreation are significant and the EIS should have stated such.
(Lori J. Cooper, Klamath Forest Alliance)

U.13 The Medicine Lake Highlands provide a valuable year-round recreation area for Siskiyou County. The USFS and the state of California have spent hundreds of thousands of taxpayer dollars to develop recreation in the area. -(pg. 3-157 table 3.11-1)

Medicine Lake is unique in that it is a high mountain lake with public access. (pg. 3-157) "Medicine lake has an estimated 40,000 recreationalist visit yearly, with increased use on the rise." Check pg. 3, paragraph 4 of this letter. The proposed geothermal project will detract from the Medicine Lake experience.
(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

W.3 Medicine Lake is a natural unspoiled lake located in a collapsed volcanic caldera, at the 6,700' elevation. What will become of pristine Medicine Lake and the surrounding environment if these huge geothermal projects are built? This is a recreation area loved by campers, hikers, fishermen, boaters, snowmobilers, hunters, and property owners. *(Carole Plank, Medicine Lake Citizens for Quality Environment)*

AT.2 It was our understanding at the tour conducted for the benefit of the Siskiyou County supervisors at Medicine Lake the first management priority for the Medicine Lake Recreational Area was in fact, recreation. We urge you give considerable weight to this value and place this project on hold for an indefinite period of time, at least until there is clearly a need for additional unsubsidized power generation. *(Kenneth and Leona Beatty)*

BN.3 Over the last twenty years the USFS has spent extensive amounts of time and money to develop this area as a recreation site, which I believe is the best use for this area. I understand that multiple use is the mandate for public lands, but this development will have a substantial negative impact on recreational use in the Medicine Lake basin. The limited amount of power produced from this project (located over 350 miles from major urban areas) does not fit appropriately into the multiple use doctrine of the Forest Service, and will ultimately negate the recreational value of the area. *(S. Peder Cuneo)*

BO.4 Finally, the current recommended site will significantly impact on the quality of the recreation at Medicine Lake which is the use the land should be protected for The Forest Service has spent significant amounts of public money developing recreation in the Medicine Lake area over the past 20 years (including a boat dock launching area, access and campgrounds, and a snowmobile staging area with a large warming hut). Recreation should be the focus of this area, not energy development. *(Suzanna S. Cuneo)*

BP.7 The appropriate use for the Public Lands in and around Medicine Lake is recreation, not geothermal power plant development

Hundreds of thousands of taxpayers dollars have been spent over the last 30+ years to develop the Medicine Lake area as a recreational area for people who enjoy accessible wilderness. Thousands of campers, boaters, hunters, fishermen and snowmobilers visit the lake each year to enjoy its pristine beauty and wildlife. How many places in California can you daily see Bald Eagles, Blue Herons, Osprey and Goshawks? Medicine Lake is one of the few remaining pristine recreational areas in Northern California that offers such a variety of opportunities. These opportunities and the unique beauty of this lake will be ruined forever if this project is approved. Once this is lost, it can never be restored. *(S. Peder and Suzanna S. Cuneo, et al.)*

BP.8 The appropriate use and future for the development of the Medicine Lake area would best be served to coordinate the future recreational development with the Park Service given the proximity to Lava Beds National Monument and the current development of the scenic corridor. *(S. Peder and Suzanna S. Cuneo, et al.)*

BQ.20 The Medicine Lake area has been developed by the USFS as a destination recreation site and has year around recreational use. The draft EIS/EIR states that 40,000 people use the Medicine Lake campgrounds, yearly and the number is increasing (page 3-157). This number does not include hunters, mushroom harvesters and winter snowmobilers that do not use formal campground facilities. Much of what brings people to Medicine Lake was described on page 3-124, "...these characteristics create a strong sense of place and remoteness to the lake..." A fundamental question is what will be the effect of this project on the recreational experience to the more than 40,000 people who visit this lake yearly. The draft EIS/EIR has some comment on what they will see (draft EIS/EIR page 4-193). This page details the negative effects on recreation because of the operation of the project. "During the project operation, the recreation experience of visitors could be affected as the result of odors, noise, and visual presence of facilities... Recreationalists would see a range of activities, including well maintenance, drilling and cooling tower and well venting steam plumes."

The recommended solution to any recreational user that is bothered or annoyed by the visual and auditory assaults from the project is to "move out of the vicinity or make a decision not to hike or hunt in proximity to this site." We feel this is not an adequate response to this problem. People who use Medicine Lake for recreation often do so because of the quality of the environment. Once this quality has been degraded, because of the effects of this project, they cannot move some place else, because there is no other place in Northeastern California like Medicine Lake. Property owners cannot reduce the effects of loss of visual quality, water quality or loss of property value by moving out of the vicinity. The effects of this project will last the duration of the power plant (45 years). *(S. Peder and Suzanna S. Cuneo, et al.)*

BQ.21 The USFS has identified the Medicine Lake area as a unique recreational site. In the draft EIS/EIR (page 3-163) it is pointed out "Timber harvests are also limited in the project vicinity by the existence of the developed recreational area at Medicine Lake. Typically, only salvage harvesting of dead and downed trees are being conducted in the project vicinity. If the unique recreational qualities of Medicine Lake are such that timber harvesting is prohibited, then how could a power plant be compatible? *(S. Peder and Suzanna S. Cuneo, et al.)*

DY.3 The Medicine Lake Area is greatly utilized presently for recreational activities across the spectrum. *(Daniel Kiely)*

FP.25 We have been coming to Medicine Lake every summer for thirty five years and 20 years respectively. During this time we have come to treasure the pristine environment that this area offers; no electricity, no television and no crowds! I can't express in words the thrill it is to see an eagle sweep down from a tree and catch a fish or a mountain lion saunter across a road or a pine martin play in your "front yard"! All these things we have witnessed and enjoyed at Medicine Lake.

The current proposed project will significantly impact on the quality of the recreation at Medicine Lake which is the use the land should be protected for. The Forest Service has spent significant amounts of public money developing recreation in the Medicine Lake area over the past 20 years (including a boat dock launching area, access roads and campgrounds, and a snowmobile staging area with a large warming hut which cost over $100,000!). Recreation should be the focus of this area, not energy development. *(Eric T. Nelson and Martha Spencer)*

GC.3 The environmental impact will be devastating to the area. This area was developed for recreational use. Currently 40,000 recreationalists visit the area each year. Snowmobiling is increasing yearly. The appropriate use for the public land in and around Medicine Lake is "recreation", Not Geothermal! Thousands of taxpayers dollars have been spent over the last 30 years to develop the Medicine area as a recreational area for people to enjoy accessible wilderness. *(Carole Plank)*

HI.7 Finally, the current recommended site will significantly impact on the quality of the recreation at Medicine Lake which is the use the land should be protected for. The Forest Service has spent significant amounts of public money developing recreation in the Medicine Lake area over the past 20 years [including a boat dock - launching area, access roads and campgrounds, and a snowmobile staging area with a large warming hut which cost over $100,000!]. Recreation should be the focus of this area, not energy development. *(Martha Spencer)*

HT.4 How is the land use affected by this development? In Section 3.11, the Recreational use of Medicine Lake is detailed. 75 improved campground sites plus a large day use picnic area and boat launch ramp. An estimated 40,000 reacreationlists visit this area each year. Use has increased by 8 to 10 % per year over the past 3 years. During the week, campgrounds have 65% occupancy, on weekends, 100%. Visitors predominate from Chico north & So. Oregon. The government, both state & Federal, has used public money to construct and maintain this recreational camping & boating site. This will be diminished by tampering with the environment by well & transmission line construction. No longer will it be a pristine area, the closest to wilderness that most city dwellers experience. *(Louise Thompson)*

HV.2 The Forest Service in its multiple use plans have designated the Medicine Lake area as prime Recreation Area. Why then are you planning to demolish it for the use of a geothermal plant which will only last 40 years. If left alone, it will be used forever by our children and grandchildren. *(Louise Thompson)*

PH3.40 Have you considered the long-term effects of recreation at Medicine Lake, following up on Brenda's—there are a lot of campers. There are hunters up there. This place is very much used. Does this balance with the power development that we are going to get? I mean, just look at Lake Tahoe after 30, 40 years of development. It's totally ruined, so much so that Clinton and Gore went a couple of weeks ago to a summit there to discuss what can be done. We have taken and ruined a jewel. And now you have got another jewel that you are going to ruin. Can you balance the benefits of this geothermal development, no matter how much you need it, against the recreation resource? California is in dire need of places like this, a pristine place that hasn't been messed up by the usual type of construction. *(Yreka Public Hearing)*

PH5.5 All the facts I'm stating are taken right straight out of that document, and some of them are straight quotes. How's the land use affected by this development? In section 3.11, the recreational use of Medicine Lake is detailed: "Seventy-five improved camp site—campground sites, plus a large day-use picnic area and boat launch ramp. An estimated 40,000 recreationalists visit this area each year; use has increased by eight to ten percent per year over the past three years. During the week, campgrounds have sixty-five percent occupancy; on the weekends, a hundred percent. Visitors predominate from Chico north, and even into southern Oregon." The government, both state and federal, have used public money, our money, to construct and maintain this recreational camping and boating site. This will be diminished by tampering with the environment by well and transmission line construction. No longer will it be a pristine area; the closest to wilderness that many city dwellers experience. *(Medicine Lake Public Hearing)*

Response—Effects on Recreation in and near Medicine Lake

Many of the comments question the compatibility of the proposed project with the recreation use of Medicine Lake. As described in the EIS/EIR, the USFS has developed two classification systems to help manage its lands to maintain recreational opportunities and maintain a high level of scenic integrity in the landscape. The compatibility between proposed projects and USFS policies is determined, in part, on

their consistency with the USFS classification system for recreational opportunities and scenic integrity. The classification system for recreational opportunities is called the Recreation Opportunity Spectrum (ROS) and is described in detail on page 3-153 of the Draft EIS/EIR. The classification system to maintain scenic integrity is called the Visual Quality Objective (VQO) system and is described in detail on page 3-125 of the Draft EIS/EIR.

As stated on page 4-199 of the Draft EIS/EIR, the proposed project would be consistent with USFS ROS designations in the project vicinity and in the vicinity of Medicine Lake. Project construction would occur entirely in areas with ROS allocations of Roaded Natural, which allows for roads and evidence of human activities. Transmission line segment A2 would pass through the Mt. Hoffman released roadless area between Mt. Hoffman and the Glass Mountain Geologic Area (see Figure 2.2-2 of the EIS/EIR). For more information on the Mt. Hoffman released roadless area, see response to "Comments—Mt. Hoffman Released Roadless Area" in the Plans and Policies Section.

Some project facilities in the proposed action would be inconsistent with USFS VQO's without mitigation. As stated on page 4-156 of the Draft EIS/EIR, the presence of segment A1 of the proposed transmission line would create an unavoidable inconsistency with the VQO of Retention that applies in portions of the Medicine Lake area. Mitigation would relocate segment A1 to reduce visual impacts (see Mitigation Measures 4.9.5a and 4.9.5b on page 4-161 of the Draft EIS/EIR).

Portions of segment A1 of the proposed transmission line would be visible from much of Medicine Lake, particularly on the south side. Steam plumes from project wells and the cooling tower could also be visible from much of Medicine Lake (see Figures 4.9-2 and 4.9-3 in the EIS/EIR). The visibility of the transmission line would be considered a significant and unavoidable impact because no mitigation is available that would remove this project feature from view. The occasional visibility of the steam plumes would contribute to this effect. The visibility of segment A1 of the transmission line in the foreground and middle ground from the Medicine Lake Lava Flow Trail would also be considered a significant and unavoidable impact. Alternative 6, the lead agencies' preferred alternative, would use segment A3 rather than segment A1.

Many of the comments suggest that the impacts of the proposed project on recreation use at Medicine Lake would be substantial or significant. As stated on page 4-191 of the Draft EIS/EIR, the proposed project may affect the general recreation experience in the vicinity by affecting the overall character of the area as defined by its sights, sounds, and air quality. These effects would be considered adverse but not significant from a recreational standpoint because the project would not substantially detract from the overall recreation experience. While the transmission line would be visible at Medicine Lake and result in a VQO inconsistency, it would not translate to a significant effect on recreation. The presence of the transmission line would not conflict or interfere with recreation uses at the lake, would not alter the ability to recreate at the lake, and would not be expected to result in avoidance of the lake by recreationists. This conclusion applies to dispersed recreation in the general region, as well as at Medicine Lake.

The determination that the project would not significantly affect the recreation of the Medicine Lake recreation area was based on the significance criteria listed on pages

4-190 and 4-191 of the Draft EIS/EIR. These criteria were taken from the CEQA Guidelines and were developed based on accepted professional standards. It is acknowledged that a visitor's recreation experience is subjective and based on individual perceptions. Thus, some visitors or residences at Medicine Lake may consider the construction or presence of the transmission line adjacent to the Medicine Lake Glass Flow to have an adverse effect on their recreation experience. While this impact may be considered adverse by some visitors, the overall recreation experience would not be adversely and significantly affected by the proposed project.

As stated on page 4-194 of the Draft EIS/EIR, the proposed project would not significantly affect developed recreation use areas, including campgrounds and other sites at Medicine Lake. The only direct impact of the proposed project to facilities in the Medicine Lake recreation area would be temporary closure of the Medicine Lake Lava Flow Trail. This trail would be closed for approximately one week during construction of a portion of segment A1 of the proposed transmission line. No other direct effects would occur to developed recreation uses in the Medicine Lake recreation area.

Comments BP.7 and HT.4 also suggest that impacts of the proposed project would be permanent and not reversible. As described on pages 2-54 through 2-56, all project facilities would be removed during the decommissioning phase of the project, which would occur after approximately 45 years of project operation. After all facilities and equipment are removed from the area, disturbed ground would be revegetated according to USFS standards. Once revegetation is complete, any adverse effects on visitor's recreation experience would be eliminated.

For a discussion of other issues raised in these comments, see the following responses to comments (all responses are in this section, unless otherwise noted):

- Adequacy of Analysis (comment U.14)
- Effects on Medicine Lake Residences (comment U.14)
- Compatibility with Forest Service Multiple Use (comment BN.3)
- Bald Eagle, in the Wildlife Section (comment BP.7)
- Osprey, in the Wildlife Section (comment BP.7)
- Northern Goshawk, in the Wildlife Section (comment BP.7)

As discussed in the response to "Comments—Adequacy of the Analysis," Alternative 6 has been identified in this Final EIS/EIR as the lead agencies' preferred alternative. Alternative 6 would use transmission line segment A3 instead of segments A1 and A2. Segment A3 would not be located in the immediate vicinity of Medicine Lake, and implementation of Alternative 6 would therefore be likely to further reduce the adverse but less-than-significant effects to recreation at Medicine Lake in comparison to Alternative 1.

Comment—Effects on Recreation in the Mt. Hoffman Released Roadless Area

K.5 The assessment of the geothermal project's impact on the Mount Hoffman Roadless Area contained in the EIS/EIR would be humorous did it not violate the National Environmental Policy Act so profoundly. For example, the EIS/EIR's "assessment" of the project's negative impact on recreation in the roadless area consists of a mere reminder that hikers and others can go elsewhere if their recreational experience is degraded by powerlines and roads (EIS/EIR, page 4- 198). We are dismayed that the Forest Service

would substitute such insulting and indefensible arguments for a legitimate analysis on recreational impacts. *(Ryan Henson, California Wilderness Coalition)*

Response—Effects on Recreation in the Mt. Hoffman Released Roadless Area

The comment references a statement on page 4-198 that "Any recreational user that is bothered or annoyed by the transmission line can readily move out of the vicinity or make a decision not to recreate in proximity to this site." This statement was not the complete "assessment" of the project's impacts on the Mt. Hoffman released roadless area. It is acknowledged in the Draft EIS/EIR that the impact on recreation use in the Mt. Hoffman released roadless area would be adverse. This adverse effect includes the effects on recreationists who choose not to recreate in proximity to the transmission line because they are bothered or annoyed by its presence. Although adverse, the effect to recreation use of the Mt. Hoffman released roadless area would not be considered significant, based on the placement of and limited amount of area that would be occupied by the transmission line, as well as the size of the released roadless area and the extensive amount of this area that would not be affected by the project.

For a complete and detailed discussion of the effects of the proposed project on the Mt. Hoffman released roadless area, see response to "Comments—Mt. Hoffman Released Roadless Area" in the Plans and Policies Section.

Comments—Effects on Recreation at Little Mt. Hoffman Lookout

IQ.2 Furthermore, development of an industrial project in this area would destroy the solitude and visual wonders enjoyed from overnight stays at the Little Mt. Hoffman lookout. *(Phil Woodward)*

IQ.17 The cumulative effects of the visual and noise impacts of the project on the quiet solitude of the Medicine Lake Highlands will be most felt at the Little Mt. Hoffman Lookout. The Lookout is a unique possession the Forest Service has allowed the public to enjoy. From the first beginning of sunrise to late at night, the solitude and unblemished view is an unique experience in Northern California. If the proposed project were to be constructed, the daylight periods would be dominated by steam plumes, shiny aluminum-clad pipelines, and the incessant rumble of the power plant. At night, the views of community lights over a hundred miles away would be obscured by the glare of lights, enhanced by reflection and diffusion within the steam plumes from the cooling towers and the effect of the noise being similar to that of living in an urban area. *(Phil Woodward)*

Response—Effects on Recreation at Little Mt. Hoffman Lookout

Table 4.9-1 on page 4-142 of the Draft EIS/EIR presents the results of the visual analysis of the proposed project from 21 sites in the Medicine Lake Highlands, including Little Mt. Hoffman Lookout (KOP 6). According to this analysis, the following project facilities would not be visible from the Little Mt. Hoffman Lookout:

- Wellfield and power plant facilities
- Wellfield and power plant lighting

These facilities would not be visible from Little Mt. Hoffman Lookout because Grouse Hill and the Crater Glass Flow would block them from view. Before mitigation, the following project facilities would be visible from Little Mt. Hoffman Lookout:

- Segment A1 of the proposed transmission line
- Power plant steam plumes (on an intermittent basis)

Mitigation Measures 4.9.4a, 4.9.2a, and 4.9.2b are proposed to reduce the visual impact of these project facilities on views within the Medicine Lake area, including from Little Mt. Hoffman Lookout. Mitigation Measure 4.9.4a on page 4-154 of the Draft EIS/EIR

would reduce the clearing necessary for erection of the transmission line and minimize the visibility of the transmission line conductors and support structures. These measures would reduce visibility from Little Mt. Hoffman Lookout. In addition, Mitigation Measures 4.9.2a and 4.9.2b on page 4-146 of the Draft EIS/EIR would minimize the size and height of the steam plume from the cooling towers, thus reducing its visibility from vantage points such as the Little Mt. Hoffman Lookout.

As stated on page 4-163 of the Draft EIS/EIR, the visual impacts from Little Mt. Hoffman (including from the lookout) would be considered less than significant after the implementation of Mitigation Measures 4.9.2a, 4.9.2b, and 4.9.4a. Although the transmission line would remain somewhat visible from Little Mt. Hoffman, they would be consistent with the VQOs of Partial Retention and Modification under the Modoc National Forest Land and Resource Management Plan. More information on the project's effects on views from Little Mt. Hoffman, see the responses to "Comments—Effects on Views from KOP 6 (Little Mt. Hoffman) in the Visual Quality Section of this document.

The effects of project-related noise on the surrounding area are described in detail in Section 4.14 of the EIS/EIR. The noise generated by the proposed power plant was estimated at various locations around the vicinity of Medicine Lake (called "receptors"). One of these receptors, "home at southwest end of Medicine Lake," is about the same distance (and general direction) away from the proposed power plant as is Little Mt. Hoffman Lookout. As shown in Table 4.14-3 on page 4-265 of the Draft EIS/EIR, the estimated sound levels from well drilling and power plant operations would not exceed ambient noise levels at Medicine Lake. Although ambient noise levels are greater at Medicine Lake than at Little Medicine Lookout, it is not expected that noise levels at Little Medicine Lookout would increase substantially. Furthermore, estimated noise levels at Medicine Lake (and, by extension, at Little Medicine Lookout) during construction and operation would be substantially less than the maximum levels allowed by the Siskiyou County Noise Element or the Federal GRO No. 4 for noise limits (see pages 4-262 through 4-268 of the Draft EIS/EIR for a detailed discussion of these data).

Although potentially detectable at times, operational noise would not be considered a significant impact. Power plant noise and noise from the cooling tower are not expected to contain any prominent tones (see Table 4.14-4 on page 4-267 of the Draft EIS/EIR). As a result, it may be difficult for people to determine what is being heard and the location of the noise. For further discussion of the potential impacts from project noise, see responses to comments in the Noise Section of this document. For a discussion of cumulative impacts, see Section 4.17 of the EIS/EIR, Cumulative Impacts, and responses to comments in the Cumulative Effects Section of this document.

Comments—Effects on Recreation in Lava Beds National Monument

HT.6 Many visitors to the Lava Beds Nat. Monument drive up to Medicine Lake as part of their visit. Use of the Monument's wilderness area is about 8000 visits per month during the summer season with a 3 to 5% yearly increase in general visitation over the past 3 years. *(Louise Thompson)*

PH5.7 Many visitors to the Lava Beds National Monument drive up to Medicine Lake as part of their visit. Use of the monument's wilderness area is about 8,000 visits per month during the summer season, with a three to five percent yearly increase in general visitation over the past three years. *(Medicine Lake Public Hearing)*

Response—Effects on Recreation in Lava Beds National Monument

As discussed on page 4-201 of the Draft EIS/EIR, construction and operation of the project would not occur near Lava Beds National Monument. Thus, no direct effects to recreation are expected to occur to visitors at the Monument. In addition, views of the project from vantage points at the Lava Beds National Monument are not expected to be significant (see Section 4.9 of the Draft EIS/EIR, Visual Resources), and would therefore not significantly affect recreation at the Monument.

EFFECTS ON DISPERSED RECREATION

Comments—Effects to Dispersed Snowmobile Use

H.14 The primary transportation issue is one that was not adequately addressed or mitigated in the document: impact of plowing and blowing snow on roads designated and groomed for snowmobile use. The Medicine Lake Highlands, along with lands connecting towards Deer Mountain, Mt. Shasta, and McCloud have always been used by snowmobilers due to the excellent snowfall and available terrain. The area has become a premiere snowmobile destination in recent years since snowmobile staging areas and warming huts have been developed and constructed at Pilgrim Creek (near McCloud), Deer Mountain (near Weed), Four Corners (near Macdoel) and Door Knob (near Tulelake/Lava Beds National Monument). These staging areas are linked with a vast network of forest roads that are now groomed for snowmobile travel, all paid for by snowmobilers through grants from the California Green Sticker program administered by the Off Highway Motor Vehicle Recreation to the Modoc, Klamath, and Shasta-Trinity National Forests. This program would be adversely impacted under all action alternatives.
(Bill Dart, American Motorcyclist Association)

U.15 Winter snowmobiling is another valuable resource for Siskiyou County. Much revenue is generated by the sport: Cost of the machines ($6,000 to $10,000), licenses, taxes, insurance, gas and oil, lodging, food, maintenance and all the misc. costs incurred by the sport.

The Medicine Lake Highlands provide some of the best snowmobiling in the county. Reasons being: wonderful snow conditions, a trail system consisting of groomed and marked trials, plenty of unmarked riding areas and four snowmobile parks that feed the area with riders two of the parks are within ten miles of the lake. The Highlands provide riding areas for every level of experience from the novice to the expert.

Geothermal development will ruin many aspects of this sport in the Highlands. The plowing of roads used as snowmobile trails, the 36" above ground steam pipelines and the transmission line will all become obstacles. Many snowmobilers will not return once they have experienced the geothermal obstacle course. *(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)*

Z.4 There is also the issue of losing more riding area. I realize there will be no riding near the Power Plant and around the pads, but my concern is over time more and more areas will be closed to snowmobiling.
(Eileen K. Maier, Shasta Sno-Mobilers Inc.)

BT.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses.
(W.S. Denham)

HT.5 Snowmobiling as a sport has shown an increase in the past few years. Usually 200 to 250 visitors frequent Medicine Lake on holiday weekends in winter, an increase of 20 to 25% per year over the past 3 years. Visual pollution by the actual power plant and transmission towers will impact on the wilderness feeling of this area in winter.
(Louise Thompson)

IV.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses.
(Shawn Adams)

IX.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses.
(Dick Carnell)

IY.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses.
(Laurie E. Denham)

IZ.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses.
(Tobin E. Frank)

JA.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses. *(Ross Loffmoy)*

JB.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses. *(Dawn E. Parkhurst)*

JC.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses. *(Matt Parkhurst)*

JD.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses. *(Robert J. Piper)*

JE.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses. *(Mark Sowert)*

JF.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses. *(Stacey Sowert)*

JG.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses. *(Ken Wallace)*

JH.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses. *(LeRoy Walland)*

JI.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses. *(A. Clayton Whitmarsh)*

JJ.2 I do not believe recreational opportunities should be sacrificed to the development, and oppose any area closures during the winter. The plan should work toward retaining the present character of the forest and its public uses. *(Bob Wolf)*

PH3.73 If somebody mentioned a snowmobile trail or something would be affected, I would like to know which one it is. *(Yreka Public Hearing)*

PH5.6 Snowmobiling as a sport has shown an increase in the last few years. Usually 200 to 250 visitors frequent Medicine Lake on holiday weekends in winter; an increase of twenty to twenty-five percent in the last three years. Visual pollution by the actual power plant and transmission towers will impact on the wilderness feeling of this area in the winter. *(Medicine Lake Public Hearing)*

Response—Effects to Dispersed Snowmobile Use

As described in the EIS/EIR, the proposed project would affect winter snowmobile use in the vicinity in three ways:

(1) Use of a parking lot near the Four Corners-Medicine Lake Snowmobile Park for winter commuters

(2) Closure of a portion of Forest Road 44N01 due to plowing for access to the power plant

(3) The erection of project facilities in the power plant and wellfield area, which would create new obstacles and a single road crossing with a snowmobile trail

For a discussion of the use of a winter commuter lot near the Four Corners-Medicine Lake Snowmobile Park, see response to "Comments—Effects to Use of the Four Corners-Medicine Lake Snowmobile Park," below.

As described in the Draft EIS/EIR on page 2-21, Calpine would periodically plow one road for access to the power plant during winter. Plowing would occur during all phases of the project, including construction and operation. The purpose of the plowing would be to provide access to the power plant for:

- A 4 X 4 commuter vehicle to shuttle workers from the Four Corners-Medicine Lake Snowmobile Park
- Any commercial vehicles bringing supplies or parts to the plant
- Emergency vehicles

Access would be provided by plowing Forest Road 44N01 from the Four Corners-Medicine Lake Snowmobile Park to the junction with Forest Road 44N64. This section of Forest Road 44N01 has been used as a designated snowmobile trail. Due to plowing, this portion of the trail, approximately 7 miles, would be closed to snowmobile use. Forest Road 44N64 would also be plowed from its junction with Forest Road 44N01 to the junction after proposed injection pad I-1 (see Figure 2.2-3 in the EIS/EIR). Within the wellfield area, a single road would be plowed from this junction to the power plant, along the cold injection line from pad I-1.

It is expected that plowing would occur at irregular intervals, on an as-needed basis. The most frequent traffic would be the 4 X 4 commuter vehicle. Winter shifts for Calpine employees would be approximately two weeks. Thus, plowing would occur at least every two weeks to allow workers to enter and exit the facility. On occasion, plowing would occur more often to allow scheduled deliveries of supplies to the facility. However, Calpine expects that the majority of supplies for the winter could be stockpiled at the site to reduce the need for commercial traffic.

All of the comments express concern over the proposed closure of a portion of the groomed snowmobile trail on Forest Road 44N01 for the life of the project. As stated in the Draft EIS/EIR on page 4-198, this road closure would be considered an adverse effect on winter recreation use in the area. However, on the western Modoc National Forest and eastern Klamath National Forest there are over 250 miles of groomed snowmobile trails available for use. Eliminating approximately seven miles of snowmobile trail would not substantially alter the recreational opportunities for snowmobiles in the region. In addition, there are three other groomed snowmobile trails that are parallel to and within six miles of Forest Road 44N01: Forest Roads 44N54, 44N50, and 43N48. Closure of Forest Road 44N01 would not affect the ability of snowmobilers to travel in an east-west direction in the project vicinity. Thus, closure of this portion of Forest Road 44N01 would not be considered a significant effect on recreation.

For a discussion of the effects of wellfield and power plant facilities on snowmobile use, see response to "Comments—Effects to Snowmobile Use of the Power Plant and Wellfield Area" below, and the response to "Comments—General Hazards" in the Human Health and Safety Section of this document. See also response to "Comments—Effects of Road Plowing on Snowmobile Use" below.

Comments—Effects to Use of the Door Knob Snowmobile Park

Z.2 My concerns for my fellow snowmobilers are as follows:

The Door Knob Snowmobile Park will be left high and dry of snow. With the plowing of the road leading past the Park, we will be unable to groom this road, therefore we will not be able to ride our snowmobiles out of the Park. As I understand it, a staging area will be provided further past the Park, but no snowmobiling between the Park itself and the Staging area will be possible. It is customary to have our warming huts as a parking lot which has groomed snowmobile trails leading away from the park. This allows snowmobilers to return to the park during their riding day to warm up, eat, or use rest rooms. Here are a few ways we could solve this problem.

a. An area along the plowed road could be provided for a snowmobile groomed trail.

b. Another route from the Park to our riding area could be provided to allow grooming.

c. The Door Knob Snowmobile Park itself could be moved further up the road to the new staging area.
(Eileen K. Maier, Shasta Sno-Mobilers Inc.)

Z.5 There are also snowmobilers whom come down from Oregon and use the Door Knob Snowmobile Park. Not all of these snowmobilers are members of our club and I can not speak for them, but it is our concern they will not have a warming hut to use either. Thank you for your time and for keeping us in the development loop. If there is anything I can help you with or any questions I could answer, please don't hesitate to contact me at the below address. *(Eileen K. Maier, Shasta Sno-Mobilers Inc.)*

Response—Effects to Use of the Door Knob Snowmobile Park

These comments express concern over the impacts of the proposed project on the Door Knob Snowmobile Park. As stated on page 2-21 of the Draft EIS/EIR, access to the proposed project site during winter would be via Forest Road 15, 44N01, and 44N64. There would be no winter access to the site from the east. Thus, there would be no effects to the Door Knob Snowmobile Park.

Comments—Effects to Use of the Four Corners-Medicine Lake Snowmobile Park

U.16 (pg. 4-212 EIS/EIR) Calpine plans to use the Four Corners Snowmobile Park as a commuters parking lot. This plan is unacceptable, the park was built with California DMV Off-Highway Green Sticker funding as a snowmobile park, not a commuters "park and ride" parking lot for Calpine employees.
(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

IN.1 Would like to see 4-Corners left as a Snowmobile Park and not a "parking lot for employees of Calpine."
(Ray Williamson)

IO.1 Would like to see 4-Corners left as a Snowmobile Park and not a "parking lot for Calpine employees."
(Sharon Williamson)

Response—Effects to Use of the Four Corners-Medicine Lake Snowmobile Park

The comments express concern over the proposed use of the Four Corners-Medicine Lake Snowmobile Park during winter as a commuter parking lot for Calpine employees. As discussed on page 2-21 of the Draft EIS/EIR, Calpine would establish a carpool area near the Four Corners-Medicine Lake Snowmobile Park during the winter months and would not use the existing snowmobile parking area for an employee carpool area. The carpool area will be maintained by Calpine and will minimize conflicts with snowmobile activity. All snow removal equipment would be stored near the power plant facility. Snow removal of roads to and from the snowmobile park and snowmobile parking area would continue to be maintained by the USFS.

As described on page 2-57 of the Draft EIS/EIR, 19 employees would staff the project facilities at any one time during project operations. These employees would park their vehicles at the carpool area located near the Four Corners-Medicine Lake Snowmobile Park in the winter and would be driven by a four-wheel-drive vehicle or snow-cat to the power plant. It is expected that employees from similar locations would rideshare, and about 5 to 10 employee vehicles would be parked at the carpool area. However, if each employee drove individually, up to 19 employee vehicles would be parked at the carpool area. The Four-Corners staging area would not be used during any phase of the proposed project.

Comments—Effects to Snowmobile Use of the Power Plant and Wellfield Area

H.19 Another significant negative impact and safety hazard would be created by the entire wellpad and the related pipeline network adjacent to groomed snowmobile route 44N54. The heat loss from the above ground pipeline network would likely create open ditches through the snow. These ditches would be a significant safety hazard that could cause death or serious injury to any snowmobiler that hit one. Even if

44N54 was closed to snowmobiling, which would be unacceptable, snowmobilers travel cross country as well and could come into the well pad area from any direction. *(Bill Dart, American Motorcyclist Association)*

H.20 Fencing is also hazardous and difficult due to the varying snow depths each year, plus difficult to maintain in deep snow conditions. During heavy snow years, snow depth could cover most or all of any fencing, creating another potentially fatal hazard to snowmobilers. Adequate measures must betaken to warn snowmobilers and make the fence visible to snowmobilers, including after dark since night riding is very common. *(Bill Dart, American Motorcyclist Association)*

Z.3 The steam pipelines which run above ground will be impassable by snowmobiles. We will not be able to get over or around these pipelines. Is it possible to have ramps over the pipelines on known snowmobiling trails? *(Eileen K. Maier, Shasta Sno-Mobilers Inc.)*

PH4.20 The steam line should be buried to avoid interfering with snowmobiling. *(Mount Shasta Public Hearing)*

Response—Effects to Snowmobile Use of the Power Plant and Wellfield Area

The comments express concern about the safety hazards posed to snowmobilers by project facilities and activities in the power plant and wellfield area. As described in Section 4.15 of the EIS/EIR, Human Health and Safety, snowmobilers would not be exposed to significant safety hazards within project facilities during the winter months.

There are major constraints in the wellfield vicinity that would prevent snowmobilers and skiers from gaining sufficient speed to have an unavoidable collision resulting in injury. For example, snowmobilers in the wellfield vicinity would be traveling at relatively slow speeds due to the high density of the Forest. These slow speeds would allow snowmobilers to spot and avoid wellfield facilities before any collisions could occur. In addition, snowmobilers would stay primarily on groomed trails in the project vicinity, which would not overlap with proposed facilities except at one location, Forest Road 44N64 (see discussion in response to "Comments—Effects of Road Plowing on Snowmobile Use" below).

The comments also raise concerns about the potential for snowmobilers to collide with wellfield facilities that are buried in snow (e.g., pipelines or fences), collide with ditches under pipelines, or collide with these facilities at night. If the facilities are buried in the snow, snowmobilers and skiers would be able to travel over the facilities, and no injuries to snowmobilers would occur. During nighttime, snowmobilers would be traveling at slow speeds, which would allow wellfield facilities to be spotted and avoided before any collisions could occur. In the severest of weather conditions (such as "white-out" conditions), snowmobilers would be expected to go sufficiently slow or stop due to the potential to run into trees, rocks, and other existing hazards. This caution would allow snowmobilers and skiers to spot and avoid wellfield facilities just like they would avoid trees, rocks, and other existing hazards.

Comment H.19 suggests that ditches would be created under pipelines in the wellfield area that could be hazardous to snowmobilers. As described on page 2-19 of the Draft EIS/EIR, production pipelines carrying hot geothermal fluids would be placed approximately 4 feet above ground level. The clearance under the pipeline, if there is any, would not be sufficient to allow passage of a snowmobile underneath, regardless of whether a ditch is present or not.

As described in response to "Comments—General Hazards" in the Human Health and Safety Section of this document, notices about the geothermal facilities, activities within these facilities, and potential risks to recreationists would be posted in the region (see Mitigation Measure 4.15.8a). These notices would be posted at access points to the

wellfield and power plant area, the Klamath and Modoc National Forest district offices, and campgrounds, picnic areas, and snowmobile parks in the project vicinity. These notices would ensure that recreationists, including snowmobilers, are fully aware of geothermal facilities and the activities within these areas. With implementation of Mitigation Measure 4.15.8a, no significant human health and safety effects would occur due to snowmobile use of the power plant or wellfield area.

Comment Z.3 expresses concern that above-ground pipelines would create a barrier to movement of snowmobilers in the power plant and wellfield area. As described in response to "Comments—Effects of Road Plowing on Snowmobile Use" below, snowmobiles would be able to easily traverse the wellfield area on the existing groomed trail (Forest Road 44N54). As described above, in most places throughout the wellfield area, pipelines would protrude above the snow level. Thus, snowmobiles would be able to traverse the wellfield area only on the existing groomed trail. However, because the majority of use through this area is already on this groomed trail, there would be no significant effect on the snowmobile use of the area from project pipelines.

Comments—Effects of Road Plowing on Snowmobile Use

H.16 44NO 1 is a major groomed snowmobile route out of the Four Corners Staging area all the way to Forest Route 49, and the primary and only direct route to the Door Knob Staging Area from Four Corners. All action alternatives would eliminate 44N01 as a snowmobile route altogether and no alternatives or mitigation was discussed, an omission that must be corrected. *(Bill Dart, American Motorcyclist Association)*

H.17 Additionally, 44N64 crosses another groomed snowmobile route, 44N54, immediately adjacent to the proposed well pad and power plant site. Plowing across 44N54 would eliminate it as a groomed snowmobile route. *(Bill Dart, American Motorcyclist Association)*

H.18 In addition, a serious safety hazard to snowmobilers is created by snow plowing in an area that has traditionally never had snow removal. Hitting a plowed road, with sudden drop-offs from the snowpack on to dirt or pavement, with sheer walls on each side is a major safety hazard, and has resulted in multiple fatalities already here on California National Forest lands in recent years. Snowmobilers are especially vulnerable since travel is not confined to specific routes or roads, but occurs throughout the forest wherever there is sufficient snow cover. The entire length of the plowed road would be a safety hazard to snowmobilers. *(Bill Dart, American Motorcyclist Association)*

H.23 The document states that snowmobilers could drive up 44NO1 to a gate at the intersection of 44NO1 and 44N64 and stage informally. This leads to questions about how adequate width for parking without obstructing through traffic will be accommodated? Will there be adequate room to turn a vehicle and trailer around? What kind of measures will betaken to mitigate the safety hazard created to west bound snowmobilers on 44NOl as they approach 44N64? Will this gate be locked year around or only in the winter. If it is locked year around, is mitigation necessary to compensate for closing this road and what would that mitigation be? *(Bill Dart, American Motorcyclist Association)*

H.24 The preferred alternative for snowmobilers is to abandon the road plowing in the winter and access the power station and well pad site by snowcat. The document calls for a snowcat on site already, since there will be times when weather conditions would close the road for periods of time due to heavy storms and deep snow accumulations. Even if another snowcat is needed, the costs are not likely to be significantly higher since removing snow over the length of road involved, 11 miles, is not inexpensive, and would require the purchase, operation, and maintenance of a grader/plow and a rotary plow, plus employee's to operate this equipment. If snowcats are used instead, all weather access will be assured for the project, snowmobilers will not lose two important groomed snowmobile routes, and an eleven mile long potentially fatal hazard to snowmobilers will not be created. *(Bill Dart, American Motorcyclist Association)*

Response—Effects of Road Plowing on Snowmobile Use

These comments address three primary issues:

- Loss of a portion of Forest Road 44N01 as a groomed snowmobile route
- Crossing Forest Road 44N54 (a groomed snowmobile route) with a plowed access road (Forest Road 44N64)
- The safety hazard created by plowing Forest Roads 44N01 and 44N64

The loss of a portion of Forest Road 44N01 (approximately 7 miles) is discussed in response to "Comments—Effects to Dispersed Snowmobile Use" above. As stated in this discussion, the loss of approximately seven miles of groomed trail from a network of over 250 miles of trail would not substantially reduce the recreational opportunities available to snowmobilers in the region.

Implementation of the proposed project would result in one location where wellfield facilities would overlap with an existing snowmobile trail on Forest Road 44N54. As discussed on pages 4-197 through 4-199, the proposed access road to the plant site would cross this trail (see Figure 2.2-3 in the Draft EIS/EIR). In addition, the cold injection line would cross Forest Road 44N54. At this intersection, the cold injection line would be placed in a conduit under Forest Road 44N54. Plowing at this intersection would be feathered to create a transition ramp where the snowmobile trail enters and exits the roadway. With the implementation of these two measures, project facilities would not interfere with snowmobile use of Forest Road 44N54. For clarity, the following information has been added to the first paragraph on page 2-20 of the Draft EIS/EIR:

> "The hot injection pipelines would be constructed of 12-inch diameter carbon steel. The cold injection lines would carry aerated fluids from the power plant to the injection wells. These pipelines would be constructed of 12-inch diameter High Density Polyethylene (HDPE). At the cold injection line crossing of Forest Route 44N54 (see Figure 2.2-3), this line would be placed in a conduit that would pass under the road."

In addition, the second paragraph on page 4-198 has been revised as follows:

> "The plowing of Forest Road 44N01 would preclude the use of this road as a snowmobile trail, which would be an adverse effect. In addition, plowing of the power plant access route would create an interruption in the snowmobile trail along Forest Road 44N54 at the intersection of this road and the access road as snowmobiles would not be able to cross the plowed intersection. The proposed cold injection line that would cross Forest Road 44N54 at this location would be placed underground and would therefore not interrupt this route. The interruption of this snowmobile trail by the access road would therefore be an adverse impact that can be mitigated."

Mitigation Measure 4.11.4a would eliminate hazards at the intersection of the access road and Forest Road 44N54. This measure would ensure that no significant human health and safety effects to snowmobilers would occur at this location. In order to clarify this mitigation measure, the following revisions have been made:

> "4.11.4a Calpine shall sign the intersection of the ~~cold pipeline~~ access road to the plant site with Forest Road 44N54 and feather ~~the~~ this crossing for snowmobiles."

Comment H.18 also raises concerns about the safety hazard posed by the plowed road to snowmobilers. As described in response to "Comment—General Hazards" in the Human Health and Safety Section of this document, notices about the geothermal facilities, activities within these facilities, and potential risks to recreationists would be posted in the region (see Mitigation Measure 4.15.8a). These notices would be posted at access points to the wellfield and power plant area, the Klamath and Modoc National Forest district offices, and campgrounds, picnic areas, and snowmobile parks in the

project vicinity. These notices would ensure that recreationists, including snowmobilers, are fully aware of geothermal facilities (including access roads), and the activities within these areas. With implementation of Mitigation Measure 4.15.8a, no significant human health and safety effects would occur due to snowmobile use near the plowed access roads.

Comment H.23 also questions the use as an informal staging area of the intersection of Forest Roads 44N01 and 44N64, where a gate would be erected. As stated in the Draft EIS/EIR on page 2-21, Calpine would be responsible for plowing these two roads in winter. In addition, Calpine would be required to maintain a plowed turn-around at the intersection of Forest Roads 44N01 and 44N64.

Calpine would not be responsible for maintaining this intersection as a snowmobile staging area. The use of this intersection as an informal staging area is discussed in the Draft EIS/EIR as a possibility of what could happen, and is not a formal proposal for Calpine to maintain it as a staging area. There are hundreds of pullouts and intersections throughout the Modoc and Klamath National Forests that are used during winter as informal staging areas for snowmobilers. Because they are informally and sporadically used, they are not maintained to allow for a turn-around or for specific parking capacity. The gated intersection would fall under this category of an informal staging area that could be used by snowmobilers.

Comments—Effects to Hunters

N.28 The executive summary states that the Klamath and Modoc National Forests will also decide whether to amend the forest Land Resource Management Plans to establish and designate a utility corridor for the proposed project's transmission line and issue forest orders to prohibit the use of firearms in the immediate power plant and wellfield area.

The DEIS/EIR did not disclose and evaluate the direct, indirect, and cumulative impacts to the public's right to hunt and also hunting on federal lands as a result of prohibiting the use of firearms in the immediate power plant and wellfield area. Prohibiting the use of firearms would have adverse impacts to the purpose of the public's right to hunt. The DEIS/EIR is deficient without disclosing and evaluating the direct, indirect, and cumulative impacts to the public's right to hunt and the effects to hunting experiences.

The California Fish and Game Commission regulates fishing and hunting in the State of California. The DEIS/EIR did not disclose whether the U.S. Forest Service has the authority to regulate hunting. This information should have been included in the DEIS/EIR. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

CH.2 Medicine Lake is already an area with a thriving tourist industry in the manifestation of hunters and fishermen. I can not see that the land would be able to support both types of industry. I strongly object to destroying a relatively pristine land which will become increasingly valuable as the years pass purely because it is comparatively undeveloped. *(Elizabeth V. Farioletti)*

CI.2 Medicine Lake is a beautiful area already used by hunters and fishermen who bring in much tourist money every year. Their impact upon the environment is minimal, whereas the geothermal plants would devastate the land, the water and the air. *(Marius A. Farioletti)*

IE.7 The proposed Fourmile Hill and Telephone Flat plants and associated pipelines, will carry "NO HUNTING" signs. Siskiyou County does not need more closed public lands. Remember these are our lands we are talking about. *(Alysa Waring)*

PH4.19 Concerned about closing areas to recreational activities, including hunting. *(Mount Shasta Public Hearing)*

PH5.51 I wanted to know why that in the literature you put out prior to the EIR report, there was nothing mentioned about infringing on the people's right to use the public lands in this area. And I believe, Mr. Stout, I think you were the gentleman that made the statement in Yreka that there would be no shooting on the leased lands. Isn't that the way you put that? *(Medicine Lake Public Hearing)*

PH5.52 We talked about this yesterday a little bit. You said that each one of the sites would probably be fifty acres, covering the pads and everything. This two-mile area—and I'm looking at a map here of this proposal. If the Forest Service puts in this firearm restriction as it does around Medicine Lake, and I

thought it was—I said two miles yesterday; somebody said one mile, and on the one mile we're looking at approximately eight square miles around each site. *(Medicine Lake Public Hearing)*

PH5.53 My figuring there, if we go—and this is one mile restrictions, we're looking at forty to fifty square miles of no shooting. And now, you hunters in the area might give that a—might not like that. This is an area that is heavily hunted, it affords a terrific amount of recreational opportunity by hunters. This is something that I think needs to really be considered. *(Medicine Lake Public Hearing)*

PH5.54 More like it would be—I'm asking the Forest Service, what is the restriction about discharging a firearm around this lake? Two miles around in all directions from the lake. If you have ten acres, you're going to go two miles north. *(Medicine Lake Public Hearing)*

PH5.55 Well, it's something that somebody better—I mean, better look at and look at it very closely. You might need to diagram what the actual restriction is. *(Medicine Lake Public Hearing)*

PH5.56 Map out the no-shooting area. *(Medicine Lake Public Hearing)*

Response—Effects to Hunters

The comments express concern that hunting opportunities would be limited by the proposed project and that these limitations may impact the tourist industry of the region. Hunting would not be prohibited anywhere in the project area. However, shooting would be prohibited in the power plant and wellfield area and at a safe distance from this area. Shooting restrictions are designed to protect Calpine employees. Shooting would not be prohibited in any other portion of the project area beyond the regulations already in place by the CDFG.

In the power plant and wellfield area, public notices would be posted to notify the public of potential risks associated with using that area for hunting or other forms of recreation (Mitigation Measure 4.15.8a on page 4-292 of the Draft EIS/EIR). In addition, Calpine would post "no shooting" signs in the vicinity of the power plant and wellfield area to reduce the risk of damage to project facilities and injury to hunters, according to Mitigation Measure 4.15.8a on page 4-292 of the Draft EIS/EIR, as revised below:

> "4.15.8b Calpine ~~The USFS~~ shall post "no shooting" signs in the vicinity of the power plant and wellfield area and ensure those signs remain posted during the entire length of the project. (C, O, D)"

In order to prohibit shooting in the power plant and wellfield area, the USFS would issue a Forest Order, as described on page 1-8 of the Draft EIS/EIR. This Forest Order would prohibit shooting within a minimum of 150 yards, as stated in 36 CFR 261 (d)(l), and a maximum of 0.25 mile, depending on topography. The Forest Order would be the same as that issued for campgrounds to protect public safety.

The benefits of prohibiting shooting in this area through reduced risk of injuries and damage to project facilities outweigh the loss of a small area for hunting. Given the extensive area (hundreds of square miles) available to hunting on the Klamath and Modoc National Forests, the loss of hunting opportunities with firearms within the power plant and wellfield area (approximately 200 acres) would not be considered significant. There is therefore no need to discuss the possible reduction in hunting due to the project in detail in the EIS/EIR.

Comment N.28 also requests that the EIS/EIR disclose whether the USFS has the authority to regulate hunting. The USFS will not be regulating hunting in the project area, only shooting (i.e., discharging firearms). Forms of hunting that do not involve discharging a firearm (e.g., archery) would still be allowed in the power plant and

wellfield area. The USFS does have the authority to regulate shooting in order to protect public safety.

Comments CH.2 and CI.2 express concern about the potential effects to the tourism industry from the proposed project. As discussed above, the proposed project is not expected to change the amount of land available to hunters in the region (except for the loss of approximately 200 acres of area available for shooting). Likewise, the proposed project is not expected to change hunters' attraction of the area or their contribution to tourism in the region. See also response to "Comment—Effects to Tourism" in the Socioeconomics Section of this document for an analysis of the potential impacts of the project on the tourism of the region.

Comments—Effects on Matsutake Pine Mushroom Harvesting

AG.162 The EIS/EIR fails to acknowledge that the Project will significantly affect commercial mushroom harvesting of the Matsutake Pine Mushroom (Tricholoma magnivelane) throughout the Project area. (EIS/EIR, p. 3-164.) The wellfield, power plant area, and transmission line segments A1, A2, and B1 all contain "suitable habitat and sources of the Matsutake mushroom." (Ibid.) Mushroom harvesting, which takes place between September and December, has increased dramatically in recent years. (Ibid.) In 1996, the District issued 865 harvesting permits. (Ibid.)

The EIS/EIR admits that the Project will have an adverse effect on mushroom harvesting, but finds the impact insignificant. (Id. at p. 4-206.) Project construction will result in the loss and disturbance of habitat. (Ibid.) The removal of larger diameter trees could affect the regeneration of mushroom populations. Construction-related dust, odor, and noise could limit or discourage mushroom harvesters, and thus, have a temporary adverse effect on the harvesters. (Ibid.) Harvesters will also be subjected to significant acute health impacts from the Project's air emissions, which are discussed in the comments on Air Quality. Additionally, mushroom habitat along the transmission line corridor and access roads would continue to be disturbed during the operation phase, although the EIS/EIR asserts that additional habitat would not be lost. (Ibid.)

The EIS/EIR's discussion fails to provide an adequate basis for its conclusion that there will be no significant impact on harvesting. It does not discuss whether local residents benefit from commercial harvesting. For example, in an area with a high unemployment rate, local residents may have come to rely on the commercial harvest and may be affected by even a small reduction in mushroom supply habitat.

Without more information regarding the Matsutake mushroom harvest, it is impossible to determine whether the Project may have a significant impact on socioeconomic resources and whether mitigation measures should be imposed. For example, construction activities could be limited during the peak harvest time as a mitigation measure or prime mushroom areas could be avoided. Given the available information, this impact could be significant.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

HT.7 A new industry has developed in the Medicine Lake Highlands; mushroom harvesting from September to December. In 1994, no permits were issued, increasing dramatically to 865 permits in 1996 issued by the Goosenest Ranger Station. The Matsutake Pine Mushroom has great commercial value, especially in Japan. Suitable habitat and sources of the Matsutake mushroom abound in the area of the power plant, well field & transmission line. If ground is disturbed, the continuation of the mushroom harvest will be affected & possibly ruined forever. A million dollar business will have been lost. *(Louise Thompson)*

PH5.8 A new industry has been developed in the Medicine Lake Highlands; mushroom harvesting from September to December. In 1994 no permits were issued; increasing dramatically to 865 permits in 1996 issued by the Goosenest Ranger Station. The Matsutake Pine Mushroom has great commercial value, especially in Japan. Suitable habitat and sources for the Matsutake mushroom abound in the area of the power plant, the well fields and transmission lines. If the ground is disturbed, the continuation of the mushroom harvest will be affected and possibly ruined forever; a million dollar business will have been lost. *(Medicine Lake Public Hearing)*

Response—Effects on Matsutake Pine Mushroom Harvesting

As discussed in the Draft EIS/EIR, harvesting of the Matsutake pine mushroom, *Tricholoma magnivelane*, occurs throughout the proposed project area. It is estimated that the annual harvest of mushrooms on the Goosenest Ranger District is 50,000 pounds (see page 3-164 of the Draft EIS/EIR). These mushrooms grow (and mushroom

harvesting activities occur) in lodgepole pine, red fir, and pine/white fir forest types, which are abundant in the Medicine Lake Highlands.

The proposed project area compromises an extremely small portion of potential Matsutake pine mushroom habitat in the Medicine Lake Highlands. As stated in the Draft EIS/EIR, the wellfield and power plant facilities would occupy approximately 50 acres, with most of these facilities located on areas that have been previously disturbed (and are not necessarily mushroom habitat). The transmission line would occupy approximately 230 acres in the Medicine Lake Highlands (see Table 2.2-3 on page 2-44 of the Draft EIS/EIR). Due to the extremely small area that would be occupied by project facilities in comparison to potential mushroom habitat in the Highlands, the proposed project would not have an effect on the Matsutake pine mushroom or the harvesting of this mushroom.

Information requested in comment AG.162 regarding local resident benefits associated with Matsutake pine mushroom harvesting is not currently available. However, it is anticipated that the proposed project would have a negligible (if any) effect on the Matsutake pine mushroom harvest. The project would therefore not affect any socioeconomic benefits that are obtained by the local community from the mushroom harvest.

EFFECTS ON DEVELOPED RECREATION USE AREAS

Comment—Effects to Campground Users at Medicine Lake

Y.6 The DEIS/EIR relegates to insignificance the loss of wilderness, forests, pristineness and recreation at Medicine Lake (see DEIS/EIR at 3-157 table 3.11-1). Some 40,000 people are known to use the campgrounds annually. These will be significantly impacted due to excessive noise, loss of visual, air and water quality and destruction of forests, plants and wildlife habitat, if the project is approved.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

Response—Effects to Campground Users at Medicine Lake

Comment Y.6 expresses concern over the potential impacts to campground users at Medicine Lake due to noise, visual quality, air quality, water quality, and biological resources impacts. For a discussion of potential impacts to Medicine Lake due to noise, visual quality, air quality, and water quality, see response to "Comments—Effects on Medicine Lake Residences" below. For a discussion of the effects to users of the Medicine Lake Lava Trail (who may also use Medicine Lake campgrounds), see response to "Comments—Effects on Recreation in and near Medicine Lake" above.

For a discussion of the effects of the proposed project on biological resources, including effects to Forests, plants, and wildlife habitat, see Sections 4.7 and 4.8 in the EIS/EIR, Vegetation and Wildlife, respectively. Also see the following responses to comments:

- General Effects on Old-Growth (Late-Seral) Forests (in the Vegetation Section)
- General Impacts to Special-Status Plants (in the Vegetation Section)
- General Impacts to Special-Status Wildlife (in the Wildlife Section)

EFFECTS ON RESIDENTIAL AREAS

Comments—Effects on Medicine Lake Residences

U.14 (pg. 4-193) "Any recreational user that is bothered or annoyed by operational noise or odors, or the visibility of the facilities at this site, can move out of the vicinity or make a decision not to hike or hunt in

proximity to this site, etc. " This response is unacceptable, people come to Medicine Lake to get away from urban industry, noise and pollution. The Medicine Lake homeowners can not move, they will be trapped by the pollution, noise, visual and water quality losses along with the loss of their property values. *(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)*

Y.7 The DEIS/EIR at 4-193 comes up with an interesting measure. We read that "Any recreational user that is bothered or annoyed by operational noise or odors, or the visibility of the facilities at this site, can move out of the vicinity or make a decision not to hike or hunt in proximity to this site..." This response is unacceptable. People come to Medicine Lake to get away from urban industry, noise and pollution. The people who own cabins will be trapped by the pollution, noise, visual and water quality losses along with the loss of their property values.

And certainly this measure cannot be said to apply to Native American uses of historic and sacred sites which are hallowed by long continuous usage.

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AN.3 Most of us have put a lot of time, work and money into our cabins and property up there so we have a place to relax, fish, boat and enjoy the beauty and wildlife of the area. We want our children and grandchildren to be able to use the area and enjoy it for years to come. Not to listen to drilling and turbines running 24 hours a day. *(John Aquila)*

HT.20 In Sec. 4.11 it is stated that visitors planning to stay in the Medicine Lake area who are bothered by the plant noise can move out of the area or make a decision not to hike or hunt in proximity of such activities. What about the 40 or 50 cabin owners - they cant move on to a new site. *(Louise Thompson)*

PH5.21 In section 4.11 it is stated that visitors planning to stay in the Medicine Lake area who are bothered by the plant noises can move out of the area or make a decision not to hike or hunt in the proximity of such activities. What about the forty or fifty cabin owners; they can't move on to a new site.

(Medicine Lake Public Hearing)

Response—Effects on Medicine Lake Residences

The comments raise concerns about the effects of the project on the recreation experience of residents at Medicine Lake. The comments raise concerns about the following types of impacts to Medicine Lake residences:

- Water quality
- Visual quality
- Air quality
- Noise
- Loss of Property Values

It should be noted that the discussion from the Draft EIS/EIR quoted in several of the comments referred to potential effects on the overall recreation experience, not to potential effects on Medicine Lake cabin owners. Potential effects to cabin owners are specifically discussed under Impact 4.11.3 on pages 4-195 to 4-197 of the Draft EIS/EIR. It is acknowledged that cabin owners are not able to move to another site, and the Draft EIS/EIR does not state this as an option for the effect to Medicine Lake homeowners. As discussed throughout the EIS/EIR and in these responses to comments, the homeowners would not be exposed to water quality, visual quality, air quality, or noise effects that would significantly affect recreation. In addition, the project would not significantly affect property values at Medicine Lake. The following discussion provides summary responses to each of these concerns.

Water Quality: Section 4.3, Hydrology, of the EIS/EIR, includes a discussion of the potential effects of the project on the water quality of Medicine Lake. The Draft EIS/EIR presents a detailed analysis of the potential effects of air emissions on the water quality of Medicine Lake (via deposition) on pages 4-34 through 4-38. As stated in that section, the results of the depositional analysis indicated that concentrations of arsenic,

antimony, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel and selenium in the upper two feet of lake water, after 45 years of accumulation (i.e., the duration of project activities), would be significantly below regulatory limits for drinking water (see Table 4.3-3 in the EIS/EIR). These conclusions were based on a depositional model with extremely conservative (and somewhat unrealistic) assumptions.

For more discussion of this analysis, and a revision of the results of the analysis (but not the conclusions), see the following responses to comments, in the Hydrology Section:

- General Depositional Effects on Surface Waters
- Effect of Ammonia Deposition on Surface Waters
- Effect of Arsenic Deposition on Surface Waters
- Effect of Mercury Deposition on Surface Waters
- Effect of Boron Deposition on Surface Waters
- Effect of Acid Deposition on Surface Waters

Visual Quality: The effects of the proposed project on the visual quality of the region, including from Medicine Lake, is discussed in Section 4.9, Visual Quality, of the EIS/EIR. As summarized in Table 4.9-1 of the EIS/EIR (on page 4-142 of the Draft EIS/EIR), there would be two project-related effects to the visual quality from Medicine Lake:

- Views of a portion of segment A1 of the proposed transmission line
- Views of the steam plume from wells and the cooling tower (on an intermittent basis)

As discussed in the response to "Comments—Effects on Recreation in and near Medicine Lake," the visibility of the transmission line would be considered a significant and unavoidable impact because no mitigation is available that would remove this project feature from view. The occasional visibility of the steam plumes would contribute to this effect. The visibility of segment A1 of the transmission line in the foreground and middle ground from the Medicine Lake Lava Flow Trail would also be considered a significant and unavoidable impact.

The transmission line would be visible from Medicine Lake, but the visibility of this structure would not result in a significant effect on recreation. The presence of the transmission line would not conflict or interfere with recreation uses at the lake (i.e., the transmission line would not alter the ability to recreate at the lake). The visual effect of the project at Medicine Lake would therefore not have a significant effect on recreation at Medicine Lake.

Mitigation Measures 4.9.5a and 4.9.5b are proposed on page 4-161 of the Draft EIS/EIR to reduce the visual impact of segment A1 of the transmission line on views from the Medicine Lake area. Mitigation Measure 4.9.5a would redesign the transmission line between mileposts 0.6 and 3.3 to reduce the visibility of the transmission poles from Medicine Lake. Mitigation Measure 4.9.5b would redesign the transmission line and associated clearing to reduce the visual dominance of the transmission line from the Medicine Lake Lava Trail. Mitigation Measures 4.9.2a, 4.9.2b, and 4.9.4a also reduce the

visual effects of the transmission line (see pages 4-146 and 4-154 of the Draft EIS/EIR). Alternative 6, the lead agencies preferred alternative, would use segment A3 rather than segment A1. See also response to "Comments—Effects on Recreation in and near Medicine Lake" above.

Air Quality: An extensive analysis of potential effects of the project on air quality is presented in Section 4.13, Air Quality, of the EIS/EIR. A brief summary of this analysis as it relates to Medicine Lake residences is presented below.

The primary project emissions would be geothermal steam and condensate from venting wells, the power plant cooling towers, and the plant vent silencers. The key constituent of concern in these emissions is H_2S, primarily due to the nuisance odor that can result from concentrations at or greater than 0.03 ppm (equivalent to 42 $\mu g/m^3$). Emissions from these sources also contain particulate matter and low levels of other constituents, such as boron, ammonia, mercury, manganese, arsenic and volatile organic compounds. Project emissions would also result from:

- Dust generated from construction vehicle traffic and construction of well pads, access roads, the plant site, and transmission line structures
- PM_{10} and criteria pollutants emitted from drill rig diesel generators and the plant back-up generator
- Vehicle emissions

These emission sources would generate primarily criteria pollutants or their precursors, including PM_{10}, NO_x, SO_x, CO, and lead. Table 4.13-1 in the EIS/EIR summarizes the sources of project emissions during each phase of the project, including construction, normal operation, and upset conditions. The analysis in Section 4.13 discusses the potential effects to air quality of each phase of project construction. Within each phase of the project, there is a discussion of each type of emission (as described above), where appropriate. Appendix F of the EIS/EIR provides more detail regarding the scenarios that were evaluated.

As summarized in Table S-5 of the EIS/EIR (on page S-18), of the 11 categories of project effects on air quality, two would be considered significant before mitigation. The other nine categories of effects on air quality would not be significant, even before mitigation. The two categories of significant effects are:

- PM_{10} emissions during construction
- Visibility during project construction

Mitigation measures are proposed in Section 4.13 of the EIS/EIR that reduce the effects of the proposed project on air quality, including the effects of construction activities. However, these mitigation measures are not sufficient to avoid either:

- Significant effects due to PM_{10} emissions during construction (see pages 4-228 through 4-235 of the Draft EIS/EIR)
- Significant effects of construction activities on visibility (see pages 2-248 through 2-252 of the Draft EIS/EIR)

Although significant and unavoidable, these impacts would be temporary, and would last only during the construction phase of the proposed project. All potential impacts of the project during operation would not be considered significant.

Comments U.14 and Y.7 express specific concerns about the potential odors of the project at Medicine Lake. Odors from the proposed project could occur from emissions of hydrogen sulfide, H_2S, from the cooling towers or the wells. Table 4.13-6 on page 4-236 of the Draft EIS/EIR presents estimates of the maximum, one-hour average H_2S concentrations associated with normal and upset operation of the project. These results indicate that the concentrations of H_2S would not exceed the standard set by the state for one-hour average concentrations.

The estimated maximum concentration of H_2S at Grouse Hill (the receptor site closest to the proposed power plant) under normal operating conditions (with two wells venting) would be 29.5 $\mu g/m^3$. The estimated maximum concentration at this receptor under upset operating conditions with two wells venting would be 30.3 $\mu g/m^3$. These concentrations are well below the state standard of 42 $\mu g/m^3$. Medicine Lake residences are over two miles from Grouse Hill. H_2S levels at Medicine Lake would be substantially lower the values estimated for Grouse Hill, under both normal and upset conditions. As a result, the odors from the proposed project at Medicine Lake would be well below nuisance levels.

For more discussion of the effects of the project on air quality, see the responses to comments in the Air Quality Section of this document.

Noise: The potential effects of the proposed project on noise in the region is discussed in detail in Section 4.14, Noise, of the EIR/EIR. Within this section, potential noise effects on sensitive receptors near Medicine Lake are analyzed (see pages 4-262 through 4-268 of the Draft EIS/EIR). Potential sources of noise are separated into two categories: noise from construction, and noise from operation.

Estimated sound levels from construction activities are presented in Tables 4.14-1 and 4.14-2 in the EIS/EIR. One receptor given in these tables is "homes at southeast end of Medicine Lake." In Table 4.14-2, an additional receptor applies to Medicine Lake residences, "homes at southwest end of Medicine Lake." According to these data, construction noise would temporarily increase ambient noise levels at these receptors. Most of this increase in noise would be caused by construction of the three transmission towers nearest Medicine Lake (a portion of segment A1). This construction activity is expected to last for less than one week, and would not occur during noise sensitive periods such as at night. The projected increase in noise levels during this week (52.3 dBA L_{eq}) would not exceed the 54 dBA L_{eq} standard identified in the Siskiyou County Noise Element. Although this noise effect is identified as an unavoidable significant effect of the project, this effect would not translate to a significant effect on recreation due to its extremely temporary nature.

As shown in Table 4.14-3 on page 4-265 of the Draft EIS/EIR, estimated sound levels from project operations would be substantially lower than the ambient sound levels at Medicine Lake. The overall noise level from power plant and in-fill well drilling operations would not be expected to increase significantly at receptor locations under atmospheric conditions that would be conducive to sound transmission toward the

noise receptors; however, the noise may be detectable at times. Table 4.14-3 shows that the average ambient noise level is 33 dBA (L_{eq}) at the homes near Little Medicine Lake, which is the quietest of the three measurement sites. Under certain conditions, such as when a thermal inversion occurs or prevailing winds are to the southeast, power plant sounds may become audible at that location. When such conditions occur, the average overall sound level is estimated to be about 30 dBA, or about 3 dBA less than ambient. However, the ambient L_{90} level (see Table 3.14-2) is expected to be about 25 dBA, so that a 30 dBA level may be detectable.

Table 4.14-4 on page 4-267 of the Draft EIS/EIR presents data on the estimated sound levels, by frequency, of power plant operations at various locations, including at homes at two ends of Medicine Lake. According to these estimates, power plant operations would not produce noise with prominent tones.

Operation of the proposed transmission line would not result in the generation of noise and therefore would not impact ambient noise levels in the Medicine Lake area. Routine maintenance activities, expected to occur twice a year, could produce temporary noise increases that are likely to be much lower than construction noise levels. Vehicles and equipment to repair downed wires, damaged towers, or other facilities could also be present along the transmission line occasionally. Noise levels from such activities would likely be less than for construction, but could result in adverse effects on Medicine Lake visitors using areas in close proximity to such activities.

In summary, the noise generated by the project during construction would be at moderate levels during one week when construction of three transmission poles near Medicine Lake would occur. Other construction activities would generate low noise levels that would only rarely be detectable at Medicine Lake. The noise generated by project operation would be below ambient noise levels at Medicine Lake. Although potentially detectable at times, operational noise would not result in a significant impact on recreation.

Property Values: The potential effect of the project on property values at Medicine Lake is discussed in Section 4.16, Socioeconomics, of the Draft EIS/EIR and in the Socioeconomics Section of this document. As discussed in these sections, the project would have a less-than-significant effect on Medicine Lake property values. This conclusion is based on research of property value effects conducted for other transmission lines, as well as the evaluation of water quality, visual quality, air quality, and noise effects presented in the EIS/EIR.

Other Project Effects: Comment Y.7 also expresses concern about the Native American use of historic and sacred sites. Section 4.6, Traditional Cultural Values, of the EIS/EIR presents extensive discussion of the impact of the proposed project on Native American use of historic and sacred sites. See also responses to comments in the Traditional Cultural Values Section of this document for more discussion of this issue.

3.13 Transportation

INTRODUCTION

This section provides responses to comments on transportation issues. The comments and responses are grouped under the following headings:

- General
- Vehicular Trips Generated by the Project
- Road Safety
- Effects on the Four Corners-Medicine Lake Snowmobile Park

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

GENERAL

Comment—General

PH4.51 Why will access to plant site pass through Bartel rather than through Tionesta?

(Mount Shasta Public Hearing)

Response—General

As discussed in Section 4.12, Transportation, of the Draft EIS/EIR, USFS and Lava Beds National Monument staff consulted with Calpine regarding access roads to the power plant and the transmission line route. Based on these consultations, it was agreed that heavy construction equipment access and winter access would occur from the northwest (Bartel) due to road stability. Northwest access would be accomplished by using Forest Roads 44N01 and 44N64. Power plant and wellfield access would also be accomplished from the northeast (Tionesta area) by using Forest Roads 97 and 44N01. However, due to the instability of these roads, traffic would be limited to light construction equipment, and access on these roads would not be permissible during the winter months.

The Forest Service determined that northwest access would be the safest route due to current road conditions on Forest Roads 44N01 and 44N64. Implementation of Mitigation Measures 4.14.1a and 4.12.2a would ensure that Forest Roads 44N01 and 44N64 would remain structurally safe as a result of the proposed project.

VEHICULAR TRIPS GENERATED BY THE PROJECT

Comment—Vehicular Trip Generation

AG.104 The EIS/EIR underestimates the Project's trip generation potential by more than 40%. The EIS/EIR should be revised to include the correct estimate and a reevaluation of the Project's impacts and required mitigation measures.

The EIS/EIR estimates maximum Project-generated traffic at 228 trips per day during the construction phase. This includes 160 construction worker trips, and 68 truck trips. (EIS/EIR, p. 4-211.) This number appears to be a miscalculation. The EIS/EIR claims to have based the construction worker trips on the maximum workforce. However, the maximum work force is 160 workers per day. (EIS/EIR, p. 4-297.) Thus, the EIS/EIR should have estimated maximum construction worker trips at 320 per day (160 workers X 2 trips per day). This correction brings total Project-generated trips to 388 per day, 70% more than estimated in the EIS/EIR.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Vehicular Trip Generation

The comment suggests that a miscalculation occurred in the Draft EIS/EIR analysis of vehicle trips generated by the proposed project. As stated on page 4-211 of the Draft EIS/EIR, the estimate of trips associated with the proposed project is based on vehicular traffic during the second summer season after project commencement. During this time, wellfield, transmission line, and power plant construction, and well drilling would occur concurrently.

As stated in the Draft EIS/EIR, this phase of the proposed project would result in a maximum of 228 vehicular trips per day. This calculation was based on the maximum workforce of 160 employees for the proposed project (see page 4-297 of the Draft EIS/EIR). The calculation assumes that there would be 160 construction worker trips plus 68 truck trips per day. Thus, the total number of trips associated with this phase of the project would be 228 trips per day. This calculation is conservative because it assumes that two workers would travel to and from the proposed project site in one vehicle. However, as stated on page 2-11 of the Draft EIS/EIR, crew buses which Calpine would provide would be used to pick up construction employees from various surrounding locations, therefore further decreasing the number of trips generated by the proposed project. The commentor assumes that each construction worker would individually drive to and from the proposed project site, thus generating 320 trips per day. As is characteristic of rural worksites, it is anticipated that the majority of workers would ride-share. An estimate of two workers per vehicle was used in the trip generation analysis. This estimate is a reasonable assumption for the traffic analysis. The analysis in the Draft EIS/EIR does not underestimate the number of trips generated by the proposed project by 40 percent; in fact, it may overestimate the number of trips by giving a worst-case estimate of vehicular trips generated by the proposed project.

ROAD SAFETY

Comments—Road Safety

AG.105 The majority of these trips would occur over Primary Forest Route 15 or 77 to Forest Road 44N01 to Forest Road 44N64. (EIS/EIR, pp. 4-211-212.) According to the EIS/EIR, Routes 15 and 77 are adequately designed to accommodate traffic levels of 228 per day. There is insufficient information to determine whether these routes could handle 388 trips per day. However, Roads 44N01 and 44N64 have current traffic volumes of only 10 to 20 trips per day.

The EIS/EIR estimated that 228 trips per day "would exceed the traffic capacity that could be safely accommodated on these two roads[,]" thus resulting in a significant impact. (EIS/EIR, p. 4-212.) As mitigation, the EIS/EIR recommends that Calpine improve these roads to ensure that projected traffic volumes can be safely accommodated. (EIS/EIR, p. 4-213, Mitigation Measure 4.12.1a.) It is unclear, however, whether these roads can be designed to safely accommodate 388 daily trips, 19 to 39 times the current traffic volumes. Moreover, the EIS/EIR failed to discuss potential impacts associated with these road improvements (e.g., vegetation removal, construction vehicle emissions). The EIS/EIR should be revised to include this information and, if necessary, proposed additional mitigation to mitigate these impacts to insignificance. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

DK.5 Another requirement that should be made of the developer is the widening of the one-lane paved road with turnouts to a full two-lane paved road to match the road near the south end of Medicine Lake. I would anticipate that there would be substantially more traffic with larger power company vehicles using this road if the project is approved. *(Roger G. Hyytinen, Hyytinen Engineering)*

Response—Road Safety

Comment AG.105 states an incorrect estimate of the number of trips generated by the proposed project as 388 trips per day. As discussed in the response to "Comment—Vehicular Trip Generation" above, the comment's estimate is based on the assumption

that each worker would drive to and from the proposed project site individually. However, as stated above, workers would be expected to rideshare, and crew buses would be used to pick up workers from various locations and drive them to and from the site. Therefore, the Draft EIS/EIRs calculation of 228 vehicular trips per day provides a conservative estimate of projected vehicular trips associated with the proposed project.

As stated in the Draft EIS/EIR, mitigation measures have been proposed to ensure that the roads to and from the proposed project area are safe, and that any damage done to these roads as a result of increased traffic associated with the proposed project are repaired by the project proponent. As stated in Mitigation Measure 4.12.1a (see page 4-213 of the Draft EIS/EIR), Calpine (under the direction of the USFS) would make improvements to Forest Roads 44N01 and 44N64 to ensure that projected vehicular volumes would be safely accommodated on these roads. It is anticipated that implementation of the road improvements proposed in Mitigation Measure 4.12.1a would produce roads that would safely accommodate the projected number of vehicle trips.

Road improvements associated with Mitigation Measure 4.12.1a would not be anticipated to include significant vegetation removal since the existing clearing limits are sufficient to accommodate these improvements. The road improvements would also not result in large amounts of construction vehicle emissions since minimal construction vehicle use would occur, and these vehicles would use similar emissions-control measures as those described in Mitigation Measure 4.13.1a in the Draft EIS/EIR (see page 4-235) to reduce construction emissions to a less-than-significant level. Additional mitigation does not need to be added to the EIS/EIR.

Comment DK.5 suggests that improvements to Forest Roads 44N01 and 44N64 include the widening of each of these roads to two lanes and pavement, similar to the roads currently present at the southern end of Medicine Lake. As stated in Mitigation Measures 4.12.1a and 4.12.2a (see page 4-213 of the Draft EIS/EIR), Calpine would finance or implement a road maintenance plan prepared by the USFS, and would be responsible for making improvements to Forest Roads 44N01 and 44N64 in order to safely accommodate vehicular traffic associated with the proposed project. Implementation of these mitigation measures would ensure road safety within the project area. It is anticipated that Forest Roads 44N01 and 44N64 would not be widened to two lanes because these roads would safely accommodate project related traffic without the addition of another lane.

EFFECTS ON THE FOUR CORNERS-MEDICINE LAKE SNOWMOBILE PARK

Comment—Effects on the Four Corners-Medicine Lake Snowmobile Park

H.22 The document discusses a carpool area near the Four Corners staging area, but no specifics were found. The Final should address this deficiency. How large is the carpool area? Where exactly will it be located? Will the Four Corners staging area be used during any phase of the project? Who will plow the carpool area? Where will snow removal equipment be stored while not in operation?

(Bill Dart, American Motorcyclist Association)

Response—Effects on the Four Corners-Medicine Lake Snowmobile Park

The comment expresses concern over the proposed use of the Four Corners-Medicine Lake Snowmobile Park during winter as a commuter parking lot for Calpine employees. As discussed on page 2-21 of the Draft EIS/EIR, Calpine would establish a carpool area near the Four Corners-Medicine Lake Snowmobile Park during the winter months, and would not use the existing snowmobile parking area for an employee carpool area. The carpool area will be maintained by Calpine and will minimize conflicts with snowmobile activity. All snow-removal equipment would be stored near the power plant facility. Snow removal of roads to and from the snowmobile park and parking area would continue to be maintained by the Forest Service.

As described on page 2-57 of the Draft EIS/EIR, 19 employees would staff the project facilities at any one time during project operations. These employees would park their vehicles at the carpool area located near the Four Corners-Medicine Lake Snowmobile Park in the winter, and would be driven by a four-wheel-drive vehicle or a snow cat to the power plant. It is expected that employees from similar locations would rideshare, and about 5 to 10 employee vehicles would be parked at the carpool area. However, if each employee drove individually, up to 19 employee vehicles could be parked at the carpool area. The Four Corners staging area would not be used during any phase of the proposed project.

3.14 Air Quality

INTRODUCTION

This section provides responses to comments on issues related to air quality. The comments and responses are grouped under the following headings:

- Regulatory Issues
- Significance Thresholds
- Methodology
- Potential for Climatic Changes
- Air Quality Analysis
- Emissions
- Air Quality Impacts
- Odor Impacts
- Health Impacts
- Visibility Impacts
- Monitoring and Reporting
- Enforcement of Laws, Regulations, and Permit Conditions
- Mitigation Measures

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

REGULATORY ISSUES

Comment—Prevention of Significant Deterioration Increments

A.47 PSD increments exist for sulfur dioxide, total suspended particulates, and oxides of nitrogen. While the project area itself is not a Class 1 Area, a Class 1 Area Impact Analysis, to assess impacts to applicable surrounding areas, should be considered for the listed increments.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

Response—Prevention of Significant Deterioration Increments

A formal PSD increment consumption analysis is not required for the proposed action, and this type of analysis was therefore not performed for the Draft EIS/EIR. The rationale behind this decision included:

- The proposed action is not expected to be a major source of air pollutants as defined in 40 CFR 52.21; the proposed action is therefore not expected to be a PSD project, and PSD regulations would not apply
- The impact analysis performed for the Draft EIS/EIR provides similar information as is typically produced by a PSD analysis, such as the potential impact of criteria pollutants at several receptor locations (including the closest points of the Lava Beds National Monument and wilderness areas)

Comments—$PM_{2.5}$ and PM_{10} Standards

V.30 The Lead Agency ignores a significant body of research regarding the effects of $PM_{2.5}$, ignores the EPA's recent regulatory changes (and the human health benefits of the proposed changes), and thus fails to evaluate the effect and decide whether it may be significant.

The Environmental Protection Agency (EPA) recently in July, 1997 set new standards for $PM_{2.5}$ pollution. These regulatory changes were proposed long before the EIR was prepared and were predicted for

implementation at this time, yet the EIR ignores them. These new standards were based on an EPA review of 86 PM related human-health studies, covering millions of people, that show harmful effects of breathing $PM_{2.5}$ pollution. $PM_{2.5}$ pollution is qualitatively and quantitatively different than PM_{10} pollution, and may be more harmful due to deep infiltration into the lungs. In spite of these new standards, there is no mention of these $PM_{2.5}$ standards in the EIR. The EIR doesn't require monitoring of $PM_{2.5}$ pollutants as the EPA now requires. The EIR must re-address standards of significance and project impacts in light of these regulatory changes and this information.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

V.31 Siskiyou County is currently rated nonattainment for particulate matter PM_{10} pollution. In part this is due to the smoke pollution from wood stoves and forest fires in this highly forested county. Yet the EIR falsely minimizes the range of pollutants by barely even mentioning smoke pollution as a source and not reporting how severe conditions can be at times of forest fires. This project will only add to those pollutants when they occur. The cumulative impact of both forest fire and power plant pollutants occurring at the same time is not evaluated, nor is a mitigation provided to shut down the power plant during adverse conditions of forest fire smoke pollution so that air quality doesn't deteriorate even further. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

V.33 The air quality standards have been changed recently for small particles but this Fourmile Hill project EIR is silent on the EPA's new $PM_{2.5}$ concerns and regulations. The EPA was under a court order to review the adequacy of the NAAQS for PM and to promulgate any changes needed to protect the public health and welfare. The process for this review involved the preparation of a multivolume "Criteria Document" that presents all the relevant scientific evidence concerning the health and welfare effects of PM. Welfare effects may include visibility impairment, soiling of materials, impacts on plants and ecosystems, etc. The EPA' s regulatory staff then prepared a "Staff Paper" which drew regulatory conclusions and recommendations from the Criteria Document on issues such as the appropriate size indicator, chemical composition and numerical range from which the EPA Administrator would select a final standard.

The EPA has prepared drafts of the Criteria Document and Staff Paper which have been released for public review and comment. The EP A is then required by the Clean Air Act (CAA) to have these documents reviewed for scientific accuracy and validity by a panel of independent scientists, mostly from academia, but with representatives from industry, states and government. This panel is called the Clean Air Scientific Advisory Committee (CASAC).

The court-ordered schedule for the PM NAAQS review included a date of Jan. 5, 1996 for CASAC to reach closure on the Criteria Document and Staff Paper. The CASAC has indicated that they need a "meaningful extension of this date." As a result, the EPA negotiated with the American Lung Association, which brought the suit resulting in the court schedule, a five month extension (until June 28, 1997) of the overall schedule for the PM NAAQS review.

The EPA Staff Paper recommended that an annual average standard .For particles less than 2.5 mm in diameter (PM 2.5) be set between 15-30 μg/m3. This compares to the current annual standard for PM_{10} of 50 μg/m3. The Staff Paper also recommended replacing the current 24 hr PM_{10} standard of 150 μg/m3 with a PM 2.5 standard of between 25-85 μg/m3. While the EIR's predicted project emissions are lower than these limits, the EIR fails to also evaluate the cumulative impacts of other foreseeable geothermal power plants in this area.

It is difficult to compare the current and proposed standards because of the simultaneous change in both the size indicator and numerical level (If the standards. In addition, the EPA is considering a statistical form for the new standard, e.g., allowing five expected exceedances of the 24 hr standard in a calendar year, that would significantly affect the relative stringency of the new standard. Nonetheless, it is likely that any new standard will require additional controls. It is also likely that PM controls under a new standard will be focused on stack emission sources (as opposed to fugitive emissions which tend to be larger parties) and also on emissions of sulfur and nitrogen oxides which result in formation of sulfates and nitrates in the atmosphere. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

V.34 The change to a $PM_{2.5}$ standard will require major changes to the national network of PM ambient monitors. Once a new PM NAAQS is set, stares will need to modify or replace their PM monitors and then take a year or two to obtain air quality data to determine what areas will require additional controls. Thus, the PM NAAQS revision will be potentially very costly in the end. Notably, this EIR fails to impose a mitigation on this project to help pay for the cost of such $PM_{2.5}$ monitoring. Thus, the Siskiyou County APCD's budget will have to bear that cost, further limiting its ability to monitor other air quality impacts of this project. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

V.35 This project, not including the other foreseeable geothermal power plants in the vicinity, is predicted to emit between about 6.8 to 15.4 tons per year of PM_{10} particles. The quantity of the even smaller $PM_{2.5}$ particles which would be emitted is so great that, even with atmospheric dispersion, it is capable of completely covering 32 square miles per year of surface area! (see calculation below) That is an area of a square approximately 5.6 miles on each side which could theoretically be covered completely by such

pollutants! There would be three times this amount of PM_{10} pollutants which are still hazardous. These particles are a significant health hazard and this hasn't be adequately addressed in the EIR.

Scientists who study particles make a distinction between coarse (large) particles and fine (small) particles. Fine particles behave entirely differently from coarse particles and, as we will see, are much more dangerous to humans. Fine particles are also much more difficult and expensive to control. They are also invisible, so when they are not controlled, there is no way to know it except by monitoring with the proper instruments.

Coarse particles are those with a diameter larger than 2.5 micrometers (micrometers); fine particles are those with a diameter less than 2.5 micrometers. A micrometer (micrometers) is a millionth of a meter and a meter is about a yard. (An older term for micrometer is micron.)

This project will emit large numbers of such particles, despite the best available control technology. One third of all the PM_{10} particles emitted will have a diameter less or equal to 2.5 micrometers.

It is difficult to imagine how small these particles are. To help understand what we're talking about, look at the dot over the letter "i" in this article's title: that dot measures about 400 micrometers in diameter. You can fit 40,000 particles with a diameter of 2 micrometers on the dot.

Each pound of fine particles emitted from will consist of about 1 quadrillion individual particles. A quadrillion is 1000 trillion. Over a year's time, this plant if operated full time and meeting the federal, state and local air quality standards, will legally emit up to about 2.3 to 5 tons of these fine particles/year. (based upon an estimate of 1/3 of the EIR's acknowledge emission of PM_{10} particles being $PM_{2.5}$ fine particles).

5 tons per year of such hazardous fine particles is a huge amount of such air pollution to be worried about. This doesn't include those larger particles which are still considered in the PM_{10} measurement.

Breaking things into fine particles has the effect of vastly increasing their surface area. A single lump of waste weighing a pound (and having the same density as water) would have a surface area of about 44 square inches (a square 6.5" on a side), about the size of a large post card. But when that same pound is broken into fine particles, its combined surface area grows to 9900 square yards (approximately two football fields). This is important for several reasons: as these fine particles are emitted, they are immersed in a bath of gaseous chemicals that are cooling and are "looking" for a place to turn from a gaseous to a solid state. Fine particles, with their large surface area, provide an inviting place and so the surfaces of fine particles become covered with pollutants ("enriched" is the technical term for this) before they are released into the local air. Fine particles become coated with whatever else is in the smoke stack.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

Response—$PM_{2.5}$ and PM_{10} Standards

$PM_{2.5}$ is airborne particulate matter with aerodynamic equivalent diameter less than 2.5 micrometers (μm). For many of the reasons discussed in the above comments, the EPA has recently promulgated new ambient air quality standards for $PM_{2.5}$. At the time the Draft EIS/EIR was published, the EPA had not yet promulgated the new standards, and the standards ultimately promulgated were somewhat different than those proposed earlier. The standards were announced July 17, 1997.[1]

The EPA promulgated new primary (health-based) standards of 65 $\mu g/m^3$ and 15 $\mu g/m^3$ for 24-hour average and annual average $PM_{2.5}$ concentrations, respectively. The existing PM_{10} standards of 150 $\mu g/m^3$ (24-hour average) and 50 $\mu g/m^3$ (annual arithmetic average) were retained, although the form of the 24-hour average standard was changed.[2] The EPA believes that the 65 $\mu g/m^3$ 24-hour standard will "provide an adequate margin of safety in communities that meet the annual standard, but have infrequent or isolated 24-hour peaks" (such as Northeast Plateau Air Basin). In contrast, the existing California PM_{10} standards are 50 $\mu g/m^3$ for 24-hour average concentrations and 30 $\mu g/m^3$ for the annual geometric mean concentration.

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1 U.S. Environmental Protection Agency, 1997. *Fact Sheet: EPA's Revised Particulate Matter Standards*. July 17. Office of Air Quality Planning and Standards.

2 Previously, the 24-hour average Federal PM_{10} standard was expressed as a value not to be exceeded more than once per year. The new standard is for the 99th percentile concentration.

Scientists and regulators often speak of the "fine" and "coarse" fractions of PM_{10}, referring to the particles less than 2.5 μm in size, and those between 2.5 and 10 μm, respectively. Because PM_{10} comprises all airborne particles with aerodynamic diameters less than 10 μm, all $PM_{2.5}$ is PM_{10}, and the concentration of $PM_{2.5}$ is always lower than (or equal to) the PM_{10} concentration. Most fugitive dust particles, such as those that would be emitted during earth-moving activities, are relatively large. Many are considerably larger than 10 μm, and most are larger than 2.5 μm. Nearly all smoke particles (including wood smoke and diesel exhaust) are fine particles.

The annual average PM_{10} concentrations in the project area are in the range of 7-9 $\mu g/m^3$ (annual geometric mean) and 8-11 $\mu g/m^3$ (annual arithmetic mean).[3] The maximum estimated annual average PM_{10} impact associated with the proposed project is less than 1 $\mu g/m^3$. The corresponding annual average $PM_{2.5}$ background concentrations and impact would be lower than these values. The sum of estimated project impacts on annual average PM_{10} concentrations and the reported background annual concentrations are in all cases less than the California and Federal annual PM_{10} and $PM_{2.5}$ standards. Therefore, the proposed project would not be expected to have a significant impact on annual average PM_{10} or $PM_{2.5}$ concentrations.

The estimated maximum 24-hour average PM_{10} impact associated with the normal operation of the proposed project after startup is just over 1 $\mu g/m^3$, and the maximum impact during a worst-case plant upset is about 4 $\mu g/m^3$ (refer to Table 4.13-4 and Table 19 or Appendix F). The maximum impact associated with the drilling of an infill well is about 17 $\mu g/m^3$ The maximum $PM_{2.5}$ impacts would be less than the corresponding PM_{10} impacts by an unknown amount.

PM_{10} concentrations measured in the Northeast Plateau Air Basin at locations distant from the proposed project area (*e.g.* Yreka) tend to be higher during the winter than during the summer. Most likely, this is due to increased fuel combustion during the winter and less favorable dispersion meteorology. Review of the available PM_{10} data for the proposed project area indicate the opposite trend; PM_{10} concentrations are higher during the summer months than during the winter. There are a number of reasons that may contribute to this. Fugitive dust emissions are undoubtedly higher during these dry, high-use months. Fuel combustion-related emissions (*e.g.*, campfires, fireplaces, wood stoves and vehicles) are probably higher during the summer. Also, the potential for transport of emissions from other areas may be greater due to seasonal differences in meteorology or greater emissions in upwind areas (which may include other air basins). Because the contribution of each of these potential sources and effects is unknown, it is difficult to assess what fraction of the PM_{10} concentrations measured in the proposed project area are $PM_{2.5}$. Of course, $PM_{2.5}$ concentrations must be less than the corresponding PM_{10} concentrations.

It is reasonable to assume that, during forest fires or prescribed burns near the proposed project, the 24-hour average $PM_{2.5}$ standard could be exceeded in the project area. Of the three years of monitoring data available for the Lava Beds National Monument

3 California Air Resources Board, 1998. PM_{10} data for the Lava Beds National Monument monitoring station, 1994-1996.

monitoring station, just one PM_{10} measurement exceeded 65 $\mu g/m^3$ (188 $\mu g/m^3$ during a prescribed burn on October 6, 1996), so it appears that such exceedances would be rare.

Typical summertime PM_{10} concentrations in the project area are 20 $\mu g/m^3$ or so, with higher concentrations occurring during prescribed burns or when forest fires are active. Even using the conservative assumption that all background PM_{10} is $PM_{2.5}$ and all project-emitted PM_{10} is $PM_{2.5}$ (clearly an overstatement in both cases), the sum of the worst-case maximum project impact and background concentrations is less than the Federal $PM_{2.5}$ standard.

As discussed in the response to "Comments—PM_{10} Impacts," it is quite unlikely that maximum project emissions, worst-case meteorological conditions, and the high background particulate matter concentrations that can occur during forest fires or prescribed burns would occur at the same time. Nonetheless, except for the single PM_{10} exceedance recorded at Lava Beds National Monument, there is no combination of measured 24-hour average PM_{10} concentration in the project area and estimated 24-hour average PM_{10} impact (for any construction or operational scenario) that exceeds 65 $\mu g/m^3$. (The corresponding $PM_{2.5}$ concentrations would be lower.) On the day that the only recorded PM_{10} exceedance in the project area (which would almost certainly also have been a $PM_{2.5}$ exceedance) was recorded, the proposed project would have added only a small fraction to the total $PM_{2.5}$ concentration, and thus would not have significantly contributed to the exceedance. It should also be noted that the new Federal 24-hour $PM_{2.5}$ standard allows 1% of the days in a three year period to exceed 65 $\mu g/m^3$. For these reasons, the proposed project is not expected to have a significant impact on ambient airborne $PM_{2.5}$ concentrations. There would therefore be no need to shut down the power plant, as suggested in comment V.31.

Although the new Federal 24-hour $PM_{2.5}$ standard is more restrictive than the previously-existing Federal 24-hour PM_{10} standard, it is not as restrictive as the California 24-hour PM_{10} standard. While the new Federal $PM_{2.5}$ standard allows areas with 24-hour average $PM_{2.5}$ concentrations exceeding 65 $\mu g/m^3$ up to 1% of the time to be in compliance, California air quality standards allow no exceedances (except for unusual events). $PM_{2.5}$ concentration are, by definition, less than or equal to PM_{10} concentrations.

The new annual Federal $PM_{2.5}$ standard may be more or less restrictive than the previously existing (and current) Federal and California annual PM_{10} standards, depending on whether the coarse or fine particles dominate the atmospheric particulate matter burden in a particular area. No monitoring data are available for the project area that could provide any indication of the relative concentrations of coarse and fine particulate matter. In any event, even if it is conservatively assumed that *all* PM_{10} in the project area is $PM_{2.5}$, the maximum estimated project annual average impact plus measured annual average background concentrations are well below the annual California PM_{10} and Federal PM_{10} and $PM_{2.5}$ standards. Thus, the project area will most likely attain the new Federal annual $PM_{2.5}$ standard with or without the proposed project (although urban areas of the air basin may not attain the standard.) Therefore, the proposed project is not expected to have a significant impact on ambient airborne $PM_{2.5}$ concentrations.

The California Air Resources Board (ARB) and the air pollution control districts in the state are currently planning the implementation of the $PM_{2.5}$ monitoring required by the new Federal standards and associated regulations. These networks will follow the regulations provided in 40 CFR Parts 53 and 58, published in the Federal Register on July 18, 1997, and described within President Clinton's Directive of July 16, 1997. No specific monitoring plan is yet available for the Northeast Plateau Air Basin, although the draft monitoring program description prepared by the Air Resources Board staff indicates that one $PM_{2.5}$ sampler will be deployed in Alturas during 1998, and one will be deployed in Yreka in 1999.[4] Both of these proposed monitoring sites will be useful for determining $PM_{2.5}$ concentrations in these populated areas, but they will provide little information about the project area.

The EPA plans to locate a $PM_{2.5}$ sampler at Lava Beds National Monument, as part of the IMPROVE network. This sampler will be deployed sometime in 1998 or 1999.[5]

The deployments of these monitors is unrelated to, and not a consequence of, the proposed project. The required monitoring is not intended to assess the impacts of specific projects or facilities, and there is no requirement for individual projects or facilities to directly fund the programs. However, the Siskiyou County APCD would collect permit fees from Calpine, and these fees would most likely be used in part to contribute to the funding of the monitoring programs operated by the District.

Comment—Federal Conformity Analysis

AG.121 The conclusion that no further federal conformity analysis is required (EIS/EIR, ß 4.13.11) should also be revisited. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

Response—Federal Conformity Analysis

As discussed in the Draft EIS/EIR (Section 4.13.11 and Appendix F), the estimated total emissions of PM_{10} during any year of construction or operation are expected to be well below the *de minimus* level of 100 tons as provided by the EPA rule on "Determining Conformity of Federal Actions to State or Federal Implementation Plans." Emissions of PM_{10} therefore would not be regionally significant. No further analysis of conformity is required.

SIGNIFICANCE THRESHOLDS

Comment—CEQA Standards of Significance

V.29 EIR page 4-220. SIGNIFICANCE CRITERIA: The Standards of Significance described in this section of the Fourmile Hill EIR appear to follow from CEQA Guidelines section 15064(I):

"If an air emission or water discharge meets the existing standard for a particular pollutant, the Lead Agency may require that the emission or discharge of the pollutant will not be a significant effect on the environment. If other information is presented suggesting that the emission or discharge may cause a significant effect, the Lead Agency shall evaluate the effect and decide whether it may be significant.

The Air Quality section of the EIR appears to consider only the first sentence of Section 15064(I).
(Carol Plank, Medicine Lake Citizens for Quality Environment)

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4 California Air Resources Board, 1998. *Draft California Particulate Matter Monitoring Network Description.* Air Quality Data Review Section. April 30 Attachment 2.

5 *id.*, p. 3-3.

Response—CEQA Standards of Significance

The analysis of impacts in the Draft EIS/EIR complies with the CEQA Guidelines. In addition to comparing the estimated impacts of criteria pollutants (those for which California or Federal ambient air quality standards exist) to the applicable standards (pages 4-219 through 4-242), the potential effects on human health of toxic air pollutants emitted from the proposed project were assessed (pages 4-243 through 4-248). Estimated acute and chronic hazard indices were calculated, as well as estimated excess lifetime cancer risk. The impacts of project emissions on visibility were assessed using procedures recommended by the U.S. EPA (page 4-249 through 4-252). The potential impact of the project on global warming was assessed (p 4-252). The impacts of cooling tower drift on vegetation were evaluated (pages 4-89 through 4-93), as well as the impact of deposition of substances emitted from the project on Medicine Lake (pages 4-34 through 4-38). For each of these potential effects the significance of the impact was evaluated and defined, and mitigation was developed to reduce project effects. No credible evidence has been presented to the lead agencies suggesting that the air emissions will violate existing standards for criteria pollutants or otherwise have a significant effect on the environment.

METHODOLOGY

Comments—Modeling Methodology

AG.108 The EIS/EIR failed to properly model air emissions. (Ex. A, Comment 1.a.) The standard practice, and the one recommended by the California Air Pollution Control Officers Association ("CAPCOA"), is to analyze emissions impacts at hundreds of locations in a grid-like format. This is because air quality standards must be met everywhere, not just at certain locations.

The EIS/EIR did not use this approach. Instead, it selected 22 receptor locations, virtually all of which are upwind of the Project's emission sources. Moreover, the EIS/EIR withholds key information about how the modeling was performed, which prevents the public from evaluating the accuracy of the modeling.

The Project's emissions should be remodeled based on standard methodologies, and included in a recirculated Draft EIS/EIR so the public can review and comment on these issues. (See Ex. A, Comment 1.a. for a more detailed explanation of this issue.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.191 Grid Spacing. Air quality modeling is used to determine if a project's emissions will violate a federal or State ambient air quality standard. These standards must be met everywhere, not just at locations where sensitive receptors are located. This is normally addressed by calculating ambient air quality concentrations at evenly spaced points on a grid around the modeled facility, typically at a spacing of 50 meters. This approach is essential to assure that the peak concentration is identified. Likewise, air quality modeling is used to estimate public health impacts. California Air Pollution Control Officers Association ("CAPCOA") Guidelines, which are virtually always followed in EIRs, require that these impacts be estimated for the so-called maximally exposed individual or the MEI.[6] The MEI is located by performing the modeling analysis on a grid of sufficient density to permit the estimation of maximum concentrations. An air quality grid would normally include hundreds of node points to assure that the maximum concentration is modeled.

This DEIR only estimates ambient concentrations at 22 receptor locations based on activity patterns in the Project area and only reports them for six to eight locations. (DEIR, pages 4-225, 4-233, 4-236, 4-246, F-31.) The correct procedure would have been to use a closely spaced grid, supplemented by specific receptor locations, to assure that the maximum concentrations were identified. The net effect of calculating concentrations at only a very few preselected locations is to overlook potential impacts. All of the air quality analyses should be repeated using a standard grid and the EIR revised and recirculated for review.

Even more troubling is the conspicuous absence of any receptors adjacent to and downwind from the facility, where the highest annual average impacts would occur. According to the windrose for the site, the prevailing wind direction is from the south (14%) and southwest (16%). Winds with a southerly

6 CAPCOA, Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines, October 1993.

component occur 65 percent of the time. (DEIR, pages 3-181, 3- 183.) However, virtually all of the receptors that are close to the power plant where the largest impacts would occur are upwind (south to southwest) of the plant, where they would be shielded from emissions a substantial fraction of the time. All of the downwind receptors are at a substantial distance from the facility, the nearest one lying about 2 miles northeast (#12). (DEIR, Fig. 4.13-2.) While this may not significantly affect 1-hour average concentrations, it would result in a substantial underestimation of annual average concentrations and cancer health risks because the maximum annual average concentrations are virtually always downwind and close to the modeled facility.

The DEIR has not estimated the maximum hydrogen sulfide (DEIR, page 4-236), PM_{10} (DEIR, page 4-233) or public health impacts (DEIR, page 4-246), as it is required to do. Therefore, the conclusions that ambient air quality standards for hydrogen sulfide and PM_{10} are not exceeded and that there are no public health impacts are not supported by the analyses and are invalid.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.192 Modeling Protocol. Normally, an EIR presents the protocol that is used to perform the air quality analyses. This protocol must include a map that identifies the boundary of the facility and locates emission sources, the source stack parameters, and modeling assumptions. None of this information is included in the DEIR. Therefore, it is not possible to evaluate the accuracy of the modeled results. The missing information should be supplied, and the DEIR recirculated for public review.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Modeling Methodology

These comments refer to a methodology described in a guidance document for preparing health risk assessments under California's Air Toxics "Hot Spots" Program.[7] The California Air Pollution Control Officers Association makes no recommendation regarding the use of this methodology in other programs such as the CEQA process, and it is not "standard practice" in the preparation of EISs or EIRs.

Neither CEQA nor the guidelines specify requirements for analysis of a project's air quality impacts.[8] There is no requirement to use gridded receptors in dispersion modeling for air quality impact analyses for EIRs or EISs. The receptors selected for use in dispersion modeling include those at which human exposure to emissions from the project are most likely to occur. Model receptor locations were established at the closest campgrounds, recreation areas, and locations of spiritual significance to native Americans. Also, more distant population centers and park areas have been used as receptor locations. The chosen receptors were agreed upon by way of a consensus among the consultants, USFS staff, and staff of the Siskiyou County APCD. This approach is reasonable and appropriate for use in this document.

A consistent set of receptor locations was used for evaluation of both short-term maximum and long-term average concentrations and potential associated health effects. It includes locations at which short-term and long-term exposures are most likely to occur, although long-term exposures are not expected to occur at all receptor locations. The estimated long-term average concentrations presented in the Draft EIS/EIR are for continuous exposure (24 hours per day, 365 days per year). For some of the receptors, continuous occupation clearly does not occur. Locations such as Grouse Hill and Fourmile Hill are used infrequently and for short periods of time. There is no possibility of any person being exposed to the long-term average concentrations estimated for these receptors. The nearest locations at which continuous (or nearly continuous) year-round exposure to the estimated average annual concentrations presented in the

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7 California Air Pollution Control Officers Association, 1993. Air Toxics "Hot Spots" Program Revised 1992 Risk Assessment Guidelines.

8 Kostka S.L., and M.H. Zischke, 1996. Practice Under the California Environmental Quality Act. p 517.

EIS/EIR may occur are the cabins at Medicine Lake and the Lava Beds National Monument park headquarters (near the Visitor's Center).

The area immediately to the north of the power plant contains no relevant receptor locations. There are no residences in the area, or any other facilities that would allow year-round occupation at any location between the proposed project site and the closest receptors used in the dispersion modeling. It would be of little value to establish additional model receptors in this area, as there is no potential for long-term exposure to significant concentrations of substances emitted from the proposed project there.

The preparers of the EIS/EIR acknowledge that other investigators may have selected different locations at which to estimate concentrations of pollutants emitted by the proposed project.

Although there are several roads through the area, persons traveling on these roads would be exposed to emissions from the project for very short periods (much less than one hour, the shortest averaging time for any air quality standard). Estimated pollutant concentrations at Receptor 20, located just east of the proposed power plant location on FS Road 49, are intended to represent the maximum short-term concentrations to which a person traveling through the area could be exposed. In the immediate vicinity of the proposed wellfield and power plant, there are no scenic vistas that might invite travelers to stop along the roadway. The nearest scenic overlook is at the Medicine Lake Glass Flow, along Forest Service Road 49. This location was included as a receptor in the dispersion modeling.

EISs and EIRs seldom present the detailed protocol that was used to perform the air quality analysis, due to space constraints. Such information is of little interest to most readers. However, such information is available for public inspection upon request. This commentor was the only reader to express an interest in the modeling methods. The emissions estimation and dispersion model computer files were provided to this commentor, as requested. The files include the information described in this comment, and other information. Maps showing the emissions sources and the lease boundary are provided on pages 2-9 and F-2. (The well field and power plant will be located mostly on only one of the six sections of the lease. For both of these figures, the scale was chosen such that the details of Section 28 are shown clearly, but only the lease boundaries near Section 28 are shown. Figure 3 of Appendix F, on page F-26, shows the entire lease boundary.)

Comment—Criteria Pollutant Emission Inventory

AG.214 The criteria pollutant emission inventory in Table 4.13-3 is incomplete and underestimates emissions from drilling and earthwork.[9] This information was supplemented in response to Public Records Act requests by Lizanne Reynolds on September 10 and 12, 1997, which are referred to here as the "Suder Files."[10] I did not receive this material until Saturday, September 27, 1997, two weekend days before comments were due. The time was inadequate to comprehensively review this material, and I reserve my right to supplement these comments. Each of these is discussed below.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

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9 The DEIR estimates construction PM10 emissions as the sum of emissions from earthwork, fugitive dust from traffic, exhaust emissions from drill rigs and the backup generator and wellhead venting and flow testing. (DEIR, pp. F-9, F-10, Mooney 1997, Table 15.) Earthwork presumably refers to clearing, grubbing, filling, and grading.

10 Letter from D.B. Mooney, De Cuit & Somach, to Rob Sears, Re: Public Records Act, September 15, 1997 ("Suder Files")

Response—Criteria Pollutant Emission Inventory

As discussed in the responses to "Comments—Emissions Calculations," "Comments—Support for Emissions Calculations," "Comments—Well Venting Mitigation," "Comments—PM_{10} Mitigation," "Comments—H_2S Concentration in Geothermal Fields," and "Comments—NO_x Mitigation," the criteria pollutant emission inventory presented in the Draft EIS/EIR is a reasonable representation of the emissions that are expected to be emitted from the proposed project.

POTENTIAL FOR CLIMATIC CHANGES

Comments—Potential for Fog or Hail

E.2 However, it may be appropriate to add to the document quantification of the effect vapor emissions will have under cold weather inversion conditions. It is my understanding that effects, such as fog or hail, depends on the constituent of the emission. Discussion and mitigation in this particular area, if needed, may be appropriate. *(Richard D. Barnum, Siskiyou County Planning Department)*

N.19 "Furthermore, moisture particles from cooling towers act as a nucleus for condensation of ambient moisture in the atmosphere and under certain moisture/temperature conditions or inversions commonly experienced in the area, will result in the formation of large fog banks or low level clouds. Such effects can easily be observed at the cogeneration plants and power plant in Burney and the Wheelabrator generation facility at Anderson. During an inversion, it is not uncommon to observe an opaque ground fog covering 10's of square miles in winter months. Under inversion conditions, the Medicine Lake Caldera would be completely fogged in by the moisture input from the proposed power plant."

We reference letter of September 12, 1997 to Randall Sharp, USFS/BLM; Fourmile Hill Geothermal Development Project; EIS/EIR Coordinator; from Phil Woodward, Registered Geologist; Certified Engineering Geologist; Certified Hydrogeologist.

Consequently, the DEIS/EIR is deficient in its disclosure, evaluation, and mitigation of adverse direct, indirect, and cumulative impacts to visual quality resulting from the proposed project.
(Robert J. Baiocci, Fall River Wild Trout Foundation)

Y.32 The overall atmospheric effects of heat and moisture from cooling towers and pipelines (carrying 500-600 degree temperatures) could change the climate of the area and contribute to global warming, as well as have effects on snowmelt, animal habitat and migration routes. The DEIS/EIR does not adequately address these issues, for many of the reasons given under Water Quality above. Nor does it adequately analyze the impacts of acid rain and fog when emissions are combined with weather conditions and fall on trees, plants and lakes and affect the food sources of wildlife.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

FK.4 On page 4-27 under Operations "During the operation phase of the proposed project, approximately 2.9 million pounds per hour of geothermal fluids would be produced from production wells and approximately 2. million pounds per hour would be injected back into the geothermal reservoir. Thus there will be a net loss of approximately 475,000 pounds per hour [approximately 5700 gallons/hour] from the geothermal reservoir." [Now where do you think all of this fluid is going? If we multiply this by 24 hours of operation, it becomes 11,400,000 pounds per day or 1,367,000 gallons per day of fluid into the atmosphere or someplace else. If we consider the potential of six plants, this brings the total to 68,400,000 pounds of fluids [or 8 million gallons] per day. This is the weight of fluids that contained all of the stink and hazardous materials. This CONDITION is listed under Section 4.19 on page 4- 332 as being one of the UNAVOIDABLE ADVERSE EFFECTS and is expected to carry PM/10 and H/2S. They may develop their own stinking rain forest. Medicine Lake area is subject to inversions and is now subject to ground fog in the mornings. With this amount of moisture added to the atmosphere, there may become a permanent fog bank in the entire Medicine Lake Caldera. I feel that the EIR/EIS is very biased in not pointing out this potential hazard.] *(Charles F. Moss)*

IQ.12 Furthermore, moisture particles from cooling towers act as a nucleus for condensation of ambient moisture in the atmosphere and under certain moisture/temperature conditions or inversions commonly experienced in the area, will result in the formation of large fog banks or low level clouds. Such effects can easily be observed at the cogeneration plants and power plant in Burney and the Wheelabrator generation facility in Anderson. During an inversion, it is not uncommon to observe an opaque ground fog covering 10's of square miles in winter months. Under inversion conditions, the Medicine Lake Caldera would be completely fogged in by the moisture input from the proposed power plant.
(Phil Woodward)

PH3.67 I have been to plywood plants in Klamath Falls in January. There are clouds of those little pill balls. Stop by and eat a couple and see what they taste like. I am dead serious. What we are going to have up there when we have ten or 15 big mushroom clouds? *(Yreka Public Hearing)*

PH3.68 Go right over to Klamath Falls and the pulp plant, that steam creates hail. *(Yreka Public Hearing)*

PH3.71 I would like to address the air-inversion problem that does exist at Medicine Lake in the wintertime. We snowmobile all the time in the winter. And in this caldera, the fog can be very, very thick during the wintertime. And we could go outside the caldera and it can be clear. So a lot of that steam plume will probably get caught in the fog and those chemicals will be held within the lake area. So that's something that has to be addressed, too. There is definitely an inversion problem there in the winter. *(Yreka Public Hearing)*

Response—Potential for Fog or Hail

The commentors are correct in their assertion that the facility's cooling tower will add water vapor and particulate matter to the atmosphere that have the potential to be active in cloud development. Condensation of water vapor in the plume will make it visible under some meteorological conditions (See Section 4.9, Visual Quality, in the Draft EIS/EIR). However, there is no scientific basis to suggest that the increased moisture or particulate matter will produce increased precipitation as hail, rain or snow. Research and operational cloud seeding programs in the western states are based on the assumption that the atmosphere has insufficient foreign matter for the formation of ice crystals (a necessary precursor for precipitation) at temperatures greater than -5°C (since natural ice nuclei for the initiation of precipitation are abundant temperatures below -5°C, additional nuclei would not have a significant effect). Only certain types of particulate matter are capable of acting as ice crystal nuclei. The cooling plume is unlikely to contain any appreciable particulate matter capable of acting as such nuclei.

The comments express concern over the transport and pooling of facility emissions in the Medicine Lake caldera during periods conducive to strong nocturnal temperature inversions (e.g., clear cool nights, light winds). During such conditions, air flows along the side of the caldera and drains into it. This results in a dome of cold air residing in the caldera, disconnected from the regional air mass. Commentors have observed that a radiation fog often develops in the caldera which persists for extended periods. They express concern that moist effluent from cooling towers will be entrained into air that drains into the caldera thus exacerbating the situation.

Steam emissions from the proposed power plant facilities originate outside the caldera rim. The measured winds at the power plant do not drain towards the caldera (refer to Appendix E of this report). When cold air pools in the caldera, air from the Fourmile Hill facility would travel over the top of the cold-air dome, disconnected from the air below. The cooling tower moisture plume can be expected to rise due to convection several hundred meters above the surface, rather than drain down into the caldera.

Comment—Potential for Toxic Fog

U.20 Medicine Lake has a natural occurring air inversion condition. It is particularly obvious in the winter time. Will this air inversion condition trap excess air emissions within the caldera? Will it lead to unsafe levels of emissions, trapped within the fog? This air inversion condition will be multiplied by cooling tower drift, well venting and plant vent silencers which will dump steam and condensate emissions into the atmosphere. Will this condition create a toxic fog? *(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)*

Response—Potential for Toxic Fog

The comment expresses concerns similar to others regarding the trapping of project water vapor and particulates in the Medicine Lake caldera. As stated in the preceding response to "Comment—Potential for Fog or Hail," the caldera is likely capped with one or more strong temperature inversions which frequently occur at night during clear skies and light wind conditions. When these conditions occur, moisture and effluents pool under the inversion near the ground, particularly in the lowest area(s). In the case of a small, well defined basin surrounded by higher terrain such as the Medicine Lake caldera, the air trapped under the inversions is confined within the basin boundary, and is disconnected from air above and outside the confines of the basin. The proposed Fourmile Hill geothermal power generating facilities are outside the confines of the Medicine Lake basin.

All steam emissions (cooling tower, well venting, plant vent silencers) would consist of buoyant steam plumes originating outside the caldera basin. The plume buoyancy is due to the higher temperature of the steam as compared to the surrounding air. This will result in the plumes rising well above the sources and the capped inversion(s) in the caldera basin.

The estimated air quality impacts presented in the Draft EIS/EIR account for the meteorological conditions in the proposed project area. The estimated maximum short-term impacts discussed are for the reasonable worst-case combinations of emissions and meteorological conditions that could be expected to occur during the construction and operation of the proposed project. Since the actual steam emissions from the Fourmile Hill project are not expected to enter the caldera basin during worst-case dispersion conditions, there is no credible threat that the project will create any "toxic fog."

Comment—Potential for Icing

U.21 Another concern is the possibility of highway icing from cold weather conditions and emissions. This icing will also occur on trees and vegetation. Please address these issues in writing.

(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

Response—Potential for Icing

A persistent steam plume from the proposed facility is most likely to occur in low wind speed situations with cold, moist ambient air. When ambient temperatures are below freezing and the air is saturated, clouds form that consist of super-cooled (liquid state at subfreezing temperature) water droplets and ice crystals. These clouds' water droplets will deposit rime or clear ice on cold (sub-freezing) objects with which they come into contact. Likewise, cloud ice crystals can deposit light rime icing, which is similar to snow, on sub-freezing objects. No icing of any type will take place in the absence of super-cooled cloud water droplets or ice crystals.

During light wind conditions, when steam cloud formation is at maximum, steam plumes produced by geothermal activities typically rise well above the source because their temperature is greater than the ambient air. The plumes rise quickly and will drift only short distances downwind before evaporating. It is possible for some ice crystals or frozen water droplets to precipitate back to the ground. However, because of the low wind speed and short duration of the particles in the air, deposition is typically confined to the area immediately surrounding the source.

Heavy clear or rime ice does not form in the vicinity of geothermal facilities unless steam plume condensate is deposited directly on a sub- freezing object. Unless it is very windy, plumes will rise too high or evaporate before they can come into contact with objects and form ice.

It is anticipated that some icing will occur on trees, vegetation and other objects in the immediate proximity of the Fourmile Hill development. Some minor icing may take place on roads within the project confines. Public roads in the area are too far from the steam sources to be threatened by significant icing.

Comments—Potential for Acid Rain

T.19 For example, if there are higher concentrations of H_2S released than have been presumed, acid fogs could form in the air inversion events which occur frequently in the Medicine Lake caldera. Acid rain or acid fog deposition effects on trees, lichens, and fungi would be adverse and could be severe for some organisms. Acid deposition into Medicine Lake could harm the fishery, which in turn would adversely affect the resident bald eagles and osprey that rely on the fishery as a food source.
(Linda L. Blum, Medicine Lake Citizens for Quality Environment)

PH3.18 The hydrogen sulfide that is released, if it is mixed in the atmosphere, does that basically make acid rain?
(Yreka Public Hearing)

PH5.25 This H2S, hydrogen sulfide, when it is combined with water, rain or snow or something of the like, isn't that apt to pick up HS, H2S. *(Medicine Lake Public Hearing)*

PH5.26 In dealing with what you were just talking about, that amount of acid rain is not an issue according to how many geothermal wells? *(Medicine Lake Public Hearing)*

Response—Potential for Acid Rain

Acid rain or fog referred to by the commentor results from the acidification of liquid in the atmospheric. By nature, rain is already slightly acidic as carbon dioxide (which occurs naturally in the atmosphere) reacts with water to form carbonic acid. The acidity of atmospheric liquid water has been documented to increase in or downwind of large urban and industrial centers. Acid rain is thought to have potential deleterious effects on forest vegetation and other elements of an ecosystem. Nevertheless, no standards or guidelines on acceptable levels have been adopted by Federal or state agencies, or local districts. Typically acid rain/fog is treated as a regional phenomenon and not apportioned to individual point sources.

The acid rain that has received the most attention is caused mainly by pollutants from large coal-burning power plants in the Midwest and western Europe. These plants burn large quantities of high-sulfur content coal and release large amounts of sulfur dioxide, as well as NO_x (nitrogen oxides) into the atmosphere. These are acid chemicals, related to two strong acids: sulfuric acid and nitric acid. These pollutants rise high into the air and are carried by winds long distances where, if exposed to wet weather, as acids become part of the rain, snow or fog. In areas where the weather is dry, the acid chemicals may be deposited to surfaces as gases or dusts.

A primary pollutant resulting from geothermal operations is hydrogen sulfide (H_2S). In the atmosphere, H_2S emissions can form SO_2 which then, in the presence of oxidizing agents and/or sunlight, forms sulfuric acid and/or sulfate particulate. The acidic chemistry and local environmental impact are the result of numerous complex processes that depend upon micro meteorological mechanisms as well as regional scale influences, chemical precursors, production rates, soil buffering capacity (i.e., ability of the soil to resist some pH change), critical loading (e.g., individual plant tolerances) and

so on. It is beyond the scope of this document to quantitatively determine the contribution of the proposed facility on atmospheric acidity and of acid rain/fog pollution effects on forest ecosystems and human heath. It is, however, very unlikely, given the quantity of H_2S emissions, that the proposed project will cause any measurable impact of a regional phenomenon such as acid rain. Acid fog is, likewise, very unlikely to impact the area surrounding the Fourmile Hill project since emissions from the proposed facilities will not drain into the Medicine Lake caldera at times when fog may occur (as discussed in Section 4.17, Cumulative Impacts, of this EIR/EIS; see also the response to "Comments—Potential for Toxic Fog" in this section).

AIR QUALITY ANALYSIS

Comments—Overall Adequacy of Air Quality Analysis

AG.107 Dr. Fox undertook an extensive analysis of the Project's air quality impacts. (See Ex. A, Comments 1-7.) She concluded that the EIS/EIR's analyses of these impacts are fundamentally flawed. They are not based on verifiable emissions estimates or standard methodologies, they grossly underestimate Project emissions, they fail to analyze several significant emissions sources, and they fail to analyze and recommend several feasible mitigation measures. (Ibid.) Dr. Fox's findings are set forth in detail in Exhibit A and summarized below.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.119 Dr. Fox has identified numerous ways in which the EIS/EIR's analyses of the Project's criteria pollutant emissions are flawed. (Ex. A, Comment 5.) These flaws include failing to evaluate the significance of these emissions (Ex. A, Comment 5.a.), omitting emissions of ozone precursors from the analysis (Ex. A, Comment 5.b.), and underestimating emissions of criteria pollutants (Ex. A, Comment 5.c.).

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Overall Adequacy of Air Quality Analysis

The emissions estimates are based on actual geothermal resource chemistry and have been independently verified by a third-party consultant. This comment summarizes several of the issues that are discussed in detail in the response to "Comments—Emissions Calculations" and "Comments—Modeling Methodology."

EMISSIONS

Comment—Support for Emissions Calculations

AG.193 Emission estimates normally provide the basis for the analysis of a wide range of potential environmental impacts. For this Project, emission estimates were used to evaluate the impact of boron emissions on vegetation, of trace metal emissions on the water quality of Medicine Lake, of public health impacts, and of the degradation of ambient air quality. Because emission estimates are critical to the process of evaluating environmental impacts, an EIR must provide support for the emissions that are used so the public can review and comment on their validity.

This support must include sufficient information to allow a knowledgeable person to verify and reproduce the calculations. This information must include either the spreadsheets used to calculate the emissions or the equations and supporting assumptions. This DEIR contains neither for any source or pollutant.[11] No supporting information is provided for any of the toxic substances of concern. Emission factors must be based on standard U.S. EPA or CARB reference documents, vendor-supplied and guaranteed values, or actual measurements on a similar plant. The emission factors used to estimate most emissions from this Project were reportedly based on the "expected composition of the geothermal resource and engineering calculations" (DEIR, page F-9), rather than these standard and acceptable sources. Finally, emissions for a CEQA document must be independently verified by a consultant working for the lead agency. Again, this DEIR has not followed this mandatory practice. Therefore, it is impossible to review and comment on the validity of the emissions.

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11 Some supporting information is provided for PM10 emissions from construction and for NOx, CO, SOx, and PM10 emissions from the drill rig. However, it is incomplete and not sufficient to allow the reproduction and confirmation of the calculations.

The emissions of 24 toxic and other substances from this Project were estimated by the applicant, not the lead agency's consultant. All supporting assumptions and calculations have been omitted from the DEIR. Emissions from the power plant were "estimated by Calpine staff based on the expected makeup of the geothermal fluid using engineering and material balance calculations." The emissions from the wellfield were also estimated by Calpine staff "based on expected well production rates, the expected makeup of the resource, and engineering calculations." (DEIR, page F-11.) These are the major sources of emissions from the Project. The DEIR does not provide any of the supporting data. The expected geothermal fluid composition and engineering and material balance calculations are omitted from the DEIR. Therefore, these data should be provided in the DEIR so the public can understand and review the basis of the analyses and conclusions in the DEIR. As it stands, the public has been asked to accept the applicant's representation of the Project's emissions on blind faith. As discussed in Comments 1.c through 1.f, it appears that the applicant has substantially underestimated emissions.

Accurate measurements of the chemical composition of the geothermal fluid or noncondensible gases in a reservoir is required to estimate toxic emissions from a geothermal power plant. These measurements must include all toxic substances of concern, including hydrogen sulfide and metals, as discussed in Comment 1.g. This essential information was not presented in the DEIR and apparently is not available. The DEIR claims that "[n]o geothermal fluid samples have been obtained from the geothermal system in the Fourmile Hill area, and thus no fluid analyses from the resource believed to underlie Calpine's leases are available." (DEIR, page 3-37.) Instead, the concentrations of nontoxic substances, including silica, sodium, calcium, magnesium and chloride, in fluids from a nearby well in the Glass Mountain Known Geothermal Resource Area ("KGRA") are presented. (DEIR, page 3-37.) However, these data are not useful for evaluating environmental impacts because they do not include any of the toxic substances of concern. Emissions, and even plant design, have apparently been based on "expected makeup" of the fluid (DEIR, pages 2-30, F-11), which has been withheld from public view. This is unacceptable.

The composition of the geothermal fluid is the *sine qua non* for estimating emissions from the Project. It is the very foundation of most of the analyses in the DEIR. These data must be acquired and provided by the applicant to support the analyses in the DEIR. Alternatively, numerous wells have been drilled in the general area, and some apparently produce fluids which could be analyzed. (DEIR, pages 3-37 to 3-39.) Methods are available for collecting and analyzing samples of geothermal fluids and noncondensible gases.[12] In the absence of actual data, emissions must be estimated using industry averages for similar facilities. Neither approach has been pursued here.

The DEIR must provide the complete chemical composition of the geothermal fluid that would be processed by the proposed Project. These data should be based on actual measurements of fluids and gases from existing wells in the general vicinity unless it can be conclusively documented that such data are not reasonably obtainable. If site-specific data are not available, emissions should be estimated using emission factors for geothermal power plants located at sites with similar geologic origin, caldera structure, volcanic origin, reservoir rocks, and comparable reservoir temperatures, to the extent feasible. All emissions and resulting environmental impacts must be calculated *de novo* and thoroughly documented. The EIR must be revised accordingly and recirculated for public review so the public has the opportunity to comment on emission estimates and environmental impacts based on them. Currently, the DEIR does not provide enough information to allow meaningful public comment.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Support for Emissions Calculations

Copies of the spreadsheets used to prepare the emission estimates for the project were provided to this commentor. No comments on the emission estimation methods or requests for similar information were received from any other commentor.

CEQA provides that lead agencies may require project applicants to provide data and information necessary for determining whether an impact is significant. If trade secrets are necessary to accomplish this task, they must be submitted to the lead agency, but the lead agency may not include the trade secrets in an EIR or otherwise disclose them. Thus, the lead agency may use the privileged information to determine whether a project will have a significant impact but such information is not subject to public disclosure. Calpine considers the resource chemistry data to be confidential trade secret

12 D. Benoit and P. Hirtz, Noncondensible Gas Trends and Emissions at Dixie Valley, Nevada, Geothermal Resources Council Trans., v. 16, 1994, pp. 113-119; A.J. Ellis and W.A.J. Mahon, Chemistry and Geothermal Systems, Academic Press, New York, 1977, Chapter 5.

information. For this reason, the resource chemistry data were not presented in the Draft EIS/EIR.

As discussed in the response to "Comments—Adequacy of Emissions Calculations," the emission estimates relied on factors specific to the project, i.e., the expected composition of the geothermal resource, measured or guaranteed performance of the equipment, engineering judgment and engineering calculations. The analyses were supported by the best available data, although some of these data were not presented in the Draft EIS/EIR due to the trade secrets consideration discussed above, and in order to avoid increasing the volume of an already lengthy document.

There is no requirement that the emissions data and/or analysis be independently verified by a consultant working for the lead agency. The EIS/EIR was prepared by a third-party consultant to the lead agencies. The lead agencies have performed their own review, and the EIS/EIR presents the independent views of the agencies.

There is no requirement that emission factors be based on U.S. EPA or California ARB (ARB) documents. For many types of sources, U.S. EPA and ARB emission factors do not exist. Geothermal resources vary greatly from one area to another. The design of geothermal power plants also varies greatly. It would be difficult for agencies such as the U.S. EPA or the ARB to develop emission factors that would apply to the entire geothermal power industry. Vendor guarantees are appropriate for some types of equipment, such as air pollution control devices, boilers, etc., but are not available for entire power plants.

Emissions estimates for this project were based on the sources listed by this commentor, where they were available and appropriate for this project. For instance, emissions of combustion products (NO_x, SO_x, PM_{10}, and CO) from drill rigs were estimated using U.S. EPA emission factors, as were emissions of fugitive dust associated with construction vehicle activities.

Other emissions estimates, such as the cooling tower drift and H_2S emissions, were made using conservative assumptions regarding control equipment performance. Calpine is very familiar with of the performance of modern drift eliminators available for cooling towers, the performance of flash vessels and equipment used to separate the geothermal steam and brine, and the level of hydrogen sulfide control available using any of a number of appropriate technologies. For the purpose of estimating impacts, it was assumed that cooling tower drift would be 0.01% of the water circulation rate, although Calpine intends to use high-efficiency drift eliminators that will reduce drift to levels less than the assumed drift rate. Likewise, although available primary hydrogen sulfide abatement equipment can reduce the hydrogen sulfide content of the noncondensible gas stream by 98% or better, the hydrogen sulfide emissions estimates used in the environmental impact analysis were based on 95% primary hydrogen sulfide control efficiency. Cyclone separators can reduce the "carryover" of geothermal brine with flashing steam by more than 99%, but the emissions estimates used in the environmental impact analyses are based on 99% and 98% control for the primary and secondary flash vessels and polishing separators, respectively. In each of these examples, the assumed use of control efficiencies that are lower than the known performance of the control devices that would be used for the project led to

overestimation of emissions and associated environmental impacts. Calpine will use high-performance equipment (performing better than these assumptions) in each of these cases, and in each case the equipment will control emissions to a greater degree than was assumed in the estimation of emissions.

Some emissions estimates were based on the performance of similar plants, as has been done for environmental impact assessments and health risk assessments for many types of sources. For instance, emissions of mercury from the plant cooling towers were estimated using the measured ratio of incoming mercury (in the steam) to mercury emissions from the cooling tower at Calpine's West Ford Flat facility, which uses a mercury removal system. Calpine will install a similar mercury abatement system at the proposed facility, if it is necessary to reduce emissions to the levels presented in this document. (Please refer to the response to "Comments—Mercury Emissions" for a more detailed discussion of mercury emissions.)

Measurements of the chemical composition of the geothermal fluid in a test well in the Glass Mountain KGRA were used to estimate the chemical composition of the geothermal fluids, as needed for the estimation of emissions. Some of the substances discussed in Dr. Fox's comments are not normally tested for in geothermal fluids. Where available, chemical composition data for the test well were used in the estimation of emissions for this project. Where resource-specific data were not available, appropriate corresponding data from Calpine's West Ford Flat facility were used. The emissions calculations, including the expected composition of the resource based on chemical analyses of the fluids from the test well and data from other geothermal resources, were provided to the commentor.

There is no requirement to use industry-wide averages to estimate emissions. Because geothermal resources and facilities vary considerably, use of averages or data from other facilities must be done carefully. (e.g., refer to the response to "Comment—Boron Emissions" for a discussion of the differences in emissions between geothermal power plants using dry steam and those using liquid-dominated geothermal resources.) The proposed plant will be thermodynamically efficient, and emissions will be very well-controlled (relative to most other dual-flash plants), so the use of industry average emission factors or factors from other power plants may be misleading. Emission factors from other plants (grams of pollutant per megawatt-hour, lb/MW-hr or equivalent units) were not used in the preparation of emissions estimates for this project.

Comment—Emissions Calculations

AG.190 In air quality analyses, emissions of criteria and toxic pollutants are normally calculated and used to estimate ambient concentrations and public health and other impacts. These complex calculations are normally based on published emission factors and standard modeling protocols that are routinely used by practitioners in the field. The resulting analyses are supported by sufficient information to allow a knowledgeable reviewer to confirm their accuracy. This DEIR deviates substantially from the standard practice and has adopted procedures that are incorrect. As a result, the air quality analyses cannot be independently reviewed, violating the requirements of CEQA.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Emissions Calculations

Emissions of criteria and toxic air pollutants were estimated as described in Appendix F of the Draft EIS/EIR. These estimates were used, along with dispersion models to estimate air quality impacts, including the potential for adverse health impacts.

Neither CEQA nor the Guidelines specify requirements for the procedures to be used in the analysis of a project's air quality impacts. Some industries traditionally have been large sources of air pollutants, and there are many decades of experience in assessing emissions from many similar plants throughout the country or the world. Geothermal power plants are not such sources. There are no "standard" methods for estimating the emissions of geothermal power plants. Compared to most industries, there are fewer geothermal plants in existence, and the emissions vary considerably in magnitude and nature due to the great differences in the physical and chemical nature of the geothermal resources, and in the age and design of the plants.

The general approach in preparing the air quality analysis was to use methods that are expected to estimate the impacts of the project as realistically as is feasible without underestimating them. Where U.S. EPA emission factors are available and appropriate, such as the estimation of fugitive dust emissions and drill rig emissions, they were used. Where data were available from other relevant facilities to calculate or estimate the performance of systems (e.g., the control efficiency of a mercury abatement system), those data were used. Some estimates are based on engineering calculations.

The dispersion modeling methods used are those presented by the U.S. EPA in relevant guidance documents.[13 14 15 16 17]

The preparers of the air quality analyses acknowledge that there exist more than one method to develop these analyses, and that other investigators may have chosen to use other valid methods. Specific issues regarding the procedures used to estimate the air quality impacts of the proposed project are discussed in the following comments and responses.

This commentor requested, and was provided with, the computer spreadsheet files used to prepare the emissions estimates presented in the Draft EIS/EIR.

Comment—Emission Source List

AG.215 The criteria pollutant emission inventory does not include any emissions from fugitive sources such as pumps, compressors, valves, and flanges, or the Stretford plant's vents and sulfur pit. These could be a substantial source of hydrogen sulfide which may be present at high concentrations in some internal gas streams, such as the noncondensibles and steam. The emission inventory also does not include exhaust emissions of CO, NO_x, or SO_x from traffic and mobile equipment used to construct the well field, power plant site, and the transmission line. (DEIR, pages F-18 to F-21; Suder Files.) This equipment is typically a major source of these pollutants during construction. These emissions can be readily estimated using standard U.S. EPA emission factors (U.S. EPA 1991, Table 2-07). Emissions from these sources should be added to the inventory reported in Table 4.13-3.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

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13 U.S. Environmental Protection Agency, 1986. Guideline on Air Quality Models (Revised). with Supplements A (1987) and B (1993). EPA-450/2-78-027R. pp. 4-9 - 5-5.

14 U.S. Environmental Protection Agency, 1995. User's Guide for the Industrial Source Complex (ISC3) Dispersion Models. Volume I - User Instructions. Office of Air Quality Planning and Standards. EPA-454/B-95-003a.

15 U.S. Environmental Protection Agency, 1995 and 1996. Model Change Bulletin #1 and Model Change Bulletin #2 for the Industrial Source Complex Dispersion Model (ISC3). Office of Air Quality Planning and Standards, Support Center for Regulatory Air Models.

16 U.S. Environmental Protection Agency, 1987. On-Site Meteorological Program Guidance for Regulatory Modeling Applications Office of Air Quality Planning and Standards. EPA-450/4-87-012. Revised February 1993.

17 U.S. Environmental Protection Agency, 1993. User's Guide to the Building Profile Input Program. Office of Air Quality Planning and Standards. Revised 1995.

Response—Emission Source List

The sources mentioned in this comment were considered in the preparation of the air quality impact analysis. They were not included in the inventory for the reasons discussed below.

Due to leakage, pumps, valves, flanges, compressors, and other fittings that handle fluids containing volatile substances can be sources of emissions of those substances. Although the leak rates at each individual fitting are generally quite small, the very large number of fittings present at a large industrial facility such as a petroleum refinery can produce a total emission rate that is considerable. This is especially true at older facilities, where the fittings may be in poor repair. At the proposed facility, the substances that would be in contact with these devices (and therefore subject to leakage) are the produced steam and the volatile constituents of the geothermal fluids (including noncondensible gases, such as H_2S). Nonvolatile constituents of the fluids (e.g., dissolved solids) would not be emitted to the atmosphere from these sources because, after leaking, they would not evaporate. Instead, they would form a scale at the leakage point.

The U.S. EPA has published emission factors for industrial facilities such as petroleum refineries, synthetic organic chemical manufacturing plants, oil and gas production facilities, *etc.* Although the facilities for which these factors were developed differ from geothermal well fields and power plants in several important ways, the emission factors published by the U.S. EPA can be used to evaluate the potential contributions of emissions from these sources to total emissions from the plant. The industry most similar to the proposed project for which the U.S. EPA has published emission factors is oil and gas production. The emission factors for valves, seals, and flanges in gas service are most appropriate for use in estimating emissions for these devices at the proposed project. The emission factors range from .0002 to 0.0088 kg/hr per device. These factors are for the *total* rate of emissions of volatile substances from these sources.

Calpine prepared a rough count of these fittings that are expected to be needed at the proposed project. A total of about 300 of these fittings would be required. Applying the highest of the emission factors above to *all* of the fittings yields a total emission rate of less than three pounds per hour, of which nearly all would be steam. The emission rates of the individual volatile substances would be equal to their concentration in the geothermal fluids times this value. Total H_2S emissions from these fittings, for instance, would be about 0.000024 lbs/hour. This is about 70,000 times less than the projected emissions of H_2S from the plant, and is negligible. The same is true for all of the other volatile substances in the geothermal fluids.

Emissions from the Stretford vents (if a Stretford system is used) and the sulfur pit are also expected to contribute negligible amounts to the total facility emissions. Hydrogen sulfide emissions would be negligible because the sulfur pit would contain elemental sulfur (sulfur cake), not H_2S. Emissions of other compounds from the Stretford (or other H_2S removal system) are expected to be negligible due to the very low flows through these vents. The emission estimates presented in the Draft EIS/EIR assume that all the volatile substances present in the noncondensible gas stream entering the H_2S abatement system (except H_2S) will be emitted. Therefore emissions from the abatement

system vents (if any) would reduce emissions from the noncondensible gas system exhaust by an equal amount, so the total emissions would not change.

The Draft EIR/EIS presents the estimated emissions of nitrogen oxides (NO_x), carbon monoxide (CO), and sulfur oxides (SO_x) from the drill rigs and the stationary diesel generator. As noted in the comment and on page 4-224 of the Draft EIS/EIR, vehicles and mobile equipment used to construct the wellfield, power plant site and transmission line will also be sources of emissions of NO_x, CO, and SO_x. These sources were not included in the quantitative air quality impact analysis because the mobile construction equipment fleet would be small, and the periods of operation of the construction equipment would brief. The tailpipe emissions from this equipment would increase the total daily and annual emissions of these pollutants; however, including these sources in the air quality analysis would not have resulted in the identification of any new significant impact.

The largest equipment fleet (in terms of total equipment horsepower) would be the earthwork equipment used during the construction of the access roads and well pads (during the first year of construction) and during the construction of the power plant pad (during the second year of construction). Even this fleet would be relatively small, probably comprising about seven pieces of equipment (*e.g.*, two bulldozers and two scrapers, one motor grader, one compactor and one backhoe). During these activities, the construction equipment on site would produce less than 10,000 horsepower-hours (hp-hr) per day. In contrast, a single drill rig is expected to require about 41,000 hp-hr on a maximum day.

Once the construction of the power plant pad is complete (fall of the second year), the construction equipment fleet would change. The bulldozers, scrapers, graders, and related earth-moving equipment would leave the site, and equipment needed to construct the power plant (e.g., cranes, manlifts, and forklifts) would arrive. As described in Appendix F, a stationary diesel generator (approximately 750 horsepower) would be installed and used to power electric equipment used in the construction of the power plant.[18] The maximum total daily power output of this equipment would be about 1,100 hp-hr per day.

Transmission line construction would occur during the summers of the second and third years. The equipment fleet used during both years would be considerably smaller than that used to construct access roads, well pads and the power plant pad, generating about 3,000 to 5,000 hp-hr per day or less.

Tailpipe emissions from vehicle traffic would be minor. During the third year of construction, when highest level of activity would occur, vehicle travel onsite would total 750 vehicle-miles per day or less, and vehicle travel along the transmission line corridor would total about 1,100 vehicle-miles per day or less. Traffic during other years would be considerably lower.

Using these estimates of the levels of activity of construction equipment and vehicle travel and typical emission factors for the equipment and vehicle fleets, the maximum

18 Emissions of the diesel generator are included in the quantitative air quality analysis presented in the EIS/EIR.

daily tailpipe emissions of NO_x during each year of construction and during operation of the power plant are estimated as follows:

Estimated Daily NO_x Emissions from Construction Equipment and Vehicles (lbs/day)

	Year 1	Year 2	Year 3	Operation
On-Site Mobile Construction Equipment	215	215	30	NA
Transmission Line Construction Equipment	NA	71	113	NA
On-Site Vehicles	3	3	10	2
Transmission Line Construction Vehicles	NA	4	15	NA
Totals	**219**	**293**	**168**	**2**

Comparing these values with the maximum daily NO_x emissions for the drill rigs and plant generator (presented in Table 6 of Appendix F, page F-18) reveals that including construction equipment and vehicle tailpipe emissions in the emissions inventory would increase the daily emissions of NO_x during any phase of construction or during plant operation by a maximum of 41%. (The increase for the third year of construction, when the emissions would be greatest, is less than 10%.) The maximum hourly NO_2 concentrations presented in Table 26 of Appendix F (page F-39) are all about half or less of the ambient air quality standard. Even if the increases in estimated NO_2 impacts were proportional to the increased emissions,[19] the increases are not large enough to cause the estimated impacts to exceed the California NO_2 standard.

With the exception of PM_{10} (for which a potentially significant and unavoidable short-term air quality impact has been identified), the estimated short-term impacts of all other pollutants emitted from fuel-burning equipment are even less of an impact than the estimated nitrogen dioxide impact. The estimated annual average impacts of all pollutants emitted by engines are far below the relevant ambient air quality standards. Therefore, inclusion of mobile construction equipment tailpipe emissions in the quantitative assessment of air quality impacts would not have changed the conclusions regarding the significance of these impacts. No new significant impacts would have been identified.

Comment—Underestimation of Emissions

AG.110 According to Dr. Fox, the EIS/EIR substantially underestimates emissions of several toxic constituents. (Ex. A, Comments 1.c.-1.f.) Dr. Fox's calculations demonstrate that the EIS/EIR underestimated emissions of hydrogen sulfide (by a factor of 2), boron (by a factor of 35), and mercury (by a factor of 140,000). (See Ex. A, Comments 1.c. through 1.f., for further discussion of these issues.) The EIS/EIR

19 The formation of nitrogen dioxide (NO_2) would be ozone-limited under the worst-case conditions. Only the increased emissions of primary NO_2 (10% or less of the NO_X emissions) would contribute increases in NO_2 concentrations at the maximally-impacted receptors. Also, the emissions from mobile construction equipment and vehicles would be distributed over a much larger area than the point-source drill rig and generator emissions and would thus have a greatly diluted impact compared to the point sources. For these reasons, NO_X emissions above those considered in the quantitative air quality impact analysis would increase the maximum NO_2 impacts less than proportionately.

should be revised to include the correct emissions estimates and recirculated.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Underestimation of Emissions

The responses to "Comments—Calculation of H_2S Emissions," "Comments—H_2S Concentration in Geothermal Fluids," and "Comments—Boron Emissions" discuss the emission estimates for these substances. Please refer to those responses.

Comment—Significance of Emission Rates

AG.212 An EIR must estimate the emissions of all criteria pollutants for both construction and operation and compare the totals to emission significance thresholds. This DEIR did not evaluate the significance of emissions, omitted ROG from the inventory, and underestimated emissions of the criteria pollutants that it did include. These errors and omissions should be corrected and the EIR recirculated for public review.

The DEIR presents criteria pollutant emissions (DEIR, Table 4.13-3), but makes no attempt to evaluate their significance. It did perform ambient air quality modeling for two of them, PM_{10} and hydrogen sulfide, but this is a separate evaluation that does not substitute for an independent assessment of the emissions themselves. Many air pollution control districts in California have established emission thresholds for CEQA purposes and published them in CEQA guidelines. These thresholds are typically tied to a district standard.

For example, BAAQMD has established thresholds of significance for emissions from project operations of 15 tons/yr or 80 lbs/day for ROG, NO_x, and PM_{10}. The thresholds for ROG and NO_x are equivalent to the BAAQMD offset threshold (15 tons/yr) for stationary sources (Regulation 2-2-302). The threshold for PM_{10} is based on the District's definition of a major modification to a major facility (Regulation 2-2-221).[20] Likewise, the Kern County APCD has used emission offset trigger levels as significance thresholds.[21] These levels are 15 tons/yr for PM_{10}, 27 tons/yr for SO_x and 25 tons/yr for ROG and NO_x. The SCAQMD based its operational significance thresholds in part on the federal Clean Air Act, which are 55 lbs/day (10 tons/yr) for ROG and NO_x, 550 lbs/day (100 tons/yr) for CO, and 150 lbs/day (27 tons/yr) for PM_{10} and SO_x. Separate thresholds were established by the SCAQMD for construction emissions and are 2.5 tons/qtr for ROG and NO_x, 6.75 tons/qtr for PM_{10} and SO_2, and 24.75 tons/qtr for CO. (SCAQMD 1993, page 6-2 to 6-4.) Finally, the San Luis Obispo APCD has established operational emission significance thresholds of 25 lbs/day (4.5 tons/yr) for ROG, NO_x, SO_2, and PM_{10}.

The SCAPCD has not published CEQA guidelines. However, using the most stringent of these, those published by the San Luis Obispo APCD which has pristine air quality comparable to Siskiyou County, operational emissions of PM_{10} (6.8 tons/yr) and NO_x (7.0 tons/yr) from the Project would exceed the significance threshold of 4.5 tons/yr and would be significant. (DEIR, Table 4.13-3.) Likewise, using the construction significance thresholds established by the SCAQMD, construction emissions of NO_x (5.7 - 43 tons/qtr) would be significant during all three years, assuming work occurs for 2.3 quarters per year. (DEIR, pages F-20, F-21.) PM_{10} emissions would also be significant in all three years if they were correctly calculated (Comment 2). Because there is no information in the DEIR on emissions of ozone precursors, there is no information to determine whether or not they may be significant.

The SCAPCD must establish significance thresholds for all criteria pollutants for both construction and operation, and the DEIR must use them to evaluate the significance of Project emissions. CEQA requires that the lead agency determine whether impacts are significant, and the DEIR has demonstrated that the emissions are substantial. The lead agency must establish objective standards and apply them. It appears that under objective standards routinely used by other APCDs, emissions of PM_{10} and NO_x from the construction and operation of the Project would be significant.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Significance of Emission Rates

The criteria pollutants emissions that could result from the project are addressed in the Draft EIS/EIR. As described in several responses to comments below, criteria pollutant emissions were not underestimated.

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20 BAAQMD, BAAQMD CEQA Guidelines. Assessing the Air Quality Impacts of Projects and Plans, April 1996, p. 15 and Table 3.

21 Kern County Air Pollution Control District, Guidelines for Implementation of the California Environmental Quality Act (CEQA) of 1990, as Amended, July 11, 1996, p. 12.

Neither CEQA nor the Guidelines specify requirements for analysis of a project's air quality impacts. CEQA does not require that Siskiyou County APCD (or any other agency) adopt thresholds of significance for air pollutant emission rates, nor is there any requirement for the EIR to apply emission thresholds (including construction emission threshold established by another agency for another region of the state.

Please refer to the responses to "Comments—Adequacy of Criteria Pollutant Inventory," "Comments—Omission of Reactive Organic Gasses/Volatile Organic Compounds," and "Comments—Incomplete Emission Source List" regarding ROG emissions and the appropriateness and accuracy of the criteria pollutant emissions estimates presented in the Draft EIS/EIR.

Comment—Drill Rig Emissions

AG.216 Drill Rigs. Emissions from the drill rigs were estimated using U.S. EPA emission factors for heavy-duty stationary diesel engines (AP-42, page 3.4-5), assuming they operated only 33 percent of the time during an average day and 67 percent of the time during the maximum hour and day. (DEIR, page F-11; Suder Files, Diesel Engine Table.) These load factors are inconsistent with information in the DEIR and they substantially underestimate drilling rig emissions.

The DEIR states that "[d]rilling operations would occur 24 hours a day, with drill rigs being lit at night to allow for continual drilling." (DEIR, page 2-14.) However, the load factor used in the DEIR corresponds to operation for about 8 hours a day. The standard U.S. EPA load factor for annual average operation of drill rigs is 75 percent (U.S. EPA 1991, Table 2-05), not 33 percent as assumed in the DEIR. Therefore, drill rig emissions should be revised to assume 100 percent load during the maximum hour and day and no less than 75 percent load during an average day.

This would increase all annual emissions from the drill rigs by a factor of 2.3 (75/33 = 2.3) and substantially increase annual emissions during both construction and operation as follows:[22]

	CONSTRUCTION		OPERATION	
	Table 4.13-3	Revised	Table 4.13-3	Revised
PM	15.4	20.7	6.8	7.3
NO	99.3	198.6	7.0	15.2
SO	12.4	24.7	0.9	1.9
CO	42.0	84.0	2.9	6.4

This would also increase maximum hourly and maximum daily emissions from the drill rigs by a factor of 1.12 (75/67), which would increase the magnitude of the visibility impacts on Lava Beds National Monument (DEIR, Attach A to Appx. F and pages 4-248, 4-250).

In addition to exceedances of significance criteria discussed above (Comment 5.a), the revised annual operational NO_x emissions also exceed the significance criteria for the BAAQMD (15 tons/yr) and the SCAQMD (10 tons/yr). The CO emissions during the third year of construction (37 tons/qtr) also exceed the SCAQMD significance threshold of 24.75 tons/qtr, assuming 2.3 quarters per year.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Drill Rig Emissions

Large drills rigs, such as those used in petroleum exploration and the construction of geothermal power production facilities, use electric motors. Electrical power is provided by multiple diesel electric generators. They are left on site for long periods of time, and drilling operations often are conducted around the clock. Redundant generation systems are employed so that maintenance of the generators (*e.g.*, oil and filter changes) can be performed without interruption of the drilling activities. For instance, the drill rigs that would be used to drill production and injection wells at the proposed project would most likely use three 850-horsepower generators. The

22 The adjusted emissions were calculated using emissions in Appendix F. The year 3 drill rig emissions for NOx in Table 12, SO2 in Table 13, CO in Table 14, and PM10 in Table 15 were multiplied by 75/33 and added to emissions from other sources.

generators are sized such that any two of them would provide sufficient power to continue drilling operations while the third unit is off-line for repairs or maintenance. Thus, no more than 1,700 horsepower generating capacity is needed at any time (67% of the total generating capacity of the rig).

In contrast, small drill rigs (such as those used to drill domestic water wells) are generally directly powered by a single gasoline or diesel engine; there is no redundant capability. These rigs are generally truck-mounted, and are therefore much more mobile than the large rigs. Engine maintenance is generally not performed in the field, and drilling operations are often performed during a single shift each day. Engine horsepower for these rigs typically is less than 300 bhp. For some operations, all of the available horsepower may be needed.

The comment refers to a U.S. EPA document describing the development of area-wide (e.g., state) emission inventories for off-road vehicles to be used for the purpose of a congressionally mandated analysis of the contribution of nonroad engines to air pollution.[23] The input data used for the analysis are listed in the document, but the load factor used is not presented as "the standard U.S. EPA load factor" as alleged in the comment. Further inspection of the EPA's supporting documentation reveals that the drilling/boring equipment surveyed in order to develop the average factor used in the EPA study had an average capacity of just 209 horsepower, indicating that the equipment surveyed were much different from the drill rigs that will be used to drill production and injection wells at the proposed project.

The loading factor used in the estimation of maximum hourly emissions from the drill rigs is based on continuous, full-load operation of two of the three 850-horsepower diesel generators. This is consistent with the ability of any two of the generators to meet the peak power demands of the rig. However, it overestimates the maximum hourly load factor because the power demands of the drilling equipment are not constant, so the generators do not run at maximum capacity continuously, even during any single hour. The maximum 24-hour average loading factor used for modeling maximum 24-hour average emissions was also 67%.

The average loading factor (33%) used to estimate average drill rig emissions over the entire period of drilling is based on observation of drill rigs similar to those that would be used at the proposed project. The electrical power needed by the drilling equipment (while operated up to 24 hours per day) would require an *average* of about 850 brake horsepower output from the diesel engines powering the generators (20,400 horsepower-hours per day). The long-term average emission rate calculations were based on this assumption, not the assumption that drilling would take place only eight hours per day, as asserted in the comment.

The maximum and average loading factors used in the preparation of the emissions estimates for the drill rig engines presented in the Draft EIS/EIR are supported by actual fuel use records for a similar drill rig while drilling a geothermal well at one of Calpine's facilities in The Geysers. The rig's maximum daily diesel fuel use was 1,900

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23 U.S. Environmental Protection Agency, 1991. *Nonroad Engine and Vehicle Emission Study - Report.* Office of Air and Radiation (ANR-443). EPA-21A-2001.

gallons (on a day that the rig drilled nearly continuously), and the average was just over 1,000 gallons. These data indicate maximum and average rig power use of about 1,550 and 815 brake horsepower (bhp), respectively.[24] These values are somewhat less than 67% and 33% of the 2,550 total bhp available for the three rig engines, indicating that the loading factors used in preparing the Draft EIS/EIR probably overestimate actual loading factors.

Comment—Construction and Drill Rig Emissions

AG.132 The EIS/EIR's analysis of air quality impacts does not mention that there will be any restriction on the number of days that the construction equipment will be operated. The calculation of air pollutant emissions does not provide any information as to how many days of operation were assumed. (Ex. A, Comment 5.c.)

Tables 6 and 12 in Appendix F show that in Year 3, three drill rigs will be used. (EIS/EIR, pages F-18, F-20.) Each drill rig emits a maximum of 530 pounds per day of NO_x. The emissions calculations in the EIS/EIR are inconsistent. Table 6 in Appendix F shows that a single drill rig engine will produce maximum daily NO_x emissions of 530 pounds. (EIS/EIR, page F-18.) Table 6 and the text on pages F-1 and F-3 show that in Years 1 and 2, only one drill rig will be used. However, Table 12 in Appendix F, which shows annual NO_x emissions from the drill rigs, shows that in Year 1 annual NO_x emissions from the drill rig will be 25,990 pounds and that in Year 2 annual NO_x emissions from the drill rig will be 51,979 pounds. (EIS/EIR, page F-20.) Emissions of other pollutants from these rigs are similarly doubled in Year 2, according to the tables in Appendix F. This implies that in Year 2, two drill rigs will be used.

The EIR/EIS should make clear how many drill rigs will be used in each year. If all three drill rigs were operated 365 days, they would emit 589,350 pounds (290 tons) of NO_x annually. In the absence of any federally enforceable limitations on operations, these emissions are large enough to constitute a major stationary source of NO_x under the federal Clean Air Act. Federally enforceable limits must be established for the use of these rigs, or they should be considered a major stationary source.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Construction and Drill Rig Emissions

On pages F-1 through F-4, the Draft EIS/EIR discusses the expected periods of drilling activity during each year of construction, as well as the number of wells expected to be drilled. The Draft EIS/EIR makes clear the number of rigs that will be used each year (pages F-1, F-3 and F-4).

The calculations of NO_x emissions are consistent. In the first year, Calpine plans to drill two wells with one rig. In the second year, four wells are planned (also to be drilled with one rig.). Therefore, the estimated NO_x emissions for the second year are twice the estimated emissions for the first year.

Major sources are defined by 40 CFR 52.21 as those with emissions exceeding 250 tons per year of any pollutant regulated by the Clean Air Act, unless the source belongs to one of 28 specified types (which this project does not). The Fourmile Hill project would not emit 250 tons per year or more of any pollutant. The proposed project would not be a major source of air pollutants and would not be considered a major stationary source under the Federal Clean Air Act. Prior to beginning drilling, Calpine must obtain authority to construct from the SCAPCD. At that time, the SCAPCD would set such permit conditions as it deems necessary to enforce relevant state, Federal and local air quality regulations.

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24 $\left(\frac{1{,}900\text{ gallons}}{\text{day}}\right)\left(\frac{7.1\text{ lb}}{\text{gallon}}\right)\left(\frac{19{,}300\text{ Btu}}{\text{lb}}\right)\left(\frac{\text{bhp-hr}}{7{,}000\text{ Btu}}\right)\left(\frac{\text{day}}{24\text{ hr}}\right) = 1{,}549\text{ bhp}$ $\qquad \frac{1{,}549\text{ hp}}{2{,}550\text{ hp}} = 61\%$

The calculation for the average fuel use is similar.

Comment—Earthwork Emissions

AG.217 The DEIR claims that fugitive dust emissions associated with earthwork were estimated using the U.S. EPA's total particulate emission factor of 1.2 tons/acre/month of activity. (DEIR, page F-9.) According to the DEIR, 388.5 acres of land would be disturbed[25] (DEIR, page 4-85), and earthwork would take place over a 2 year period (DEIR, page F-21, Table 15 only shows earthwork in the first 2 yrs) from April to October (DEIR, pages 2-42, 2-56). Using the DEIR's assumptions that 50 percent of this is PM_{10} and that dust control would reduce emissions by another 50 percent (DEIR, pages F-9, F-10), PM_{10} emissions from earthwork would be about 1,600 tons over the two year period.[26] The DEIR only reports 3.4 tons from earthwork for this period. (DEIR, page F-21, Table 15.)

The Suder Files indicate that this discrepancy is due to underestimating both disturbed area and number of days of activity. The DEIR states that the Project would remove the vegetation from and disturb 388.3 acres of land. (DEIR, page 4-85.) The site would be cleared, grubbed, and graded. (DEIR, page 2-34.) The emission calculations, on the other hand, assume that only 36.28 acres would be disturbed. The areas used in the emission calculations are only those within the boundaries of the new road segment right-of-ways and the well and power plant pads. The transmission line is excluded, as well as all of the emissions associated with clearing, grubbing, filling, and grading the balance of the well field and plant site, which underestimates emissions by a factor of about 11. (Suder Files, Fugitive Dust Emissions from Earthwork.)

The emission calculations also assume that emissions would be contributed only during the time when the road segment and pads are being constructed, or 14 to 42 days per road segment, 14 days per well pad, and 42 days for the power plant pad. However, other construction activities take place over the 33-month construction period (DEIR, page 2-42) which contribute dust, including construction of the power plant, installation of the transmission line, and revegetation. In addition, the cleared, grubbed, and graded area would be a continuous source of wind-blown dust from soil erosion until it is revegetated. The DEIR's calculations of earthwork dust have ignored these sources. (Suder Files, Fugitive Dust Emissions from Earthwork.

Therefore, the DEIR substantially underestimates PM_{10} emissions from earthwork. These emissions should be recalculated using correct disturbed areas and construction activity times. The revised emissions would substantially increase PM_{10} construction emissions and result in frequent exceedance of the State 24-hour PM_{10} standard during Project construction.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Earthwork Emissions

Earthwork emissions are generally considered to be the fugitive dust associated with clearing by heavy machinery such as bulldozers. Fugitive dust associated with vehicular traffic over paved and unpaved surfaces is estimated differently. Earthwork includes road construction, well pad preparation, and transmission line pad preparation. When earthwork in these areas is complete, the fugitive dust emissions associated with earthwork cease. In the case of roads, fugitive dust emissions associated with vehicular traffic will continue, but these are calculated using different procedures, and are no longer counted as part of "earthwork" emissions.

Fugitive dust emissions presented in the EIS/EIR have not been underestimated. Earthwork will take place on only a small portion of the total disturbed area. Fugitive dust emissions associated with earthwork would occur only from areas in which earthwork would actually take place, thus it would be inappropriate to apply this emission factor to the entire disturbed area.

As described on pages F-1 though F-5, earthwork in the well field would include construction of the well pads and access roads. At the power plant site, earthwork would consist of grading, compaction, etc., of the plant site in preparation for the plant

25 The DEIR indicates 388.5 acres of land would be disturbed by the Project. Of this amount, 310.3 acres would be cleared and 78.2 acres would only be disturbed. (DEIR, p. 4-85.) Therefore, the burning calculations use 310.3 acres, which correspond to the number of acres of vegetation removed, while the earthwork calculations are based on the total disturbed area.

26 Construction PM10 emissions during the first two years of construction = (388.5 ac)(1.2 tons PM/ac/mo)(14 mo)(0.5)(0.5) = 1,631.7 tons.

construction. Along the transmission line corridor, earthwork would include the construction of access roads and the preparation of transmission line tower pads. All of these activities were accounted for in the air quality impact assessment, using the emission factor referenced in this comment.

Earthwork activities at the well field and power plant site would take place during short periods over the first two years of construction. Earthwork activities along the transmission line corridor would take place during the second year of construction. Appendix F, Section 1 describes the expected timing and duration of these activities.

Contrary to the assertion of the commentor, fugitive dust emissions were not estimated just for the times earthwork would occur. Fugitive dust emissions associated with vehicle traffic over paved and unpaved surfaces during the entire period of construction and plant operation were also estimated, using U.S. EPA emission factors, and included in the air quality impact analysis as described in Appendix F, Section 2.

Wind erosion of exposed soil surfaces is not expected to be a significant source of emissions at the proposed project. As discussed in Section 3.13, data recorded by the meteorological monitoring system operated at the project site indicate that wind speeds in the area are very low, especially during the summer (when the ground surface is dry). The access roads constructed at the well field and power plant site would be paved. A dust suppression program would be used along the transmission line corridor access roads during the dry season. Therefore, emissions resulting from exposed soil surfaces will be less than significant.

Comment—Geothermal Fluid Data

AG.109 Emission estimates are the building blocks of an EIS/EIR's air quality analysis. Thus, they are crucial to an understanding of a project's air quality impacts. As Dr. Fox explains, the EIS/EIR fails to provide supporting data for its emission estimates. (Ex. A, Comment 1.b.) This is of particular concern here, because the EIS/EIR does not provide any supporting information for toxic substances used in the health risk assessment. The failure to include this information precludes the public from verifying the accuracy of the estimates and, in turn, supplying meaningful comments on the EIS/EIR. The EIS/EIR should be revised to include this data and recirculated for public review and comment. (See Ex. A, Comment 1.b. for additional discussion of this issue.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Geothermal Fluid Data

The expected geothermal fluids composition, engineering and material balance calculations were provided to the commentor, as requested. There were no other requests for this information. Geothermal fluid data are provided in the responses to "Comments—Chemical Composition of Geothermal Fluids" in the Geothermal Resources Section.

Comment—Cooling Tower Drift Emissions

A.48 According to the DEIS the cooling tower drift (dissolved and suspended particulates in water vapor) would emit at a rate of 448 pounds per hour. For purposes of full and fair discussion in NEPA documents [40 CFR 1502.1] the FEIS should break down the estimate of the drift emissions as percentages according to the mentioned constituents (pg. 2-29 of the DEIS).

(Deanna M. Wieman, U.S. Environmental Protection Agency)

Response—Cooling Tower Drift Emissions

Cooling tower drift comprises liquid water droplets and the associated dissolved and suspended solids that are emitted from a cooling tower. (Drift does not include water

vapor.) Drift is caused by the entrainment of circulating water droplets into the upward-moving air stream in the cooling tower. In addition to cooling tower drift, the cooling tower would emit water vapor, gases that volatilize from the cooling water, and gases from the noncondensible gas treatment system.

Table 1 of Appendix F in the Draft EIS/EIR (page F-12) presents the estimated total emissions (all of the above) from the cooling tower during normal operations, and Table 3 of Appendix F (page F-14) presents the estimated total annual cooling tower emissions.

Tables could be prepared that present the concentrations of cooling tower drift constituents as percentages of total emissions. However, such tables would be potentially misleading. The rate at which each constituent is emitted from the cooling tower is the basis for determining effects from airborne concentrations and deposition rates, not the percentage of the total emissions that each constituent represents. The emission rates were calculated from the expected concentration of the substances in the cooling tower drift and the total drift rate. The airborne concentrations and surface deposition rates are dependent on the emission rates, not just the concentration of the substances in the drift. The percentage concentrations of constituents would not substantiate the analysis of cooling tower drift emissions since this type of information was not used in the analysis. In addition, the percentage concentrations of constituents would be much less than 1% for every substance emitted from the cooling tower except water. This information could potentially give a reader the impression that an attempt is being made to minimize the emissions from the project. Tables that present the concentrations of cooling tower drift constituents as percentages of total emissions therefore are not included in the Final EIS/FEIR.

Comment—H_2S Emissions Calculation Methods

AG.194 As discussed in Comment 1.b, no support is provided for the claimed hydrogen sulfide (and other) emissions from the proposed Project. Additionally, the hydrogen sulfide emissions appear to have been substantially underestimated.

First, if geothermal fluid composition data are not available for the proposed Project, emission factors for other similar facilities and locations should have been used. Hydrogen sulfide emission data have recently been published for the Medicine Lake area, where the plant would be located.[27] These data indicate that the hydrogen sulfide emission factor for a dual-flash geothermal power plant is 0.06 lb/MWh.[28] Using this factor, the hydrogen sulfide emissions from the Project would be 26,200 lbs/yr,[29] or roughly twice as high as claimed in the DEIR (14,400 lbs/yr). (DEIR, page 4-229.)

Alternatively, the California Energy Commission, which has evaluated many similar plants, has published hydrogen sulfide emission factors for geothermal plants in California.[30] The Project is a 49.9 MW dual-flash geothermal power plant. (DEIR, pages 2-4, 2-10.) The average hydrogen sulfide emission factor for eleven separate dual-flash plants in California is 0.29 pounds per megawatt hour ("lbs/MWh").

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27 J.E. Houck and D.W. McClain, Air Quality Assessments in Support of the Environmental Impact Statement (EIS), Oregon Air Contaminant Discharge Permit (ACDP) and Oregon Energy Facility Siting Council Certificate (EFSC) for the Newberry Geothermal Pilot Project, Geothermal Resources Council Transactions, v. 20, 1996, pp. 19-27.

28 From Figure 2 in Houck and McClain (1996), the total hydrogen sulfide emissions for a 33 MW double-flash geothermal plant based on the Coso plant in California is 9.18 metric tonnes. This is equivalent to 0.070 lb/MWh, estimated from (9.18 MT/yr)(2.205x103 lb/MT)/(33 MW)(365 day/yr.)(24 hr/day). The wellfield hydrogen sulfide emissions are 1.69 kg/hr based on Medicine Lake data and are 2.09 kg/hr based on Coso data. Therefore, the emission factor for the total plant based on Medicine Lake data is 0.06 lb/MWh, estimated from (1.69/2.09)(0.070 lb/MWh).

29 Hydrogen sulfide emissions using Medicine Lake data = (0.06 lb/MWh)(24 hr/day)(365 day/yr.)(49.9 MW) = 26,227 lb/yr.

30 V. Tiangco, R. Hare, K. Birkinshaw, and M. Johannis, Emission Factors of Geothermal Power Plants in California, Geothermal Resources Council Transactions, v. 19, 1995, pp. 145- 151,

> Among these, the geology of the Medicine Lake area is similar to the Coso Hot Springs KGRA, except the Coso reservoir contains more noncondensible gases than Medicine Lake and represents the high end of expected emissions.[31] The average hydrogen sulfide emission factor for this area is 0.19 lb/MWhr. Using this factor, the hydrogen sulfide emissions from the Project could be as high as 83,100 lbs/yr,[32] or nearly six times more than claimed in the DEIR. (DEIR, page 4-229.) The DEIR does not contain any evidence to support its estimate, and it is contrary to published scientific data based on actual measurements in the same geothermal reservoir and other similar reservoirs.
>
> *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—H_2S Emissions Calculation Methods

Estimates of H_2S emissions from the proposed project were prepared from measured H_2S concentrations in the Glass Mountain KGRA geothermal fluids.

This comment refers to a 1996 paper published by members of the EIS/EIR project team for CalEnergy's Newberry Geothermal Pilot Project, a 33-MW dual-flash geothermal power plant proposed at the Newberry Volcano in central Oregon.[33] In that paper, the authors present emissions estimates for the project based on "an emission factor obtained from Medicine Lake, California" and "an emission factor from the Coso, California wellfield." The authors did not cite the source of the Medicine Lake data, did not explain how they developed an emission factor from them, and did not make any representation that their emissions estimates would be appropriate for any other power plant.

No actual measured emission factors are available from the Medicine Lake area, because there are no operating geothermal power plants in the area. Most likely, Houck and McClain used measured H_2S concentration data for the Glass Mountain resource—data similar to those from which the emissions estimates for the proposed project were developed. In order to develop emission estimates for the Newberry plant, the authors of the cited paper necessarily had to prepare calculations similar to those prepared for this EIS/EIR. Differences in plant design and abatement equipment logically would lead to different calculated emission factors. Also, emissions estimates would be different if the preparers of the Newberry EIS assumed a higher H_2S concentration would be present in the produced geothermal fluids at the Newberry project than were measured in the Glass Mountain geothermal resource (e.g., to introduce additional conservatism into their analysis).

Not all dual-flash geothermal power plants would have equal emission factors, even if they were all operated on steam from the same well field. The proposed Fourmile Hill power plant would include primary and secondary H_2S abatement (removal of H_2S from the noncondensible gas stream and from the condensate). The Newberry Pilot Project apparently will not include secondary abatement, and such abatement does not appear to be proposed for the Telephone Flat project at the time of this writing. All other things being equal, a plant without secondary abatement would produce higher H_2S emissions than the proposed Fourmile Hill plant.

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31 Bonneville Power Administration ("BPA") and U.S. Bureau of Land Management ("BLM"), Newberry Geothermal Pilot Project Draft Environmental Impact Statement, 1995, p. 4-23

32 H2S emissions using CEC dual-flash average emission factor for Coso KGRA = (0.19 lb/MWh)(49.9 MW)(365 days/yr.)(24 hr/day) = 83,054 lbs/yr.

33 Houck, J.E. and D.W. McClain, 1996. "Air quality assessments in support of the environmental impact statement (EIS), Oregon air contaminant discharge permit (ACDP) and Oregon energy facility siting council certificate (EFSC) for the Newberry geothermal Pilot Project." GRC Transactions 20:19-27.

The emission factor for CalEnergy's Coso projects, cited by Houck and McClain and by the commentor, is not necessarily relevant to the Fourmile Hill project. CalEnergy operates four dual-flash facilities in the Coso KGRA (the Navy 1, Navy 2, and BLM east and west plants). These facilities have had a number of problems over the years that have caused elevated emissions.[34] As CalEnergy has addressed the emissions problems over time, the emissions have continued to diminish. As reported by Tiangco, et al. in 1995, the H_2S emission factors were 0.54 lb/MWh (for the Navy 1 facility) and 0.031 lb/MWh (for the BLM facility).[35] [36] The planned future emission factors are 0.0016-0.0185 lb/MWh for Navy 1 and 0.0036-0.0356 lb/MWh for Navy 2. The emission factors reported as current in 1995 for the BLM facility, and those reported as "future" emission factors for the Navy 1 and Navy 2 facilities, are all equal to or less than the estimated emission factor for the proposed Fourmile Hill facility, despite the higher noncondensible gas content of the Coso KGRA (note: noncondensible gases include H_2S and CO_2). At PG&E's Unit 16 geothermal power plant in The Geysers KGRA, the H_2S emission factor is 0.013 lb/MWh.[37] These data indicate that the emissions estimated for the proposed facility are achievable in modern geothermal power plants.

When the first production well is constructed at the site, geothermal fluids from the resource underlying the Fourmile Hill project will be sampled. If the H_2S concentration in the fluids is greater than expected, Calpine will design a higher level of H_2S control into the plant, so that the emissions estimates presented in the EIS/EIR will not be exceeded.

The fluids produced from the resource would be injected, minus the noncondensible gases. In other geothermal resources where condensate is injected, such as the Dixie Valley, Nevada geothermal field, substantial decreases in noncondensible gas (including H_2S) concentration in the produced fluids have been observed over time. If this occurs at the proposed project, continually decreasing abatement efficiencies will be needed to maintain the H_2S emission rates at a constant level, or emission rates would decrease if the abatement efficiencies remain constant.[38]

Comments—H_2S Concentration in Geothermal Fluids

AG.195 Second, the DEIR states that for design purposes, it has been assumed that the hydrogen sulfide concentration in the production fluid is approximately 60 parts per million by weight ("ppmw"), although actual concentrations are expected to be lower. (DEIR, page 2-30.) However, emissions were apparently estimated assuming the hydrogen sulfide concentration in the geothermal fluid is only 8 ppmw. (DEIR, pages 4-241, F-11.) The higher design value should have been used to estimate emissions. Using the 60 ppmw value, the corresponding emissions would be 106,500 lbs/yr. Therefore, the DEIR's estimate is inconsistent with its own information about hydrogen sulfide concentrations.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.196 Finally, the DEIR suggests that Fourmile Hill fluid would be similar to that from nearby Glass Mountain, and actually suggests that hydrogen sulfide concentrations could be lower than assumed based on

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34 Mason, Thomas R., 1996. "CalEnergy's Coso operation: a substantial commitment to the environment pays off." GRC Bulletin, June.

35 Tiangco, Valentino, R. Hare, K. Birkinshaw and M. Johannis, 1995. "Emission factors of geothermal power plants in California." GRC Transactions 19:147-150.

36 Although the commentor refers to the Tiangco, et al. paper as "published by the California Energy Commission", it is not an Energy Commission publication. It was published in the GRC Transactions by the individual authors, who are staff employees of the Energy Commission.

37 PG&E, 1994. Air Toxics "Hot Spots" Emission Inventory Report for 1993.

38 Benoit, Dick, and P. Hirtz. "Noncondensible gas trends at Dixie Valley, Nevada." GRC Transactions 16:113-119.

preliminary Glass Mountain data. (DEIR, pages 2-30, 3-39.) However, other recent documents suggest that higher concentrations of hydrogen sulfide are present in Glass Mountain fluids than assumed in the DEIR. The DEIR assumes that 60 ppmw hydrogen sulfide would be present in the geothermal fluid. About 50 percent of the hydrogen sulfide is partitioned into the noncondensible gases (DEIR, page 2-30), and the noncondensible gases comprise about 0.25 percent of the fluid.[39] Therefore, the hydrogen sulfide concentration of the noncondensible gases would be about 1.2 weight percent. CalEnergy's operating plan for a 33 MW geothermal power plant in the Glass Mountain KGRA states that the hydrogen sulfide content of noncondensible gases from Glass Mountain ranges from 1 to 5 weight percent and averages 3 weight percent, or about a factor of two higher than assumed in the DEIR. (CalEnergy 1996, Table 1.) Hydrogen sulfide emissions would be about 36,000 lbs/yr[40] if these data were used to estimate emissions. This is consistent with the estimate presented above using Medicine Lake data.

In sum, it appears that hydrogen sulfide emissions have been substantially underestimated by the applicant. An EIR must evaluate a Project's maximum potential emissions, not a low estimate of what they might be. Standard practice and the available information support emissions in the range of 26,200 to 106,500 lbs/yr. The much lower emissions of 14,400 lbs/yr reported by the applicant are not supported by the record. Air quality and other analyses that rely on H_2S emissions should be revised using the higher emissions. As discussed below, these higher emissions would result in frequent exceedances of the State H2S standard and severe odor problems in a large area surrounding the proposed facility. The DEIR should be revised accordingly and recirculated for public review. The permit to operate for the facility should be limited to the emissions used to assess environmental impacts.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—H_2S Concentration in Geothermal Fluids

The expected H_2S content of the geothermal steam is 8 ppm or less. All aspects of the current power plant design are compatible with much higher H_2S content. This does not mean that higher H_2S content is expected; it reflects the fact that the plant will be constructed of durable, corrosion-resistant materials. Higher levels of H_2S than those proposed by Calpine could be accommodated with the appropriate technology, but this is not needed because the H_2S impacts are not significant. As discussed in the response to the previous comment, the expected H_2S content of the geothermal fluids was used appropriately to estimate emissions. Also as discussed in the previous responses, Calpine will design and construct more efficient abatement equipment if required by the Siskiyou County APCD to ensure that H_2S emissions do not exceed the emission rates presented in the Draft EIS/EIR.

Emissions of H_2S from the proposed project and CalEnergy's proposed Telephone Flat project are not expected to be equal. As discussed in the response to "Comment—H_2S Emissions Calculation Methods," the proposed project will include primary and secondary H_2S abatement, as well as backup H_2S abatement system that will control H_2S emissions in the event of a dual-turbine, bypass-unavailable upset. The proposed Telephone Flat plant, as proposed at the time of this writing, does not appear to include secondary abatement, and may not include a backup abatement system.

As discussed in response to "Comments—H_2S Emissions Calculation Methods", the H_2S emissions estimates for the proposed Fourmile Hill project are based on measurements of H_2S concentration in the geothermal fluid of the Glass Mountain KGRA, and the known performance of available primary and secondary abatement technologies. The estimated emission factor is readily achievable. It is within the range of those reported for other modern geothermal power plants, including dual-flash facilities. An appropriate level of abatement will be designed into the plant to ensure that H_2S emissions do not exceed the estimated emission rates presented in the Draft EIS/EIR.

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39 California Energy General Corporation ("CalEnergy"), Plan of Operations for Utilization and Disposal, 33 MW Geothermal Power Plant, Glass Mountain Geothermal Unit Area, August 15, 1996, p. 27.

40 Revised emissions using CalEnergy noncondensible gas hydrogen sulfide concentration = (14,400 lbs/yr.)(3%/1.2%) = 36,000 lbs/yr.

The partitioning of H_2S in the power plant condenser is expected to be 60 to 70 percent (meaning that 60 to 70 percent of the H_2S will remain in the gas phase, while 30 to 40 percent will dissolve in the condensate. The third sentence of the fourth full paragraph on page 2-30 of the Draft EIS/EIR has been revised to reflect this. In addition, the first sentence of the fifth full paragraph on page 2-30 has been revised as follows:

> "In the power plant condenser, ~~The remaining~~ 30 to 40 ~~50~~ percent of the H_2S present ~~flow would be~~ dissolved in the steam will be dissolved in the condensate~~;~~. The remaining 60-70% will enter the noncondensible gas treatment system (the primary abatement system), where 95% or more will be removed. The secondary abatement system will remove 75% or more of the H_2S dissolved in the condensate. ~~some of the condensate would be emitted from the cooling tower with the evaporative losses, and a portion would be injected back into the geothermal reservoir as cooling tower blowdown.~~"

Comment—H_2S-Related Corrosion

CB.2 I also noticed a great deal of corrosion of the various metal objects in the vicinity. *(Richard Dye)*

Response—H_2S-Related Corrosion

H2S emissions from the proposed project are not expected to cause significant corrosion in the project area because no facilities or equipment that could be affected by corrosion are located in the immediate vicinity of the proposed project and because the estimated ambient H2S concentrations are far below levels at which significant corrosion is likely to occur. Furthermore, the land adjacent to the proposed project site is free from industrial or other development that might be affected by H_2S emissions. Corrosive effects are therefore considered insignificant for this proposed project.

Comment—Boron Emissions

AG.197 Boron emissions also appear to have been substantially underestimated. Boron is present at high concentrations in reservoir fluids from the Glass Mountain KGRA. Regional Water Quality Control Board ("RWQCB") data indicate concentrations of boron in geothermal fluids from the Medicine Lake area range from 4.8 to 14.9 mg/L. (RWQCB 1982, 1989.)[41] U.S. Geological Survey ("USGS") data for thermal springs of the Modoc Plateau, California, and Klamath Falls, Oregon indicate boron concentrations range from 1 to 7.6 mg/L.[42] These concentrations are at the high end of the range found in geothermal waters from around the world. (Hartley 1978, page 24.) As discussed above, if geothermal fluid composition data are not available for the proposed Project, emission factors for other similar facilities should have been used to estimate emissions.

Boron emissions for two units at the Geysers have been published. (Lang et al., 1986, Table 1.) These data indicate that the boron emission factor for Unit 5-6 is 0.0025 lb/MWh and for Unit 13, 0.00038 lb/MWh. Using the average of these two factors, boron emissions from the Project would be 612 lbs/yr.[43] In comparison, the applicant estimated that boron emissions would only be 17.4 lbs/yr or 35 times lower.

The DEIR's analyses that rely on the applicant's unsubstantiated boron emission estimates, including the Medicine Lake deposition analysis and the vegetation assessment, should be revised using the higher emissions. As discussed below, these higher emissions would result in significant water quality impacts in Medicine Lake and would aggravate the already significant effect on vegetation. (Comments 8.a, 8.c, and 13.a.) The DEIR should be revised accordingly and recirculated for public review. The permit to operate for the facility should be limited to the emissions used to assess environmental impacts.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

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41 Central Valley Regional Water Quality Control Board, Inspection Report, Union Oil Company, Glass Mountain Geothermal, Medicine Lake, CA, Well 68-8, October 6, 1989; Letter from J.J. Beall, Phillips Petroleum Company, to D.C. Joseph, North Coast Regional Water Quality Control Board, Medicine Lake Well No. 44-33, October 4, 1982.

42 R.H. Mariner, T.S. Presser, and W.C. Evans, Geothermometry and Water-Rock Interaction in Selected Thermal Systems in the Cascade Range and Modoc Plateau, Western United States, Geothermics, v. 22, no. 1, 1993, pp. 1-15.

43 Boron emissions using average emission factor for The Geysers = (0.0014 lb/MWh)(49.9 MW)(365 days/yr.)(24 hr./day) = 611.97 lbs/yr.

Response—Boron Emissions

Boron emissions from the proposed facility are based on the measured concentration of boron in the Glass Mountain KGRA and conservative estimates of the performance of plant equipment. The proposed facility will have lower boron emissions than The Geysers Units 5 and 6, for a number of reasons.

In 1989, Unocal (then the unit operator) flow-tested well 68-8 in the Glass Mountain KGRA. (This test is the subject of the Central Valley RWQCB inspection report referred to by the commentor.) The produced fluids apparently were analyzed for chemical composition during that flow test. The collected brine was also sampled by Central Valley RWQCB personnel. Analysis of the sample collected by CVRWQCB indicated a boron concentration of 14.0 mg/l.[44] Data collected during a flow test of nearby well 31-17 were similar. The other data sources cited by the commentor indicate lower concentrations, but they are irrelevant because they were not collected from the geothermal fluids of the Glass Mountain KGRA. Calpine used a value of 18 mg/l in its emissions estimates. (Data recently published for the Telephone Flat project indicate boron concentrations in the Glass Mountain geothermal fluids are 10-12 mg/l, approximately 30-40% lower than this estimate.[45])

There are significant differences in the fate of nonvolatile components of dry steam resources (such as The Geysers) and liquid-dominated resources (such as the Glass Mountain KGRA) as they pass through a geothermal power plant. In a dry steam plant, solids are generally separated from the steam in a single separator. Any solids that are not removed at that point are carried through the turbine, eventually ending up with the condensate in the circulating water of the cooling tower. In the case of the proposed facility, there will be two flash stages of separation, each followed by a polishing separator. This will produce a much higher degree of separation between the steam and the liquids (including dissolved and suspended solids). As a result, a much higher fraction of the solids will be removed at the proposed facility than would be at a dry-steam plant, and the emission factors are not comparable. Calpine's emission calculations account for the known performance of the flash vessels and polishing separators to be used in the proposed power plant. These calculations have been provided to the commentor.

The Geysers Units 5 and 6, the source of the boron emission factors cited by the comment, is the oldest operating geothermal power plant in California. It was designed in the 1960s and went on line in 1971, a period when emissions control was given less attention than it is today, and the geothermal power production industry was less sophisticated. The proposed Fourmile Hill plant will be much more efficient than Geysers Units 5 and 6 in removing boron (and other solids) from the geothermal fluids, resulting in a lower boron emission factor.

The emissions of nonvolatile substances present in the geothermal fluids (dissolved and suspended solids) from the proposed plant are expected to be lower than most other single- or dual-flash geothermal power plants, as well. The use of polishing separators following the high pressure and low pressure flash tanks, and upstream of the plant

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44 It is not clear whether other materials were also collected in this sump, so chemical analyses of the sump fluids may not be representative of the geothermal fluids.

45 U.S. Department of Interior, U.S. Department of Agriculture, and Siskiyou County Air Pollution Control District, 1998. Telephone Flat Geothermal Development Project. Draft Environmental Impact Statement and Draft Environmental Impact Report. Table 3.2.1

silencer, as proposed by Calpine, would reduce "carryover" of geothermal brine (including the dissolved and suspended solids) to the turbine to levels much lower than most other dual-flash geothermal power plants. As a result, much less of the dissolved and suspended solids would be transferred to the steam condensate and ultimately to the cooling tower than in other dual-flash power plants. This would result in lower emissions factors (mass of emissions per unit energy generated, e.g. lb/MWh, or mass of emissions per mass of steam produced, e.g., lb/lb steam) for these substances than is typical of other dual-flash power plants.

As discussed in the response to "Comment—Support for Emissions Calculations," the cooling towers would have high-efficiency drift eliminators, which would reduce the emissions of boron present in the cooling tower drift to levels well below the conservative estimates presented in the Draft EIS/EIR.

Comments—Mercury Emissions

AG.198 Mercury emissions also appear to have been substantially underestimated. Mercury is present at high concentrations in reservoir fluids from the Glass Mountain KGRA. RWQCB data indicate that concentrations of mercury in geothermal fluids from the Medicine Lake area are 3 μg/L (RWQCB 1982), which is on the high end of the range normally found in geothermal waters. (Hartley 1978; Ellis 1978.)

As discussed above, if geothermal fluid composition data are not available for the proposed Project, emission factors for other similar facilities should have been used to estimate emissions. Mercury emission factors have been published in two separate studies. In the first, mercury emission factors were reported based on extensive field measurements and a mercury mass balance, for four geothermal units at two separate facilities, Cerro Prieto and The Geysers Units 3, 7, and 8. The factors are 2.2, 1.6, 0.70, and 0.66 grams per megawatt per day ("g/MW-day").[46] In the second study, mercury emission factors were reported for three geothermal power plants located at Wairakei (New Zealand), Broadlands (New Zealand), and The Geysers. The factors are 0.69, 0.96, and 1.10 g/MW-day,[47] comparable to those reported by Robertson et al. (1977). All of these emission factors are substantially higher than the factor used to estimate emissions from the Project, which is 0.0000047 g/MW-day,[48] even though mercury concentrations in the parent geothermal fluids are similar. The factor used by the applicant is simply not credible, and the DEIR provides nothing to support it.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.199 The applicant estimates that mercury emissions from the Project during normal operations, including short-term upsets, would be only 0.000188 lbs/yr. (DEIR, page 4-245.) This very tiny amount is inconsistent with the emission factors reported above and the substantial published information on mercury emissions from geothermal projects, which demonstrate that mercury is typically present in geothermal fluids and noncondensible gases at much higher concentrations than those represented by these tiny emission estimates.[49] Using the average of the seven independent measurements, 1.13 g/MW-day, mercury emissions from the Project would be 45 lbs/yr.[50] Even when using the lowest published

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46 D.E. Robertson, E.A. Crecelius, J.S. Fruchter, and J.D. Ludwick, Mercury Emissions from Geothermal Power Plants, Science, v. 196, 1977, pp. 1094-1097.

47 A.J. Ellis, Geothermal Fluid Chemistry and Human Health, Geothermics, v. 6, 1978, pp. 175-182.

48 Mercury emission factor used to estimate Project emissions = (0.000188 lbs Hg/yr.)(454 g/lb)/(49.9 MW)(365 days/yr.) = 4.69 x 10-6. The Project mercury emissions are from Table 4.13- 8, page 4-245 of the DEIR.

49 R. P. Hartley, Pollution Control Guidance for Geothermal Energy Development, U.S. EPA Report EPA-600/7-78-101, June 1978, Figure 24; D.E. Robertson, J. D. Ludwick, J.C. Evans, and C.L. Wilkerson, Characterization of Gases and Trace Elements at The Geysers Geothermal Power Plants and D.E. Robertson, J.D. Ludwick, J.C. Evans, and C.L. Wilkerson, Chemical Characterization of Gases and Trace Elements in Natural Hot Springs and Fumaroles in the Mono-Long Valley, California KGRA, In: Pacific Northwest Laboratory Annual Report for 1979 to the DOE Assistant Secretary for Environment, Part 4. Physical Sciences, Report PNL-3300, February 1980, pp. 87-97; D.E. Robertson, J.S. Fruchter, J.D. Ludwick, C.L. Wilkerson, E.A. Crecelius, and J.C. Evans, Chemical Characterization of Gases and Volatile Heavy Metals in Geothermal Effluents, Geothermal Resources Council Trans., v. 2, 1978, pp 579-582; J. Kestin, R. DiPippo, H.E. Khalifa, and D.J. Ryley, Sourcebook on the Production of Electricity from Geothermal Energy, Report DOE/RA/4051-1, March 1980, p. 802.

50 Mercury emissions using the average reported emission factor = (1.13 g/MW-day)(49.9 MW)(365 days/yr.)(1/454 g/lb) = 45.33 lbs/yr.

mercury emission factor of 0.66 g/MW-day, emissions of mercury from the Project would be 26 lbs/yr[51] or over 140,000 times higher than estimated by the applicant.

The DEIR's analyses that rely on the applicant's unsubstantiated mercury emission estimates, including the Medicine Lake deposition analysis and the health risk assessment, should be revised using the higher emissions. These higher emissions would result in significant water quality impacts in Medicine Lake, as discussed below. The DEIR should be accordingly revised and recirculated for public review. The permit to operate for the facility should be limited to the emissions used to assess environmental impacts.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Mercury Emissions

The "RWQCB data" cited by the comment are presented in a letter from Unocal to the Regional Water Quality Control Board, North Coast Region.[52] Attached to the letter are analytical data for groundwater samples collected from a temperature stratification test well (Well No. 44-33). These samples were not collected from the geothermal resource, but rather from shallower groundwater. Thus, these data are not indicative of mercury concentrations (or any other substance) in the Glass Mountain KGRA.

Research performed and published by Robertson, et al. indicates that mercury in liquid-dominated geothermal fluids partitions primarily into the steam at separation.[53] [54] For this reason, and because no measurements of mercury concentration in the separated steam or condensate of the Glass Mountain geothermal resource have been made, mercury emissions estimates for the proposed project have been revised. For purposes of the EIS/EIR analysis, it has been assumed that mercury will be present in the separated steam of the resource at a concentration equal to that measured in the steam of Calpine's West Ford Flat facility (0.0085 mg/kg). West Ford Flat mercury data were used because no measurements of mercury concentration in the gas phase of the geothermal fluids are available. Most likely, the mercury content of the Glass Mountain geothermal resource will be lower than at West Ford Flat, because The Geysers is a dry-steam resource with much higher noncondensible gas content than the Glass Mountain resource. The Westford Flat steam concentration of mercury may be considerably higher than the level at Fourmile Hill. It was further assumed that 100% of the mercury present would flash into the steam at the first stage of separation. (This assumption leads to maximum emissions because none of the mercury would be injected with the brine, but would instead pass through the turbine to the condenser.)

At the West Ford Flat facility, Calpine uses abatement equipment to remove mercury from the noncondensible gas before it enters the noncondensible gas treatment equipment (a Stretford system). This prevents mercury contamination of the sulfur cake produced in the Stretford system. The resulting mercury emission factor is 0.0045 g/MW-day, or 8.5×10^{-9} lb/lb steam.[55] Calpine would use a similar mercury abatement system at the proposed facility if emissions testing shows elevated mercury levels and it is necessary (as determined by the Siskiyou County APCD) to ensure that mercury emissions will not exceed the estimated rates presented here, or to prevent contamination of the sulfur cake. The determination of whether mercury abatement is

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51 Mercury emissions using lowest reported emission factor = (0.66 g/MW-day)(49.9 MW)(365 days/yr)(1/454 g/lb) = 26.48 lbs/yr.

52 Beall, Joseph J., 1982. Letter to D.C. Joseph, Executive Officer, California Regional Water Quality Control Board, North Coast Region re: Water sample analysis, Medicine Lake Strat Test No. 3, Siskiyou County, California. October 13.

53 Robertson, D.E., E.A. Crecelius, J.S. Fruchter, and J.D. Ludwick, 1977. "Mercury emissions from geothermal power plants." Science 196 pp. 1094-1097

54 Robertson, D.E., J.S. Fruchter, J.D. Ludwick, C.L. Wilkerson, E.A. Crecelius, and J.C. Evans "Chemical characterization of gases and volatile heavy metals in geothermal effluents." GRC Transactions 2:579-582.

55 Ellis, A.J. and W.A. Mahon, 1977. Chemistry and Geothermal Systems. Academic Press, New York. p. 287.

needed (and if so, what level of control) will be made based on the results of chemical analysis of the geothermal resource when the confirmation wells are completed. At the time of plant startup, source testing will confirm that mercury emission rates are as expected. The proposed mercury emission rates and abatement system (if needed) must be approved by the Siskiyou County APCD. Using the West Ford Flat emission factor (on a per-pound-of-steam basis) for normal operations and 100% emissions for upsets and flow testing, the revised estimated mercury emissions from the proposed project are 0.96 lb/yr., including upsets and well venting. The Draft EIR/EIS has been revised to reflect the new emissions estimates (see pages 4-244, 4-245, and F-12 through F-17).

The significance of mercury emissions from the proposed project was not evaluated individually. Rather, the potential health impacts of the emissions of all toxic pollutants from the proposed project were considered together. The significance of these emissions from the proposed project were assessed by estimating the resulting project contribution to long-term average concentrations of these substances in the ambient air. These estimated concentrations of toxic pollutants (including mercury concentrations based on the revised mercury emission rates) are presented in Table 32 of Appendix F, and are included in the calculation of chronic and acute hazard indices (Table 4.13-9 and Appendix F, Tables 36 and 37). As discussed in Section 4.13.8, Appendix F, Section 3.2, and in the response to comment AG.219 (under the response to "Comment—Hazard Characterization and Index"), the potential health impacts are not considered to be significant (It should be noted that mercury emissions contribute less than 1% each to the maximum estimated chronic and acute hazard indices).

The conclusion regarding potential health impacts is unchanged from the Draft EIS/EIR.

Comment—Arsenic, Fluoride, Sulfate, and Ammonia Emissions

AG.200 In addition to hydrogen sulfide, mercury and boron, it appears that the emissions of other toxic substances are also underestimated, including arsenic, fluorine, sulfate, and ammonia. Emission factors and reservoir fluid data for these and other toxic substances have been published for five geothermal power plants from around the world -- Cerro Prieto, Mexico; Wairakei and Broadlands, New Zealand; Larderello, Italy; and The Geyers, USA. (Ellis 1978; Robertson et al. 1980.)[56] Using these emission factors, Project emissions would be substantially larger than estimated in the DEIR.

The concentrations of toxic substances in reservoir fluids from the Glass Mountain KGRA are comparable to those used to estimate these emission factors. The concentration of arsenic in Glass Mountain fluids ranges from 5.1 to 6.6 mg/L (RWQCB 1982, 1989), which is at the high end of the range normally found in geothermal waters. (Hartley 1978, page 24; Ellis 1978, Table 3; Layton and Anspaugh 1981, Table IV.) Similarly, fluorine concentrations range from 5.9 to 15 mg/L in geothermal wells (RWQCB 1982, 1989) and from 1.4 to 5.4 mg/L in thermal and mineral springs in the area (Mariner et al. 1993, Table 1), well within the range normally found in geothermal resources. (Hartley 1978, page 24.) These data clearly indicate that the applicant has underestimated toxic emissions from the Project. The DEIR should be revised to provide accurate information and be recirculated for public comment. The permit to operate for the facility should be limited to the emissions used to assess environmental impacts. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

PH4.22 Concerned about release of arsenic, selenium, etc. from wells. *(Mount Shasta Public Hearing*

Response—Arsenic, Fluoride, Sulfate, and Ammonia Emissions

Emissions of arsenic, fluoride, sulfate and ammonia have not been underestimated. Please refer to the response to "Comments—Support for Emissions Calculations." The confidential measurements of chemical concentrations in the Glass Mountain geothermal fluids have been reviewed by the lead agencies. The estimated emissions of the substances cited in the comment presented in the EIS/EIR are based on these

56 D.W. Layton and L.R. Anspaugh, Health Impacts of Geothermal Energy, International Symposium on Health Impacts of Different Sources of Energy, June 22-26, 1981, UCRL-85334, Table IV.

measurements, and the specific design features of the proposed project. In developing the emissions estimates, Calpine used conservative estimates of the performance of emissions-reducing equipment (e.g., separators and cooling tower drift eliminators). The actual performance in reducing emissions is expected be better than the estimates used in preparing the emissions estimates, thus the emissions are likely to be lower than presented in the EIS/EIR.

Emission factors for the proposed facility, whether expressed as mass of emissions per unit energy generated (e.g., lb/MWh) or mass of emissions per mass of steam produced (e.g., lb/lb steam), are expected to be lower than most dry steam or flashing geothermal power plants. Please refer to the responses to "Comments—Calculation of H_2S Emissions" and "Comments—Boron Emissions" for further discussion.

The comment presents data from a number of references. Most of the references (e.g., Ellis 1978) present data for geothermal resources worldwide, but not from the Glass Mountain geothermal resource. Some of the references present chemical concentration data for mineral springs or groundwater in the project area, but not for geothermal fluids (e.g., Mariner et al., 1993). Other references cited by the comment are mischaracterized as to their source and content. For example, the upper end of the fluoride concentration range presented by the comment is from the reference cited as RWQCB (1982). This document was not prepared by the RWQCB and does not present any information about geothermal fluids. The reference is actually a letter from Unocal to the North Coast RWQCB presenting analyses of groundwater samples produced from a temperature stratification well. The well was completed above the geothermal resource, and no geothermal fluids were produced from it. The chemical analyses presented in that letter were for groundwater samples, not geothermal fluids.

The only reference cited by the comment that presents chemical concentrations for fluids produced from the Glass Mountain geothermal resource is cited as RWQCB (1989). In 1989, Unocal (then the unit operator) flow-tested geothermal exploration well 68-8. The produced fluids apparently were analyzed for chemical composition during that flow test. The collected brine was also sampled by Central Valley RWQCB personnel. Analysis of the sample collected by the Central Valley RWQCB indicated a fluoride concentration of 5.9 mg/l and an arsenic concentration of 6.0 mg/l. More recent data recently published for the Telephone Flat project indicated fluoride and arsenic concentrations in the Glass Mountain geothermal fluids of less than 1 mg/l. For the purpose of estimating arsenic emissions from the proposed project, Calpine assumed an arsenic concentration of 7.5 mg/l. This value is higher than the concentration measured by the CVRWQCB (1989), higher than the concentration reported in the Telephone Flat Draft EIS/EIR, and above the upper end of the range of concentrations presented by the comment. Thus, the arsenic emissions presented in the Draft EIS/EIR are higher than if any of these other values (including those presented in the comment) had been used, and are most likely overestimated.

The response to "Comments—Radioactive Elements, Fluorine, Bromine, Lithium, Strontium, Barium Emissions" discusses the bases for selecting the potentially toxic substances for which emissions from the proposed project, and associated concentrations in ambient air were estimated. The response to "Comments—Fluoride,

Bromine, Lithium, Barium and Strontium Emissions " discusses potential emissions of fluorine compounds from the proposed project.

Comment—Fluoride, Bromide, Lithium, and Strontium Emissions

AG.203 Very high concentrations of fluorine, bromine, lithium, strontium, and barium are present in geothermal fluids and emissions from geothermal plants. (Ellis 1978; Hartley 1978.) These substances are toxic to plants and would have effects comparable to or greater than those described in Comment 13.a for boron. They should have been included in the vegetation deposition analysis in the DEIR. (DEIR, page 4-89.) Some, most notably bromine and hydrogen fluoride, are also very toxic to humans at low concentrations and should have been included in the acute health risk assessment in the DEIR. (DEIR, pages 4-243, 4-244.) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Fluoride, Bromide, Lithium, and Strontium Emissions

The Ellis and Hartley references cited do not include any information about fluids of the Glass Mountain geothermal resource. Rather, they present chemical data from a number of other geothermal resources.

While the concentrations of some substances in the geothermal fluids might be considered very high for some uses (e.g., drinking water), the only use of the geothermal fluids that is proposed is power production in the proposed power plant. The estimated emissions from the proposed project, as well as the estimated potential impacts on ambient air quality, surface water quality and vegetation, are based on the expected chemical composition of the Glass Mountain geothermal resource, which has been developed primarily from measured concentrations of these substances in the fluids of the Glass Mountain resource. The results of the analyses presented in the Draft EIS/EIR indicate that the substances present in the fluids, when used as proposed, are not expected to produce significant impacts.

Fluoride has been detected in geothermal fluid samples produced from several of the wells in the area. Data recently published for the Telephone Flat project indicate fluoride concentrations of 0.8 to 0.9 mg/l in the geothermal fluids. Ellis and Mahon (1975) report that for near-neutral-pH geothermal waters, total fluoride is present mainly as the fluoride ion. Data presented by these authors indicate that the ratio of hydrogen fluoride to total fluoride is on the order of 1:10,000, indicating that hydrogen fluoride concentrations in the geothermal fluids are negligible.

Analyses of geothermal fluids available to Calpine indicate that bromide has not been detected in the fluids. This is confirmed by chemical analyses recently published for the Telephone Flat project. Analyses of geothermal fluids available to Calpine do not include lithium, strontium, or barium. Data published for the Telephone Flat project indicate that lithium is present at concentrations of 2-3 mg/l, and strontium at 0.025 mg/l. No data appear to be available for barium concentrations. Given the expected negligible concentrations of hydrogen fluoride in the Glass Mountain geothermal fluids, there is no need to include this substance in the air quality impact analysis. It would not have been possible to include barium in the assessment of potential health effects, because it is not a known or suspected carcinogen and neither the Cal-EPA nor the U.S. EPA has developed a Reference Exposure Level for barium. The effects of fluoride, bromide, lithium and strontium are discussed in the responses to comments in the Vegetation Section of this document.

For a discussion of potential effects of power plant emissions on vegetation, please see the responses to "Comments—Effects of Emissions on Vegetation" in the Vegetation Section.

Comment—Emissions of Toxic Substances, Including Radionuclides

AG.111 The EIS/EIR also failed to analyze emissions of many toxic substances. (Ex. A, Comment 1.g.) These include radioactive elements (e.g., uranium, radium, radon), flourine, bromine, lithium, strontium, barium, which are typically found in geothermal fluids and, consequently, emitted from geothermal plants. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

Response—Emissions of Toxic Substances, Including Radionuclides

The potential adverse health effects associated with air contaminants can only be evaluated for substances for which quantitative health-based criteria are available (that is, for substances for which concentrations can be estimated and for which appropriate quantitative toxicity data are available). Emissions were estimated for those potentially toxic air pollutants that are expected to be emitted from geothermal power plants and for which the Cal-EPA has prepared a Cancer Potency Factor (CPF), Unit Risk Factor (URF) or a Chronic or Acute Reference Exposure Level (REL), and the value is listed in CAPCOA's *Air Toxics "Hot Spots" Program Revised 1992 Risk Assessment Guidelines*.[57] There are no applicable CPFs, URFs, or RELs for uranium, radium, strontium or barium. California's Office of Environmental Health Hazard Assessment has not developed these values. Although the Air Toxics "Hot Spots" program applies only to existing sources, the toxicity data were prepared by Cal-EPA based on existing toxicological data, and after reviewing lists of potentially toxic air pollutants prepared by other agencies. These lists were used because they include substances that may have toxic effects (at sufficient exposures) and for which the toxicity data needed to quantitatively assess potential health effects are available.

Many of the substances for which Cal-EPA has published a CPF, URF or REL are also listed pursuant to the California's Proposition 65 (the Safe Drinking Water and Toxic Enforcement Act of 1986) as chemicals "known to the State to cause cancer or reproductive toxicity." Two substances (cobalt and antimony) that may be emitted from the proposed project, but for which the Cal-EPA has not published a CPF, URF or REL, are listed as chemicals known to cause cancer.[58] Because the quantitative toxicity data needed to estimate the associated cancer risk or hazard indices for cobalt and antimony are not available, they could not be included in the quantitative assessment of potential health risk. However, daily and annual emissions estimates are presented for these substances in the EIS/EIR.[59] Please note that the response to "Comment—Fluoride, Bromide, Lithium and Strontium Emissions" discusses fluorine and bromine emissions from the proposed project. The response to "Comment—Radon Emissions" discusses the effects of radon emissions from the project.

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57 Id., pp. III-25, III-41, and III-47.

58 Antimony oxide, cobalt oxide, and cobalt metal powder are listed as chemical known to the State to cause cancer. Other forms of these substances are not listed.

59 Cobalt has not been detected in the fluid samples for which Calpine has analytical data, nor in the samples reported by CalEnergy in the Telephone Flat Project DEIS/DEIR.

Comments—Radioactive Elements and Chlorine Byproducts Emissions

AG.112 The EIS/EIR also failed to analyze emissions of chlorination byproducts (e.g., chloroform), which are used in, and emitted from, cooling towers. (See Ex. A, Comment 1.g. for more detail.) These emissions should be analyzed and included in a recirculated EIS/EIR, along with appropriate mitigation measures. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.201 The toxic emission inventory for the Project, besides underestimating emissions as discussed above, excludes a number of substances that will cause or contribute to significant environmental impacts. These substances are radioactive elements, fluorine, bromine, lithium, strontium, barium, and chlorination byproducts. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.204 Chlorine would be added to the circulating water flow of the cooling tower to control the growth of algae. (DEIR, page 2-29.) It is well known that the chlorination of circulating water produces significant amounts of trihalomethanes, including chloroform, bromodichloromethane, dibromo-chloromethane, and bromoform as well as chlorine. These compounds are emitted from cooling towers in the drift and by evaporation. About 20 to 30 percent of volatile compounds such as chloroform which are present in the circulating water are stripped from the cooling water on each pass through the tower.[60] *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.205 None of these substances was included in the toxic emissions inventory for the Project nor included in the environmental analyses for water quality, vegetation, and human health impacts. Emissions of these substances should be estimated and used to revise the Medicine Lake deposition analysis, the vegetation deposition analysis, and the health risk assessment. The EIR should be revised and recirculated for review. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Radioactive Elements and Chlorine Byproducts Emissions

Trihalomethanes, such as chloroform, can be formed in chlorinated water in presence of some organic compounds. However, the cooling tower at the proposed project would have a low potential for trihalomethane formation, due to the very low concentration of organic compounds in the geothermal fluids, the steam condensate, and the ambient air. While emissions from cooling towers in highly industrialized areas may, in aggregate, contribute significant quantities of trihalomethanes to the ambient air, trihalomethane emissions from individual cooling towers have not been identified to pose a significant health risk. Discussion of the emission of radioactive elements are discussed in the response to "Comments—Radioactive Elements Fluorine, Bromine, Lithium, Strontium, Barium," above.

Comments—Radon Emissions

AG.202 Radioactive elements are generally found in geothermal fluids. These include uranium and thorium isotopes, radium, and radon. Radon, a radioactive gas and one of the products of radium decay, is the most significant. A U.S. EPA survey of geothermal waters in the western U.S. reported a range of 13 to 14,000 picocuries per liter ("pCi/L") with a median of about 510 pCi/L.61 A Battelle Pacific Northwest Laboratory study reported concentrations of 280 to 27,800 pCi/L in noncondensible gases from six geothermal projects in California and concluded that essentially all of the radon in the noncondensible gases is released to the atmosphere. (Robertson et al., 1978.) Another study reported radon concentrations of 10 to 1,262 pCi/L in noncondensible gases from geothermal wells in Imperial Valley, California and Louisiana.62 In fact, radon is so common in geothermal systems that it is used as a steam tracer63 and in exploration.64 Radon is a widely recognized carcinogen65 and should have been

60 J.H. Smith, J.C. Harper, and Bruce C. DaRos, Atmospheric Emissions from Electric Power Plant Cooling Systems, In: R.L. Jolley et al. (Eds.), Water Chlorination. Environmental Impact and Health Effects, vol. 4, Ann Arbor Science, 1981; J.C. Harper, J.H. Smith and B.C. DaRos, Airborne Emissions from Power Plant Cooling Towers, EPRI Report EA-4706, August 1986; M. B. Rogozen, H. E. Rich, and M. A. Guttman, Sources and Concentrations of Chloroform Emissions in the South Coast Air Basin, CARB Report, April 1988.

61 M.F. O'Connell and R.F. Kaufman, Radioactivity Associated with Geothermal Waters in the Western United States, Technical Note ORP/LV-75-8A, U.S. EPA, March 1976.

62 J.D. Ludwick, D.E. Robertson, J.S. Fruchter, and C.L. Wilkerson, Analysis of Well Gases from Areas of Geothermal Power Potential, Atmospheric Environment, v. 16, no. 5, 1982, pp. 1053-1059.

63 Stanford University, Radon as an In Situ Tracer in Geothermal Reservoirs, EPRI Report AP-5315, August 1987.

included in the cancer risk analysis in the DEIR. (DEIR, page 4-243.) The inclusion of radon would substantially increase cancer health risks over those reported in the DEIR.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

PH4.21 Radon emissions and contamination should be addressed in the EIS/EIR. *(Mount Shasta Public Hearing)*

PH5.34 And they found this in oil wells and drilling that they have come up with nonionizing radiation, which is basically radon. What's the possibility of that occurring, because you're going approximately the same depth as oil, right, or close, or maybe even deeper? *(Medicine Lake Public Hearing)*

Response—Radon Emissions

In response to comment AG.202, because geothermal fluids often contain radon (at less-than-significant levels), the emissions estimates, estimated ambient concentrations, and dispersion modeling, were revised to include radon. Radon (Rn^{222}), an inert gas, is a member of the U^{238} decay chain. Products of radon decay are referred to as "radon daughters." Radon occurs naturally and is emitted from the soil surface throughout the world. Radon concentrations in the atmosphere are generally relatively low. However, because the ground surface (and some building materials) are sources of radon, concentrations of the gas can build up in confined spaces of buildings, especially basements and crawlspaces. Due to differences in geology, soil porosity, and building construction, the range of concentrations that has been measured in buildings is quite large.

In the environment, radon remains in equilibrium (or near-equilibrium) with radon daughters. Although radon is the member of this decay chain that is most often measured, radon and radon daughters always occur together. Radon concentration measurements are treated as indicators of radon daughter concentrations. The health hazard associated with radon (and radon daughters) is ionizing radiation, which makes it carcinogenic. The hazard of radon (and radon daughter) exposure in buildings (especially residences, where exposures may be nearly continuous) prompted the U.S. EPA to recommend that corrective measure be taken to reduce the concentrations of these substances if radon concentrations in buildings exceed four picocuries per liter of air (pCi/l).

The emissions estimates for radon are now included in Tables 4.13-7 and 4.13-8, and in Tables 1, 2, 3, 4, and 5 of Appendix F. The estimated annual average concentrations of radon are presented in Table 32 of Appendix F.

A discussion of the potential health impacts of radon emitted from the project has been added to the end of Appendix F, Section 3.2. The maximum estimated radon concentrations are more than 1,000 times below the level at which the U.S. Environmental Protection Agency recommends corrective measures, thus radon emissions from the proposed project are not expected to have a significant impact.

Please refer to the response to "Comments—Fluoride, Bromide, Lithium and Strontium Emissions" for a discussion of the other substances mentioned in this comment.

Comments—Reactive Organic Gases/Volatile Organic Compounds

AG.120 For example, the EIS/EIR does not include any analysis of volatile organic compounds (VOCs). (Ex. A, Comment 5.b.) VOCs are a criteria pollutant, and the analysis must provide information about the Project's potential to emit them. Construction of the Project will include use of drill rigs which are powered by stationary diesel engines. Such engines have the potential to emit VOCs, and those

64 J.C. Witcher, Radon Soil-Gas Surveys with Diffusion-Model Corrections in Geothermal Exploration, Geothermal Resources Council Transactions, v. 15, 1991, p. 309.

65 R.F. Jostes, Genetic, Cytogenetic, and Carcinogenic Effects of Radon: A Review, Mutation Research, v. 340, 1996, pp. 125-139.

emissions should be quantified, along with any other VOC emissions from construction or operation of the Project. According to Dr. Fox, the Project would emit substantial quantities of ozone precursors. (Ibid.)

These errors and omissions should be remedied and a revised analysis of impacts and mitigation measures included in a recirculated EIS/EIR.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.213 Ozone is a criteria pollutant. It is often characterized and evaluated as reactive organic gases, or ROG, which are converted into ozone in the atmosphere. ROG must be included in emission inventories. Emissions of ROG were not included in the criteria pollutant emissions inventory in Table 4.13-3 and should have been. Substantial quantities of ROG would be emitted by the Project. During construction, ROG would be emitted by construction equipment such as crawler tractors, scrapers, graders, backhoes, and trucks[66] and the drill rigs. (AP-42, page 3.4-5.) During operation, it would be emitted by drill rigs used for infill and other drilling, the power plant backup generator, the cooling tower, and vent silencer. ROG emissions from the latter two sources are included in Appendix F and total 3,283 lbs/yr. (DEIR, page F-14.) U.S. EPA emission factors exist for ROG from all of these sources. The EIR should be revised to include a complete ROG emission inventory and an evaluation of the significance of these emissions.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Reactive Organic Gases/Volatile Organic Compounds

Volatile organic compound (VOC) emissions are not presented in the Draft EIS/EIR because VOCs are not a criteria pollutant. The Federal standard for non-methane hydrocarbons was rescinded in 1983. Concentrations of VOCs were not estimated in ambient air, because there is no ambient air quality standard with which to compare them.

Because there are Federal and state ambient air quality standards for ozone, it is a criteria pollutant. However, the formation of ozone is a complex process involving reactions between precursor substances such as organic gases and nitrogen oxides in the presence of sunlight. Emissions of ozone precursors from a single source can increase or decrease downwind ozone concentrations, or have virtually no effect, depending on the type emitted, the emission rates, ambient temperature and sunlight intensity, and the background concentrations of a number of pollutants. For this reason, ozone impacts and control strategies are assessed on regional basis, using complex numerical models with extensive input data requirements. Such studies are extremely time-consuming and expensive, in large part due to the effort involved in developing the required estimates of the temporal and spatial distribution of meteorological variables and anthropogenic and biogenic pollutant concentrations for an entire region. It is not possible or feasible to determine the effect of a single source on ambient ozone concentrations.

The statement that "ROGs are converted to ozone in the atmosphere" is incorrect. ROGs are not converted to ozone, although they participate in many of the reactions that may lead to the formation of ozone under proper conditions.

ROGs are not criteria pollutants. There is no requirement for an EIS or EIR to include estimates of ROG emissions, and there would be no meaningful way to assess the significance of those emissions, if such estimates were included.

66 U.S. EPA, Nonroad Engine and Vehicle Emission Study – Report, Report 21A-2001, November 1991, Table 2-07.

AIR QUALITY IMPACTS

Comments—General Air Pollution

U.17 The air quality within the Glass Mountain KGRA is excellent, only marred by minimal road dust. The geothermal developments will bring an array of new air pollutants, including maximum construction road dust conditions. But road dust is the least of our concerns.
(Jane and Rob Painter, Medicine Lake Citizens for Quality Environment)

BH.6 The Draft EIS/EIR goes on to say that the Calpine project will add significant dust and adversely effect air quality. *(Richard S. Cimino)*

CH.3 I also object to an industry that would release hydrogen sulfide gas into the air or heavy metals into the ground and/or water in an area of natural forest beauty, a clear, unpolluted lake and clean air.
(Elizabeth V. Farioletti)

DU.1 My family and have been enjoying Medicine Lake since 1960. The Forest service has been doing a fine job of repairing the unsightly roads and cleaning up the campgrounds and old dumps in the area it is truly a beautiful place to enjoy.

This is why I can't understand the current proposal to put power plants in such a pristine area. Clean air will be polluted with poisons, *(Charles B. Jones)*

FP.19 The Medicine Lake Highlands currently experiences exceptional air quality. There are no industrial users in the area, limited vehicular traffic and minor smoke exhaust from the two local campgrounds. We are concerned about the effect of emissions from the plant on the air quality and the possible number of plant upset conditions. *(Eric T. Nelson and Martha Spencer)*

GP.6 It will generate significant air pollution with machinery, compounds in the steam given off and chlorine.
(Fred L. Rinne)

HD.12 Additionally, the report states that wind blows from the project area towards Medicine Lake about 11 percent of the time; however, the effects of dust blowing to Medicine Lake was not evaluated.
(Amanda Spencer)

HT.8 Another reason I object to this project is that there are so many unknowns. How much air pollution will occur over the lake? *(Louise Thompson)*

PH2.4 And like I say, there's a statement in here that the wind does not affect it, but wind does blow across the lake, which is generally in the evening; blows from north to south coming right down that canyon where you propose the power lines. *(Klamath Falls Public Hearing)*

PH5.9 Another reason I object to this development is that there's so many unknowns. How much air pollution will occur over the lake? *(Medicine Lake Public Hearing)*

Response—General Air Pollution

However, high particulate matter concentrations in the project area can and do occur during forest fires and prescribed burns. Relatively high particulate matter concentrations occur throughout the air basin and elsewhere in the immediate vicinity of unpaved roadways during dry periods.

Section 4.13 of the EIS/EIR presents the estimated impacts of the proposed project on ambient air pollutant concentrations. The results of the analyses indicate that, on some days during the construction period, the project may have a significant impact on airborne particulate matter concentrations in the immediate vicinity of the construction activities. For all other pollutants, however, the analysis concludes the project's effect will be less than significant. Mitigation measures are designed to reduce project effects.

In addition, the impacts of project emissions on pollutant concentrations at Medicine Lake are presented in Tables 4.13-2 (page 4-233), 4.13-4 (page 236) and Tables 19 through 32 of Appendix F (pages F-31 through F-47). The impacts of project dust emissions are included in the estimated PM_{10} concentrations presented in Tables 4.13-2, and Tables 19, 20 and 21 of Appendix F. The projected air quality impacts due to dust at Medicine Lake would be less than significant. For further discussion of the potential effects of air emissions on Medicine Lake, please refer to the responses to "Comments—

General Depositional Effects on Surface Waters" in the Hydrology Section of this chapter.

Comments—PM_{10} Impacts

AG.113 The EIS/EIR incorrectly concluded that the Project's emissions of particulate matter ("PM_{10}") would not cause a significant impact on ambient air quality. (Ex. A, Comment 2.) This was based on two errors - underestimating the Project's emissions, and applying the wrong significance standard. According to Dr. Fox, when the Project's PM_{10} emissions are calculated correctly, they indicate that the Project will cause exceedance of the ambient air quality standards up to 25% of the time. (See Ex. A, Comment 2 for further discussion.) The EIS/EIR's PM_{10} analysis should be corrected and this significant impact addressed with appropriate mitigation. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.206 The DEIR estimates the increase in ambient concentrations of particulate matter less than 10 microns in size ("PM_{10}") due to Project emissions and concluded that impacts were not significant because the increment plus background was less than air quality standards. (DEIR, pages 4-232 to 4-234.) However, the calculations were done incorrectly. When the errors are corrected, the impacts are significant.

Air quality standards must be met everywhere at all times, not simply "on average" or at sensitive receptors. To determine compliance with standards, the maximum increase in concentration from an emission source must be estimated using a grid as discussed in Comment 1.a and added to the maximum background concentration. The DEIR apparently added the incremental concentration to the average background concentration instead of the maximum background concentration. When maximum background concentrations are used, which is the correct procedure, the Project's PM_{10} impacts are significant.

Ambient PM_{10} data collected by the Siskiyou County Air Pollution Control District ("SCAPCD") at four stations in the Project area are included in Attachment A. The maximum estimated 24-hour PM_{10} increments occur at the FR 49 receptor. They are 20.5 $\mu g/m^3$ during the first year of construction, 18.0 $\mu g/m^3$ during the third year of construction, 17.0 $\mu g/m^3$ during worst-case plant upset, and 16.5 $\mu g/m^3$ during normal operation while one well is being drilled. (DEIR, page F-31.) The PM_{10} ambient air quality standard of 50 $\mu g/m^3$ would be exceeded when these increments are added to the highest ambient PM_{10} concentrations measured at each of these stations. For example, the ambient air quality standard of 50 $\mu g/m^3$ would be exceeded during the first year of construction up to 19 percent of the time based on the power plant site, up to 25 percent of the time based on the Medicine Lake headquarters station, up to 29 percent of the time based on the Medicine Lake station, and up to 2 percent of the time based on the Lava Beds station. Violations would also occur during the third year of construction, worst-case plant upset, and normal operation with one well being drilled.

In sum, the PM_{10} analyses in the DEIR demonstrate that the Project will have a significant impact on ambient air quality during the first and third years of construction, during upset conditions, and during normal operations when one well is being drilled. This is a significant impact that must be mitigated. The impacts described here would be proportionately larger if PM_{10} emissions were larger than those used in the DEIR. This could occur, for example, if emissions are underestimated (Comments 4 and 5.c), or additional units were constructed in this general area. The EIR should be revised to include appropriate mitigation for this significant impact and recirculated for public review.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—PM_{10} Impacts

Contrary to comment AG.113, the Draft EIS/EIR on Page 4-235 states that fugitive PM_{10} (dust) emissions associated with construction activities have the potential to cause localized exceedances of the California 24-hour PM_{10} standard, and are thus considered to be a potentially significant impact. The 25% frequency of exceedance of the California 24-hour PM_{10} standard asserted in this comment is an unreasonable exaggeration of the project's likely impacts. The commentor apparently calculated this by assuming that the project's maximum estimated impact would occur daily. This inappropriately overstates the frequency of potential exceedances of the PM_{10} standard.

The Draft EIS/EIR did not conclude that project impacts on ambient PM_{10} concentrations are not significant for all phases of the project. Section 4.13.1 (pages 4-228 through 4-235) presents the effects of construction PM_{10} emissions. The conclusion of the section (page 4-235) states that the level of significance after mitigation is indicated as "*significant and unavoidable* on a short-term basis" (emphasis added).

The significance of the impact of PM_{10} emissions after plant startup were assessed by adding the maximum estimated PM_{10} concentrations associated with plant operation under normal conditions, worst-case upset conditions (a dual-turbine upset, with the turbine bypass unavailable), well drilling, well venting at one or two well pads, and many combinations of these activities to typical background PM_{10} concentrations. In all, 26 different scenarios for operation after plant startup were evaluated. The scenarios evaluated are presented in the following table.

Scenarios Included in Modeling of Maximum 24-Hour Average PM_{10} Impacts*

Normal plant operation	Well drilling on pad P-3 during a dual-turbine, bypass-unavailable plant upset	Well drilling on pad P-5 and well venting on pad P-5 during a dual-turbine, bypass-unavailable plant upset
Dual-turbine, bypass-unavailable plant upset	Well drilling on pad P-4 during a dual-turbine, bypass-unavailable plant upset	Well drilling on pad P-5 and well venting on pads P-1 and P-5 during a dual-turbine, bypass-unavailable plant upset
Well drilling on pad P-1 during normal plant operation	Well drilling on pad P-5 during a dual-turbine, bypass-unavailable plant upset	Well drilling on pad P-4 and well venting on pad P-4, during a dual-turbine, bypass-unavailable plant upset
Well drilling on pad P-2 during normal plant operation	Well drilling on pad P-1 and well venting on pad P-1 during a dual-turbine, bypass-unavailable plant upset	Well drilling on pad P-4 and well venting on pads P-1 and P-4 during a dual-turbine, bypass-unavailable plant upset
Well drilling on pad P-3 during normal plant operation	Well drilling on pad P-1 and well venting on pads P-1 and P-2 during a dual-turbine, bypass-unavailable plant upset	Well drilling on pad P-4 and well venting on pads P-4 and P-5 during a dual-turbine, bypass-unavailable plant upset
Well drilling on pad P-4 during normal plant operation	Well drilling on pad P-1 and well venting on pads P-1 and P-5 during a dual-turbine, bypass-unavailable plant upset	Well drilling on pad P-3 and well venting on pad P-3 during a dual-turbine, bypass-unavailable plant upset
Well drilling on pad P-5 during normal plant operation	Well drilling on pad P-2 and well venting on pad P-2 during a dual-turbine, bypass-unavailable plant upset	Well drilling on pad I-3 and well venting on pads P-4 and P-1 during a dual-turbine, bypass-unavailable plant upset
Well drilling on pad P-1 during a dual-turbine, bypass-unavailable plant upset	Well drilling on pad P-2 and well venting on pads P-2 and P-5 during a dual-turbine, bypass-unavailable plant upset	Well drilling on pad I-3 and well venting on pad P-4 and P-5 during a dual-turbine, bypass-unavailable plant upset
Well drilling on pad P-2 during a dual-turbine, bypass-unavailable plant upset	Well drilling on pad P-2 and well venting on pads P-2 and P-1 during a dual-turbine, bypass-unavailable plant upset	

* All scenarios presented in the table include fugitive dust emissions from on-site vehicle traffic.

Table 19 of Appendix F (page F-31) presents the estimated maximum impact of project emissions on ambient PM_{10} concentrations. After plant startup, Calpine expects that the plant will operate normally about 99% of the time. The maximum estimated PM_{10} impact during normal plant operation is just over 1 $\mu g/m^3$, and this would occur under worst-case meteorological conditions. Under more favorable meteorological conditions, the impact would be less.

Plant upsets are expected to be rare events, occurring about one percent of the time or less over the life of the plant. Even during these occurrences, plant PM_{10} emissions would be well-controlled, because the flash vessels and separators would remain on-line. The maximum impact under these circumstances and worst-case meteorological conditions is estimated to be just under 4 $\mu g/m^3$.

The maximum estimated PM_{10} impact would occur during the very unlikely event of a dual-turbine plant upset concurrent with the venting of two wells and the drilling of an infill well (during worst-case meteorological conditions). The expected frequency of occurrence of such an upset is much less than one-hundredth of one percent, and the associated estimated maximum PM_{10} impact is about 17 $\mu g/m^3$. The likelihood of this occurring (if at all) simultaneously with worst-case meteorological conditions is nil.

Drilling a single infill well would take about six weeks. This activity is expected to occur no more than once per year, and will probably occur in less than half of the years of plant operation. Thus, during years that infill wells are drilled, the activity would occur over about 10% of the year. When drilling at well pad P-1 coincides with normal plant operations, the estimated maximum PM_{10} impact (under worst-case meteorology) would be similar to that estimated for a worst-case upset concurrent with well drilling, about 17 $\mu g/m^3$. (The impact under more favorable meteorological conditions would be less, and the maximum impact associated with drilling at other well pads would be considerably less under any meteorological conditions.)

All of the maximum PM_{10} impacts cited above are estimated for the worst-case meteorological conditions, at the maximally-impacted receptor. Review of the estimated annual average PM_{10} impacts provides some indication of what typical PM_{10} impacts would be. Appendix F, Table 20 provides these estimates.[67] It may be seen that the highest estimated average impact is about 0.36 $\mu g/m^3$, and this only at the receptor located within 200 meters of the plant.

The comment has attempted to estimate the maximum PM_{10} concentrations in the project area by adding the *maximum* concentration recorded by the SCAPCD to the *maximum* estimated PM_{10} impacts presented in the EIS/EIR. This assumes that the maximum project impact would occur simultaneously with the maximum PM_{10} concentrations in the project area. Although *possible*, this is very unlikely. Maximum project impacts could only occur during the simultaneous occurrence of the worst-case project emissions *and* worst-case meteorology. Each of these events individually is expected to occur during a small percentage of the time, and the frequency of their combined occurrence is expected to be very low. A meaningful estimate of the frequency of occurrence of two or more infrequent event can only be made when the expected frequency of occurrence of each event is correctly accounted for in the calculation of the expected frequency of their simultaneous occurrence.[68]

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67 Due to the typical frequency distribution of air pollutant concentrations, it is usually the case that the most frequent concentrations are *less* than the average concentrations, thus the most likely PM_{10} impact at any randomly-selected time is likely to be less than the values indicated in Table 20.

68 For statistically *independent* discrete events, the expected frequency of their joint occurrence is equal to the product of their individual frequency of occurrences. This case is considerably more complicated, because the events are probably not statistically independent and because there are an indefinite number of combination of background concentrations and project impacts that

The Northeast Plateau Air Basin is a nonattainment area for the California PM_{10} standard, meaning that the standard is exceeded at times. The maximum PM_{10} concentrations occurring in the project vary considerably from year to year. For instance, the maximum PM_{10} concentrations measured at Lava Beds National Monument (the nearest permanent PM_{10} monitoring location) in 1994, 1995 and 1996, respectively, were 34, 26 and 188 $\mu g/m^3$ (micrograms per cubic meter), respectively. Less than 1 percent of the samples exceeded the PM_{10} standard, and about 3 percent of the samples exceeded 30 $\mu g/m^3$. For the entire Northeast Plateau Air Basin, the average proportion of PM_{10} samples per year that exceeded the California PM_{10} standard during the period 1988-1996 was 6.5 percent. The only monitoring stations in the Northeast Plateau that were active for this entire period were located in Yreka and Alturas. As these stations are in much more heavily populated areas than the Medicine Lake Highlands, they may not accurately represent the frequency of occurrence of PM_{10} exceedances near the proposed project site.

Some of the highest PM_{10} concentrations in the project area are expected to occur when forest fires are active in the air basin or upwind areas.[69] In 1996, a 24-hour average PM_{10} concentration of 188 $\mu g/m^3$ was measured at the Lava Beds monitoring station during a prescribed burn within the park boundary, and this was the highest value measured in the Northeast Plateau Air Basin during the entire 1988-1996 period.[70] During these unusual events, the estimated maximum PM_{10} impact associated with normal operation of the project or with project upsets would not be a significant contribution to the total PM_{10} concentration. The PM_{10} emissions associated with drilling an infill well could contribute significantly to background PM_{10} levels in a small area near the source *if* well drilling, unusually high background PM_{10} concentrations, and worst case meteorology coincided. This combination of events is extremely unlikely.

Concerning emissions offsets, the Siskiyou County APCD requires that new stationary sources provide mitigation in the form of emissions offsets for any net emission increase of any pollutant for which a national ambient air quality standard was exceeded three discontinuous times within the district within the three years immediately preceding the date when the application for a permit to construct was filed (Rule 6.1-E1). Conversely, offsets are not required for new stationary sources if there have been not more than three exceedances of the national standard in any of the preceding three years. Construction and operation of the Fourmile Hill geothermal plant in the district is expected to result in net emissions increases of PM_{10}. However, because there have not been more than three exceedances of the national PM_{10} standard within the district in the preceding three years, the applicant, Calpine, will not be required to provide offsets.

could add up to more than 50 g/m^3 *if they occurred simultaneously*. The simple calculation offered by the commentor does not account for the probability distribution of the project's impacts, thus the estimated frequency of occurrence of exceedances of the PM_{10} standard are inco

69 Griffin, Patrick, 1998. personal communication. January 27.

70 The second and third highest 24-hour average PM_{10} concentration measured at Lava Beds during the entire three- year period for which data are available were 34 and 30 g/m^3, respectively.

California ARB Monitoring data of the four highest daily PM_{10} measurements for each year from 1995-1997, taken at three separate monitoring locations in the district[71], demonstrate that for the preceding three years there has been only one exceedance of the national daily PM_{10} standard of 150 micrograms per cubic meter. This exceedance was measured on October 6, 1996 at the Lava Beds National Monument, where a reading of 188 micrograms per cubic meter was recorded. Aside from the October 6, 1996 reading, the highest PM_{10} measurements in the County have ranged from 14 to 46 micrograms per cubic meter. The anomalous October 6, 1996 measurement occurred as a result of a prescribed burn by the Park Service that day, which burned to within 40 to 50 feet of the monitoring station. This reading is therefore considered to be an extraordinary circumstance.

Since there has been only one exceedance of the federal daily PM_{10} standard in the past three years, Calpine will not be required to provide offsets for any increases in PM_{10} emissions resulting from the proposed Fourmile Hill geothermal plant.

Comments—Controlled Burning Emissions and Impacts

AG.115 The EIS/EIR failed to assess impacts associated with burning of vegetation during Project construction and operation. The EIR/EIS mentions that the project will include "slash burn of vegetation" (page 4-228) and that there will be "limited controlled burns" (page 4-234). The EIS/EIR refers to controlled burns as being at the power plant site or along the transmission line (page 4-234). However, there does not appear to be any discussion of the timing, extent or purpose of these burns. Appendix F, which supplies supporting information about the air quality analyses does not mention burning at all. Yet, the EIR/EIS states that the limited controlled burns could contributed to localized increases in PM_{10} in the immediate vicinity of the burn and that slash burn could result in exceedances of the state 24-hour PM_{10} standard in close proximity to the burning activities (page 4-234).

According to Dr. Fox, emissions from burning could cause exceedance of the State PM_{10} standard by a factor of 2 to 12. (Ex. A, Comment 4.b.) The potentially significant impacts associated with this burning were not analyzed or mitigated in the EIS/EIR. (See Ex. A, Comment 4.a., for Dr. Fox's full analysis.) One potential mitigation measure for PM_{10} impacts from the proposed burning is to deliver the material to a biomass plant for disposal. Another is to deliver the material to a landfill. (Ex. A, Comment 4.a.) The EIR/EIS should discuss mitigation measures.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.116 This burning will also generate significant emissions of several toxic air pollutants, including ammonia and carcinogenic polynuclear aromatic hydrocarbons. (See Ex. A, Comment 4.b., for more detail.) These emissions were not analyzed in the EIS/EIR, nor included in the Project's health risk assessment.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.117 The EIR/EIS also fails to provide an analysis of the visibility impact of smoke from these burns. There is no discussion of whether the smoke will comply with the requirements of California Health & Safety Code section 41701 and Siskiyou County APCD Rule 4.1 regarding smoke.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.118 Additionally, the California Health & Safety Code generally prohibits non-agricultural burning (ß 41800), with limited exceptions. One exception is for wood waste from trees, vines or bushes on property being developed for commercial purposes (ß 41802). In that case, section 41804 provides that the district board may authorize the disposal of such waste on the property where it was grown only if:

(a) The district board finds that it is more desirable to dispose of such waste by burning than to dispose of it by other available means, such as, but not limited to, by removing it to sanitary fills.

(b) The district has developed criteria for such disposal, which shall include provisions to improve the combustibility of such waste to reduce its smoke level.

(c) The state board has approved the criteria developed pursuant to subdivision (b).

Here, the Siskiyou County APCD has adopted a rule (4.3) which addresses non-agricultural burning. While Rule 4.3 contains a general prohibition against non-agricultural burning, and contains an

[71] Measurements were taken at the Mt. Shasta-N Old Stage Road, Lava Beds National Monument and Yreka-Foothill Drive Measuring Stations. Monitoring data are attached as Exhibit A. Source: Siskiyou County APCD.

exception for commercial development, it does not contain any finding required by 41804(a) or any criteria required by 41804(b). Thus, is does not appear that whatever non-agricultural burning is proposed complies with the California Health & Safety Code. In the absence of state-approved criteria for such burning, it does not appear that such burning can be authorized. The EIR/EIS does not discuss this issue. The issue must be discussed so that the decisionmakers and the public can evaluate the project's compliance with this requirement.

The EIS/EIR should be revised and recirculated to include information about, and mitigation for, these significant impacts. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.208 The DEIR indicates that the plant site would be cleared and grubbed. Felled trees would be cut to commercial lengths and salvaged, sold, or hauled away for disposal. All slashed materials would be burned on-site. (DEIR, page 2-34.) Along the transmission line right-of-way, cleared vegetation could be hauled from the site, burned on-site, or scattered over open areas in the right-of-way vicinity. (DEIR, page 4-232.)

It is well known that burning of vegetation is a major source of criteria and toxic air pollutants. The DEIR failed to estimate emissions from burning or the corresponding impact on air quality, vegetation, wildlife, or public health. Although the DEIR did qualitatively discuss potential air quality impacts and conclude that burning could result in exceedance of the State 24-hour PM_{10} standard in close proximity of burning, it failed to quantify the impact or recommend any mitigation for it. (DEIR, page 4-234.)

Burning emissions can be readily estimated using standard U.S. EPA procedures. The DEIR indicates that preparation of the wellfield, power plant, access roads, and transmission line sites for construction would remove 310.3 acres of predominately forested land. Of this, 47 percent is lodgepole pine forest, 29 percent is mixed conifer forest, 18 percent is other forest, and 6 percent is sagebrush, meadows, and herbaceous cover. (DEIR, Table 4.7-1.) Average available fuel (i.e., combustible material consumed in a wildfire, which excludes larger woody material such as tree trunks which would be removed from the site) in forested areas in California is 18 tons per acre ("tons/ac").[72]

Burning emissions were estimated using the average emission factors for burning of conifer logging slash debris as reported in U.S. EPA's AP-42, Sections 2.5 (Table 2.5-5) and 13.1 (Table 13.1-3). This material is similar to the debris that would be produced by clearing the Project site. These factors are 18 lbs/ton for PM_{10},[73] 218 lbs/ton for CO,[74] and 8.8 lbs/ton for reactive organic gases ("ROG").[75] (AP-42, Tables 2.5-5 and 13.1-3.) In addition, an emission factor of 4 lbs/ton is normally used for nitrogen oxides ("NO_x") from open burning of forest residues (AP-42, pages 13.1-3 and page 2.5-11, note n), although higher values have been measured recently (5.1 lbs/ton).[76] Emissions of sulfur oxides are negligible, and no emission factors have been published. (AP-42, page 13.1-6.) These values, which were derived under controlled laboratory conditions, are generally believed to be at the lower limits of what might reasonably be expected from slash burning in the field because laboratory fuels were generally free of living herbaceous vegetation, moist duff material, and soils that are always incorporated in real fuel beds[77] and which substantially increase emissions. (AP-42, page 13.1-6.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.209 Multiplying these factors together yields 100,500 lbs (50 tons) of PM_{10},[78] 22,340 lbs (11 tons) of NO_x,[79] 1.2 million lbs (609 tons) of CO,[80] and 49,200 lbs (25 tons) of ROG.[81] As discussed in Comment 7.a,

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72 U.S. EPA, Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, 5th Edition, Report AP-2, January 1995 ("AP-42"), Section 13.1, Wildfires and Prescribed Burning, Table 13.1-1 and p. 13.1-1.

73 The average PM10 emission factor is calculated as (13 + 13 + 4 + 6 kg/Mg)/4 x (2 lbs/ton per kg/Mg) = 18 lbs/ton. The individual values are for broadcast slash burning of short needle and long needle conifer (fire) and dozer piled conifer from Table 13.1-3 and ponderosa pine forest residue from Table 2.5-5.

74 The average CO emission factor is calculated as (175 + 126 + 37 + 98 kg/Mg)/4 x (2 lbs/ton per kg/Mg) = 218 lbs/ton. The individual values are for short needle and long needle broadcast slash burning of conifer and dozer piled conifer (fire) from Table 13.1-3 and ponderosa pine forest residue from Table 2.5-5.

75 The average ROG (nonmethane total organic carbon) emission factor is calculated as (3.5 + 4.2 + 5.5 kg/Mg)/3 x (2 lbs/ton per kg/Mg) = 8.8 lbs/ton. The individual values are for broadcast slash burning of short needle and long needle conifer (fire) and dozer piled conifer from Table 13.1-3 and ponderosa pine forest residue from Table 2.5-5.

76 D.A. Hegg, L.F. Radke, P.V. Hobbs, R.A. Rasmussen, and P.J. Riggan, Emissions of Some Trace Gases from Biomass Fires, J. Geophysical Research, v. 95, no. D5, 1990, pp. 5669-5675.

77 D.V. Sandberg, S.G. Pickford, and E.F. Darley, Emissions from Slash Burning and the Influence of Flame Retardant Chemicals, J. Air Poll. Control Assoc., v. 25, no. 3, 1975, pp. 278- 281.

78 PM10 emissions from burning slashed vegetation = (310.3 ac)(18 tons vegetation/ac)(18 lbs PM10/ton vegetation) = 100,537 lbs = 50.3 tons.

79 NOx emissions from burning slashed vegetation = (310.3 ac)(18 tons vegetation/ac)(4 lbs NOx/ton vegetation) = 22,342 lbs = 11.2 tons.

construction emission thresholds are normally established to evaluate the significance of construction emissions. The DEIR fails to do this. The South Coast Air Quality Management District ("SCAQMD") has established construction emission thresholds to evaluate the significance of construction impacts for CEQA analyses. These apply in the South Coast Air Basin and the Coachella Valley, where federal and state PM_{10} standards are exceeded.[82] They are also applicable in the study area because ambient PM_{10} concentrations periodically exceed both the federal and state PM_{10} standards, primarily due to burning. (DEIR, page 3-186.) In fact, peak PM_{10} concentrations in the study area exceed those in the SCAQMD due to burning for forest and range management, recreational campfires, and wildfires.[83]

The following table compares the SCAQMD construction emission significance thresholds with Project emissions from burning calculated as described above:

	SCAQMD Significance Threshold (tons/qtr)	Project Burning Emissions (tons/qtr)
PM_{10}	6.75	21.7
NO_x	2.5	4.8
CO	24.75	264.8
ROG	2.5	10.9

The quarterly Project burning emissions in the above table were estimated assuming that all of the clearing and associated burning occurred during the first year of construction between April and October. (DEIR, page 2-42, 2-56.) Therefore, the total burning emissions calculated above would occur over 2.3 quarters, and quarterly emissions are estimated by dividing total emissions (e.g., PM_{10} = 50 tons/yr) by 2.3. This comparison shows that Project burning emissions exceed the significance thresholds by factors of two to 11 (100% to 1100%). These substantial emissions would probably result in exceedances of ambient air quality standards. Ambient PM_{10} data for Lava Beds, for example, include a 24-hr average PM_{10} concentration of 187.8 $\mu g/m^3$, which exceeds both the State standard of 50 $\mu g/m^3$ and the federal standard of 150 $\mu g/m^3$. This exceedance was attributed to prescribed burning. (SCAPCD 9/97.) The above- estimated Project burning emissions should be modeled to determine whether they would cause exceedances of the ambient air quality standards.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.210 This is a significant impact that is not revealed in the DEIR. The EIR should be revised to include emissions from burning. Burning emissions are clearly significant and should be mitigated. There are feasible alternatives to burning cleared vegetation, including hauling it away from the site for off-site disposal and scattering it over nearby open areas. (DEIR, page 4-232.) Therefore, the EIR should be also modified to prohibit burning.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.211 In addition to PM_{10}, burning of forests and slash is also a source of a number of toxic pollutants, including dioxins,[84] acrolein,[85] polynuclear aromatic hydrocarbons,[86] ethylene,[87] methyl bromide,[88] methyl chloride,[89] chlorofluorocarbons, ammonia (Hegg et al., 1990), ozone,[90] and aldehydes, among

80 CO emissions from burning slashed vegetation = (310.3 ac)(18 tons vegetation/ac)(218 lbs CO/ton vegetation) = 1,217,617 lbs = 608.8 tons.

81 ROG emissions (nonmethane total organic carbon) from burning slashed vegetation = (310.3 ac)(18 tons vegetation/ac)(8.8 lbs ROG/ton vegetation) = 49,152 lbs = 24.6 tons.

82 SCAQMD, CEQA Air Quality Handbook, April 1993, p. 6-4.

83 SCAPCD, Lava Beds PM10 data 6/19/96 - 12/29/96.

84 R.R. Bumb and others, Trace Chemistries of Fire: A Source of Chlorinated Dioxins, Science, v. 210, 1980, pp. 385-390; C. Tashiro, R.E. Clement, B.J. Stocks, L. Radke, W.R. Cofer, and P. Ward, Preliminary Report: Dioxins and Furans in Prescribed Burns, Chemosphere, v. 20, nos. 10-12, 1990, pp. 1533-1536.

85 J.B. Terrill, R.R. Montgomery, and C.F. Reinhardt, Toxic Gases from Fires, Science, v. 200, 1978, pp. 1343-1347.

86 R.W. Gerstle and D.A. Kemnitz, Atmospheric Emissions from Open Burning, J. Air Poll. Control Assoc., v. 17, no. 5, 1967, pp. 324-327; B.M. Jenkins, A.D. Jones, S.Q. Turn, and R.B. Williams, Emission Factors for Polycyclic Aromatic Hydrocarbons from Biomass Burning, Environmental Science and Technology, v. 30, 1996, pp. 2462-2469.

87 M. Feldstein, S. Duckworth, H.C. Wohlers, and B. Linsky, The Contribution of the Open Burning of Land Clearing Debris to Air Pollution, J. Air Poll. Control Assoc., v. 13, no. 11, 1963, pp. 542-545.

88 S. Mano and M.O. Andreae, Emission of Methyl Bromide from Biomass Burning, Science, v. 263, 1994, pp. 1255-1257.

89 T.E. Reinhardt, Chlorinated Emissions in Smoke from Burning Forest Fuels, M.S. Thesis, University of Washington, Seattle, 1987; M.O. Andreae and others, Methyl Halide Emissions from Savanna Fires in Southern Africa, J. Geophysical Research, v. 101, no. D19, 1996, pp. 23,603-23,613.

90 G. Helas and others, Ozone Production Due to Emissions from Vegetation Burning, J. Atmospheric Chemistry, v. 22, 1995, pp. 163-174.

others. Emission factors for burning have been published for many of these substances. In addition, smoke itself is a health hazard.[91]

Two studies have published emission factors for the PAHs. These indicate that 4.1 to 8.8 grams of PAHs are released when one ton of slash is burned and that the carcinogenic PAHs comprise 3.2 to 39 percent of total. For the Project, slash burning would release 50[92] to 109[93] lbs of PAHs, including 3.4 to 19 lbs of potent carcinogens. Likewise, burning of pine, brush, and douglas fir releases 4 lbs/ton of ammonia and 2.3 g/ton of CF_2Cl_2 (Hegg et al. 1990). Therefore, the Project would emit an additional 11 tons of ammonia[94] and 28 lb of chlorofluorocarbons[95] that were not included in the DEIR's analyses. The DEIR's health risk assessment should be revised to include toxic emissions from the burning of vegetation during construction or the practice should be prohibited.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Controlled Burning Emissions and Impacts

The project has been revised to eliminate the burning of cleared vegetation. Pages 2-34, 2-50, 4-204, and 4-285 through 4-286 of the Draft EIS/EIR have been revised to reflect this change. Mitigation Measure 4.15.5d in the Draft EIS/EIR has been removed.

ODOR IMPACTS

Comment—Odor Impact Criteria

AG.114 In assessing odor impacts, the EIS/EIR relied on the State significance standard for hydrogen sulfide ("H_2S"). However, as Dr. Fox explains, this standard was established over 25 years ago and more recent studies have established a much lower odor threshold. (Ex. A, Comment 3.) According to these more recent studies, the Project will cause significant odor impacts even at the underestimated levels of H_2S emissions presented in the EIS/EIR. This is a significant environmental impact that was not identified or mitigated in the EIS/EIR. (See Ex. A, Comment 3 for supporting data.) Thus, the EIS/EIR should be revised and recirculated for public comment.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Odor Impact Criteria

Odor thresholds are subjective and vary among individuals. An individual's odor threshold is affected by time, the presence of other odors, the individual's age, and other factors. Given this variation in odor thresholds, there is some ambiguity in assessing odor impacts.

The maximum estimated hydrogen sulfide concentrations for some receptors exceed the upper end of the range of reported odor thresholds for hydrogen sulfide. Hydrogen sulfide therefore would be detectable at times at locations close to the project, such as Grouse Hill, Lookout Butte, Badger Peak, Fourmile Hill and Forest Service Road 49 near the plant site. However, there would likely only be limited use of these locations. The maximum estimated concentrations at the other receptors in the Medicine Lake Highlands and at the southwest corner of Lava Beds National Monument are within the range or reported odor thresholds. Under worst-case meteorological conditions, odors may be detectable by some persons at these receptor locations some of the time.

The nature of air quality impacts is that the maximum concentrations are reached only rarely. Much lower concentrations occur far more frequently. To illustrate this, consider For example, at the Medicine Lake campground headquarters, the estimated peak

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91 P.A. Breysse, Health Hazards of Smoke, J. Forestry, v. 82, 1984, p. 89.

92 PAH emissions from burning of landscape residue = (4.07 g/ton)(18 tons/ac)(310.3 ac)/454 g/lb) = 50.1 lbs. (Gerstle and Kemnitz 1967, Table IV.)

93 PAH emissions from burning of pine slash = (9731 µg/kg)(18 tons/ac)(310.3 ac)(907.18 kg/ton)/[(106 g/ug)(454 g/lb)] = 108.6 lbs. (Jenkins et al. 1996, Table 6.)

94 Ammonia emissions = (310.3 ac)(18 ton/ac)(4 lbs/ton) = 22,342 lbs. The ammonia emissions factor is from Hegg et al. 1990, Table 2 for pine, brush, and douglas fir (Myrtle/Fall Creek).

95 Chlorofluorocarbon emissions = (310.3 ac)(18 ton/ac)(2.3 g/ton) = 12,846 g = 28.3 lbs. The chlorofluorocarbon (CF2Cl2) emissions factor is from Hegg et al. 1990, Table 2 for pine, brush, and douglas fir (Myrtle/Fall Creek). Because this is for a single compound, total chlorofluorocarbons could be larger.

hourly average hydrogen sulfide concentrations are 2.3 $\mu g/m^3$ (during a scenario of normal or upset operation, two wells venting and worst-case meteorology) and 0.3 $\mu g/m^3$ (during normal operation and worst-case meteorology). The long-term average concentration at the same location is 0.004 $\mu g/m^3$. The highest hourly concentration expected to ever occur at this location may be detectable by certain individuals. However, the highest hourly concentration expected during normal operation, even under worst-case meteorological conditions, is lower than the lowest reported odor threshold. The average concentration at this location is several orders of magnitude below the lowest reported odor detection threshold.

Odor impacts are not considered significant because detectable odors are expected to be very infrequent at most locations, and the maximum estimated concentrations are below the California Ambient Air Quality standard for hydrogen sulfide.

The California standard is a 0.03 ppm (42 $\mu g/m^3$) for a one-hour average, and is based on odor.[96] The California ARB has reviewed this standard, and decided not to revise it.[97] Please refer to the response to "Comments—Odor Thresholds and Nuisance Levels" for a further discussion.

Comment—Odor Thresholds and Nuisance Levels

AG.207 The DEIR estimates the maximum 1-hour hydrogen sulfide concentrations at 22 receptors in the vicinity of the Project. Estimated concentrations range from 0.1 $\mu g/m^3$ during normal operations at Tionesta, Tulelake, Dry Lake and elsewhere to 30.3 $\mu g/m^3$ during upset conditions at Grouse Hill. (DEIR, page F-44.) The DEIR concludes that odor complaints would be unlikely because these concentrations are below the state hydrogen sulfide standard of 42 $\mu g/m^3$. (DEIR, pages 4-237, 4-241.) This is not correct.

The area surrounding the Project site is pristine national forest that is used by hikers, hunters, and other recreators. Several special interest areas and a Class I wilderness area are nearby. Offensive odors are virtually absent and would be "generally perceived as negative impacts by wilderness users." The U.S. Forest Service has established guidelines for assessing air pollution odor impacts in wilderness areas. These guidelines stipulate that moderate deterioration has occurred if any air pollutant odor is detectable and severe deterioration has occurred if any air pollutant odor is the only detectable odor.[98] The concentrations of hydrogen sulfide that are estimated to occur in the vicinity of the Project, while less than the State standard, are high enough to be detected.

The State hydrogen sulfide standard was promulgated in 1970 based on a single odor panel experiment and corresponds to the geometric mean hydrogen sulfide concentration that was detected by 16 subjects.[99] Since then, numerous studies have been conducted to determine the odor threshold of hydrogen sulfide. Several parties have peer reviewed these data. The American Industrial Hygiene Association ("AIHA") in 1989 reported an acceptable range of odor threshold values for hydrogen sulfide of 1 to 18 $\mu g/m^3$, a geometric mean for recognition of 6, and a geometric mean for detection of 13 $\mu g/m^3$.[100] Another study reported an acceptable range of 0.7 $\mu g/m^3$ to 14 $\mu g/m^3$.[101] Since then, more recent work in Japan and the Netherlands using modern, state-of-the-art measuring methods has found that the odor detection threshold for hydrogen sulfide ranges from 0.4 to 0.7 $\mu g/m^3$.[102] Inspectors working for the Bay Area Air Quality Management District ("BAAQMD") and the South Coast Air

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96 California Air Resources Board, 1969. Recommended Air Quality Standards. Presented to the Board by the Technical Advisory Committee in conjunction with the California Department of Health.

97 Duffy, Gordon, T. del Junco, and R. Hughan, 1984. Report of the Committee Regarding the Review of the AAQS for Hydrogen Sulfide. Memorandum to the Air Resources Board.

98 D.L. Peterson, D.L. Schmoldt, J.M. Eilers, R.W. Fisher, and Robert D. Doty, Guidelines for Evaluating Air Pollution Impacts on Class I Wilderness Areas in California, U.S. Forest Service, Pacific Southwest Research Station Report PSW-GTR-136, November 1992, p. 15.

99 The Technical Advisory Committee and the State Department of Public Health, Recommended Ambient Air Quality Standards, May 21, 1969.

100 American Industrial Hygiene Association, Odor Thresholds for Chemical with Established Occupational Health Standards, 1989, p. 20.

101 J.H. Ruth, Odor Thresholds and Irritation Levels of Several Chemical Substances: A Review, Am. Ind. Hyg. Assoc. J., v. 47, 1986, pp. A-142 - A-151.

102 Y. Hoshika, T. Imamura, G. Muto, L.J. Van Gemert, J.A. Don, and J.I. Walpot, International Comparison of Odor Threshold Values of Several Odorants in Japan and The Netherlands, Environmental Research, v. 61, 1993, pp. 78-83 (Attachment B).

Quality Management District ("SCAQMD") report that odor complaints in urban areas are generally reported when ambient hydrogen sulfide concentrations reach about 1 $\mu g/m^3$.

In addition to this work, two studies have determined the proportion of the exposed individuals who can detect hydrogen sulfide, who complain, and who are annoyed as a function of concentration. A study performed for California Air Resources Board ("CARB") estimated the percent of persons who were able to detect a hydrogen sulfide odor and who were annoyed by it for concentrations ranging from 0.5 ppb (0.7 $\mu g/m^3$) to 200 ppb (284 $\mu g/m^3$). This work was based on the then current most probable values of the mean detection threshold, the standard deviation of the threshold, the exponent of the odor intensity equation, and the ratio between the annoyance and detection threshold.[103] Since then, the Canadian Air Resources Branch has conducted studies in which panel members were administered increasing concentrations of hydrogen sulfide and their reactions were recorded in terms of detection, complaint, and annoyance. This study found that the concentration at which 50 percent of the population could detect hydrogen sulfide is 5.5 $\mu g/m^3$. This work generally shows that a larger percentage of the population can detect very low concentrations of hydrogen sulfide than suggested by CARB's calculations and that a larger percentage also complained than the CARB study reported were annoyed.[104]

Most of the Project's ambient hydrogen sulfide concentrations estimated in the DEIR (DEIR, Table 4.13-6, page F-44) exceed the reported odor thresholds for hydrogen sulfide and would be detected by some individuals exposed to these concentrations. Some of the estimated hydrogen sulfide concentrations for the Project exceed levels that have been demonstrated to result in complaints and to annoy a substantial number of people. Actual concentrations of hydrogen sulfide would be substantially higher than estimated in the DEIR because hydrogen sulfide emissions were underestimated (Comment 1.c). Therefore, odor impacts would be more severe than discussed here.

Based on the recent Japanese work, malodors from hydrogen sulfide can be detected at concentrations as low as 0.4 $\mu g/m^3$. Even assuming the DEIR's estimates of hydrogen sulfide concentrations are correct, estimated maximum 1-hour hydrogen sulfide concentrations of 0.4 $\mu g/m^3$ would be equalled or exceeded at over 75 percent of the sensitive receptors for one or more scenarios, including normal operation. (DEIR, page F-44.) These include a number of heavily used areas including Lava Beds National Monument, Medicine Lake campgrounds, campground headquarters and cabins, Little Medicine Lake, Medicine Lake Glass Flow, and two distant snowmobile parks. A small percent of the general population would be able to detect hydrogen sulfide odors this low and some would complain and be annoyed by it.

The number of people potentially affected by hydrogen sulfide odor would increase at higher concentrations. The CARB study estimated that about 6 percent of the population is able to detect a hydrogen sulfide concentration of 1 $\mu g/m^3$ and that about 1 percent of the population would be annoyed by it. Estimated maximum 1-hour concentrations equal or exceed this concentration at 17 out of the 22 sensitive receptors that were modeled for two or more of the scenarios. A concentration of 5.5 $\mu g/m^3$, which would be exceeded at four nearby receptors for at least two scenarios would be detected by 30 to 50 percent of the population, would result in complaints from over 20 percent, and would annoy 5 percent of the population. A concentration of 11 $\mu g/m^3$, which would be exceeded at three nearby receptors for at least two scenarios would be detected by 50 to 70 percent of the population, would result in complaints from about 35 percent, and would annoy 11 percent of the population. Finally, a concentration of 14 $\mu g/m^3$, which would be exceeded at two nearby receptors (Grouse Hill, Forest Service Road 49) for at least three scenarios, including normal operation, would be detected by 56 to 80 percent of the population, would result in complaints from about 40 percent, and would annoy 17 percent of the population (Amoore 1985, Table VI; Nagy 1991, page 1360). (DEIR, page F-44.)

Malodors would be detected during construction, normal operation, and upset conditions. During normal operation, the detection threshold of 0.4 $\mu g/m^3$ would be equalled or exceeded at 64 percent of the sensitive receptors and would reach concentrations as high as 14.7 $\mu g/m^3$ at Forest Road 49 near the plant site and 15.7 $\mu g/m^3$ at Grouse Hill. During the third year of construction, malodors would be detected at 77 percent of the sensitive receptors and would reach concentrations as high as 13.9 $\mu g/m^3$ at Grouse Hill. During upset conditions, which are common, ranging from three or four 6-hour upsets per year up to long-term shutdowns lasting 10 to 15 days (DEIR, page F-8), malodors would be detected at up to 82 percent of the sensitive receptors and would reach concentrations as high as 30.3 $\mu g/m^3$ at Grouse Hill. (DEIR, page F-44.)

Applying the U.S. Forest Service guidelines, moderate to severe deterioration in air quality would occur over a very large area. This is a significant environmental impact that was not identified in the DEIR. The impacts described here would be proportionately larger if hydrogen sulfide emissions were larger than those used in the DEIR. This could occur, for example, if emissions are underestimated (Comment 1.c), or additional units were constructed in this general area. Mitigation measures should be required to reduce hydrogen sulfide emissions below the hydrogen sulfide odor detection threshold of 0.4 $\mu g/m^3$ in all wilderness areas accessible to the public. The DEIR should be revised and recirculated for public comment. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

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103 J.E. Amoore, The Perception of Hydrogen Sulfide Odor in Relation to Setting an Ambient Standard, Report Prepared for CARB, April 10, 1986 (Attachment B).

104 G.Z. Nagy, The Odor Impact Model, Journal of the Air & Waste Management Association, v. 41, no. 9, 1991, pp. 1360-1362 (Attachment B).

BV.1 I worked on the realignment and repair of the road from the McDowell Yard to Plant #13 at the top of the hill. I worked for the Military G.E.B. I stayed at the Boy's Camp where you turn to the left above Lincoln Rock. I was the Master Mechanic most weeks. I worked 6 days a week. The job was a real challenge but the environment smelled like sulfur. The air, the ground -- everything! *(Carlos DeRossett)*

BV.3 I don't think Medicine Lake needs this. When I moved my trailer out of there on Christmas Eve, you could smell it for 6 months. Everyone wanted to know if my holding tanks were full. *(Carlos DeRossett)*

CB.1 I am a retired engineer from Pacific Gas & Electric Co. During my employment at PG&E, I had several occasions to go to the geothermal field at the Geysers. The purpose of these trips were to determine where transmission lines were to be located or relocated. I can only say that I was always glad to be on my way home. The stench from the wells which also pumped out hydrogen sulfide was quite overpowering. It permeated our clothes, the car and one could smell it on one's skin for hours afterward. *(Richard Dye)*

FD.1 Most of the opponents of this project have expressed adequately the is- sues of concern. I wish to point out three particular concerns which have convinced me to oppose this project.

From 1978 to the late '80s I flew in my light airplane on a regular basis between Sacramento and Gualala on the Mendocino Coast. The path brings one over the Geyers Geothermal facility in Lake County. My flight level was between 5,500 ft. and 7,500 ft. altitude. Consistently, I detected the sulfur smell common in and around geothermal plants. I am not aware of any considerations in the draft EIR for the Fourmile project of any negative impacts this common sulfur odor might have in surrounding areas. *(H. K. "Bud" Miller)*

FM.5 The rotten-egg smell of the geothermal generation will not go with the smell of pine trees. *(Ana Mulvaney)*

PH3.48 Well, like the smell comes off the paper plants up through Oregon, Montana, and whatnot. Now, that is considered an acceptable level. Say if one of those paper plants was in California? I mean—you know, I mean, you know, you say that this is acceptable. Well, how bad will it smell? *(Yreka Public Hearing)*

PH3.49 Like those smells, they don't consider that they will hurt you, but they are just offensive to people smelling them, I suppose. *(Yreka Public Hearing*

Response—Odor Thresholds and Nuisance Levels

CEQA gives agencies the authority to adopt standards for determining whether a given impact is "significant." The Office of Planning and Research has described "thresholds of significance" as a quantitative or qualitative standard, or set of criteria, pursuant to which the significance of a given environmental effect may be determined. (OPR, Thresholds of Significance: Criteria for Defining Environmental Significance (CEQA Technical Advice Series, September 1995), page 4.)

There is some disagreement between the odor threshold studies cited in comment AG.207. Nonetheless, it is likely that odor threshold for H_2S for some individuals is lower than the estimated short-term maximum H_2S impacts associated with the proposed project, indicating that the odor may be detectable at some locations at some times.

The California Ambient Air Quality Standard for H_2S is 0.03 ppm (42 $\mu g/m^3$) for a one-hour average, and is based on odor.[105] The California ARB was aware at the time the standard was promulgated that some persons can detect H_2S at levels below the standard. The California ARB has reviewed this standard, and decided not to revise it.[106,107] The Siskiyou County APCD has not adopted a stricter odor-based ambient air quality standard for H_2S. Therefore, it is appropriate under CEQA for the EIR to rely

105 California Air Resources Board, 1969. *Recommended Air Quality Standards.* Presented to the Board by the Technical Advisory Committee in conjunction with the California Department of Health.

106 Duffy, Gordon, T. del Junco, and R. Hughan, 1984. *Report of the Committee Regarding the Review of the AAQS for Hydrogen Sulfide.* Memorandum to the Air Resources Board.

107 The review of the hydrogen sulfide standard by the ARB committee included hearing testimony from Dr. Amoore, one of the investigators cited in the comment who has reported odor thresholds below the California ambient air quality standard.

upon the significance standard set by the California ARB. By the commentor's admission only the smallest group of sensitive individuals, approximately one percent, may be able to detect H_2S odors at the suggested standard of 1 $\mu g/m^3$ at some but not all of the sensitive receptors. The unlikelihood of any significant number of persons detecting H_2S, let alone being annoyed by it, even under the commentor's suggested standard, suggests that impacts would not be significant under either standard.

The comment suggests that the significance determination should be based on information contained in a USFS document entitled *Guidelines for Evaluating Air Pollutant Impacts on Class I Wilderness Areas in California*. This document does not apply to the Fourmile Hill EIS/EIR for several reasons. First, as indicated by the title, the document applies only to Class I Wilderness Areas on Forest Service land. Contrary to the commentor's assertion, there are no USFS Class I Wilderness areas in the project area. Second, the document provides no guidance on making a determination of significance. The document indicates that some pollutants are readily identified by smell and provides the following condition classes:

Condition Class	Class Description
No effect	No chemical or sensory interference with human smell.
Moderate deterioration	Air pollutant odor is detectable.
Severe deterioration	Air pollutant odor is the only detectable odor.

The terms "moderate deterioration" and "severe deterioration" as referenced in the USFS Guidelines, do not equate with the CEQA/NEPA definitions of significance. The document does not define a significant impact. Thus, the document does not apply to the assessment of the significance of H_2S odor impacts.

The comment refers to odor complaint experience in urban areas. There are many reasons that citizens may make odor complaints, including emotional irritation with the source of the odors. The SCAPCD regulations include a general nuisance regulation, which is, and will be, enforced by the District. If the proposed project were to create an odor nuisance, the District would take measures to bring the facility into compliance. These measures could include the setting lower emission limits, or requiring additional abatement (*e.g.*, during wellhead venting).

The comment that most of the estimated H_2S impacts for the proposed project exceed the odor threshold is misleading. While the *maximum* estimated H_2S concentrations at locations close to the project exceed the odor thresholds reported by some investigators, these concentrations would occur infrequently. Typical concentrations would be much lower. During the construction of the well field, H_2S emissions would only occur during well flow testing. After plant startup, H_2S emissions would be continuous, but the maximum estimated concentrations would only occur during worst-case meteorology.

Comment—Contrasting Odor Impacts with Telephone Flat

A.46 The FEIS should include an estimate of H_2S emissions at Telephone Flat, and a statement describing the expected differences, if any, in air emissions from the two projects.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

Response—Contrasting Odor Impacts with Telephone Flat

Available information about the H_2S emissions from the Telephone Flat project has been included in the cumulative analysis for the Fourmile Hill project (see the response to "Comments—Cumulative Air Quality Impacts" in the Cumulative Effects Section of this document. The Final EIS/EIR for the Fourmile Hill project includes available information about H_2S estimates from the Telephone Flat project, as well as a description of any expected differences in air emissions from the two projects).

Comments—Odor Mitigation

BQ.23 Our primary concern is the effect of H_2S from the operation of the plant. On page 4-240 there is an analysis of emissions. Our concern is the availability to the public of information generated by receptors and the effectiveness of Mitigation Measures. Will the public (campers and cabin owners) be informed if emissions exceed allowable limits? Mitigation Measure 4.13.2a states that "SCAPCD could require additional control measures to ensure compliance with emission limitations." We believe that this wording is too vague and that this Mitigation Measure should be more strongly worded to insure that SCAPCD would require compliance with air quality emissions. *(S. Peder and Suzanna S. Cuneo, et al.)*

BQ.25 We are concerned that Mitigation Measure 4.13.5c does not do enough to prevent excessive H_2S emissions in that Calpine must throttle back well production "if possible" after 6 hours to meet SCAPCD emission requirements. Will the public be informed if these emission requirements are not met and will the public be provided with information on the actual amount of H_2S produced by this plant annually? *(S. Peder and Suzanna S. Cuneo, et al.)*

Response—Odor Mitigation

There are no applicable Federal H_2S ambient standards, only a state one-hour standard discussed in the previous response to "Comments—Odor Impact Criteria." It is estimated that the maximum one-hour H_2S average concentration would be 13.9 $\mu g/m^3$ for the second and third years of construction. This average is well below the state H_2S standard of 42 $\mu g/m^3$. Since the state standard is also the odor nuisance threshold, there would be no odor nuisance resulting from the construction of the proposed project.

Furthermore, mitigation measures have been proposed to prevent any exceedances of the California Ambient Air Quality Standards for hydrogen sulfide, and to minimize the occurrence of detectable odors.. Emissions would be monitored during flow testing and reported to the Siskiyou County APCD. The APCD would impose additional control measures if any emissions exceed existing limits.

During normal operations of the proposed plant, there is projected to be no exceedance of the state one-hour standard. Even during plant upset conditions, assuming a worst-case scenario of 100% diverted steam flow, no exceedance of the one-hour standard is expected. A backup abatement system would provide approximately 80% H_2S control efficiency in such situations. Furthermore, Calpine would throttle-back wells for upsets lasting longer than 24 hours, which would reduce the steam flow to about two-thirds of full flow.

Additional mitigation measures provide considerable protection against odors associated with elevated H_2S emissions. If the initial well drilling operation revealed that H_2S concentrations in the steam would exceed the expected 8 ppm, emissions would be remodeled accordingly. Additional mitigation measures could be imposed, such as the use of a surface condenser instead of a direct-contact condenser. Also, it is provided in Mitigation Measures 4.13.5c that Calpine would throttle back the wells to 50% of full-flow after one hour of full-flow venting. After six hours, Calpine would

further reduce flow to a level that meets the Siskiyou County APCD emission requirements for H_2S. This control of H_2S emissions would eliminate the potential for any significant odor impacts.

Monitoring and emission data would be available to the public through the Siskiyou County APCD.

HEALTH IMPACTS

Comment—Hazard Characterization and Index

AG.219 Acute health impacts must be determined by calculating the maximum 1-hour average concentration at grid points around a facility, estimating a hazard index at each grid point,[108] and then summing over all pollutants. The maximum hazard index from among all those estimated is the result of the analysis. If this maximum hazard index exceeds 1, acute health impacts are significant. (CAPCOA 1993, page III-38.)

The DEIR performed these analyses, notwithstanding the problems documented above, and found that the hazard index was greater than 1 for respiratory irritation at two locations, Grouse Hill and Forest Service Road 49. (DEIR, page F-48.)[109] However, instead of finding a significant impact, as is required by the CAPCOA guidelines, the DEIR mischaracterized and dismissed the impact.

Mischaracterization. The DEIR attempts to dismiss the exceedance of the acute significance criterion by claiming the index was less than 1 for only noncriteria pollutants. In fact, criteria pollutants must be included in the index if they are emitted by the facility because they contribute to acute health impacts. Then, the DEIR adds back the criteria pollutants emitted by the facility and incorrectly calls them "background." The DEIR acknowledges that this index did exceed the significance threshold, but argues that the impact would not occur because it is unlikely that all required conditions would occur at the same time.

The DEIR claims that the incremental hazard index for the Project is only 0.75 for respiratory irritation at one receptor, which is less than 1 and therefore not significant. It further claims that the hazard index only exceeds 1 after the background concentrations of criteria pollutants are added to the Project incremental index. (DEIR, page 4-247.) This is incorrect.

Appendix F very clearly shows that the incremental hazard index for respiratory irritation is 1.2 for two receptors. (DEIR, page F-48.) The index of 0.75 cited in the DEIR is obtained by eliminating sulfur dioxide (51.9 $\mu g/m^3$) and nitrogen dioxide (182.1 $\mu g/m^3$) from the index for the Grouse Hill receptor. This is not correct because these incremental concentrations are due to emissions from the Project and must be included in the incremental Project index. (DEIR, F-35, F-39.) These two pollutants are then erroneously called "background" concentrations and added to the 0.75 to get the 1.2 cited in the DEIR on page 4-247. (DEIR, page F-53.)

This entire process is flawed. Two of the incremental hazard indices are equal to 1.2, not one. Nitrogen dioxide and sulfur dioxide are included in the calculation of these indices because they are emitted by the Project. (DEIR, page F-48.) The guidelines require that when the incremental hazard index exceeds 0.5, the average background concentrations of the criteria pollutants ozone, nitrogen dioxide, sulfur dioxide, sulfates, and hydrogen sulfide must be additionally used to calculate a new hazard index, which is equal to the facility's contribution plus background (CAPCOA 1993, page III-38). The DEIR did not report any ambient air quality data for any of these pollutants, and there are no nearby CARB ambient air quality stations where any of these pollutants have been measured.

Recalculating the Project's hazard indices using the lowest measured 24-hr sulfate concentration in 1995 (0.50 $\mu g/m^3$), which was measured at Olympic-Squaw Valley, the sulfate hazard index is 0.02 (0.5/25). Using the lowest measured 1-hr annual average concentration in 1995, 2 $\mu g/m^3$, the hazard index for nitrogen dioxide is 0.004 (2/470). Annual average sulfur dioxide is frequently zero in pristine areas and therefore is omitted from this analysis.[110] Finally, the background ozone hazard index calculated in the DEIR is 0.56. (DEIR, page F-53.) Therefore, the total hazard index for the Project plus background is 1.78

108 The hazard index is the ratio of the estimated ambient concentration to a reference exposure level.

109 The description of the results of the acute analysis in the DEIR, page 4-247, conflicts with the Air Quality Appendix at page F-48. The DEIR suggests that the maximum hazard index is 0.75 at Grouse Hill and that this was adjusted to 1.2 after adding background concentrations of criteria pollutants. The appendix table, on the other hand, clearly shows that the hazard index is 1.2 at two receptors before adding background concentrations. Actual hazard indices would be much larger than 1.2 after adding background concentrations and adjusting concentrations for correct emission rates. The DEIR must be revised accordingly.

110 CARB, California Air Quality Data. Summary of 1995 Air Quality Data, Gaseous and Particulate Pollutants, v. XXVII, 1997.

(1.2+0.02+0.004+0.56). This hazard index is substantially higher than the significance threshold of 1 and the maximum claimed index of 1.2 in the DEIR.

In sum, the DEIR erroneously concludes that acute impacts are not significant. (DEIR, page 4-247.) The hazard index exceeds the significance level established in the DEIR and widely used throughout California. Therefore, the impact is significant and must be mitigated. The DEIR should be revised and recirculated for public review.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Hazard Characterization and Index

Please refer to the response to "Comment—Modeling Methodology" regarding the selection of dispersion model receptors. The chronic- and acute-hazard indices were calculated as described in the response to comment AG.108.

CEQA does not specify how air quality impacts analyses are to be prepared for EIRs. The CAPCOA reference cited in the comment is a guidance document for preparing health risk assessments under California's Air Toxic "Hot Spots" Act (AB 2588) which applies only to existing facilities subject to the Act. It does not apply to CEQA or the preparation of EIRs. However, the procedures presented in the CAPCOA guidelines provide a useful method for conservatively estimating the potential health effects associated with the air quality impacts of a proposed facility such as the Fourmile Hill project.[111] These procedures, with appropriate modifications, were used for this EIS/EIR. Nonetheless, it must be recognized that the CAPCOA procedures are designed to err on side of overestimation of health impacts.

There is no state or federal standard for total hazard index. The procedures for calculating hazard indices are presented in the CAPCOA *Air Toxics "Hot Spots" Program Risk Assessment Guidelines*. CAPCOA (the California Air Pollution Control Officers Association) is not a regulatory agency. The Guidelines are a document that presents a recommended methodology for preparing health risk assessments under the Air Toxics "Hot Spots" Act (AB 2588) for certain existing sources of toxic air contaminants, based on measured emission rates. AB 2588, and the subsequent regulations, are enforced by the local air pollution control districts, who are under no obligation to use the CAPCOA *Guidelines* (although most do use them, sometimes with modifications). Under the "Hot Spots" program, the local air districts determine what constitutes a significant risk

Amendments to the Air Toxic "Hot Spots" Act approved by the Governor in 1992 (SB 1731) require the Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA) to prepare and adopt risk assessment guidelines. OEHHA is in the process of doing so.

Total acute hazard indices are calculated by dividing the maximum estimated concentration of each pollutant by its Reference Exposure Level, then summing the results for all pollutants that can affect the same target organ or system. Thus, if the maximum estimated concentrations for two pollutants that can affect the same target organ or system are each 75% of their respective RELs, the total acute hazard index is 1.5 (If acute hazard indices were calculated for measured maximum hourly criteria pollutant concentrations, many areas would frequently have total acute hazard indices exceeding 1.0).

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111 California Air Pollution Control Officers Association, 1993. *Air Toxics "Hot Spots" Program Revised 1992 Risk Assessment Guidelines*. p. I-3.

Regarding the total acute hazard index, the CAPCOA *Guidelines* state:

> "Acute exposure estimates greater than the REL or total acute hazard indices greater than one may indicate that the source has a significant potential to cause adverse non-cancer risks. As for the chronic hazard index estimates, the district may wish to contact OEHHA for guidance in assessing hazard indices greater than one." (CAPCOA 1993, page III-39)

The *Guidelines* also state:

> "There is a great deal of uncertainty associated with the process of risk assessment. The uncertainty arises from lack of data in many areas necessitating the use of assumptions. The assumptions used in these guidelines are designed to err on the side of health protection in order to avoid underestimation of risk to the public." (CAPCOA 1993, pages 1-3)

The response to "Comments—Health Impacts" presents the reasoning behind the conclusion that maximum acute hazard index of 1.3 is not considered significant.

Even for existing facilities that are subject to the requirements of the Air Toxic Hot Spots Act, the CAPCOA guidelines do not require that any value of hazard index be considered significant. Rather, AB 2588 leaves the determination of the significance of the results of risk assessments to the discretion of the local air pollution control district. CEQA, likewise, leaves the determination of significance of these effects to the lead agencies (including the Siskiyou County APCD, in this case).

As noted in the comment, the maximum acute-hazard index estimated for two locations (Grouse Hill and the point on Forest Service Road 49 closest to the proposed power plant) exceeded 1.0. The maximum estimated acute hazard index is 1.3 for the case of a dual-turbine, bypass-unavailable plant upset concurrent with two wells venting, worst-case meteorology and average background ozone concentrations, and 1.2 for the same upset case during well drilling). Appendix F, Table 37 presents the contributions of the substances emitted from the plant to these estimated hazard indices. In either of the two worst-case scenarios, the primary contributor is H_2S (contributing 0.72 to the total acute hazard index). The combined contribution of all other emissions of substances present in the geothermal fluids is 0.03. For the case of a dual-turbine, bypass-unavailable upset, two wells venting, and drilling of an infill well, the impact of NO_x and SO_x emissions from the drill rig add 0.41 to the acute hazard index, for a total of 1.2. In the case of a dual-turbine, bypass-unavailable plant upset concurrent with two wells venting and no drilling, the background ozone concentration would add 0.56 to the 0.76 contributed from the plant upset for a total hazard index of 1.3.

Nitrogen oxides are emitted to the atmosphere from combustion sources primarily in the form of nitric oxide (NO)[112]. Although some nitrogen dioxide is emitted directly to the atmosphere from these sources, most nitrogen dioxide is formed as a result of reactions between nitric oxide and ozone (O_3). The net reaction consumes one molecule of nitrogen oxide and one molecule of ozone to form one molecule of oxygen and one

112 Roughly ten percent or less of the nitrogen oxides emitted from a combustion source is emitted in the form of nitrogen dioxide. These primary nitrogen dioxide emissions are primarily due to reactions that occur at the elevated temperatures and nitrogen oxides concentrations that exist within the combustion zone and exhaust system of the source.

molecule of nitrogen dioxide. If the amount of ozone available to react in the ambient atmosphere is less than the amount of nitric oxide available, the formation of nitrogen dioxide is said to be ozone-limited. In this situation, all of the ambient ozone is depleted by reaction with NO. This would be the case for receptors downwind and close to a drill rig under worst-case meteorological conditions. For this reason, it is not possible for the NO_x and SO_x emissions from a drill rig and background ozone concentrations to contribute to the maximum total acute hazard index at the same time. It would be inaccurate to include the contributions of project-emitted NO_x and SO_x in the calculation of acute hazard index along with the background ozone concentration. For this reason, the maximum acute hazard index with and without drilling have been presented in the EIS/EIR. As it turns out, the background ozone concentrations in the project area would make a slightly greater contribution to the estimated acute hazard index than would the maximum estimated impact of drill rigs. Therefore, the estimated maximum acute hazard is higher for a scenario that does not include the impacts of drilling than one that does.

As noted in the comment, facility-emitted NO_x and SO_x were incorrectly labeled as "background facility-emitted criteria pollutants" in Table 37 of Appendix (page F-53). This has been corrected by deleting the word "background" from that phrase. The description of the table in the text of Draft EIS/EIR is correct.[113]

The comment regarding the contribution of background sulfate concentrations to the acute hazard index and the suggestion to use California ARB sulfate data from Squaw Valley is noted. However, the use of pollutant concentration data from a monitoring site several hundred miles away, and in a much different air basin is inappropriate. The Tahoe air basin is not a pristine area, and the ambient pollutant levels would not be expected to be similar to the project area. The comment is in error regarding both the time these data were collected (they were collected during a three-month winter period in 1996, not in 1995), and the minimum value reported was 0.2 μg/m3, not 0.5 μg/m3. In any event, the contribution of sulfate to the acute hazard index, even if the Squaw Valley data were used, would be negligible.

Please refer to the response to "Comments—Health Impacts" for a discussion of the significance of the estimated maximum acute hazard index.

Comments—Health Impacts

AG.122 The EIS/EIR's health risk assessment underestimated impacts to public health by failing to use standard modeling methodology, substantially underestimating emissions, and omitting emissions of several highly toxic substances. (Ex. A, Comment 6.a.) The health risk assessment must be revised to accurately assess public health impacts.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.123 The EIS/EIR also downplays the Project's significant acute health impacts. (EIS/EIR, ß 4.13.8.) The EIS/EIR's health risk assessment concluded that the acute (short-term) health hazard index at the maximum exposed receptor is 1.3. (EIS/EIR, page 4-246, F-43-55.) The significance standard for acute effects is 1.0. (EIS/EIR, page 4-221.) Thus, the Project will cause significant health impacts. Moreover, the Project's correctly calculated acute health hazard index (Project plus background) is 1.78, which is substantially greater than the 1.0 significance threshold. (Ex. A, Comment 6.b.)

113 The inclusion of facility-emitted criteria pollutants in the calculation of estimated hazard index is not part of the CAPCOA procedures. They were included in the calculation in order to fully assess the potential for acute health effects.

However, the EIS/EIR attempts to explain away this significant impact through what Dr. Fox characterizes as "mathematical sleight of hand." (Ex. A, Comment 6.b.) There is simply no basis for the EIS/EIR to conclude that these impacts will not be significant. The EIS/EIR should be revised to incorporate corrected health hazard indexes and to eliminate the misleading discussion about the significance of these impacts. (See Ex. A, Comment 6, for Dr. Fox's detailed analysis of these impacts.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.218 The public health impacts of the Project are underestimated in the DEIR because they are not based on maximum concentrations at the maximally exposed individual ("MEI") receptor location (Comment 1.a), emissions were substantially underestimated by the applicant (Comments 1.c through 1.f), several highly toxic substances were omitted from the analysis (Comment 1.g), and emissions from burning were omitted (Comment 4.b). These errors and omissions should be corrected, and the EIR revised and recirculated for review. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.220 The DEIR argues that a hazard index of 1 is not significant because it would occur only during unusual events. (DEIR, page 4-247.) However, the DEIR establishes a hazard index of 1 as the significance level, without any exceptions. (DEIR, page 4-221.) Further, this circumvents standard guidelines for performing health risk assessments, which require that health impacts be found significant when the hazard index exceeds 1. (CAPCOA 1991, page III-39.) These guidelines do not allow any exceptions. It also deviates from standard practice throughout the field, which likewise requires that hazard indices greater than 1 be found significant. Second, the co-occurrence argument is misleading because it suggests exceedances would only occur if "a dual-turbine, bypass-unavailable plant upset occurred concurrently with the drilling of an infill well and two wells venting, worst-case meteorological conditions, and annual average ozone concentrations." A comparison of Table 4.13-6 at page 4-236 with Table 33 at page F-48 indicates that the threshold of 1 would still be exceeded for normal operation with two wells venting. Most of the emissions are actually from normal operation, not upset conditions. Further, as explained above, omitting annual average background ozone concentrations would not alter the results because the threshold is exceeded even without adding background concentrations.

The EIR should be revised to find a significant acute health impact, as required by the CAPCOA guidelines and standard practice. Mitigation should be required to eliminate this impact and the EIR recirculated for review. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Health Impacts

The potential for respiratory irritation as a result of exposure to emissions from a worst-case plant upset is not considered significant for several reasons. The most important reason the acute hazard index is not significant is that the H_2S ambient air quality standard is based on odor, not on respiratory irritation. The acute Reference Exposure Level (REL) for H_2S has been set equal to the California Ambient Air Quality Standard. The lowest H_2S concentration for which respiratory irritation associated with short-term exposure have been reported in a scientific study is about 2.5 parts per million (83 times higher than the ambient air quality standard and the acute REL).[114] In another study, a group of ten asthmatic volunteer subjects who were exposed to 2 ppm H_2S for 30 minutes exhibited no statistically significant changes in pulmonary function. (The H_2S concentration to which these subjects were exposed is 67 times higher than the ambient air quality standard and the acute REL.) At that concentration, the volunteer subjects reported experiencing a very unpleasant smell, but they "rapidly became accustomed to it." The Occupational Safety and Health Administration (OSHA) has established a Permissible Exposure Level (PEL) for H_2S at 10 ppm (333 times the acute REL). In occupational settings, workers may work for eight hours in concentrations up to this level. It would appear, therefore, that the estimated short-term maximum H_2S concentration for the Fourmile Hill project (about 75% of the ambient air quality standard) is several orders of magnitude below the lowest concentrations at which respiratory irritation is likely to occur.

114 Bhambhani Y, and Singh M. 1985. Effects of hydrogen sulfide on selected metabolic and cardio-respiratory variables during rest and exercise. Report submitted to Alberta Worker's Health and Safety and Compensation. June, 1985. Cited by Alberta Health (1990).

Pollutants would rarely combine to exceed an acute hazard index of 1.0. The comment correctly states that the combination of two wells venting and *either* normal operation of the power plant or a plant upset, concurrent with worst-case meteorology, could produce H_2S concentrations of about 30 $\mu g/m^3$. The text of Appendix F and Section 4.13 have been revised to clarify that this impact, together with average background ozone concentrations or the maximum impact associated with drilling an infill well, could produce an estimated acute hazard index exceeding 1.0. However, the venting of wells after plant startup will be an infrequent event. (There is no need to perform flow tests after plant startup. Well venting through portable silencers will only be necessary in the case of unusual events, such as pipeline problems.)

Calpine estimates that about six well-days of venting through portable silencers will occur per year, or about 29 well-hours of venting per well pad per year. (This could be 29 hours of a single well venting, 14 hours of two wells venting, or some combination.) Therefore, the frequency of well venting at any pad is expected to be 0.33% of the time or less.

In order to produce the maximum H_2S impacts presented in the EIS/EIR, two wells would have to be vented, on some combination of well pads P-1, P-2, and P-5, while worst-case meteorological conditions prevailed. The expected joint frequency of occurrence of two wells venting at these well pads and meteorological conditions sufficiently unfavorable to produce H_2S impacts high enough to produce a calculated hazard index (when combined with average or higher background ozone concentrations) greater than 1.0 has not been calculated, but is expected to be quite low (certainly less than several hours per year). The frequency of occurrence of two wells venting at these pads, adverse meteorological conditions and a drill rig operating at pad P-1 would be much lower. Of course, in order for an exposure to the maximum estimated concentrations leading to the maximum estimated hazard indices to occur, a person would have to be present where the impact was occurring, while it was occurring.

The probability of a person being present in an area in which the concentrations of pollutants combine to create a hazard index greater than 1.0 during such an event can not be precisely estimated. However, given that the events that could combine to produce such an impact are expected to occur less than a few hours per year, that a hazard index in excess of 1.0 is likely to occur only within a few hundred meters of the power plant site (if at all), and that there are no features (such as campgrounds, scenic vistas, or rest stops) that are likely to attract passing motorists to stop along the section of FS Road 49 passing by the power plant, it appears that the likelihood of a person being present in the impacted area at the time the impact occurs is quite low.

The primary adverse effect of hydrogen sulfide at concentrations approaching the ambient air quality standard is an unpleasant smell, which would most likely be noticed immediately.

Contrary to the comment's assertions, neither the Draft EIS/EIR nor CEQA establish an acute hazard index of 1.0 as a significance threshold. The Draft EIS/EIR states that "a total HI equal to or greater than 1.0 means that the ambient concentration of a toxic compound or a combination of compounds *may* produce significant health effects. A

total HI less than 1 is not considered to be significant." (page 4-221, emphasis added.) CEQA does not specify how air quality impacts are to be prepared for EIRs, and there is no requirement that the CAPCOA *Guidelines* be used. Furthermore, the CAPCOA *Guidelines* do not set any absolute significance criteria for estimated hazard indices. The *Guidelines* (and the Air Toxics "Hot Spots" Program for which they were developed) leave the assessment of the significance of estimated potential health effects to the local air pollution control district.

The assessment of potential health effects in the Draft EIS/EIR does not deviate from "standard practice throughout the field." On the contrary, risk assessment and associated risk management decision-making nearly always involves consideration of the likelihood and the severity of any estimated impact, unless the impact is so low that such consideration is moot.

Because of the low expected frequency of pollutant concentrations capable of producing an acute hazard index in excess of 1.0, and the likelihood that the only consequence of such events (if they occurred at all) would be an unpleasant odor, this impact is not considered to be significant.

Comments—Emission Effects on Vegetation, Wildlife, and Human Health

U.18 (pg. 3-185 table 3.13-3 EIS/EIR) This table only evaluates Calpine's compliances with the State Ambient Air Quality Standard. Evaluations must also be made on the effects to the water quality and on the total biology of the area. (pg. 4-36 table 4.3-3 EIS/EIR) This table shows the Deposition of Air Emission on Medicine Lake. Included in these emissions are hydrogen sulfide, boron, mercury, lead, arsenic and other heavy metals. These air emissions will change the air quality of the area, excellent air quality will no longer exist. The emissions will also settle on vegetation, wildlife and their food sources, and humans. These issues must be addressed in writing.
(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

BQ.29 The Draft EIS/EIR provides assurances that non-criteria pollutants will not provide substantial human health risks (page 4-246). There is no information on the effects of these projected emission levels on wildlife (fish and predatory birds) or what mitigation measures would be taken if it is determined that higher levels of these pollutants are being emitted. *(S. Peder and Suzanna S. Cuneo, et al.)*

HD.11 The report indicates that dust ("PM") could be a concern during plant and transmission line construction. Volcanic rock often contains heavy metals; however, an investigation and risk evaluation on the effects of the dust on construction worker health or the environment (e.g., birds) during was not performed. *(Amanda Spencer)*

Response—Emission Effects on Vegetation, Wildlife, and Environmental Health

Section 3, 4.7, Vegetation, Section 4.8 Wildlife, and Section 4.13.10 of the Draft EIS/EIR describe in detail the environment that may be affected if the proposed project is constructed and operated and the effects of the project on vegetation, wildlife, and human health and safety. See also the responses to comments in the Vegetation and Wildlife Sections for an elaboration of effects on biological resources.

Potential adverse impacts to surface water from acid rain are discussed in the Hydrology Section of the Draft EIS/EIR, Section 4.3.7. The potential for acid rain is discussed in the response to "Comments—Potential for Acid Rain."

The Draft EIS/EIR addresses the potential effects on global warming that the proposed project might have. Both Sections 3.13 and 4.13.10 state that the proposed project could have an adverse, but not significant, impact on global warming. Section 4.13.10 states the project's insignificant emissions of CO_2 could have a minimal adverse effect on global warming.

Comment—Impacts of Particulate Emissions on Health

V.36 Here's where these small particle emissions become very significant: this plant when emitting 5 tons/year of fine particles among other things, is emitting a quantity of hazardous dust capable of completely covering about 32 square miles per year! (10,000 lbs. x 9,900 square yards per pound x 9 square feet per square yard / 43,560 sq. ft. per acre / 640 acres per square mile = about 32 square miles). When such small particles are covered with condensed carcinogens and other hazardous substances, this volume and huge area of dust becomes a significant health hazard.

As the human body evolved throughout its long history, it adapted to the environment. One factor in the environment has always been dust, principally from dust storms. Dust from storms is larger than 5 micrometers in diameter and the human body evolved mechanisms for protection against such large particles. The hairs inside the nose, the mucous membranes lining the nose, throat and lungs, and even the shape of the throat, help to trap dust. As air is inhaled, the shape of the throat causes the air to swirl, so heavy dust particles are thrown outward by centrifugal force, where they strike the mucous-lined walls. As the tubes and passageways leading to the lungs twist and branch, they provide many opportunities for particles to collide with sticky walls and become trapped before they enter the lungs. Once trapped by mucous, coarse particles are coughed up and excreted.

Nature has gone to great lengths to protect the lungs because the deepest regions of our lungs provide places (called alveolar sacs, or alveoli) where oxygen passes into the blood and carbon dioxide passes out of the blood. The lungs provide a large surface area for contact with air, and thus with fine particles; the surface area of the alveoli is 65 square yards, which is larger than two tennis courts.

Thus, the deep regions of the lung provide very efficient, direct access to the blood stream and, by this means, to every part of the body. Unfortunately, humans now produce huge numbers of fine particles, and these are not caught by the body's protective mechanisms—they are simply too small. Fine particles pass easily into the deepest regions of the lungs, the alveoli, or alveolar sacs. There they remain indefinitely because no clearance mechanisms effectively remove them. Nature did not protect us against such particles, because none existed until very recently. Once lodged in the deep regions of the lung, fine particles, with their enormous surface area enriched with toxics, provide a particularly efficient means for delivering metals and organic pollutants directly into the blood stream. Their large surface area provides effective contact with moist tissue and the opportunity for dissolving or for other chemical reactions, putting pollutants directly into the victim's blood. Once in the circulatory system, toxics are then distributed throughout the body.

Fine particles have one other characteristic worthy of mention. The remain airborne for long periods of time and travel long distances—hundreds of miles, or even farther. This occurs because they are so small and light that gravity does not pull them downward efficiently, so the slightest air current holds them aloft.

Furthermore, as we shall see, they are not removed from the atmosphere efficiently by rain. Therefore, for a long time after they are released into the environment, they remain available for humans to breathe in.

The National Academy of Sciences, in AIRBORNE: PARTICLES (Baltimore: University Park Press, 1979), discussed the health dangers of fine particles from many points of view. The "background level" of these fine particles in uninhabited regions of Canada is 1 to 3 micrograms in each cubic meter of air; in the rural Midwest you'll find 5 to 12 micrograms in each cubic meter of air. This is not a "natural" background level; it represents pollution created by humans. Nevertheless, this background level is a good standard against which to judge the allowable emission of particles.

The EPA is relying upon dilution to protect us. They will argue that, by this time those particles reach your lungs, they will be diluted in a lot of fresh air and thus won't be quite so far above background levels when you breathe them. But this, of course, depends upon how close you live to a geothermal plant, how the wind currents go, whether there are thermal inversion conditions in your local atmospheric, and so forth. There is growing evidence that the EPA's dilution strategy isn't safe.

"In summary," said the National Academy, "particulate atmospheric pollutants may be involved in chronic lung disease pathogenesis as causal factors in chronic bronchitis, as predisposing factors to acute bacterial and viral bronchitis, especially in children and cigarette smokers, and as aggravating factors for acute bronchial asthma and the terminal stages of oxygen deficiency (hypoxia) associated with chronic bronchitis and/or emphysema and its characteristic form of heart failure (cor pulmonale)."

Now, just two years later, an extensive medical study has shown that human illness can result from particles in the air at levels that fall within EPA guidelines. In other words, an area may meet the federal requirements and yet still make residents sick.

The Harvard researchers say their results are important for another reason: there is some evidence that chest ailments during childhood predispose a person to permanent, serious breathing problems, like emphysema, in later life.

The study revealed that the 571 students (10.5% of the total) with asthma or persistent wheeze were particularly susceptible to bronchitis. Bronchitis was reported among 25.5% of the children with asthma or wheeze versus 4.0% of those without; for chronic cough the rates were 29.5% versus 3.2% and for chest illness 36.5% versus 7.6%.

An important point of this study is that it confirms that the relationship between particles in the air and childhood disease is "linear," which means that the more particles in the air, the more disease there is. This means that ANY increase in particles in the air is likely to cause disease in someone, somewhere. The defense, "I'm meeting all applicable state and federal standards" isn't sufficient to prevent illness. Even when a polluter meets those standards, someone will most likely get sick.

The absence of a threshold means that ANY exposure to fine particles will take its toll on the health of the exposed population. The fine particles produced by this plant are harmful to humans, especially to children. The cumulative evidence is now overwhelming and has been ignored for too long by the polluters such as this proposed Fourmile Hill geothermal power plant. It's time they were forced to confront the consequences of their dangerous technology.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

Response—Impacts of Particulate Emissions on Health

As discussed in detail in "Comments—$PM_{2.5}$ and PM_{10} Standards," the EPA undertook an extensive review of the available information regarding the health effects of fine particles and carefully considered that information before promulgating the new $PM_{2.5}$ standards. In its announcement of the new standard, the EPA stated the following.

> "EPA establishes the annual $PM_{2.5}$ standard level of 15 $\mu g/m^3$ in order to protect public health with an adequate margin of safety. Although health effects at lower annual concentrations are possible, the evidence for effect at such levels is highly uncertain and the likelihood of significant risk becomes smaller at concentrations well below the 15 $\mu g/m^3$ and approaching background levels. After reviewing public comments on the proposed standards, EPA changed the level of the 24-hour $PM_{2.5}$ standard from 50 $\mu g/m^3$ to 65 $\mu g/m^3$. In conjunction with greater protection afforded by the changes to the forms and associated monitoring requirements, EPA believes that a 24-hour $PM_{2.5}$ standard set at 65 $\mu g/m^3$ will provide an appropriate supplement to the annual standard and provides an adequate margin of safety in communities that meet the annual standard, but have infrequent or isolated 24-hour peaks. The resulting suite of PM standards will give greater flexibility to individual sources of pollution while still ensuring that public health is protected." [115]

As discussed in the response to "Comments—$PM_{2.5}$ and PM_{10} Standards," the proposed project is not expected to have a significant effect on ambient $PM_{2.5}$ concentrations or public health. PM_{10} monitoring data for the project area suggests that the area will attain the new $PM_{2.5}$ standards. Although, as stated in the Draft EIS/EIR, the project may have a significant short-term effect on ambient PM_{10} concentrations during construction, this potential impact is due primarily to fugitive dust emissions (which are expected to contain little $PM_{2.5}$). No significant impact on ambient $PM_{2.5}$ concentrations is expected.

The analyses presented in the Draft EIS/EIR explicitly considered the potential health impacts of hazardous substances present in the geothermal fluids that will be emitted to ambient air, both as gases (e.g., hydrogen sulfide) and as particulate matter (e.g., arsenic). The results of the analyses, presented in Appendix F and summarized in Section 4.13, indicate that the impact of these emissions are not expected to be significant.

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115 U.S. Environmental Protection Agency, 1997. *Fact Sheet: EPA's Revised Particulate Matter Standards*. July 17. Office of Air Quality Planning and Standards. p.4.116 Hydrogen sulfide emission factor used in the DEIR = (14,400 lbs/yr)/(49.9 MW)(365 days/yr)(24 hr/day) = 0.033 lbs/MWh.

Comments—Health Risks Associated with H_2S Concentrations

A.49 The FEIS should also identify atmospheric conditions which could exacerbate and/or intensify concentrations of hazardous air pollutants, and should relate these conditions to the activities under consideration. As an example, hydrogen sulfide (H_2S), a listed emission at the site, tends to collect in low-lying areas, a situation which could be intensified under certain meteorological conditions. The FEIS should identify areas prone to H_2S concentrations and should discuss the impacts and amplify on health risks related to the situation. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

CI.3 Hydrogen sulfide gas is a very toxic poison which in extremely minute quantities causes great damage to not only humans, but any animal life. *(Marius A. Fariolettı)*

PH3.45 There is a state standard for the sulfides in the air, right? *(Yreka Public Hearing)*

PH3.46 And it is known that in volcanic areas, there is sulfite in the air from this being in a volcanic area, correct, as a rule? *(Yreka Public Hearing)*

PH3.47 Is the production and natural going to meet the same criteria, or is production going to get a different leeway? *(Yreka Public Hearing)*

Response—Health Risks Associated with H_2S Concentrations

Comment A.49 describes two different sorts of atmospheric phenomena that are quite different. The first is the "pooling" of dense gases. This behavior occurs when the density of a gas or mixture of gases is sufficiently greater than the air it displaces, causing it to sink. (This occurs for the same reason that, if cream is gently poured into a cup of hot coffee, it will sink to the bottom. The cream is more dense than the hot coffee it displaces.) The density difference may be due to a significantly lower temperature of the gas, or it may be because the average molecular weight of the gas is significantly higher than the average molecular weight of air. This effect cannot separate gases that are already mixed (just as coffee and cream, once mixed, cannot be separated.)

None of the exhaust streams at the proposed project will be sufficiently more dense than air to exhibit the dense-gas behavior discussed above. (Actually, most exhaust streams will be significantly less dense than ambient air due to their elevated temperatures. The exhaust from these sources will tend to rise above the emissions sources. Thus, pooling of hydrogen sulfide or other project emissions in low-lying areas is not expected to occur.

The second atmospheric phenomenon mentioned in the comment refers to the widely varying dispersion of pollutants under different meteorological conditions. In general, pollutants are dispersed better in higher winds than in lower winds, and are dispersed better when the atmosphere is unstable (such as on a sunny day) than when it is stable (such as at night). Worst-case scenarios for most types of emission sources are cold, clear nights with low wind speeds. The analysis of air quality impacts described in Section 4.13 and in Appendix F evaluates dispersion under all meteorological conditions that occurred at the project site during the full year of meteorological monitoring that was performed there. The estimated short-term maximum air quality impacts reported in Tables 4.13-4, 4.13-5, 4.13-6, and Tables 19, 21, 22, 23, 24, 26, 28, 29, 30, and 31 of Appendix F are the highest estimated concentrations for any one-hour, three-hour, eight-hour, 24-hour, or monthly period occurring during the period that the emissions would occur. (For instance, the maximum one-hour average hydrogen sulfide concentrations reported in the first column of Table 4.13-6 are the highest concentrations estimated by the dispersion model for any emissions scenario that could occur during the first year of construction, based on the meteorological data for the months those activities could occur.) Estimated long-term average concentrations

presented in the Draft EIS/EIR were also calculated using the actual meteorological data collected at the proposed project site.

Hydrogen sulfide is toxic at high concentrations. The lowest concentrations at which any acute adverse health effects have been reported are greater than a part per million (more than 40 times higher than the highest estimated short-term impact estimated for the proposed project). The reported health effects at concentrations of two to five parts per million were coughing, throat irritation, and several reports of headaches. At lower concentrations, hydrogen sulfide has a rotten-egg odor.

The California ARB has set the California Ambient Air Quality Standard for hydrogen sulfide at 30 parts per billion (42 $\mu g/m^3$) for a one-hour average. Although the health effects of hydrogen sulfide were considered by the Air Resources Board when the standard was set, the standard was based on odor. The maximum estimated hydrogen sulfide impact associated with the proposed project is less than the California Ambient Air Quality Standard. Therefore, no significant impacts to human or animal life are anticipated as a result of the project.

The estimated air quality impacts presented in the Draft EIS/EIR fully account for the meteorological scenarios that occur in proposed project area. The estimated maximum short-term impacts presented are for the reasonable worst-case combinations of emissions and meteorological conditions that are expected to occur during the construction and operation of the proposed project.

In understanding dispersion modeling, it is important to note that maximum ground-level pollutant concentrations occur directly downwind of the source(s) under either:

- Conditions of stable atmospheric conditions and low wind speed (such as might occur on a clear night)
- Conditions of near-neutral stability conditions and relatively high wind speeds (this situation occurs when aerodynamic wake effects of structures near a source cause an emission plume to be "downwashed" to the ground close to the source)

As the comment notes, some pollutants can collect in low-lying areas under certain conditions. However, this type of phenomena would not occur as a result of the proposed project. Pollutant-emitting sources at the proposed power plant and wellfield site would all be elevated, and would all emit buoyant plumes. These sources would include the combustion sources, the plant vent silencer, portable silencers (used during well flow testing and venting), and the cooling tower. Since the sources would be elevated and emit buoyant plumes, these plumes would rise, and would not collect in low-lying areas. Droplets in the cooling tower drift and fugitive dust particles would settle and be deposited on the ground and other surfaces. The larger droplets and particles would settle faster and be deposited closer to the sources. The smaller droplets and particles would settle at a slower rate and be deposited farther away. However, no impacts to human or animal life would occur from this deposition due to extremely low concentrations of hazardous air pollutants that the project will generate.

Comment—Poisonous Gas Release

DT.5 Third: Evidence regarding the safety and economic viability of geothermal energy projects is incomplete. While the Draft EIS/EIR downplays the risks posed by this project, the EPA is currently spending over $5 million (per well) of taxpayer's money to prevent wells at the Geysers geothermal development from emitting poisonous gas clouds over portions of Lake and Sonoma counties. *(Carolyn D. Jones)*

Response—Poisonous Gas Release

The estimated air quality impacts of the proposed project are presented in Section 4.13 and Appendix F. All air quality abatement equipment needed for the proposed project would be funded by the project proponent. It is beyond the scope of this document to comment on the actions of regulatory agencies with respect to other projects or facilities.

For various reasons, poisonous gas emissions are not a threat associated with the construction, operation, or decommissioning of the proposed plant. The primary gas pollutant from the project would be H_2S, emissions, the impacts of which have been explained elsewhere in this document, including in the response to "Comments—Health Risks Associated with H_2S Concentrations."

Tables 4.13-7 and 4.14-8 provide the maximum daily and annual emission levels of non-criteria pollutants. Excess lifetime cancer risk, chronic total hazard index, and acute total hazard index were calculated using the procedures outlined in the *CAPCOA Risk Assessment Guidelines* (CAPCOA 1993). The analysis of these tables is provided in Section 4.13.8 of the Draft EIS/EIR.

From these analyses, it is projected that the maximum short-term and average long-term concentrations of toxic air pollutants emitted by the project will be well below concentrations at which toxic effects could be expected to occur. Likewise, the estimated maximum excess cancer risk associated with emissions from the project is much less than one in one million, assuming a continuous 70-year lifetime of exposure.

VISIBILITY IMPACTS

Comments—Visibility Modeling and Impacts

AG.124 Similar to its analysis of acute health risks, the EIS/EIR finds that there will be no significant visibility impacts from the Project's air emissions, even though the EIS/EIR's own modeling indicated that these impacts would, in fact, be significant:

The model results show exceedances of visibility thresholds (which could indicate that a plume may be visible) both outside Lava Beds and within its boundaries during construction activities, including well drilling." (EIS/EIR, page 4-250.)

The significance of the impact is dismissed on the grounds that (1) the Project's NO_x and PM_{10} emissions rates were overestimated; (2) the modeling methodology used in the EIS/EIR overestimates visibility impacts; and (3) experience at other geothermal fields has not produced visibility impacts. None of these provide sufficient basis to conclude that this impact will not be significant.

As to reason (1), Dr. Fox's analyses indicate that the Project's emissions were underestimated, not overestimated. (Ex. A, Comment 7.e.) With regard to (2), the EIS/EIR cannot have it both ways. If the preparers of the EIS/EIR select a particular model to assess an impact, the significance of the impact should rely on the results of that model. Moreover, the model used (VISCREEN) was the model recommended by the U.S. EPA. Rather than discounting the results of the model, the preparers should have conducted more refined visibility modeling (e.g., PLUVUE II) before dismissing the impact as insignificant. (See EIS/EIR, page F-57.) As for (3), the EIS/EIR provides no data about whether other geothermal fields are located in visibility-sensitive areas, such as this Project.

As Class I airsheds, the Lava Beds National Monument and Wilderness Areas are subject to the most stringent visibility standards. According to the scoping comments submitted by the National Park Service ("NPS"), "[u]nimpaired viewshed is an important part of the [Lava Beds] visitor experience." (Ex. I, Letter from George Turnbull, Superintendent, NPS (July 12, 1996).) Despite overwhelming

evidence to the contrary, the EIS/EIR concluded that this impact would not be significant.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.125 Moreover, as Dr. Fox explains, the mitigation measures proposed for this impact (e.g., dust control, truck speed limits, covering trucks) will not mitigate the impacts because these control strategies were already factored into the underlying emissions calculations. (Ex. A, Comment 7.a.) The EIS/EIR should be revised to acknowledge the significance of this impact and to recommend effective mitigation measures. (See Ex. A, Comment 7.e. for Dr. Fox's recommended mitigation measures.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

PH5.41 I'd like somebody to explain here the Viscreen deal; what are the visibility. *(Medicine Lake Public Hearing)*

PH5.42 In many cases it says that the test is unproven and basically doesn't really work, if you read it.
(Medicine Lake Public Hearing)

PH5.43 How can you tell that it works when you're saying in here many times that this test—there's no guarantee what you've done is going to work? *(Medicine Lake Public Hearing)*

Response—Visibility Modeling and Impacts

Comment AG.124 is incorrect. This impact has not been dismissed. Rather, based on the results of visibility modeling as described in Section 4.13.9, the Draft EIS/EIR concludes that the impact of drill rig emissions on visibility are potentially significant and unavoidable (page 4-252). The Draft EIR/EIS also discusses the conservative nature of the VISCREEN model and contrasts the model results with experience at other similar projects. Exceedances of screening thresholds do not necessarily mean that a significant impact to visibility will occur, because the model is extremely conservative. Appropriate and feasible mitigation measures designed to minimize the potential impacts to visibility are presented on page 4-235.

Page 4-252 of the Draft EIS/EIR states that the expected effects of the mitigation measures proposed in the Draft EIR/EIS have been accounted for in the analysis of project impacts on visibility.

Comment—Opacity from Well Venting and Cooling Tower

AG.126 In addition, California Health and Safety Code section 41701(b) and Siskiyou County APCD rule 4.1 contain prohibitions against discharge into the atmosphere from any source whatsoever any air contaminant, other than uncombined water vapor, for a period or period aggregating more than three minutes in any one hour which is of such opacity as to obscure an observer's view to a degree equal to or greater than smoke that is as dark or darker in what as than designated as No. 2 on the Ringelmann Chart.

Here, the EIS/EIR states that steam plumes will be emitted from well venting and from the cooling tower. (EIR/EIS, pages 4-138-139.) That steam contains H_2S. (EIR/EIS, pages 4-224, 235.) The EIR/EIS states that these steam plumes will be visible. (EIR/EIS, page 4-142.) The EIS/EIR should discuss whether these steam plumes comply with the requirements of Health & Safety Code section 41701 and SCAPCD Rule 4.1. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

Response—Opacity from Well Venting and Cooling Tower

The proposed project would comply with the cited regulations. The procedure used by Siskiyou County APCD and other air pollution control districts for evaluating plume opacity requires that the evaluation take place in a portion of the plume that does not contain condensed water. Experience with well venting at other geothermal projects and cooling towers at many types of facilities indicates that the opacity of the cooling tower and well venting plumes in regions of the plumes that do not contain condensed water will be less than that indicated as No.2 on the Ringelmann Chart.

MONITORING AND REPORTING

Comments—Emission Monitoring and Reporting

U.19 The Siskiyou County Air Pollution Control District is going to monitor the amount of emissions pumped into the atmosphere. Will a new employee have to be hired to do this? And how often will pollution levels be monitored? When an "upset" condition occurs will the public be informed of dangerous emission levels? Will SCAPAD warn the public? These emissions could lead to a public health hazard.
(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

Y.33 Data gained through monitoring of air quality and air inversion analyses during the exploratory stages must be part of the Final EIS/EIR, and data must be provided for long-term commercial operations.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

BQ.24 We are also concerned about the possible number of plant upset conditions. The model used to determine total H_2S emissions is based on a specific number of plant upsets annually. We want to know how the number of plant upsets is reported and if this information is provided to the public.
(S. Peder and Suzanna S. Cuneo, et al.)

BQ.26 How does SCAPCD plan to insure that air quality standards are continually monitored?
(S. Peder and Suzanna S. Cuneo, et al.)

BQ.28 Table 4.13-8 provides the annual emissions of Non-Criteria Pollutants (lbs./year). Again this table is based on assumptions of a specific number of plant upsets, along with plant operation and infill well drilling. How will the actual levels of these non- criteria pollutants be measured? It is unclear from the Draft EIS/EIR if there will be long term monitoring stations and if these stations will measure the actual amount of pollutants. *(S. Peder and Suzanna S. Cuneo, et al.)*

BQ.30 We would like to know how criteria and non-criteria pollutants will be measured, how the accumulated amounts will be measured and how the public will be informed. *(S. Peder and Suzanna S. Cuneo, et al.)*

PH4.54 Will Calpine pay for air quality monitoring? *(Mount Shasta Public Hearing)*

Response—Emission Monitoring and Reporting

The Draft EIS/EIR sets forth a comprehensive modeling analysis for possible sources of air quality impacts from the proposed power plant. The response to "Comments—No Support for Most Emissions Calculations" contains an analysis of the emissions calculations for the project. Also see the response to "Comments—Modeling Methodology" for a discussion of the modeling utilized in the air quality impacts analysis. Within this section, each potential source of air pollution is addressed to the greatest detail possible at the time of publishing. For each potential or projected source of air pollution that could have a significant impact, a mitigation measure is proposed to reduce the potential impact.

Upset conditions may occur at the power plant due to power plant equipment failure, transmission line fault or failure, and switchyard or substation failure. Upset conditions have been modeled for the maximum potential air quality impacts assuming a worst-case scenario. Under this scenario, it is assumed that both turbines would be non-operational ("dual-turbine outage upset") and the turbine bypass system would be unavailable. Calpine estimated the frequency of such upsets based on operating experience at other facilities. Upset conditions shall be reported to the Siskiyou County APCD as soon as possible, but no later than one hour after its detection on a regular business day, or one hour after the start of the next business day, whichever is sooner. The APCD Officer will investigate the report and determine if a breakdown occurred . If the reported incident was not a breakdown, the APCD will take the appropriate enforcement action pursuant to District Rule 2.12.

During upset conditions, Calpine would immediately reduce the output from the turbines. Upset conditions with a full-flow scenario will generally last less than 24 hours. It is estimated that an average of three or four short-duration upsets

(approximately six hours in duration) could occur each year. Calpine would attempt to keep one or both of the turbines operational under such conditions. If not , a backup generator would be used to keep the plant in a standby mode. When the turbine bypass system is unavailable, H_2S emissions would be abated by a backup abatement system which provides approximately 80% H_2S control efficiency. Comprehensive plant protocols for full-flow upset conditions are provided in Appendix F of the Draft EIS/EIR.

The Draft EIS/EIR addresses the potential impacts associated with criteria and non-criteria pollutants, and the associated human health risks in Section 4.13.8, and more fully addresses issues of Human Health and Safety in Section 4.15.

In case of a dual unit outage, light and audio alarms will be sounded. Before leaving the control room, the operator will attach a portable personnel H_2S detector, as will other plant personnel. The vented H_2S would be abated and would not be expected to be at levels warranting PPE (note: PPE—personal protective equipment—will be available at the site).

ENFORCEMENT OF LAWS, REGULATIONS, AND PERMIT CONDITIONS

Comment—SCAPCD's Hexavalent Chromium Rule

AG.131 Siskiyou County APCD Rule 8.4 and CARB regulations (17 CCR ß 93103) prohibit any person from adding any hexavalent chromium containing chemicals or any compound that may produce hexavalent chromium to a cooling tower. Rule 8.4 and the CARB regulations also prohibit operation of any cooling tower unless the hexavalent chromium levels do not exceed 0.15 milligrams/liter of circulating water.

The EIR/EIS shows that the proposed cooling towers will emit chromium (page 4-244; Apages F, page F 12). The EIR/EIS should discuss whether the chromium is hexavalent chromium and should discuss whether the cooling tower will comply with District Rule 8.4 and CARB regulations.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—SCAPCD's Hexavalent Chromium Rule

Historically, hexavalent chromium compounds have been widely used as corrosion inhibitors in cooling towers. However, the use of chromium in cooling towers has been banned by the regulations cited in the comment and others. Calpine has not proposed to, and would not, add any chromium-containing chemicals to the circulating water of the proposed cooling towers.

Chromium is a common constituent of geothermal fluids, although often at very low concentrations. However, it has not been detected in the fluids of the Glass Mountain geothermal resource. The detection limits for the chromium analyses available to Calpine were in the range of 0.003 to 0.005 mg/l. If chromium is present at very low concentrations (below the analytical detection limit) in the geothermal fluids, the concentration would be much lower yet in the circulating water of the cooling tower. Because chromium is a nonvolatile substance, nearly all of it would be remain with the geothermal brine and be returned to the geothermal resource via the injection wells. Thus, chromium concentrations in the circulating water of the cooling tower (if it is present at all) are expected to be extremely low (many orders of magnitude below 0.15 mg/l).

Therefore, the proposed project would be in compliance with the cited regulations.

Comment—Permit Conditions

AG.228 The DEIR lists six conditions that "would be considered for inclusion in the ATC and PTO that Calpine would be required to obtain." (DEIR, page 4-219.) However, the DEIR does not evaluate them and does not require that they be implemented as mitigation. Further, some of them would allow emissions far in excess of those evaluated in the DEIR and found to be significant. These conditions should be revised to reduce impacts to a less than significant levels and proposed in the EIR as mitigation measures.

The first condition would limit hydrogen sulfide "emissions from a single well during drilling, testing, reworking, or venting operation to 10 lbs/hr." (DEIR, page 4-219.) This is a very large amount of hydrogen sulfide, far more than evaluated in the DEIR and found to cause significant impacts. As discussed in Comment 7.c, the hydrogen sulfide modeling completed for the DEIR demonstrates that emissions of 1.8 lbs/hr from two wells venting simultaneously are sufficient to result in malodors over a large area around the facility. Modeling analyses should be performed to determine the maximum hourly hydrogen sulfide emission rate that would not cause malodors (Comment 3). This value should be specified as a mitigation measure in the EIR and required as a permit condition.

The second condition requires control of hydrogen sulfide from well drilling, testing, reworking, or venting using abatement methods approved by the SCAPCD. The abatement methods are not identified or specified in any way. (DEIR, page 4-220.) The SCAPCD is obligated to impose feasible mitigation that the EIR finds would reduce impacts to a less than significant level. This DEIR failed to identify any such mitigation measures. As discussed in Comment 7.c, modeling analyses should be performed to determine the maximum hydrogen sulfide emission rate from well venting that would not cause malodors. This value should be used to specify a hydrogen sulfide removal efficiency that an abatement system would have to meet. This removal efficiency should be specified as a mitigation measure in the EIR and required as a permit condition.

The fourth condition limits hydrogen sulfide emissions from the plant to 0.11 lbs/MWh. (DEIR, page 4-220.) This is a very large amount of hydrogen sulfide, far more than evaluated in the DEIR and found to cause significant impacts. The DEIR assumes that 14,400 lbs/yr of hydrogen sulfide would be emitted by the Project. (DEIR, Table 4.13-3.) On a per megawatt-hour basis, this correspond to 0.033 lbs/MWh.[116] The emission of 0.033 lbs/MWh of hydrogen sulfide during normal operation of the Project would result in the widespread exceedance of the hydrogen sulfide odor threshold of 0.4 $\mu g/m^3$. Modeled 1-hr average hydrogen sulfide concentrations would exceed this threshold at numerous receptors including Medicine Mountain (1.0 $\mu g/m^3$), Medicine Lake Glass Flow (0.7 $\mu g/m^3$), Grouse Hill (15.7 $\mu g/m^3$), Badger Peak (3.9 $\mu g/m^3$), Little Mt. Hoffman (1.5 $\mu g/m^3$), the goshawk nest (1.8 $\mu g/m^3$), Fourmile Hill (6.3 $\mu g/m^3$), Lookout Butte (2.6 $\mu g/m^3$), the southwest corner of Lava Beds National Monument (0.5 $\mu g/m^3$), and Forest Service Road 49 near the plant site (14.7 $\mu g/m^3$). (DEIR, page F-44.) Therefore, the proposed limit of 0.11 lbs/MWh is not suitable. Modeling analyses should be performed to determine the maximum amount of hydrogen sulfide that could be emitted during normal operation without causing malodors. This value should be specified as a mitigation measure in the EIR and required as a permit condition.

The sixth condition requires that a turbine bypass system be installed to route produced steam around the turbine to the condenser and primary abatement system during startup, shutdown, and upsets. (DEIR, page 4-220.) It is not clear whether the Project would include this system. The Project description in Section 2 does not mention a turbine bypass system. However, Section 4.3, Air Quality, discusses air quality impacts during upset conditions as though a turbine bypass system were installed. (DEIR, pages 4-223, 4-225.) Finally, Appendix F describes emissions during plant upsets as though the Project would include a turbine bypass system. (DEIR, pages F-7, F-8.) The EIR should be modified to require the installation of a turbine bypass system and to specify the conditions under which it would be used. This information should be included in the Project description in Section 2, or specified as an air quality mitigation measure in Section 4.13.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

PH4.55 Will the project require a special use permit from the SCAPCD or any other approval that could be revoked if Calpine is not in compliance? *(Mount Shasta Public Hearing)*

Response—Permit Conditions

The Draft EIR/EIS includes a list of permit conditions that the Siskiyou County APCD was *considering* for inclusion in Authorities to Construct (ATC) or Permits to Operate (PTO) at such time as these permits are applied for.[117] The conditions related to the control of H_2S emissions. The Siskiyou County APCD subsequently stated in a letter

117 Griffin, Patrick J. Letter to Hub Adams, MHA Environmental Consulting. Siskiyou County Air Pollution Control District.

(Griffin 1998) to the third-party consultant preparing the EIS/EIR that the conditions outlined were general in nature, and that "It would be inappropriate to include these conditions as mitigation measures prior to the completion of the EIR."

Because the project is not expected to have significant H_2S impacts, no mitigation measures (beyond those already designed into the project and described in the Draft EIS/EIR) are required to be presented in this EIS/EIR. Therefore, any additional permit conditions would be supplemental to any described in the EIS/EIR. If they are not necessary to reduce significant environmental impacts, CEQA does not require that EIRs include as mitigation measures the specific conditions for all permits that will be issued for a project. Therefore, pages 4-219 and F-66 of the Draft EIS/EIR have been revised to remove this speculative discussion of conditions that would be included in the air quality permits.

Reference:

Griffin, Patrick J. Letter to Hub Adams, MHA Environmental Consulting, Inc. Dated January 28, 1998.

MITIGATION MEASURES

Comments—Adequacy of Air Quality Mitigation

V.24 This project is predicted by the EIR to emit about 7.2 tons per year of hydrogen sulfide gas, smelling like rotten eggs, which as a light gas would occupy a very large volume. The Siskiyou County Air Pollution Control District wrote a letter stating that the Fourmile Hill EIR didn't adequately control emissions. (See APCD's letter dated February 3, 1997 to Calpine attached hereto as Exhibit "B") It therefore recommended expanding the "mitigation segment" of the EIR by adding measures to be imposed within the permit to operate. It included the following mitigations, but none of these were ever added to the EIR as mitigations! A statement in the EIR that Calpine has indicated that they will comply with these conditions simply isn't equivalent of actual CEQA mitigations; nothing yet provided prevents Calpine from changing its mind. As such, the public has no way of knowing that these mitigations will in fact later be adopted as conditions of permit approval.

The Siskiyou County APCD requested a mitigation limiting hydrogen sulfide emissions from any single well operation to not exceed 10.0 lbs./hr. That mitigation was never added to the EIR.

The Siskiyou County APCD also requested a mitigation controlling hydrogen sulfide emissions by "injection of hydrogen peroxide and/or sodium hydroxide into the blooie line." That mitigation was never added to the EIR either.

The Siskiyou County APCD requested a third mitigation controlling hydrogen sulfide emissions from the power plant to not exceed 50 grams/MwHr. That mitigation was never added to the EIR either. As a result, even if it were actually imposed, the EIR fails to contain any quantitative mitigations limiting hydrogen sulfide emissions from the power plant operation!

The Siskiyou County APCD also requested a mitigation that stated: "The plant shall install a turbine bypass to reduce emissions during startup, shut down, and upset conditions. The bypass will direct the steam around the turbine, through the main condenser, and on to the primary H_2S abatement system prior to venting. That mitigation was never added to the EIR either.

If this is any measure of the effectiveness of the Siskiyou County APCD in implementing CEQA requirements, then its failure to insure adequate mitigation in the EIR is just a foreshadowing of its future ineffectiveness in protecting the surrounding area from this power plant's air pollution.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

V.27 Mitigation measure 4.13.2a is legally defective in deferring to some later time the determination of the schedule for monitoring and the allowable limit for emissions. It essentially allows the APCD to either monitor this facility or not depending upon its staff budget, personnel availability, or some other unstated reason. If the emissions exceed some presently undisclosed limit, then the mitigations states the APCD "could require compliance with the emission limitation," but by the same token it could also not require compliance. What protection does the public have from some ill-defined mitigation written so loosely that it isn't even mandatory? How is the public to be able to independently evaluate at this brief opportunity for review if that "mitigation" will ever be effective or not? Moreover, when the APCD is

considered the Lead Agency for CEQA review, effectively policing itself or not if it wishes with such poorly written mitigations, where will the public turn to if this project's air pollutants overwhelm them?
(Carol Plank, Medicine Lake Citizens for Quality Environment)

V.28 Similarly, mitigation measure 4.13.5b is legally defective in deferring to some later time the determination of additional mitigation measures during operation of the power plant. If such mitigation measures are later determined to be needed, but after the conclusion of this limited public review period, the public will be denied its right under CEQA to examine such mitigation measures for their effectiveness. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

AG.127 The foregoing discussion, as supported by the analyses of Dr. Fox, demonstrates that air emissions from the Project will cause several significant impacts. These impacts have not been mitigated to significance. Dr. Fox points out several problems with the mitigation measures proposed in the EIS/EIR. (Ex. A, Comment 7.) She also identifies several additional feasible mitigation measures. These include common methods of reducing construction PM_{10} emissions (Ex. A, Comment 7.a.), mitigating cooling tower emissions (Ex. A, Comment 7.b.), reducing emissions from well ventings (Ex. A, Comment 7.c.), and limiting emissions during upset conditions (Ex. A, Comment 7.d.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.221 These comments indicate that the Project will have a number of significant impacts that were not identified in the DEIR. These include adverse impacts to vegetation and perhaps wildlife from the deposition of toxic metals and other substances (Comment 13), degradation of the water quality of Medicine Lake (Comment 8), adverse public health impacts (Comment 6), odor impacts (Comment 3), and degradation of air quality (Comments 3 and 4). These impacts are all caused by the emission of criteria and toxic pollutants during construction and operation. The operational impacts are primarily caused by emissions from the cooling towers and vent silencers. All of these impacts can be eliminated or greatly reduced by using standard equipment and methods, many of which are mentioned in the DEIR, but not explicitly required as mitigation. The EIR should be revised to require the mitigation identified below for these impacts and recirculated for review.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Adequacy of Air Quality Mitigation

The Draft EIS/EIR identifies as significant the impacts of project emissions during construction on visibility (pages 4-252 and 4-235) and on ambient PM_{10} concentrations (page 4-235). Feasible mitigation measures that will substantially lessen these impacts, although not below a level of significant, are provided (page 4-252). In addition, page 4-252 has been revised to include as a mitigation measure the use of low-sulfur diesel fuel in all on-site equipment for which it is available.

Mitigation Measures 4.13.2a and 4.13.5b require monitoring to verify the EIR's conclusions that impacts from H_2S concentrations at adjacent receptors are less than significant. Because the Draft EIS/EIR concludes that H_2S impacts will not be significant, no mitigation is required. Here, the monitoring is not required to assess the significance of an impact but only to verify the Draft EIS/EIR's conclusions, and this does not violate CEQA. Moreover, the types of possible mitigation that could be imposed if monitoring reveals a need are identified, including reducing the number of wells venting simultaneously, and adding abatement measures such as caustic injection between the flash tank and the portable silencer.

CEQA does not require that all possible mitigation measures be adopted for significant impacts; rather, it requires that all feasible measures necessary to substantially lessen or avoid a significant impact be included. For a discussion of possible mitigation measures for impacts that are not expected to be significant, and for which mitigation is thus not required, please refer to the following responses to comments: "Comments—Cooling Tower Mitigation;" "Comments—Construction Mitigation;" "Comments—Well Venting Mitigation;" "Comments—Upset Conditions Mitigation;" and "Comments—PM_{10} Mitigation."

Comment—Expanding Mitigation Analysis

AG.130 The EIS/EIR should be revised to include an analysis of all feasible measures for mitigating the Project's significant impacts. Failure to do so violates the requirements of CEQA and NEPA (Cal. Pub. Res. Code ß 21100(b)(3); 14 CCR ß 15126(c); Robertson, 490 U.S. at page 352.), as well as the GROs (GRO No. 4.) The revised EIS/EIR should be recirculated so the public has an opportunity to comment on these mitigation measures. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

Response—Expanding Mitigation Analysis

The Draft EIS/EIR includes analyses of all feasible mitigation measures that would substantially reduce or avoid the project's significant impacts on the environment.

Comment—Consequences of Chronic Noncompliance

BQ.27 If Calpine is found in chronic noncompliance with air quality emission requirements what will be the response of SCAPCD and the USFS? We would like a written response to these questions.
(S. Peder and Suzanna S. Cuneo, et al.)

Response—Consequences of Chronic Noncompliance

The Siskiyou County APCD is charged with local regulation of both the Federal Clean Air Act and the California Clean Air Act. Furthermore, the U.S. EPA has umbrella enforcement authority of the Federal Clean Air Act. Accordingly, any chronic violations of air quality standards are subject to the enforcement provisions of these and other statutes. Chronic noncompliance will not be tolerated. There are considerable penalty provisions in the California Health and Safety Code to prevent such activity.

However, it is not projected that such violations will occur under the comprehensive permit conditions that are associated with the proposed project. The Siskiyou County APCD has adopted New Source Review (NSR) requirements specifying the use of Best Available Control Technology (BACT) and the identification of the need for emission offsets. Under these requirements, the ATC and PTO permits necessary for the development of the proposed project will be contingent on adherence to strict air quality standards prescribed by the Siskiyou County APCD. The list of conditions are dependent on final NSR and BACT review, and precise conditions are subject to change pending test drilling and well flow testing. Violation of these conditions, and applicable state and Federal air quality standards could result in possible action by both the Siskiyou County APCD and the EPA, which could include the imposition of fines, revocation or permit, and other penalties. The USFS does not enforce air quality emission requirements.

Comment—Construction Mitigation

AG.222 The DEIR concludes that there would be significant and unavoidable impacts from construction on a short-term basis in close proximity to construction activities and required four mitigation measures. These mitigation measures include applying water or a dust palliative to all active construction areas, inactive areas with disturbed soils and soil stockpiles, limiting vehicle speeds to 25 mph on all unpaved roads, and covering all construction trucks that travel off forest roads. (DEIR, pages 4-234, 4-235.) In addition to the impacts identified in the DEIR, first-year construction activities would result in the exceedance of the State 1-hr PM_{10} standard (Comment 2). These impacts have not been mitigated.

The construction mitigation proposed in the DEIR is not adequate. All feasible mitigation is required when impacts are significant and unavoidable. Both the BAAQMD (BAAQMD 1996, Table 2) and SCAQMD (SCAQMD 1993, Tables 11-2 to 11-4) have prepared CEQA guidance documents that identify feasible construction mitigation measures. The following additional technically feasible mitigation measures from these CEQA handbooks should be imposed on the Project to reduce PM10 impacts:

- Pave, apply water three times daily, or apply non-toxic soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites;
- Sweep daily with water sweepers all paved access roads, parking areas and staging areas at construction sites;

- Replant vegetation in disturbed areas as quickly as possible;
- Install wheel washers for all exiting trucks, or wash off the tires or tracks of all trucks and equipment leaving the site;
- Install wind breaks or plant trees/vegetation wind breaks at windward side(s) of construction areas;
- Suspend excavation and grading when winds (instantaneous gusts) exceed 25 mph;
- Use methanol, natural gas, propane, or butane powered on-site mobile equipment, where available, in the order of preference listed; and
- Limit all vehicle speeds to 15 mph (rather than 25 mph recommended in the DEIR).

These additional mitigation measures for construction PM_{10} should be imposed on the Project to reduce significant and unavoidable PM_{10} air quality impacts.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Construction Mitigation

The Draft EIS/EIR includes reasonable and feasible mitigation measures to reduce the impacts of fugitive dust during construction. While other air pollution control districts have required different mitigation measures for projects within their jurisdiction, CEQA does not require that all lead agencies impose the same mitigation measures. Rather, lead agencies adopt requirements that meet the unique needs and circumstances of the project and project area.

There are many differences between air districts such as the South Coast Air Quality Management District and the Siskiyou County APCD which make mitigation measures for particulate matter that are used in those urban districts unnecessary, ineffective or infeasible in the project area. These differences include, but are not limited to:

- PM_{10} concentrations in Siskiyou County are much lower than in the SCAQMD and other urban districts. For this reason, more extreme measures are needed to control district-wide PM_{10} emissions in the urban areas.
- Many of the roads in the project area are bare-dirt or gravel, whereas there are very few such roads in urban areas.
- Construction sites in many urban areas are not surrounded by tall forest canopies, thus they may benefit from artificial wind breaks.
- Commercial street sweeper services are readily available in urban areas, whereas they generally are not in rural areas.
- Urban districts such as the SCAQMD may have attainment problems for other pollutants that make low-emissions construction vehicles necessary.

Comment—Construction Curtailment as Mitigation

AG.128 Further, the EIS/EIR repeatedly states that there are no feasible measures to mitigate PM_{10} emissions from the drill rigs during construction. However, those emissions could be mitigated if the project were required to halt or limit construction work during periods of poor air quality. That mitigation measure should be considered in the EIR/EIS.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Construction Curtailment as Mitigation

As suggested by the response to "Comments—NO_x Mitigation," the project and the EIS/EIR have been revised to reflect the use of low-sulfur diesel fuel as a feasible mitigation measure for PM_{10} emissions from drill rigs and other diesel engines.

Limiting or halting construction work during periods of poor air quality is not a feasible mitigation measure for PM_{10} impacts, for several reasons. PM_{10} impacts associated with fugitive dust are highly localized, so general concentrations of PM_{10} or other pollutant

concentrations measured elsewhere within the air basin are not likely to be indicative of the potential for high PM_{10} concentrations in the project area. (An exception would be the presence of large forest fires, which may increase the PM_{10} concentrations throughout the air basin substantially.)

The PM_{10} ambient air quality standards (the criteria of significance for PM_{10} impacts) are based on 24-hour average and annual average concentrations. (It is only the 24-hour average standard that may be significantly impacted by construction activities at the proposed project.) Unlike gaseous pollutants, PM_{10} concentrations are analyzed by passing a known volume of air through a filter over a 24-hour period, then weighing the filter on a sensitive laboratory balance. (The filter weighing procedures require that the filters be "conditioned" for some period of time, usually a day or more, before weighing.) Therefore, PM_{10} concentrations are not known in real time, but are determined later.

Consequently, cessation of construction activities during periods of high PM_{10} concentrations is not a feasible mitigation measure.

Comment—Well Venting Mitigation

AG.224 During construction, wells would be vented directly to the atmosphere for 2 days to clean out the well followed by 30 days for flow testing. (DEIR, page 2-14.) Wells are also normally vented directly to the atmosphere during maintenance, which could occur as frequently as once every year. (BPA and BLM 1995, page 4-30.) The DEIR concludes that these emissions are not significant because the State hydrogen sulfide standard would not be exceeded. Therefore, no mitigation is required to reduce venting emissions. (DEIR, pages 4-235, 4-237.)

However, concentrations of hydrogen sulfide due to well venting during construction are high enough to be detected as malodors by sensitive receptors in a wide area around the facility. Malodors from hydrogen sulfide can be detected at concentrations as low as 0.4 μg/m3. (Comment 3.) Modeled 1-hr average hydrogen sulfide concentrations exceed this threshold at numerous receptors including Medicine Lake Campground (1.0-1.7 μg/m3), Medicine Lake Campground Headquarters (1.5-2.2 μg/m3), Medicine Lake Cabins (1.0-1.6 μg/m3), Little Medicine Lake (1.5-2.2 μg/m3), Medicine Lake Glass Flow (1.8-3.2 μg/m3), Grouse Hill (9.8- 13.9 μg/m3), Badger Peak (2.2-3.7 μg/m3), the goshawk nest (2.1 μg/m3), Fourmile Hill (3.5-5.9 μg/m3), Lookout Butte (1.8-3.3 μg/m3), the southwest corner of Lava Beds National Monument (0.5-0.9 μg/m3), Forest Service Road 49 near the plant site (5.3-8.8 μg/m3), the Door Knob Snowmobile Park (0.5-1.0 μg/m3), and the Fourcorners-Medicine Lake Snowmobile Park (0.7- 0.8 μg/m3). (DEIR, page F-44.) These receptors include many pristine areas, such as Lava Beds National Monument.

The DEIR argues odor is not a concern because humans would be infrequently present and worst-case meteorological conditions generally occur at night and in the winter when recreators are unlikely to be present. (DEIR, pages 4-241, 4-248.) This is not correct. Individuals would be present to detect these odors in both the winter and at nights year round because there are year round residences in the area and substantial winter recreation (e.g., snowmobiling, cross-country skiing) occurs in the area. (Leydecker 1972, page 8.)118 Hydrogen sulfide concentrations exceed odor thresholds at several residential areas that are occupied year round, including two snowmobile parks and residential areas around Medicine Lake.

These are significant impacts that are not recognized as such in the DEIR and which should be mitigated. Although the DEIR does not include any mitigation measures to reduce hydrogen sulfide from well venting, it does require that hydrogen sulfide emissions from flow testing be monitored and reported to the SCAPCD. If measured emissions exceed SCAPCD emission limits, the SCAPCD could require mitigation, such as reduction in the number of wells venting simultaneously and implementation of wellhead treatment. (DEIR, page 4-237, Mitigation Measure 4.13.2a.) This is not adequate mitigation.

Monitoring is not mitigation. The DEIR's own analysis (using underestimated hydrogen sulfide emissions) clearly shows that well venting during construction will cause odor problems in sensitive recreational areas around the facility. This significant impact must be mitigated by stipulating measures that will reduce hydrogen sulfide emissions below levels that would cause odor problems. The DEIR's proposed Mitigation Measure 4.13.2a only requires monitoring. It does not require any reduction in hydrogen sulfide emissions. Monitoring does not reduce emissions. Instead, it leaves the decision to

reduce emissions to the discretion of the SCAPCD, and then only if an unspecified emission limit is exceeded. This is unacceptable.

Even if monitoring detects a problem, the mitigation imposed by the SCAPCD would not reduce impacts to insignificance. The trigger emission limit for mitigation is not specified. A preliminary list of SCAPCD permit conditions is included elsewhere and includes a proposed hydrogen sulfide limit of 10 lbs/hr during well drilling, testing, reworking, or venting. (DEIR, page 4-219.) This is substantially larger than the emission levels that caused the significant odor impacts (1.6 lbs/hr). (DEIR, pages F-19, Table 10.) Therefore, even if the proposed SCAPCD limit of 10 lbs/hr were adopted as mitigation, it would not reduce the odor impacts due to well venting.

Mitigation Measure 4.13.2a should be revised to require that hydrogen sulfide emissions from well venting be reduced below the odor detection threshold of 0.4 μg/m3 at sensitive receptors. As noted in the DEIR, this could be accomplished by reducing the number of wells allowed to vent simultaneously and by requiring wellhead treatment to remove hydrogen sulfide. (DEIR, page 4-237.) Well-head treatment could be accomplished by injecting sodium hydroxide and/or hydrogen peroxide between the flash tank and the portable silencer (DEIR, page 4-225), using an iron catalyst secondary system (CalEnergy 1996, page 29), or using another suitable method, as appropriate.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Well Venting Mitigation

Section 4.13 and Appendix F discuss the expected impacts of the project on ambient hydrogen sulfide concentrations. No mitigation is required for H_2S emissions from wellhead venting, because these emissions are not expected to cause any significant impact. Please refer to response to "Comments—Significance Criteria," "Comments—Adequacy of Air Quality Mitigation," and "Comments—Odor Threshold and Nuisance" for additional discussions.

Comments—Cooling Tower Mitigation

AG.129 With regard to the cooling tower emissions, Dr. Fox proposes feasible mitigation measures that are capable of reducing or eliminating the emissions and size of the visual steam plumes. (Ex. A, Comment 7.b.) For example, the use of air-cooled condensers will completely eliminate the steam plumes. (Ibid.) This will reduce impacts associated with air quality, as well as impacts to water quality, wildlife, vegetation, and visual resources.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.223 The emissions of arsenic, boron, hydrogen sulfide, and other constituents result in significant impacts that were not mitigated in the DEIR. These include vegetation damage from boron and other toxic pollutant emissions (Comment 13), public health impacts from consuming water and organisms from Medicine Lake contaminated with arsenic and mercury in deposition (Comment 8), odor impacts from hydrogen sulfide emissions (Comment 3), and respiratory irritation from the emission of a number of compounds, including hydrogen sulfide and ammonia (Comment 6.b). (DEIR, page F-53.) Roughly half of the emissions of hydrogen sulfide and most of the other toxic pollutants that cause these significant impacts originate from cooling tower drift and evaporation. These emissions can be substantially reduced by using air or surface condensers, or high-efficiency drift eliminators. The DEIR must discuss and evaluate these mitigation measures.

Air-Cooled Condensers. Steam from the turbines is condensed in water-cooled, direct- contact condensers, and the condensate is cooled in a mechanically induced draft cooling tower. (DEIR, page 2-28.) The cooling tower is the source of roughly half of the toxic emissions from the facility. (DEIR, page F-12.) The cooling tower steam plume could be visible year round, rising up to 320 feet above the ground (tower is 70 ft tall and plume is up to 250 ft tall). (DEIR, pages 4-139, 2-28.) Cooling tower drift and evaporation emissions and the cooling tower plume could be eliminated by replacing the water-cooled condensers and supporting cooling tower with air-cooled condensers. This would also increase the amount of fluid reinjected into the geothermal reservoir and, thus, mitigate depletion of the resource and reduce subsidence potential.

Air-cooled condensers have been widely used in steam turbines in small power plants (1 to 50 MW) for several decades,119 including binary geothermal power plants.120 Air-cooled condensers alone are not practical for the dual-flash geothermal plant as currently designed by Calpine. However, they could be

119 T.C. Elliott, Air-Cooled Condensers, Power, January 1990, pp. 13-21.

120 A. Elovic and M. Grassiani, Air Cooled Condensers for Geothermal Power Plants, Geothermal Resources Council Trans., v. 17, 1993, pp. 355-359.

effectively used if the plant were modified to use Ormat's combined cycle technology. This process uses a back pressure turbine followed by energy converters operating on an organic Rankine cycle. Brine energy can be recovered in a binary plant. This process maintains the geothermal fluid above atmospheric pressure without the use of vacuum pumps or ejectors, saving power, maintenance expenses and eliminating the handling of noncondensibles. Air-cooled condensers are used, which result in a lower plant profile, reduced visual impacts, no water consumption, reduced use of chemicals, reduced emissions, and no cooling tower plumes. This allows all of the spent brine to be reinjected and facilitates hydrogen sulfide abatement. This technology has been successfully used on numerous plants on six continents that have accumulated over 10 million hours of operation.121 It was recently used at the 125 MW Upper Mahiao geothermal power plant in the Philippines, which is the largest air-cooled plant as well as the largest geothermal combined cycle plant in the world.122

The EIR should be revised to require air-cooled condensers for the Project to eliminate the numerous problems associated with emissions from the cooling tower. These can be readily accommodated in a combined cycle configuration and would substantially reduce environmental impacts, reduce operating costs, increase efficiency and reliability, and avoid depleting the geothermal resource. Alternatively, high efficiency drift eliminators and a surface condenser should be required, which are discussed below.

High-Efficiency Drift Eliminators. As noted above, roughly half of the Project's toxic pollutants is emitted from the cooling tower during normal operation. Substances dissolved in the cooling water are either evaporated or emitted with the drift, which is small droplets of water created by the falling and splashing of circulating water. Virtually all of the nonvolatile constituents, such as PM_{10} and boron, as well as some of the volatile components, are emitted as cooling tower drift.

It is possible to reduce the drift to a very tiny percent of the circulating water rate by using high-efficiency drift eliminators, which are baffles arranged to change the direction of air flow and catch the droplets. The DEIR does not reveal the Project's design drift rate (the percent of the circulating water flow that would be emitted as droplets) nor require any specific criteria for the proposed cooling tower. In fact, the DEIR is ambiguous on what the actual drift rate would be. It uses 0.001 percent to calculate PM_{10} emissions (DEIR, page 2-29) and elsewhere states that high-efficiency drift eliminators can typically reduce drift to "less than 0.008% of the water circulation rate," (DEIR, page F-6), but stops short of specifying a rate for this Project. The Suder Files, on the other hand, indicate that a drift fraction of 0.01 percent was used to estimate cooling tower emissions. (Suder Files, Table 5.)

Two currently proposed power plants have proposed lower drift rates than those mentioned in the DEIR. Calpine's Sutter power plant has proposed to use a drift rate of 0.0006 percent.123 The High Desert Power Project has proposed to use a drift rate of 0.0008 percent. 124 Therefore, lower rates are clearly technically feasible. If water-cooled condensers are retained, the EIR should be modified to require that the drift eliminators be designed to achieve the lowest technically feasible drift rate (i.e., <0.0006%).

Surface Condenser. The Project proposes to use a direct-contact condenser to separate the turbine steam into condensate and noncondensible gases. The condensate is routed to the cooling tower and the noncondensible gases to the steam jet gas ejectors. (DEIR, page 2-30.) However, a direct-contact condenser is not as efficient as a surface condenser because it leaves a larger fraction of the noncondensible gases in the condensate. The noncondensible gases that remain in the condensate can be emitted from the cooling tower. The direct-contact condenser partitions 60 to 70 percent of the hydrogen sulfide into the noncondensible gases, leaving 30 to 40 percent in the condensate where it can be emitted from the cooling tower. The surface condenser, on the other hand, partitions 85 to 90 percent of the hydrogen sulfide into the noncondensible gases, leaving only 10 to 15 percent in the condensate. (DEIR, page 4-240.) If air-cooled condensers are not used, the EIR should require the use of surface condensers to reduce the emission of hydrogen sulfide and other volatiles, including radon, mercury, and ammonia.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Cooling Tower Mitigation

No mitigation is required for emissions from the cooling tower, because no significant impacts associated with cooling tower emissions have been identified. Although not

121 Ormat, Upper Mahiao Combined Cycle Geothermal Power Plant Fact Sheet, 1996.

122 N. Forte, The 125 MW Upper Mahiao Geothermal Power Plant, Geothermal Resources Council Transactions, vol. 20 1996, pp. 743-747; N. Forte, The 125 MW Upper Mahiao Geothermal Power Plant, Geothermal Resources Council Bulletin, August/September 1996, pp. 298-303.

123 Calpine, Sutter Power Project, Section 2.0, Project Description, Draft Application Materials Submitted to the California Energy Commissions, 1997, p. 11.

124 High Desert Power Project, Application for Certification for High Desert Power Project, Submitted to the California Energy Commission, June 1997, p. 5.12-50.

required as a mitigation measure, the cooling towers would have high-efficiency drift eliminators, which would reduce the emissions of nonvolatile substances present in the cooling tower drift to levels well below the conservative estimates presented in the Draft EIS/EIR. Refer to the response to "Comments—Support for Emissions Calculations" for further discussion.

Comment—Upset Conditions Mitigation

AG.225 During worst-case upset conditions, 100 percent of the steam flow would be vented directly to the atmosphere. Hydrogen sulfide would be removed by a secondary treatment system capable of removing 80 percent. (DEIR, page F-8.) The ambient air quality analysis indicates that hydrogen sulfide concentrations would be high enough to cause malodors over a large area around the facility. Modeled 1-hr average hydrogen sulfide concentrations would exceed the odor detection threshold of 0.4 $\mu g/m^3$ (Hoshika et al. 1993) at numerous receptors including Medicine Mountain (1.0 $\mu g/m^3$), Medicine Lake Glass Flow (0.5 $\mu g/m^3$), Grouse Hill (16.6 $\mu g/m^3$), Badger Peak (3.9 $\mu g/m^3$), Little Mt. Hoffman (1.5 $\mu g/m^3$), the goshawk nest (0.5 $\mu g/m^3$), Fourmile Hill (8.5 $\mu g/m^3$), Lookout Butte (2.7 $\mu g/m^3$), the southwest corner of Lava Beds National Monument (0.7 $\mu g/m^3$), and Forest Service Road 49 near the plant site (5.2 $\mu g/m^3$). (DEIR, page F-44.) These receptors include many pristine areas, such as Lava Beds National Monument. These are significant impacts that were not recognized as such in the DEIR and which have not been fully mitigated.

The only mitigation included in the DEIR is to throttle back the wells to 50 percent of full flow after 1 hour of full-flow venting. (DEIR, page 2-41.) This is in lieu of Calpine's proposal of two-thirds of full flow over an 8 hour period after 24 hours of venting. (DEIR, page 4-240.) Although it is stated that additional cutbacks may be required if feasible without damaging the wells to meet SCAPCD emission requirements, there is no commitment to do so, nor is any emission limit provided. (DEIR, page 2-241.) Reducing the well flow by 50 percent would roughly halve the ambient hydrogen sulfide concentrations modeled in the DEIR and summarized above. Remaining concentrations would still exceed the odor threshold in a number of locations. Further, actual hydrogen sulfide emissions would likely be substantially larger than those used in the DEIR modeling (Comment 1.c).

Therefore, additional mitigation is required to reduce impacts from the worst-case upset scenario to a less than significant level. This is clearly feasible. According to the Newberry DEIR, during routine upset conditions, wells would be shutdown gradually by 50 percent after 1 hour and 25 percent after 6 hours. During life-threatening emergencies, wells could be shutdown within 60 seconds, although this could cause casing collapse (BPA and BLM 1995, page 4-30).

The DEIR should be modified to specify more stringent well shutdown requirements as additional mitigation for significant odor impacts. These should include complete shutdown of wells where feasible without damaging the well. If a life-threatening situation exists, mandatory shutdown should be required. Otherwise, flow should be cut back to 50 percent of full flow within 1 hour and to 25 percent within 6 hours. In addition, the DEIR should evaluate increasing the sulfur removal efficiency of the secondary abatement system to greater than the proposed 80 percent. The proposed sodium hydroxide/hydrogen peroxide process is capable of reducing hydrogen sulfide by 90 to 94 percent.[125]

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Upset Conditions Mitigation

As discussed in the response to "Comments—Well Venting," hydrogen sulfide impacts associated with emissions from the proposed project are not expected to cause or contribute substantially to an exceedance of the California Ambient Air Quality Standard, nor produce hydrogen sulfide concentrations high enough to create a public health hazard. Mitigation Measure 4.13.5c, providing for a 50% throttling-back of full flow after one hour of full-flow venting (during upset conditions), would not cause emissions to exceed the California Ambient Air Quality Standard. Therefore, the impacts are not expected to be significant, and no mitigation measures for hydrogen sulfide emissions are required.

125 P. Hirtz and T. MacPhee, Development of a Safer and More Efficient Method for Abatement of H2S during Geothermal Well Drilling, Geothermal Resources Council Transactions, v. 13, 1989, pp. 403-407.

Calpine would, of course, shut down a well if necessary to curtail a life-threatening situation.

Primary, secondary and backup abatement systems could be designed to provide higher levels of hydrogen sulfide control. However, higher levels of control are not required because no significant impacts associated with hydrogen sulfide emissions are expected, under normal operation, upsets, or during well venting.

If the hydrogen sulfide content of the geothermal resource is higher than expected, or if hydrogen sulfide emissions from the project are greater than expected, a higher level of hydrogen sulfide control will be used to ensure that no significant impacts result from hydrogen sulfide emissions.

Comment—PM_{10} Mitigation

AG.226 The DEIR finds that Project emissions of PM_{10} and NO_x during construction could result in a potentially significant, short-term impact on visibility within Lava Beds National Monument. The principal sources of the emissions that cause the impairment are construction PM_{10} and the drill rig emissions. (DEIR, page 4-248, Appx. F.) Actual visibility impairment would be substantially larger than estimated in the DEIR because emissions from both of these sources were underestimated by substantial amounts (Comment 5.c) and burning emissions were not considered. (Comment 4.) The DEIR incorrectly suggests that these impacts would be mitigated to insignificance. As described below, the emissions used in the visibility impact analyses already include reduction due to the proposed mitigations. Therefore, these mitigation measures do not reduce visibility (or any other significant impact). The DEIR should be revised to include bona fide mitigation for the significant visibility and other impacts.

Earthwork. For PM_{10} emissions from earthwork, the DEIR claims that these emissions would be minimized by Mitigation Measure 4.13.1a (DEIR, page 4-251), which is a dust control program. However, the emissions that were used in the visibility calculations assume that the dust control program was already in place. (DEIR, page F-10.) Therefore, the emissions used in the visibility analysis already included the reductions proposed as mitigation, and the proposed mitigation measures do not reduce the projected emissions nor the visibility impact. Mitigation to reduce PM_{10} emissions from construction is described in Comment 7.a and should be adopted in the EIR to reduce visibility and other Project impacts. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

PH3.103 On your hydrologist report, you have got dust control, I think, for your first segment of construction, is 10,000 gallons a day, which would be about 45 minutes of water wetting of the roads. Is all of your numbers in that like that? You are going to have run a water truck round the clock. Are all your numbers you picked as far off as that one? Ten thousand gallons a day? *(Yreka Public Hearing)*

Response—PM_{10} Mitigation

As discussed in the responses to "Comments—Drill Rig Emissions" and "Comments—Earthwork Emissions," project emissions of PM_{10} and NO_x have been estimated fairly according to accepted methodology.

Actual visibility impacts are expected to be less, not greater, than those presented in the Draft EIS/EIR due to the conservative nature of the VISCREEN model. (Appendix F, Section 4 discusses the conservatism of the model.) In the absence of a much more detailed visibility analysis, the impact of project emissions (primarily NO_x emissions from the drill rigs) on visibility were identified in the EIS/EIR as potentially significant. The comment is correct in stating that the mitigation measures described in the EIS/EIR were accounted for in the visibility impact analysis (as is clearly stated in the Draft EIS/EIR on page F-67). However, the comment incorrectly states that the EIS/EIR suggests that these impacts would be mitigated to insignificance. The Draft EIS/EIR concluded that the visibility impacts are potentially significant and unavoidable, although it recognized that the estimated impacts are probably overstated.

Comment—NO_x Mitigation

AG.227 For the drill rig, the DEIR recommends the use of ignition timing retard on the diesel engines used to power the drill rigs to reduce NO_x emissions. (DEIR, page 4-251.) However, the emission factors used to calculate drill rig emissions assume the engines are already controlled using ignition timing retard. (DEIR, pages F-11, F-62.) Therefore, the emissions used in the visibility analysis already included the reductions proposed as mitigation, and the proposed mitigation measures do not reduce the projected emissions nor the visibility impact.

Peak daily and hourly emissions from the drill rigs could be reduced by simply restricting operations to a single rig at a time. During the first and second years of construction, two wells would be drilled simultaneously and during the third year, six wells would be drilled using three rigs. (DEIR, pages F-3, F-4.) The DEIR argues that the use of only two drill rigs in the third year instead of three would not reduce total project PM_{10} and NO_x emissions because it would only "spread out" the emissions over a longer time. (DEIR, page F-61.) While this is true for total emissions from drilling, it is not true for hourly, daily, or even annual emissions, which would be reduced by restricting the number of rigs. Peak emissions over these shorter time periods cause significant air quality impacts, which are based on short-term exceedances of air quality standards. Spreading out the emissions, in fact, reduces these violations which are due to peak emissions.

The NO_x and PM_{10} emissions from the rigs, the main pollutants of concern, could also be substantially reduced by requiring best available control technology ("BACT"). Air pollution control districts throughout the State have established BACT guidelines for diesel-fired internal combustion engines such as the ones that would be used on the drill rigs. In the Bay Area, technologically feasible and cost-effective BACT for NO_x is an emission factor of 0.0033 lbs/hp-hr (compared to 0.013 lbs/hp-hr assumed in the DEIR), which the BAAQMD states can be achieved using selective catalytic reduction ("SCR") plus timing retard plus a turbocharger with an intercooler. BACT for PM_{10} is low sulfur, low ash fuel oil.[126] In the South Coast district, achieved-in-practice BACT for NO_x for internal combustion engines is catalytic reduction.[127] In the San Joaquin Valley, technologically feasible BACT for NO_x for internal combustion engines is selective catalytic reduction or alternatively, an LPG-fired engine with a NO_x catalyst. Achieved-in-practice BACT in the San Joaquin Valley for PM_{10} is low-sulfur diesel fuel (0.05% S by weight or less) and positive crankcase ventilation or a crankcase control device that is 90 percent efficient.[128]

Therefore, NO_x emissions from the drill rigs should be mitigated by using either SCR or an LPG-fired engine equipped with a NO_x catalyst. The DEIR argues that SCR is too expensive, emits ammonia, and reduces power output. (DEIR, page F-62.) However, the cost, $4,000/ton (DEIR, page F-63), is well below $17,500/ton, which is generally considered to be economic in California. (BAAQMD 1995, page 9.) Further, this technology is frequently permitted in California on large diesel engines,[129] and the U.S. EPA also recommends SCR for NO_x control on large diesel engines without any qualifications. (AP-42, page 3.4-4.)

Similarly, PM_{10} emissions from drill rigs should be mitigated by requiring diesel fuel that contains no more than 0.05 weight percent sulfur. This would also reduce sulfur dioxide emissions by a factor of four because the sulfur dioxide emissions in the DEIR are calculated assuming a sulfur content of 0.2 weight percent.[130] The DEIR must discuss and analyze these mitigation measures.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—NO_x Mitigation

Appendix F, Section 6 discusses the mitigation of emissions from the drill rigs. For NO_x emissions, it concludes:

> "Based on review of the economic, logistical, and environmental consequences of the control technologies available for diesel engines, as well as historical

126 BAAQMD, BACT/TBACT Workbook Guidelines for Best Available Control Technology, June 30, 1995, p. 96.1.1.

127 SCAQMD, Best Available Control Technology (BACT) Guidelines, February 1992, p. 96.D1.

128 San Joaquin Valley Unified Air Pollution Control District, Best Available Control Technology Clearinghouse, Fourth Quarter 1996, p. 3-13.

129 CARB, A Compilation of California BACT Determinations Received by the CAPCOA BACT Clearinghouse, 2nd Edition, November 1993; CARB, BACT Determinations Received by the CAPCOA BACT Clearinghouse During First Quarter 1997, August 7, 1997, p. 3.

130 Sulfur content of fuel oil assumed in the DEIR = 66 lbs/day/[(0.00809 lb/hp-hr)(2550 hp)(24 hrs/day)(2 rigs)(0.33)] = 0.2%. (AP-42, p. Table 3.4-1.)

> requirements for their use, it appears that injection timing retard is the only proven and feasible NO_x emission control technique for diesel engines in this application. SCR does not appear to be feasible because 1) it is very expensive, 2) it is not proven for load-varying applications such as drill rigs, 3) it would require the transport and handling of an additional hazardous material to and at the project site, 4) it may produce a hazardous waste, and 5) PM_{10} emissions may be increased, due to ammonia slippage"

The engines that would most likely be used on drill rigs at the project would have injection timing retard, turbochargers and intercoolers. This is considered the Best Available Control Technology (BACT) for NO_x from portable diesel engines in the Siskiyou County APCD. The comment suggests that an additional control system, selective catalytic reduction (SCR) should be used at the proposed project, and states that SCR is BACT in the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD), the Bay Area Air Quality Management District (BAAQMD), and the South Coast Air Quality Management District (SCAQMD). These other districts have much different air quality, demographic, industrial, economic, social and political situations than does Siskiyou County APCD. Unlike the Siskiyou County APCD, the SCAQMD and SJVUAPCD have long-standing ozone attainment problems, and the BAAQMD's ozone attainment status is tenuous. Despite this, none of those districts require SCR as BACT for portable diesel engines.[131,132,133,134,135] Staff of the SCAQMD, SJVUAPCD, and the Monterey Bay Unified Air Pollution Control District (which also does not require SCR for drill rig engines[136]) all described some of the operational problems that can results from the attempted use of SCR on drill rig engines or similar applications. These problems are discussed in Appendix F, Section 6 of the EIS/EIR. All of these districts require NO_x emission levels for portable diesel engines in general, or drill rigs specifically, that can be met by turbocharged, intercooled diesel engines with FITR.

The commentor states "the U.S. EPA also recommends SCR for NO_x control on large diesel engines without any qualifications. (AP-42, page 3.4-4)" The cited reference reads as follows:

> "SCR is an add-on NO_x control placed in the exhaust stream following the engine and involves injecting ammonia (NH_3) into the flue gas. The NH_3 reacts with the NOx in the presence of a catalyst to form water and nitrogen. The effectiveness of SCR depends on fuel quality and engine duty cycle (load fluctuations). Contaminants in the fuel may poison or mask the catalyst surface causing a reduction or termination in catalyst activity. Load fluctuations can cause variations in exhaust temperature and NO_x concentration which can create problems with the effectiveness of the SCR system."

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131 Heinen, George, 1998. Personal communication San Joaquin Valley Air Pollution Control District.

132 Erickson, Lance, 1998. Personal communication. San Joaquin Valley Air Pollution Control District.

133 Hunyh, Kien, 1997. Personal communication South Coast Air Quality Management District.

134 Hunyh, Kien, 1998. Personal communication. South Coast Air Quality Management District

135 Lim, Kenneth, 1998. Personal communication. Bay Area Air Quality Management District.

136 Steele, Jerry, 1997. Personal communication. Monterey Bay Unified Air Pollution Control District.

The comment has mischaracterized this reference. It does not include any recommendation of SCR. Rather than recommending the use of SCR in *all* large diesel engines, the U.S. EPA recognizes that SCR is not equally effective in all situations, and can be subject to problems in load-varying applications (such as drill rigs). This is consistent with the information provided by the air pollution control agencies contacted, as well as engine manufacturers and vendors.

NO_x catalysts are an emerging technology that holds some promise for controlling NO_x emissions from diesel engines, but are as yet unproven. Nevertheless, as discussed in the EIS/EIR, NO_x emissions will not be significant because the project will not cause exceedence of state or federal ambient air quality standards, and no mitigation is required.

The comment also suggests that PM_{10} emissions be reduced by using low-sulfur diesel fuel in the drill rigs. Calpine intends to do this. Although the sulfur oxides emissions estimates presented in the Draft EIS/EIR were based on a sulfur content of 0.2%, fuel containing 0.05% sulfur will be used. Unfortunately, no data are available regarding the decrease in PM_{10} that would result from the use of low-sulfur diesel. The U.S. EPA emission factor for sulfur oxides emissions, however, does include an adjustment for fuel sulfur content. The Final EIS/EIR has been revised to reflect this four-fold decrease in sulfur oxides emissions and associated sulfur dioxide concentrations.

The comment suggests mitigating emissions by allowing operation of only one drill rig at a time. This is not feasible for this project, because it would substantially increase the overall cost of construction by drawing it out over a longer period, and would have other negative impacts on project economics, as well.

3.15 Noise

INTRODUCTION

This section provides responses to comments on noise issues. The comments and responses are grouped under the following headings:

- General
- Methodology
- Existing Setting
- Significance Criteria
- Noise Sources During Construction
- Noise Impacts During Construction
- Noise Sources During Operation
- Noise Impacts During Operation
- Noise During Decommissioning
- Potential Vibration Impacts
- Alternatives
- Mitigation Measures

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

GENERAL

Comments—General Adequacy of Noise Analysis

V.2 A legally adequate EIR must contain sufficient detail to help ensure the integrity of the process of decision making. "The EIR must contain facts and analysis, not just the bare conclusions of a public agency. An agency's opinion concerning matters within its expertise is of obvious value, but the public and decision-makers, for whom the EIR is prepared, should also have before them the basis for that opinion so as to enable them to make an independent, reasoned judgment." (Santiago Water District v. County of Orange (4th Dist. 1981) 118 Cal.App. 3d 818,831.

Accordingly, this EIR is inadequate because most of the evaluation of noise impacts is unsupported by sufficient data and analysis within the EIR. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

AG.135 The EIS/EIR admits that the Project will cause significant unavoidable noise impacts to sensitive receptors. (EIS/EIR, Table S-5, p. S-18; see also EIS/EIR, pp. 257-58 (listing significance criteria).) However, as is noted in the letter from Thomas Reid Associates, which is attached to this letter as Exhibit B, the EIS/EIR's noise analysis is so fundamentally flawed that it is not possible to evaluate mitigation measures. Dr. Fox provides additional comments. (Ex. A, Comments 18, 19.) The document should be revised and recirculated. (Cal. Pub. Res. Code § 21092.1; 14 CCR § 15088.5; Laurel Heights Improvement Association of San Francisco v. Regents of the University of California (1993) 6 Cal.4th 1112, 1130.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.136 The EIS/EIR has characterized the Project's impacts as significant without sufficient investigation, data gathering, or reasonable analysis, as required under CEQA and NEPA. (14 CCR § 15151; Concerned Citizens, 42 Cal.3d at p. 935; Seattle Audubon, 798 F.Supp. at p. 1479.) Specifically, the EIS/EIR has failed to adequately identify Project-related noise generators and sensitive receptors such as Native American tribal members, forest users, residences, and wildlife. Also, the noise sampling methodology does not comport with standard sampling methods, but the EIS/EIR does not explain why it relied on that particular methodology. The EIS/EIR's analysis is wholly unsupported by data, reference sources, or graphics. Without this information, the EIS/EIR not only fails to crystallize noise-related issues, but it also precludes the public and decisionmakers from evaluating the Project's impacts, mitigation measures, and alternatives. (Seattle Audubon, 798 F.Supp at p. 1479.) The comments of Thomas Reid Associates and Dr. Fox discuss this issue in more detail. (Ex. B. § 4.14; Ex. A, Comments 18, 19.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.308 The Fourmile Hill Geothermal Development Project EIS/EIR identifies noise as a significant unavoidable adverse impact to forest users and visitors to Medicine Lake, tribal members engaged in traditional activities at cultural sites, and residents of Medicine Lake and Tionesta. However, the noise analysis is so completely inadequate that the area that would be affected by substantial increases in ambient noise cannot be determined, the impact itself cannot be characterized and the number of sensitive receptors adversely affected cannot be estimated. The information presented is largely anecdotal and unsupported by data, reference sources or graphics. Thus, the lack of sufficient information and analysis prevents meaningful assessment by the public of the potential noise impact or the development of effective and feasible mitigation. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—General Adequacy of Noise Analysis

A thorough analysis was performed to determine noise impacts associated with the proposed project. A description of the methods used to assess noise impacts is presented in the Draft EIS/EIR (pages 3-191 to 3-194). As described in the Draft EIS/EIR, a noise propagation model was used to estimate noise levels from project construction, operation, and decommissioning (pages 4-260 to 4-262). Expected noise levels from well drilling and geothermal operations were based on noise measured at other existing geothermal operations including The Geysers (G.S. Nolte and Associates 1986) and Coso KGRA (MHA 1988).

The results of the analysis are contained in the Draft EIS/EIR (pages 4-262 to 4-269) and are supported by the collected data. The analysis is consistent with Federal guidelines outlined in the Geothermal Resource Order (GRO) No. 4 (USGS 1980), the Siskiyou County General Plan, and the Modoc County General Plan. Effects of the proposed project were analyzed under NEPA and CEQA Guidelines.

The project's noise generators have been identified in categories such as construction, well drilling, power plant operation, and decommissioning. The locations of the sensitive noise receptors in the Medicine Lake area have been identified and located in Figure 3.14-1 in the Draft EIS/EIR. As stated in the Draft EIS/EIR (page 3-192), sensitive receptors in the Medicine Lake area are defined as sites where the majority of residents and seasonal visitors congregate. These sites could be affected by potential project noise. These sites include residences, campgrounds, and recreational facilities in the Medicine Lake area. As stated in the Draft EIS/EIR (page 3-158), there are 35 residences at the southeast end of Medicine Lake, a single cabin at the southwest end of the lake, and three residences near Little Medicine Lake. As described in Table 3.11-1 on page 3-157 of the Draft EIS/EIR, there are 75 campsites on the north and west end of Medicine Lake distributed amongst four developed campgrounds.

The community of Tionesta is identified as a sensitive noise receptor on page 3-194 of the Draft EIS/EIR, and potential noise effects to sensitive noise receptors at Tionesta are discussed under Impact 4.14.3 on pages 4-268 and 4-269 of the Draft EIS/EIR. Figure 3.14-2 has been added to Section 3.14, Noise, of the Final EIS/EIR to clarify the location of sensitive noise receptors in the Tionesta area. As discussed on page 3-163 of the Draft EIS/EIR, there are about 12 to 15 homes within Tionesta.

In addition to evaluating noise effects on specific sensitive receptors, the Draft EIS/EIR includes an ambient noise analysis that was performed in the general project vicinity. The ambient noise is described in Section 3.14 of the Draft EIS/EIR.

The sampling methods used for measuring ambient noise levels are consistent with methods promulgated in the American National Standards Institute guidelines. These

guidelines provide an accurate and adequate method for analysis of ambient noise levels consistent with applicable Federal and state regulations. For this analysis, it was assumed that Forest users could be anywhere in the Forest and therefore noise estimates were performed without taking into account noise attenuation features of the existing environment. Noise attenuation features, such as vegetation and terrain, tend to reduce the level of noise perceived at receptor locations. Thus, the noise estimates for Forest users are conservatively high, providing a worst-case estimate.

The effects of noise on wildlife are discussed in Section 4.8 of the Draft EIS/EIR. Several mitigation measures identified in this section are designed to mitigate the potential effects of project-related noise on wildlife (Mitigation Measures 4.8.2a, 4.8.3b-4.8.3e).

Due to confidentiality, Native American tribes did not want their sensitive noise receptor locations identified. These receptors were therefore not specified in the Draft EIS/EIR. However, effects to these receptors were considered in the evaluation of potential impacts to American Indian use of sacred sites in the project vicinity (see Section 4.6, Traditional Cultural Values in the Draft EIS/EIR).

Comments—Concerns About Project Noise

H.28 One of Medicine Lakes attractions is that it is relatively quiet. Local vehicle traffic and boating are the primary sources. Even the boating noise is very low during most of the day due to the restrictions on high speed ski boats that limit operation between the hours of 11 AM to 4 PM. Even though the estimated levels are low numerically, they would be an annoyance to anyone enjoying the existing low noise levels. Even when project noise is not measurable above background levels, but is audible, it would annoy some people. *(Bill Dart, American Motorcyclist Association)*

Y.38 The impacts of noise would be heard over an area of more than four square miles, and the noise impacts from 24-hour plant operations, not to mention years of drilling and construction are greatly underestimated. The impacts of construction drilling would last at least 3 years, and over 20 years cumulatively if other power plants go in. These are downplayed, and their impacts on wildlife, cultural and scenic values are extremely underestimated in the DEIS/EIR.

The area presently enjoys virtually only natural sounds and great peace and tranquillity. Again the effects must be measured against a very pure existing condition, not urban conditions.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

DZ.1 My husband and I started taking our children to Medicine Lake camping 45 years ago. At that time, camping was allowed at lakeside and it took 3 hours driving from Highway 89 to reach the lake. Every year we spent one week with our children, then our grandchildren and now are taking our great grandchildren. This is, I am sure, part of the basis for a good, clean and prosperous life they all have. The Fourmile Hill project will put an end to a quiet and enjoyable outing for many families.
(Bill and Bette Kinyon)

Response—Concerns About Project Noise

The concerns expressed in the comments regarding project-related noise are noted. As discussed in the Draft EIS/EIR, noise levels associated with the operation of the proposed power plant would not have a significant effect on sensitive receptors in the Medicine Lake area. The noise sensitivity of the Medicine Lake Highlands is acknowledged, and the existing conditions were considered in the noise analysis presented in the Draft EIS/EIR. Concurrent drilling of two wells and power plant operation noise levels would be below existing ambient noise levels at Medicine Lake sensitive receptor sites and would not be audible in the Medicine Lake area (please see Table 4.14-3 on page 4-265 of the Draft EIS/EIR).

As discussed on page 4-258 of the Draft EIS/EIR, drilling during the construction period would occur for periods of approximately six months for three consecutive years. The cumulative noise effects from implementation (including well drilling) of the

proposed project and the Telephone Flat project are addressed in Section 4.17, Cumulative Impacts of the Draft EIS/EIR. These two projects are the only reasonably forseeable geothermal projects in the Medicine Lake Highlands, and a 20-year construction period mentioned in comment Y.38 is not envisioned at this time. In addition, potential noise effects on wildlife, cultural, and visual resources are evaluated in the Draft EIS/EIR (see Sections 4.8, Wildlife, 4.5, Cultural Resources, and 4.9, Visual Quality of the Draft EIS/EIR).

Comment—Request for Additional Noise Data

AG.341 Page 3-195, paragraph 1. The paragraph states that during noise monitoring, campsites at Medicine Lake were at a 10 to 15 % occupancy. It does not state what number corresponds to this occupancy percentage. The EIS/EIR also does not discuss how it determined that noise levels would be approximately 8 dB higher during peak use periods. Noise data should be collected during both peak and low visitation periods. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Request for Additional Noise Data

The number of campsites in the Medicine Lake area are shown in Table 3.11-1 in the Draft EIS/EIR (see page 3-157). There are a total of 4 campgrounds at Medicine Lake with a total of 75 units. During noise monitoring, Medicine Lake campgrounds were at a 10 to 15% occupancy rate. Thus, 8 to 12 of the total number of units were occupied by campers at the time of noise monitoring.

Noise measurements during peak visitation periods would not have contributed significant information to the noise analysis. Ambient noise levels would increase during peak visitation periods. Thus, the difference between project and ambient noise levels would be less and the project would have even less of an effect relative to ambient noise levels. By sampling noise levels when campground occupancy was relatively low, the generally quiet ambient noise levels of the area were more accurately captured.

Comment—Need for Noise Attenuation Maps

AG.360 Page 4-261, paragraph 1. The EIS/EIR states that noise levels at varying distances from the operational project were estimated using standard attenuation. The noise analysis should map contours that show unattenuated and attenuated noise levels in relation to noise sources. This would identify the area affected by the project's operations in relation to any sensitive receptors.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response— Need for Noise Attenuation Maps

As stated in the response to "Comments—Study Area for Noise Analysis" later in this section, the relative effectiveness of terrain as a noise barrier varies with the locations of the noise sources and the sensitive receptors in the proposed project area. Under these conditions, a noise contour map would not be as effective as specification of the noise levels at each receptor, as was done for the Draft EIS/EIR. Noise level contours associated with the proposed project would not have symmetrical shapes such as those used for airports, where noise sources are overhead and barriers do not exist. In the case of the proposed project, existing terrain leads to noise attenuation and noise level contours, as a result, would show high noise levels on the source side of the terrain noise barrier and low noise levels on the other side of the barrier. Therefore, when evaluating the noise levels associated with the proposed project, a noise contour map would not prove as effective as specification of the noise levels at each sensitive receptor location.

Comment—Need for Noise Appendix

AG.383 Page 3-191. The noise analysis conducted by Consultants in Engineering Acoustics should be attached to the EIS/EIR as an appendix. The Appendix should include:

any reports, letter reports or memoranda prepared by the acoustical consultant for the EIS/EIR consultant;

information on the methodology used for field collection of data, including specifics on each location measured, the type of equipment used, the time periods and dates monitored, weather conditions, primary noise sources during the monitoring period, and a schematic drawing of the location and the noise meter position.

a description of the methodologies used and an explanation of why the methodologies were selected for a) measuring ambient noise levels, b) measuring or deriving equipment noise levels, and c) the evaluation of octave band noise. If equipment noise is derived from the manufacturer or from similar equipment at other installations, the source materials should be listed in the appendix. If derived from direct monitoring at other facilities, those dates and locations should be listed. Differences between the proposed project and any equipment used to simulate project impacts should be identified and described as to the relative noise generation of the proposed project. The methodology should identify the distances used in noise analysis for attenuation of noise sources and the calculation used for attenuation including attenuating factors and barriers.

Field notes and data files from monitoring equipment.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Need for Noise Appendix

The lead agencies believe the information provided in the Draft is adequate to support the conclusions regarding noise impacts of the project. Information describing the methodology used for field collection of data, monitoring equipment used, locations of sites measured, and a detailed map depicting sites that were measured is provided in Sections 3.14 and 4.14 of the Draft EIS/EIR (see pages 3-192 to 3-194 and pages 4-257 to 4-259). Ambient noise levels were sampled on September 13 and 14, 1996. Measurements were taken in the morning in order to provide for a conservative estimate of ambient noise levels. The noise measurements had a total duration of approximately 1.5 hours.

An evaluation of existing and proposed project octave band noise levels appears in Tables 3.41-2 and 4.14-4 on page 3-196 and 4-267 (respectively) of the Draft EIS/EIR. Figure 3.14-1 on page 3-193 of the Draft EIS/EIR depicts all sites sampled as part of the noise analysis in the Medicine Lake area. As discussed in the response to "Comments—General Adequacy of Noise Analysis," Figure 3.14-2 has been added to the EIS/EIR to clarify the locations of possible residences at Tionesta. Consistent with methodology governing noise data collection, noise meters were positioned to provide an accurate reading of ambient noise levels at the sites sampled.

METHODOLOGY

Comments—Study Area for Noise Analysis

N.16 16. As stated by Phil Woodward, Registered Geologist; Certified Engineering Geologist; Certified Hydrogeologist:

"A serious bias in the EIS/EIR is that many of the comments and investigations center around Medicine Lake, a developed recreational and part time residential area, and the main forest access road instead of the project site which is isolated from most human invasions. Background noise and visual interruptions from Medicine Lake are NOT representative of the Medicine Lake Highlands as a whole and should not be used to determine the effects of the project on noise or visual interruptions. A proper evaluation of the project's impacts would be to use the ambient noise levels of the project area itself and the surrounding forest. Here background noise consist of the rustle of leaves, wind blowing through trees, and the occasional screech of a bird of prey. Instead the EIS/EIR determines "significant" impacts based on standards and benchmarks that are more appropriate for populated areas and/or industrial centers

where ambient effects are quite high. Such standards are inappropriate for an evaluation in a quiet and pristine environment as the Medicine Lake Highlands."

We reference letter of September 12, 1997 to Randall Sharp, USFS/BLM; Fourmile Hill Geothermal Development Project; EIS/EIR Coordinator; from Phil Woodward, Registered Geologist; Certified Engineering Geologist; Certified Hydrogeologist.

Consequently, the DEIS/EIR is deficient in its disclosure, evaluation, and mitigation of adverse direct, indirect, and cumulative impacts to ambient noise levels resulting from the proposed project.
(Robert J. Baiocci, Fall River Wild Trout Foundation)

AG.316 The impact area is never identified though the use of simple noise attenuation methods. The basis of analysis could easily have been transferred to maps of potentially affected areas and receptors. The impact area in vicinity of the power plant, well fields, and transmission line needs to be mapped.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

IQ.5 A serious bias in the EIS/EIR is that many of the comments and investigations center around Medicine Lake, a developed recreational and part time residential area, and the main forest access road instead of the project site which is isolated from most human invasions. Background noise and visual interruptions from Medicine Lake are NOT representative of the Medicine Lake Highlands as a whole and should not be used to determine the effects of the project on noise or visual interferences. A proper evaluation of the project's impacts would be to use the ambient noise levels of the project area itself and the surrounding forest. Here background noise consists of the rustle of leaves, wind blowing through trees, and the occasional screech of a bird of prey. Instead the EIS/EIR determines "significant" impacts based on standards and benchmarks that are more appropriate for populated areas and/or industrial centers where ambient effects are quite high. Such standards are inappropriate for an evaluation in a quiet and pristine environment as the Medicine Lake Highlands. *(Phil Woodward)*

Response—Study Area for Noise Analysis

The Draft EIS/EIR provides noise level estimates for construction, operation, and decommissioning within close proximity (200 to 400 feet) of the proposed wellfield and power plant. These estimates utilize the ambient noise levels of the surrounding Forest and thus take into consideration the low noise levels associated with the surrounding area. The EIS/EIR provides a discussion of potential impacts at Medicine Lake because it is the area with the greatest concentration of people. For a discussion of potential noise effects on wildlife, please see the Wildlife Section of the Draft EIS/EIR.

Comments N.16 and IQ.5 state that the Draft EIS/EIR determines "significant" impacts based on principles that are more appropriate for urban environments. The Draft EIS/EIR complies with NEPA and CEQA significance criteria. As discussed in the Draft EIS/EIR (pages 4-257 to 4-258), in accordance with CEQA and NEPA, significant noise impacts would be expected to occur if:

- The project would generate noise levels that would conflict with local noise regulation
- Project operations substantially increase noise levels in areas of sensitive receptors
- The land uses proposed by the project are not compatible with ambient noise levels

Additionally, construction noise impacts would be considered significant if:

- Construction activities would affect noise-sensitive receptors
- Expected noise levels would endanger the hearing of receptors near the construction site
- Construction activities would affect receptors during noise sensitive periods, at night for example

The Draft EIS/EIR discloses all potential noise impacts associated with the proposed project in Section 4.14, Noise. A detailed discussion of the methodology used to evaluate noise impacts is presented in the Draft EIS/EIR (pages 3-192 to 3-193, 4-257 to

4-258). The projected noise levels generated by the project have been evaluated against the existing ambient noise levels (including those of the project site and surrounding Forest) in which the project-related noise effects would occur.

Several mitigation measures have been proposed to mitigate any adverse impacts the proposed project might have on existing ambient noise levels in the project area. These mitigation measures include limiting construction segments of the transmission line to weekdays and Saturdays from 7:00 a.m. to 10:00 p.m. and the utilization of feasible noise controls on construction equipment (for a detailed list of additional mitigation measures, please refer to the Draft EIS/EIR, pages 4-267 to 4-269).

Figure 3.14-1 in the Draft EIS/EIR (page 3-193) illustrates the sensitive receptors located roughly three miles, on average, from the proposed power plant and wellfield. The distance between the most widely separated sensitive receptors (receptor No. 4 and the residences at the southeast end of Medicine Lake) is about 1.6 miles. The relative effectiveness of terrain as a noise barrier varies with the locations of the noise sources and the sensitive receptors. In order to develop an "impact area" map as requested in comment AG.316, a noise contour map would have had to have been developed. As discussed in the response to "Comment—Need for Noise Attenuation Maps," due to environmental characteristics of the proposed project area, a noise contour map would not be as effective as the methodology used in the Draft EIS/EIR, which specified project noise levels at each sensitive receptor site. The identification of noise levels at sensitive receptors and the evaluation of potential ambient noise effects in the Draft EIS/EIR provides an adequate analysis of noise effects of the project.

Comments—Noise Modeling and Sampling

V.3 p. 4-266, ¶2 The highest noise levels discernible at the Schonchin Picnic Area from the plant during operation and drilling is predicted to be 26.6 dBA Leq. This prediction however is legally inadequate because it is merely conclusory without any supporting facts and analysis. Also, the EIR states this noise level is less than the Siskiyou County Noise Element's standard of 60 dB(A) Ldn, but the EIR misquotes the Noise Element's actual and significantly lower standard which, when adjusted with factors to account for the rural area's quiet, provides a standard of 40 dB(A) Ldn.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

V.10 The EIR accordingly should not be based upon mere rules of thumb and theoretical calculations. Instead, the EIR's analysis should be derived from actual tests in this project's vicinity. It is not unreasonable, unrealistic nor expensive to simulate the noise loudness of this proposed geothermal facility by some other means, and actually measure the resultant noise levels at the homes and recreational facilities in question. The Siskiyou County General Plan even notes that actual noise measurements are sometimes needed rather than have the evaluation rely upon a simple value found in it:

"The following land use criteria are provided as the required response mechanism to the question "Is the projected noise effect of this project acceptable and in conformance with the General Plan?" In some instances reference to noise contour maps and equal noisiness zones will not provide the specific answer. It may be necessary to ask an applicant to provide noise readings, either as part of the environmental review process or an independent request through an appropriate mechanism (e.g., ordinance or adopted standards for plan submission) or for the county staff to undertake specific noise recordings." (emphasis added) Siskiyou County General Plan Noise Element (p. 53)

For example, such test noise could have been simulated with large loudspeakers using representative frequencies in recordings from other geothermal plants. To do so would more accurately predict the real noise impact upon this unique environment. Now however some of the public is left wondering why such a simple testing procedure wasn't done? Is the EIR attempting to hide the project's real impacts? By not having heard such a test, those members of the public who use or live in the area have had no advance warning on an experiential level of the real impact that people may soon be exposed to.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

AG.338 Page 3-194, paragraph 4. This paragraph describes the field monitoring results of ambient noise at sensitive receptor locations. There are 5 identified receptor locations, but only three locations were field-

monitored for an undefined period of time. No explanation is given to justify why noise levels sampled at site #3 are also assigned to site 4 and 5. Why weren't the 3 closest locations to the primary noise sources (receptors #1,#3 and #4) monitored for ambient noise instead of #1, #2 and #3?

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.386 Page 4-257, paragraph 1 through 4. These paragraphs purport to describe the elaborate noise model constructed to assess project impacts but the discussion of methodology is very misleading. Confusion stems from the following:

The EIS/EIR author refers to source materials for noise levels of similar projects but does not identify either the similarities between the projects nor the noise levels recorded.

The EIS/EIR author discusses a seemingly complex noise model that was used "to determine projected noise levels at identified receptor locations." Paragraphs 2 and 3 discuss the effects of hemispheric spreading, atmospheric absorption, barriers, wind and heat, etc., but there is no indication that any of these factors were employed.

No information from the cited source "Power Plant Noise Guide" appears to have been used in the "mathematical noise model."

The only calculations clearly used are the simple attenuation calculation used for stationary noise sources, i.e. a reduction of 6 dB as distance doubles.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Noise Modeling and Sampling

Comment V.3 states that the predicted noise level of 26.6 dBA at the Schonchin Picnic Area during drilling and power plant operation is "merely conclusory without any supporting facts and analysis." This noise level is discussed on page 4-266, and presented in Table 4.14-3 on page 4-265 of the Draft EIS/EIR. All of the sound levels presented in Table 4.14-3 were obtained by using the computerized noise propagation model, a standard means of noise estimation for projects with many noise receptors and noise sources in complex terrain. As stated in the Draft EIS/EIR, expected sound levels from well drilling and geothermal operation are based on noise measured at other existing geothermal operations (see page 4-257 of the Draft EIS/EIR). These noise levels have therefore been based on supporting facts. For a discussion of noise standards in Siskiyou County's Noise Element, see the responses to "Comments—Applicability and Use of County Noise Standards" in this section.

Comment V.10 suggests that actual sound simulation of an operational geothermal power plant be performed in the project area. It would not have been practical nor efficient to bring in "large loudspeakers" and assorted noise simulation equipment into the general vicinity of the proposed project area. The basis behind the science of noise estimation is to accurately predict noise levels without conducting an invasive and expensive noise simulation. The physics of noise estimation takes into account noise attenuation features characteristic of the surrounding environment, the molecular absorption of sound, and distance between the noise source and receptor. Therefore, it is not necessary to simulate noise levels when a specific science and methodology have been created specifically to estimate these levels. In addition, experience measuring noise levels of geothermal power plants has verified the effectiveness of this approach.

Measurement of ambient noise levels did not occur at Site 4 (Schonchin picnic grounds) or Site 5 (home at southwest end of Medicine Lake) because ambient noise levels at Sites 4 and 5 are expected to be similar to those at Site 3, where noise measurements were taken. This conclusion is based on the proximity of Sites 4 and 5 to Site 3 and their general remoteness. In addition, the users of the picnic grounds are not as likely to be affected by noise associated with the proposed project. Picnickers tend to be relatively noisy and their stays in the vicinity brief, and overnight camping is not allowed in this

area. Site 5 is located on private property and permission to access the property for noise measurements was not obtained at the time of data collection.

It is common practice in noise estimation to obtain ambient noise level measurements that are representative of the largest number of people potentially affected. For the proposed project, the three residences and picnic area near Little Medicine Lake, the campsites on the north side of Medicine Lake, and the residences on the southeast end of Medicine Lake were those areas.

Comment AG.386 states that the Draft EIS/EIR author refers to source materials of similar projects but does not identify the similarities between the projects. However, as stated in the Draft EIS/EIR, the projects which were used for comparison in the noise analysis (The Geysers and Coso KGRA) are geothermal operations. Since similar equipment is used during the drilling and operational phases of geothermal projects, the noise levels from these existing facilities can be used to estimate project noise levels at other proposed geothermal projects.

The text of the Draft EIS/EIR states that a mathematical noise level projection model was used for the analysis of noise levels at sensitive receptor sites at Medicine Lake and that the model included the distance between the noise source and noise receptor (page 4-257). This particular model is a commonly used method of analysis for assessing noise levels. As stated in the Draft EIS/EIR (page 4-257), the *Power Plant Environmental Noise Guide* (Edison Electric Institute 1984) was used in developing the mathematical model. According to these guidelines, the model does take into account hemispherical spreading and molecular absorption of sound. The model also permits an estimate of the expected noise increase if atmospheric conditions (wind direction or a thermal inversion) are conducive to transmitting sound toward a receptor (page 4-257 of the Draft EIS/EIR).

Comment—Inclusion of All Possible Noise Sources

V.7 The EIR assumes the loudness of a few noise sources on page 4-258, but omits some of the most important noise sources. It only estimates the noise of the operation of heavy equipment and transmission line construction equipment. It provides no figures for helicopter noise which it admits may result from the transmission line construction. Amazingly, no measurement nor assumption is provided in the EIR of the exterior noise level of the power plant itself, but this is what people most concerned about! It also fails to include the noise from blasting during construction which the Forest Service has publicly acknowledged would likely occur. Without the EIR providing such information, neither the public nor reviewing agencies have any way to independently examine the EIR's unsupported conclusions. This failure to adequately describe the project's noise levels and thenceforth to disclose supporting documentation purportedly used in reaching conclusions clearly violates CEQA. The EIR essentially asks the public to trust its conclusions without providing any way to independently check them. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

Response—Inclusion of All Possible Noise Sources

The Draft EIS/EIR includes helicopters in its analysis of construction noise on pages 4-263 and 4-268 of the Draft EIS/EIR. The Draft EIS/EIR states that helicopter noise levels would be the loudest at sites closest to the helicopter noise source. Please refer to the response to "Comments—Potential Helicopter Noise During Construction" for further information pertaining to the effects of helicopter noise. A complete analysis of power plant noise levels (operational noise levels) is contained in the Draft EIS/EIR (page 4-261). In order to assess the proposed project's noise levels on general Forest users, a straight line analysis was used. The straight line analysis presented in the Draft EIS/EIR

does not take into account terrain features which result in noise attenuation, but considers only the distance between noise source and receptor. Theoretically, Forest users could be anywhere in the Forest and it would be impossible to take into account all of the noise attenuation features, at all possible locations where Forest users might be located at any one given time. Thus, estimates of operation noise levels on Forest users are conservatively high.

The Draft EIS/EIR describes exterior noise levels of the power plant that the public may be exposed to. The results of a straight line noise analysis estimated that a Forest visitor driving past the power plant site on Primary Forest Route 49 would hear noise levels of approximately 66 dBA at 850 feet from the site. A hiker or hunter passing by the site in close proximity (200 to 400 feet) to the site would hear noise levels ranging from 72 to 78 dBA. At sensitive receptor locations around Medicine Lake, estimated noise levels from operation ranged from 11 to 18 dBA.

In order to assess the proposed project's operation noise levels and their effects on sensitive receptor sites in the Medicine Lake area, a noise propagation model was used. This model takes into account features that are characteristic of the surrounding environment.

The noise analysis in Section 4.14 of the Draft EIS/EIR acknowledges the potential for significant noise effects during construction, even after mitigation. Although not explicitly discussed, this unavoidable significant effect could include noise from blasting for some transmission line support structure installation. Any blasting that may be done would occur in remote, rugged areas, and would likely not be noticeably audible at Medicine Lake. The noise from this blasting would be occasional, sporadic, and temporary, and is considered to fall within the analysis of construction noise effects presented in the Draft EIS/EIR.

Comments—Definition of L_{eq}

V.19 Even more distressing is the evidence that the EIR has again understated the true significance of the predicted noise levels by confusing two different noise level measurement methods. The EIR presents noise levels in decibels as Leq measurements, rather than as Ldn or LCNEL measurements which the Siskiyou County General Plan uses for comparison to its standards. Leq measurements are defined in the EIR (p. 3-195, Table 3.14-2 note #2) as being 24-hour average hourly measurements. The EIR however confuses Leq and Ldn measurements by stating that Leq measurements have a +10 dB weighting applied to them when that isn't the convention. Otherwise, if they have the same value at this EIR states, then why differentiate between Ldn and Leq measurements? To the contrary, for a given constant 24-hour noise source like these power plants, the Day-Night average measurement Ldn will be approximately 7 dBA louder than the Leq measurements presented in this EIR to account for increased nighttime sleep disturbance quality of night noise. CNEL (Community Noise Equivalent Level) values, as used in the Siskiyou County General Plan Noise Element, are typically in this quiet area about 0.2 dBA higher than Ldn values, and these values were used above. As a result, before the EIR's Leq values can be compared to the Siskiyou County General Plan standards, they have to be adjusted to Day-Night average LCNEL measurements by adding what works out to be 6.7 dBA to each.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

AG.340 Page 3-195, Table 3-14.2. Leq is decibel measurement of an equivalent noise levels of time-varying noise over a given time period. Leq does not imply an hourly measurement nor a 24-hour period measurement. The definition of Leq given in Footnote #2 is incorrectly and confusingly defined as:

"the average hourly equivalent sound level over a 24-hour period with a +10 dB weighting applied to the nighttime, which is what Ldn is based on. Leq, or equivalent sound level, is the loudness of a constant sound having the same sound energy as the actual sound which varies in loudness over a given time period."

If the Leq values listed in Table 3.14-2 have had a 10 dB penalty assigned, this should be clearly stated in the column heading as Leq + 10 dB.

> Also, the Table cannot be clearly interpreted. The time period monitored for each location should be presented as a footnote. The EIS/EIR does not contain a justification as to why noise levels for location 3 are assigned to locations 4 and 5. This should be discussed.
>
> *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Definition of L_{eq}

Throughout Section 4.14 Noise of the Draft EIS/EIR, the distinction between noise descriptors L_{dn} and L_{eq} is made by providing both values and distinguishing between the two values. The L_{dn} values presented in the Draft EIS/EIR have a +10 dB penalty added to them for the hours between 10:00 p.m. and 7:00 a.m., (as opposed to the +7 dB penalty suggested in comment V.19), thus resulting in a worst-case estimate to which proposed project noise was compared.

The definition for L_{dn} appears on page 3-191 of the Draft EIS/EIR. The L_{dn} definition on this page states that, "The "Day-Night Average Noise Level" scale (L_{dn}) measures the average equivalent sound level during a 24-hour period. To account for the greater noise sensitivity of the noise receptor at night, a +10 dB weighting is applied to nighttime measurement (the period between 10:00 p.m. and 7:00 a.m.)." In order to clarify the difference between L_{eq} and L_{dn}, an additional definition for L_{eq} has been added to the first sentence of the fourth paragraph on page 3-191 of the Draft EIS/EIR.

> "L_{eq} is the equivalent steady-state sound level, which, in a stated period, would contain the same acoustical energy as the time-varying sound level during the same period. For example, if noise measurements were taken over a one-hour period, the L_{eq} would be the equivalent average sound level over this period."

In order to clarify the difference between L_{dn} and L_{eq} presented in the Draft EIS/EIR on page 3-195 in Footnote 2 of Table 3-14.2, Footnote 2 has been revised and a third footnote has been added as follows:

> "[2] L_{dn} is the average hourly equivalent sound level over a 24-hour period with a +10 dB weighting applied to the nighttime.
>
> [3] ~~L_{eq} is the average hourly equivalent sound level over a 24 hour period with a +10dB weighting applied to the nighttime, which is what L_{dn} is lased on.~~ L_{eq}, or equivalent sound level, is the loudness of a constant sound having the same sound energy as the actual sound which varies in loudness over a given time period. ~~L_{01}, L_{10}, etc. is the noise level exceeded 1, 10 , etc. percent of the time over a specified time period. L_{01} can be considered the maximum, or loudest, noise level while L_{99} is the lowest or more quiet.~~

In the Draft EIS/EIR, the footnote reference "2" appears as a superscript to the "L_{eq}" heading. Footnote 2 clearly states that L_{eq} measurements have a +10 dB penalty added to nighttime hourly measurements, thus adding L_{eq}+10 dB to this heading would be redundant.

As stated in the responses to "Comments—Need for Noise Appendix" and "Comments—Methodology Used to Evaluate Potential Noise Impacts at Medicine Lake," noise measurements were taken on September 13 and 14, 1996 in the morning.

As stated in the response to "Comments—Sampling Methods," noise measurements were not taken at Sites 4 or 5 because the ambient noise levels measured at Site 3 are

considered to be representative of noise levels at Sites 4 and 5. Site 4 is an active picnic area and users at this picnic area would be relatively noisy and their stays in the vicinity brief. Site 5 is located on private property and permission to access the property was not obtained at the time of data collection.

Comments—Noise Levels of Primary Noise Generators

AG.311 Assumptions are not explained and sources are not given for any of the noise generation levels assigned to construction and operation activities and used as the basis of the noise analysis. Noise generation by stationary sources is typically characterized by a steady state noise level (Leq) in dBA sampled at a distance of 50 or 100 feet. If these measurements cannot be obtained from similar equipment or previous noise analyses, the manufacturer of the equipment can supply noise levels measured according to industry standards. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.312 The EIS/EIR never identifies the noise levels of the stationary sources it identifies as the primary noise generators: well drilling, the operational well field, and the operational power plant. The noise levels presented in EIS/EIR tables are not identified as single or combined noise levels and a source for the noise levels used in the analysis is not cited. Noise levels presented in the tables are given only as noise attenuated by the unspecified distance between the source and the receptor.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Noise Levels of Primary Noise Generators

Since equipment used during operations would be similar to the equipment currently used at other existing geothermal facilities, noise measurements for the primary noise generators were obtained from previous noise analyses at other geothermal operations, including The Geysers (G.S. Nolte and Associates 1986) in Lake County, California and Coso KGRA (MHA 1988) in Inyo County, California. Therefore it is not necessary to consult equipment manufacturers for equipment noise level measurements when actual noise measurements were obtained at the above geothermal facilities.

The footnotes and titles to Tables 4.14-1, 4.14-2, and 4.14-3 in the Draft EIS/EIR describe whether the noise levels shown are from single or multiple sources. For instance, Table 4.14-1 shows the noise levels at the receptors associated with simultaneous construction of two well pads, the power plant, and "concurrent construction of the three tower sites nearest each receptor." Distances between noise source and receptors may be estimated roughly from Figure 3.14-1 in the Draft EIS/EIR. The distances between the proposed power plant and wellfield and the receptors range between approximately 2.3 and 3.7 miles.

The *Power Plant Environmental Noise Guide* (Edison Electric Institute 1984) was consulted to formulate the noise prediction model used in the noise analysis for Medicine Lake sensitive receptor sites. The *Power Plant Environmental Noise Guide* does not use a steady state noise level (L_{eq}) in dBA sampled at a distance of 50 or 100 feet. Rather, the *sound powers* (and not the sound pressures) of the various noise sources are calculated based upon certain relevant equipment parameters. These calculated levels are then used to determine the frequency spectrum of the sound power radiated by the equipment. For example, the formula for estimating the sound power radiated by the cooling towers is:

$L_w = 95 + 10 \log (fan\ hp)$; (where (*fan hp*) is the total horsepower of all fans in the array and L_w is the sound power in watts.)

For the proposed project noise analysis, 10 fans were used as the worst-case scenario. At 200 horse-power per fan, the total fan horse-power is 2,000 horse-power. A correction for each of the nine octave bands between 31 Hz and 8,000 Hz was then added to the

result, L_w = 128 dB, to obtain the radiated power spectrum. These data were then used as the inputs for the computer model to determine proposed noise levels. The following discussion of noise modeling for the North Campgrounds (Site 1) is provided as an example of the method of modeling that was used for Medicine Lake sensitive receptors throughout the noise analysis.

For the North Campgrounds receiver location, the barrier switch for the noise estimation computer program was turned to "on". In this case, the barrier is the ridgeline between the wellfield area and Medicine Lake that is located to the east at a distance of 6,492 feet (in the coordinate system used for this project). This barrier has an elevation of 7,050 feet (according to the elevation shown on the USGS map).

In the computer program that was used for the project, the barriers generally run in the north-south direction, so a north (y) coordinate is not necessary. The computer calculates the noise reduction with the barrier at an oblique angle with respect to the line-of-sight between noise source and receptor. In order to calculate total noise levels at the North Campgrounds, the sound levels generated by the operating power plant and wellfield operations were each calculated, and then added together. At the power plant, there would be three noise sources: the cooling tower, transformer, and power plant. The estimated noise levels of the power plant were generated over an octave band frequency of 63 hertz (Hz) to 8 kilohertz (Khz). Prior to noise level reduction due to molecular sound absorption, the estimated power plant noise level (from all sources at the power plant) was 20 dBA. After factoring in molecular sound absorption, the estimated noise level from power plant operations at the North Campgrounds was 13 dBA (see Table 4.14-4 on page 4-267 of the Draft EIS/EIR).

The calculation of noise at the wellfield assumed drilling of wells at well pads P-1 and P-2 since these well pads would be located closest to the receptors at Medicine Lake (and therefore have the greatest potential for noise effects). The calculation also assumed a certain level of noise from general wellfield operations at each of the other well pads (this noise would be less than drilling noise). Similar to plant operations, estimated noise levels of wellfield operations were generated over an octave band frequency of 63 Hz to 8 Khz. Prior to noise level reduction due to molecular sound absorption, the estimated wellfield noise level was 30 dBA. After factoring in molecular sound absorption, the estimated noise level from wellfield operations at the North Campgrounds was 25 dBA (see Table 4.14-2 on page 4-265 of the Draft EIS/EIR).

Using the sound levels generated for the operating power plant and wellfield operations, the computer program then estimated the combined effect of this noise on the North Campgrounds. As shown in Table 4.14-3 on page 4-265 of the Draft EIS/EIR, all of the noise generated by the project during operations would result in a project-related noise level at the North Campgrounds of 25.3 dBA.

Comments—Methodology Used to Evaluate Potential Noise Impacts at Medicine Lake

V.6 The EIR attempts to portray the existing low levels of noise in this project's area. This Medicine Lake area is profoundly quiet at times in that it is far from freeways and urban areas which produce noise that most of Californians are used to. The EIR only provides average sound level for existing conditions in the Medicine Lake area of between 33.0 to 37.0 dBA Leq. These are apparently estimates of "ambient noise" including measurement of the louder daytime conditions. The EIR provides no measurements for existing noise levels at night though. Nighttime is when less vehicles, motorboats, and other activities typically create noise, and of course when people need adequate quiet to enjoy the reason they visit the

area and to sleep. Nighttime measurements are critical to determine how much louder this 24 hour project will be than the existing background noise levels. In extremely quiet rural areas, where ambient noise measurements in the range of 20 - 25 dBA Leq are common, the sound of people talking in normal voices 1/4 mile away is perceptible and sometimes even understandable. In that this project will be as loud as an automobile horn which doesn't shut off, and will operate 24 hours per day, a project like this will be very noticeable and annoying in that other noise sources may not exist to obscure it. The EIR thus fails to disclose sufficient information such that the public can evaluate the full impact of this project and other foreseeable geothermal projects in the vicinity.

The EIR does not provide an accurate estimate for the existing loudness at night. It provides measurements of "Ambient Octave Band Sound Levels" which illustrate the loudness of existing noise at various frequency bands. But there is no indication of when these "brief samples" were taken. Presumably they were taken during the daytime. If so, then the ambient noise at night when vehicles, boats, and other noise producing human activity isn't as loud would be significantly quieter. The EIR however ignores such night measurements from which the public should b able to compare the sound of the proposed project. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

V.17 All we know from reading the EIR is that, for example, at the northern campgrounds, the current ambient noise levels without this project are about 37.0 dBA Leq. This is a 24-hour average which doesn't numerically describe the louder daytime levels nor the quieter nighttime levels. Conceivably, this area could be as quiet as 20 dBA at nighttime when activity isn't occurring, but the EIR doesn't give us that measurement. The EIR only estimates a range of 20 - 30 dB under such circumstances when people aren't present. Estimations aren't as valuable as measurements, but then again, if the EIR was attempting to underplay the true impacts of this project actual measurements could give that ruse away. This area is quiet because there are no freeways nor railroads nearby to raise these extremely quiet ambient noise levels unlike in most other parts of the state. Therefore, any constant noise increase from these power plants of more than about 5 dB above those nighttime quiet levels would be discernible and objectionable. An increase of more than 10 dBA should be identified as "significant." Remember, it matters not that the average noise level portrayed in the EIR may be 37.0 dB if people are trying to sleep or enjoy a night sky when the noise levels are in the mid 20 dB's; they will be greatly annoyed by the intrusive sounds of these projects which could be significantly higher.
(Carol Plank, Medicine Lake Citizens for Quality Environment)

AG.313 Ambient noise levels were sampled by an unusual methodology over unspecified time periods. Ambient noise should be sampled by standard techniques currently used in noise impact assessment. Noise levels should be measured using integrating sound level meters acquiring data at a rate of 8 samples per second and calculating the samples into continuous equal intervals (such as every 1 minute or every 15 minutes) over a 24-hour period. This common methodology identifies peaks and lulls during a 24-hour period and is also used as the basis for computing community noise level descriptors for planning (such as Ldn and CNEL). Sampling noise for 20 seconds of each 5 minutes, as in the EIS/EIR analysis, requires long measuring periods before L10 or Leq can be determined with reasonable accuracy. This type of coarse monitoring can miss significant loud events, which are particularly important when measuring Leq (a descriptor which is greatly affected by higher readings). Noise should be sampled at receptor locations either concurrently or under very similar conditions for comparison to be valuable. Information as to the duration and dates of the monitoring period at each location should be given.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.337 Page 3-194, paragraph 2. The methodology paragraph needs to contain information listed below in order for the public to determine that the noise environment was adequately characterized. The methodology section should provide the following information:

Who actually collected the noise data and performed the analysis? The tables in the section are credited to a subconsultant, but it is not clear whether the consultant or the subconsultant collected the data.

On what dates and at what times were noise measurements taken at the 3 locations around Medicine lake? Was noise monitored for 1 hour or 24 hours at each location?

How is "low to moderate recreational use" determined and what does it represent? How close was the nearest occupied campsite to Site 1 during monitoring? Was Site 1 physically closed off during monitoring?

What were the primary influences at each location during monitoring?

Why was the unusual noise monitoring methodology selected and what are the advantages of this methodology over the standard 24-hour continuous sampling normally performed? Monitoring 20 seconds each 5 minutes is monitoring only 7% of all noise in a 24-hour period. In the standard method, integrated sound level meters sample sound continuously, several times a second, and this method produces more accurate descriptors for ambient noise. It is likely that the EIS/EIR's sampling method missed many of the loudest noises in the interval (e.g. car door slamming, person shouting, etc.) that would have affected the calculated Leq.

How were sensitive receptor locations selected? What assumptions were used to assign ambient noise levels recorded at one location to other locations? What assumptions were used to assign noise levels to sensitive receptor locations that were not field-monitored for noise?

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.339 Page 3-194, paragraph 5. The EIS/EIR author states that L90 and L99 are good indicators of background noise levels because they are less affected by relatively high noise events. L90 and L99 indicate the lowest 10% and 1% of noise levels, respectively, recorded during a sampling period. This is the ambient noise level without any of the louder, intrusive noise which have the greatest proportional influence on Leq. Given the coarse sampling method employed for EIS/EIR assessment, the L01 and L10 (highest 1% and highest 10% of noise sampled) and the L90 and L99 levels shown in Table 3.14-2 are not accurate. It is highly likely that sampling only 7% of noise over an undefined time period would not yield a large enough data set to determine the range of extremes of noise experienced during the sampling period. In the case of the areas sampled for the EIS/EIR, Table 3.14-2 shows essentially no noise events louder than quieter speech under the column L01 (42.9 dBA to 44.7 dBA). Even birds chirping close to a noise meter would produce noise exceeding these levels.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Methodology Used to Evaluate Potential Noise Impacts at Medicine Lake

Comments V.6 and V.17 express concern regarding the absence of night-time noise measurements in the noise analysis. Overnight (24-hour) measurements were not possible due to noise equipment safety. Although these measurements were not possible, adjustments were made to account for quieter night-time periods, and the ambient noise levels presented in the Draft EIS/EIR are considered representative and adequate. As stated on page 4-267 of the Draft EIS/EIR, power plant noise would not be expected to contain any prominent tones. Furthermore, power plant noise would be indistinguishable from other noises and it would be difficult for people to discern what is being heard and the source of the noise. Thus, it is anticipated that power plant noise would not be perceived during night-time periods and would be indistinguishable from other night-time noises. Please see the response to "Comments—Definition of L_{eq}" for further information regarding night-time noise estimates.

Comments AG.313 and AG.337 refer to the methodology in the noise analysis as "unusual." However, the methodology used in the noise analysis is consistent with the accepted acoustical standard found in The American National Standard Institute's *Measurement of Sound Pressure Levels in Air.* The measurements that were taken are considered to be wholly representative of ambient noise in the area. Ambient noise measurements were obtained on Friday, September 13, 1996 and Saturday, September 14, 1996. Measurements were obtained on Saturday morning in an attempt to discern potential increases in noise levels which were anticipated due to the increase in visitors and recreational activities during weekends. The noise measurements had a total duration of approximately 1.5 hours at each location (one hour on Friday and one-half hour on Saturday).

Comment AG.313 states that the noise sampling method used for the noise analysis can "miss significant loud events." During the analysis, tape-recorded sounds that were collected in the field were listened to in order to identify and eliminate sounds which would not be considered normal or which would distort the ambient noise levels. Some examples of eliminated noises included chirping birds or buzzing bugs close to the microphone and noise from aircraft or vehicles on nearby roads. Therefore, noisy events were deliberately excluded from the analysis in order for the ambient level data to represent the more quiet ambient noise levels. Thus, the average level (L_{eq}) was estimated to be as low as possible so that comparisons of project noise levels with ambient noise levels would result in a worst-case analysis.

Consultants in Engineering Acoustics (CIEA) collected the data for the noise analysis. CIEA specializes in noise analyses, with special expertise in the analysis of geothermal noise. The noise analysis presented in the Draft EIS/EIR was prepared as a joint effort by both CIEA and the independent, third-party consultant for the project, under the direction of the lead agencies.

There is no formal definition for "low to moderate recreational use." At the time of the noise data surveys, 10 to 15% of the campsites were occupied. This level of occupancy can reasonably be said to constitute "low" recreational use. Furthermore, there were approximately eight fishing boats and two motor boats (one of these motor boats was pulling a water-skier) on Medicine Lake. This use can reasonably be considered "moderate" recreational use. Thus, the term "low to moderate recreational use" was used to describe the extent of recreational use of the Medicine Lake area at the time of the survey. The nearest occupied campsite to Site 1 was about 50 feet from Medicine Lake. Site 1 was closed during monitoring because the surveyor's vehicle occupied the only available parking area assigned to that particular campsite (Campsite No. 31). However as stated above, 10 to 15% of the campsites were occupied, which is customary for that particular time of year.

The "primary influences" at Site 1 were noises associated with campground activities such as people talking, distant music, people walking, distant traffic and wind rustling through the foliage. A power generator at the residences near the lake produced noise for a short period of time as well. Nearby traffic noises and loud noises (greater than 50 dBA) were eliminated from the analysis. At Site 2, the primary noise sources were those sounds associated with human activities at the group of residences to the south (i.e., talking, construction, music, and a power generator). Motorboats, talking by fishermen on the lake, and rustling foliage were also present. At Site 3, there was little human activity, and noises consisted of rustling leaves, birds chirping, frogs croaking, and insects. As discussed in the response to "Comments—Sampling Methods," noise levels were estimated at Sites 4 and 5 where noise measurements did not occur. These noise estimates were based on previous experiences with noise measurements in remote locations, and on observations and measurements of noise levels taken during project site visits. Ambient noise levels at Sites 4 and 5 are expected to be similar to those at Site 3 because of their close proximity to Site 3 and their general remoteness. For a discussion of sensitive receptor designation, please see the response to "Comments—Existing Sensitive Receptors."

Reference:

American National Standards Institute. 1995. *Measurement of Sound Pressure Levels in Air*. New York, NY. pgs 11 to 12.

Comments—Other Possible Methodologies for the Noise Analysis

V.13 The discussion in the EIR of how a certain frequency of sound was considered is inadequate for the nature of the project at hand. It is true that people are more sensitive to noises in the "A"-weighted frequency range of 1000 hz to 4000 hz, but that doesn't mean that lower frequency sounds should be discarded from consideration. Industries like these power plants often produce much of their noise at frequencies less than 500 hz. The EIR even provides evidence of that when it estimates that over 40 dB of noise would are expected at the low end of the frequency scale. (Table 4.14-2) The "C"-weighted scale takes into account those frequencies down to 50 hz where much industrial noise is generated. Noise level

meter readings on the "C"-weighted scale can often be 8 dB louder than those on the "A"-weighted scale as presented in this EIR!

The booming sound of heavy equipment can greatly impact nearby residences and campgrounds. Homes and campers often are constructed with lightweight wooden walls and thin windows which are not good at blocking low frequency sounds.

This project is apparently required to comply with County regulations, but sometimes state environmental regulations turn out to be even stricter in protecting neighboring residential uses. The County's General Plan may, according to the EIR, regulate noise levels based upon the "A"-weighted noise scale /1/.

[Note 1: The "A"-weighted noise scale emphasizes noise in the 500-20,000 Hz frequency range, while the "C"-weighted noise scale more broadly covers the lower frequency 50-20,000 Hz range where much noise will be generated.]

However, CEQA requires full evaluation of adverse noise impacts on people who are also sensitive to lower noise frequencies not counted on the "A"-weighted scale. The "C"-level scale is more appropriate for certain industrial uses which generate significant noise levels in frequency ranges below 500 Hz which are capable of inducing vibration in buildings, such as this geothermal facility demonstrably does. However, this EIR largely dismisses the lower frequency sound energy measurements which would be counted if the "C"-weighted scale was used but for no good reason! In so doing, the EIR underestimates the real noise impact upon neighboring residents. It matters little that the "A"-weighted scale is used in most ordinances when a specific industrial facility generates loud, low-frequency noise levels not included in that "A"-weighted scale. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

AG.309 The major flaws in the EIS/EIR analysis are outlined in the Summary of Comments section and specific flaws are discussed in the Detailed Noise Comments section below.

However, in order to fully comprehend the inadequacies of the EIS/EIR's noise analysis, it is first helpful to understand what an acceptable noise analysis would encompass. Accordingly, the Standard Noise Impact Assessment Methodology section below is provided to establish a framework for this discussion.

II. Standard Noise Impact Assessment Methodology

Noise impacts can range from perception, to annoyance to hearing nerve damage and other adverse health effects. The most common adverse effects of noise on humans are increased levels of annoyance and stress, and disturbance of sleep. It is therefore important for EIS/EIRs to accurately characterize noise impacts so that their significance and the corresponding need for mitigation can be determined. Predicting noise impacts must be based on those factors which can be accurately measured — existing ambient noise levels, distances from sources to receptors, height and width of barriers, atmospheric absorption of noise over distance, machine-generated noise levels, etc. It is the grounding of the assessment in field-derived quantifiable data that gives credence to any prediction of future noise impacts.

In addition to adequate data, it is also important to understand the significance criteria used to assess the noise impacts. In this case, the EIS/EIR states that the Geothermal Resources Operational Orders (GRO) apply (p. 4-256). The EIS/EIR also uses the Siskiyou and Modoc county noise standards to evaluate impact significance under CEQA (p. 4-258). Additionally, Appendix G of the CEQA Guidelines states that a project may have a significant effect on the environment if it will conflict with adopted environmental plans and goals of a community where it is located or increase substantially the ambient noise levels for adjoining areas.

Hence, to be considered adequate, a noise impact assessment of a proposed industrial project must include the following information, most of which is missing from the EIS/EIR:

A. Setting. The accurate description of the existing noise environment must be based on:

1. An accurate description of terms and concepts that will be used in the noise assessment and the appropriate applications of each.

2. Identification of likely sensitive receptors that would be impacted by project-generated noise. Sensitive receptors would include on-site workers, residential areas and noise sensitive land uses such as, in the case of this project, recreational land uses. Sensitive receptors should be mapped at a scale allowing a relatively accurate assessment of distance and, if relevant, intervening noise barriers.

3. An adequate sample of field-collected noise data which will represent the existing noise environment at the locations of representative sensitive receptors (collected for the assessment at hand or from other recent and relevant studies). The sampling locations must be described, including type of equipment used, interval period set, date and time of sample, weather conditions, location of noise meter, and primary noise sources during the sampling period.

Typically, noise is recorded in decibel levels by integrated sound level meters (SLMs) which sample the noise environment 8 times per second. The SLM can be programmed to calculate a range of noise descriptors over fixed intervals, such as every 15-minutes, during the 24-hour period. For environmental

assessments, the SLM is set to adjust the sampled noise levels to approximate the response of the human ear to frequencies. This adjustment is referred to as the A-weighting scale and noise levels are recorded as A-weighted decibel levels or dBA.

An important descriptor calculated by the SLM is Leq (equivalent noise level) which is a single decibel representation of the varying sound energy levels recorded by the sound meter over the full interval. Leq is used to describe ambient or background noise, the baseline noise level to which project-generated noise will be added in an assessment of noise impact. A review of the interval data from a 24-hour period identifies those periods of the day which are most noise-sensitive (typically those intervals with the lowest noise levels).

Recording noise over a 24-hour period also allows the most accurate representation of "community noise levels" such as Ldn and CNEL, which are the descriptors most often used in planning to determine noise compatibility levels with differing land use types. Ldn, which is based on interval-collected Leqs, assigns a 10 dB penalty to nighttime noise (10 pm to 7 am) to account for a community's added sensitivity to noise during normal sleep periods. Ldn was used as a criteria of significant impact in the Fourmile Geothermal Development Project EIS/EIR.

4. Noise levels and descriptions of expected noise-generating industrial activities associated with the construction and operational phases of the project. These activities, which are actually assemblages of operational equipment, should be individually described as to component elements, location in relation to other assemblages and sensitive receptors, expected frequency of operation, and identification of sources used for noise level data.

Unless recent and relevant noise data are available for similar assemblages of equipment sampled at other facilities, each area of activity should be calculated as a noise generating source based on the noise levels of the component elements. Noise levels of components can be obtained from the manufacturer or measured in the field.

5. Relevant regulatory setting. Identification of existing plans, policies and regulations which apply to the area and land use of proposed project and the sensitive receptors. Most commonly these are Noise Elements of local general plans, or related Noise Ordinances. In the case of the Fourmile Hill project, the Geothermal Resources Operational Orders (GRO) of the U.S. Geological Survey, the Siskiyou and Modoc County noise elements, and CEQA apply.

B. The Impact Assessment will determine whether a potentially significant impact could occur as a result of project approval. Impact assessment must include the following components:

1. Identification of Significance Criteria to be used to assess the threshold of impact above which project noise would be considered an adverse effect of the project. CEQA identifies a substantial increase in project noise as an significant impact. However, if the increase in noise would still result in noise levels near the lower threshold of perception, then ordinary significance criteria (e.g. a 5-decibel increase) may not be appropriate. Plans, policies and regulations governing an activity or jurisdiction may also apply. The criteria should distinguish between short-term construction-related impacts and long-term noise generation.

In the case of the proposed project, the relevant criteria of significance are the GRO criterion of 65 dBA Leq at 0.5 miles from the source, and the Siskiyou County standard for open space areas of 50 dBA Ldn. The local standard is an appropriate measure of significant impact under CEQA.

2. Identification of the area potentially impacted by project noise. The impact area is defined based on calculations of a worst-case scenario of combined project noise sources. Calculations should include composite noise attenuated for distance, vegetative cover and physical barriers (if relevant) and atmospheric absorption. The longevity of the noise impacts should be considered. For example, construction that lasts for only a week may have less of an impact on receptors than other noise. In the case of multiple sensitive receptors, the impact area or potential noise level should be mapped. This is the area which would exceed the noise level set in the significance criteria.

3. Identification of sensitive land uses within the impact area and description of the potential impact and its effect on each sensitive land use.

4. If an adverse impact is identified, any further mitigation measures which could effectively and feasibly further reduce noise levels should be listed.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Other Possible Methodologies for the Noise Analysis

The opinions expressed in the comments regarding alternative noise methodologies are noted. The noise analysis that was conducted for the project and presented in the Draft EIS/EIR was performed in accordance with accepted and established noise evaluation methodologies and includes all of the types of information suggested in comment

AG.309. Noise calculations were performed and compared to established standards in order to provide an accurate and adequate evaluation of potential noise effects.

Tables 3.14-3 and 4.14-4 on pages 3-196 and 4-267 (respectively) in the Draft EIS/EIR depict existing ambient and project-related noise levels according to octave band sound levels that are not A-weighted. The tables depict octave band sound levels ranging from 63 Hz to 8 Khz and take into account noises which possess low frequency sound levels. The octave band sound level analysis was performed in order to analyze the effects of lower frequency sounds, such as well drilling, on sensitive receptor sites. In order to perform the noise analysis using a C-weighted scale, the County Noise Standards would have to be C-weighted as well. If sound measurements and County Noise Standards were C-weighted, then each would increase proportionately. Thus, sound levels measured would result in higher readings and corresponding County Noise Standards would be higher as well.

EXISTING SETTING

Comment—Existing Winter Noise Levels

H.34 Winter activities can be expected to be more impacted by noise, since ambient noise levels are likely to be lower, making additional noise more apparent. A calm winter evening at Medicine Lake will measure about as low an ambient noise level as can be found outdoors, and it would be a shame to change that. *(Bill Dart, American Motorcyclist Association)*

Response—Existing Winter Noise Levels

Ambient noise levels at sensitive receptor sites were taken in the morning in order to provide for a conservative estimate of ambient noise levels. Furthermore, the noise propagation model used in the noise analysis allows for estimation of expected noise levels in the case of atmospheric conditions that might increase sound levels (such as wind direction or thermal inversion). Therefore, the analysis presented in the Draft EIS/EIR takes into account the variations in noise levels that might occur in the project vicinity due to weather conditions and time.

Comment—Existing L_{dn} Values for Sensitive Receptors

AG.384 Page 3-191, paragraph 4. The noise descriptor Ldn is defined here, on page 3-193 paragraph 4, and again in footnote 2 in Table 3-14-2 but no Ldn values for the sensitive receptors are presented in the entire section. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Existing L_{dn} Values for Sensitive Receptors

The L_{dn} levels for the sensitive receptor sites can be obtained by adding 6.4 dBA to the values shown in the L_{eq} column in Table 3.14-2 on page 3-195 of the Draft EIS/EIR. Table 3.14-2 has been revised to include the L_{dn} values for the sensitive receptor locations.

Table 3.14-2: Ambient Noise Levels at Medicine Lake[1]

Site	Noise Levels in dBA							
	L_{dn}[2]	L_{eq}[3]	L_{01}[4]	L_{10}[4]	L_{50}[4]	L_{90}[4]	L_{99}[4]	[5]Noise Levels Representative of Conditions Elsewhere[3]
1. North Campground ≈50 ft from road (Campsite 31)	43.4	37.0[2]	41.9	38.9	36.8	30.3	28.1	Campgrounds on north side of Medicine Lake
2. Southeast corner of Medicine Lake, south of boat ramp	42.2	35.8	44.7	38.8	33.4	30.7	29.7	Group of homes southeast of Medicine Lake
3. Homes and Picnic area near Little Medicine Lake	39.4	33.0	42.9	37.0	28.2	24.7	23.9	Schonchin Picnic Area (Site 4), north of Little Medicine Lake; home on southwest end of Medicine Lake (Site 5)

Notes:

1 The values shown are averages over recording periods conducted in September 1996.

2 L_{dn} is the average hourly equivalent sound level over a 24-hour period with a +10 dB weighting applied to the nighttime.

3 L_{eq}, or equivalent sound level, is the loudness of a constant sound having the same sound energy as the actual sound which varies in loudness over a given time period.

4 L_{01}, L_{10}, etc. is the noise level exceeded 1, 10 etc. percent of the time over a specified time period. L_{01} can be considered the maximum, or loudest noise level, while L_{99} is the lowest, or most quiet.

5 The ambient noise measurements taken at receptor locations 1 through 3 are also representative of ambient noise levels at the other locations identified in this column. The Schonchin Picnic Area (Site 4) and the home on the southwest corner of Medicine Lake (Site 5) would have similar ambient noise levels to those measured at Little Medicine Lake (Site 3).

6 Ambient noise measurements were obtained on September 13 and 14, 1996.

Comments—Ambient Octave Band Sound Levels

AG.342 Page 3-195, paragraph 3. The EIS/EIR describes the composition of octave band frequencies and states: "For reference, the predominant frequency of middle C on the piano is about 250 Hz but the piano produces a tone at 250 Hz, not an octave band of sounds." This explanation of tones produced by a piano does not seem to make any sense. The EIS/EIR does not discuss how this is relevant to an explanation of the effect of the octave band on noise actually heard by a receptor.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.343 Page 3-196, Table 3.14-3: Ambient Octave Band Sound Levels at Three Representative Receptor Locations. There is no interpretation of the data presented in this table. The EIS/EIR does not explain why this data was presented or its relevance to the analysis at hand.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Ambient Octave Band Sound Levels

The Draft EIS/EIR's reference to the predominant frequency of middle C on the piano was made to provide a frame of reference for the discussion of frequencies immediately preceding it, and to allow for interpretation of the octave band noise levels shown in Table 3.14-3 on page 3-196 of the Draft EIS/EIR. The reference to the frequency of middle C on a piano was made to illustrate the concept that octave bands of noise

contain a greater variety of sounds (tones) as opposed to the relatively singular sound (tone) produced by striking middle C on a piano.

The octave band level data presented in Table 3.14-3 on page 3-196 illustrates ambient octave band sound levels at sensitive receptor locations according to different frequencies. These octave band levels provide a frame of reference for the Draft EIS/EIR's analysis of the effects of drilling noise frequency associated with the proposed project on sensitive receptor sites. The analysis of drilling noise frequency and its potential effects on sensitive receptor sites is discussed on pages 4-264 to 4-265 of the Draft EIS/EIR.

Comment—Effects of Atmospheric Conditions on Noise Estimates

V.5 ¶3 The EIR concludes that during certain atmospheric conditions, the project noise will be slightly louder at sensitive receptor locations, estimating it to average about 30 dBA. However, this conclusion is not supported by any analysis in the EIR. Furthermore, it is unrealistic to think that noise levels only increase by that small increment under the worse atmospheric conditions. Since the DEIR states earlier that the "highest noise level in the Schonchin picnic area is estimated to be about 27 dBA Leq," then when winds blow toward these receptors, the EIR's average estimate of 30 dBA is only about 3 dBA higher than otherwise. Other acoustical engineers estimate that wind direction alone can increase noise levels as much as 10 dBA. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

Response—Effects of Atmospheric Conditions on Noise Estimates

The Draft EIS/EIR states that a mathematical model was used to provide the noise analysis (see page 4-257 of the Draft EIS/EIR). As stated (above) in the response to "Comments—Modeling of Noise Impacts," the particular model used in the noise analysis is part of a standard method of analysis, commonly used in assessing noise levels. The model permits an estimate of the expected noise increase if atmospheric conditions (wind direction or a thermal inversion) are conducive to transmitting sound toward a receptor (page 4-257, Draft EIS/EIR). As stated in comment V.5, an estimate of 30 dB for sensitive receptor sites was the value produced by the mathematical model during adverse atmospheric conditions.

Comment V.5 references information presented in the Draft EIS/EIR on page 4-266, and misinterprets noise estimates for the picnic area near Little Medicine Lake and the Schonchin picnic area. On page 4-266 of the Draft EIS/EIR, information regarding the worst-case estimate of operation noise levels (concurrent power plant operation and the drilling of two wells) is presented. The Draft EIS/EIR states that the ambient noise level for the picnic area and homes near Little Medicine Lake (Site 3) is 33 dBA (L_{eq}). During adverse atmospheric conditions when no atmospheric absorption would occur, it is possible that operational noise levels at Site 3 could be up to 30 dBA (L_{eq}) at times. This level would be 7 dBA greater than the typical 23 dBA project noise level experienced during most times at Site 3. The noise levels under these adverse conditions would be less than the 33 dBA ambient noise levels, and would still not result in significant increases in noise levels at this receptor (please see Table 4.14-3 on page 4-265 of the Draft EIS/EIR).

It would not be accurate to interchange noise levels associated with adverse atmospheric conditions for Site 3 and the Schonchin picnic area (Site 4). These noise levels take into account site location and prevailing weather patterns characteristic of that particular location. However, if one were to use the estimate for Site 3 and apply it Site 4, the noise level estimate during adverse atmospheric conditions would be about

34 dBA (L_{eq}), based on a 7 dBA increase in noise levels from 26.6 dBA due to no atmospheric absorption. A 34 dBA noise level would be only 1 dBA greater than the ambient L_{eq} of 33 dBA for Site 4, and would not result in significant increases in noise levels at this receptor. A 34 dBA noise level would also be significantly lower than the 54 dBA L_{eq} limit from the Siskiyou County Noise Element.

Comment—Effects of the Existing Environment on Noise Estimates

V.9 EIR claims that it uses measurements from other sites, and mathematically predicts noise loudness at receptor locations in this area. The EIR's noise analysis is flawed because that doesn't account for unique characteristics of the Medicine Lake geography however. Nearby mountains tend to reflect and increase noise levels and actually surround Medicine Lake, the proposed geothermal plant, and neighboring sensitive receptor locations. Medicine Lake also, with its smooth water surface, allows sound to travel (without the typical noise attenuation losses) greater distances than are calculated. Everyone knows that sound travels much farther over water. The EIR's assumption that noise is attenuated 6 dBA for each doubling of distance is therefore inappropriate over open water in consideration of receptors on the other side of the lake. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

Response—Effects of the Existing Environment on Noise Estimates

Contrary to the statement made in the comment, topographic and vegetative features in the project vicinity would actually serve to absorb (and reduce) noise. The noise propagation model used to estimate sound levels at Medicine Lake sensitive receptor sites took into account terrain features, as well as distance from sound source to receptor and molecular absorption of sound. The commentor's reference to the 6 dBA attenuation for each doubling of distance refers to noise estimates for Forest users. As discussed in the response to "Comments—Inclusion of All Possible Noise Sources" a straight line analysis was used to determine potential noise effects on Forest users. This straight line analysis applies a 6 dBA attenuation for each doubling of distance from the noise source.

Comments—Existing Sensitive Receptors

AG.310 The detailed comments below are lengthy and address the EIS/EIR's noise analysis, paragraph by paragraph. A summary of the main points addressed by the detailed comments is therefore appropriate.

Assumptions supporting the selection of sensitive receptors are not explained. The analysis should focus on those sensitive receptors which are within areas potentially impacted by project noise. The impact area of the power plant and well field and the transmission line should be delineated on graphics at a reasonable scale such as 1 inch = 2000 feet. Recent aerial photos should be consulted to identify the locations of sensitive land uses. All potential sensitive receptors and sensitive land uses (such as areas with traditional recreational use) that are within the potential impact areas should be shown on the maps so the relation to the impact area can be understood. Receptors which are miles from the power plant and well fields do not need to be assessed or depicted.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.314 The EIS/EIR assigns ambient noise levels sampled at one location to other locations without justification. Noise levels for the Tionesta vicinity are estimated to be within a 20 dB range typical of rural areas while other rural receptor areas were field sampled. There is no explanation given as to why certain locations were sampled and other locations were assigned an assumed ambient noise level. All locations of potential sensitive receptors should have been sampled for noise levels.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.333 Page 3-192, paragraph 1. The EIS/EIR author identifies the sensitive receptors for project noise as the recreational areas and seasonal residences at Medicine Lake, the community of Tionesta and sites important to local tribal members.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.334 The EIS/EIR refers to Figure 3.14.-1 and Figure 3.6-1 for location of the sensitive receptors. Figure 3.14-1 indicates only one residence and that is mapped at the southwestern edge. In contrast, in Section 3.11 (Land Use and Recreation), residences are described as being clustered at the south and southeastern edges of Medicine Lake. The area to the southeast is labeled "residences." Also, the scale of Figure 3.14-1 is too coarse to begin to determine the distance from residences to the project. It is never clearly stated or

mapped where residences are in relation to the potential impact area for project noise.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.335 It is possible that proper noise analysis could show that other sensitive receptors exist that were not identified in the EIS/EIR. For example, if any residences or campgrounds in the Medicine Lake area are found to be within the area impacted by project noise, recent aerial photographs should be used to show the location of these homes in relation to project components. Relevant sensitive receptors close to the principal project site such as trails and roads should also be identified on aerial photos to demonstrate their relation to the project noise sources.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.336 Page 3-193, Figure 3.14.1 does not include the community of Tionesta and does not indicate the location of residences in the Medicine Lake area in a meaningful way. The figure also does not identify receptors 4 and 5 in the legend and does not indicate recreational uses in the vicinity of the power plant and wellfield. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Existing Sensitive Receptors

As stated on page 3-192 of the Draft EIS/EIR, seasonal residents and visitors to the Medicine Lake area would most likely be affected by noise associated with the proposed project, and make up the largest number of people that would potentially be affected by project-related noise. Therefore, it was determined that areas where seasonal residents and visitors congregate would be the most reasonable areas for sensitive receptor designation. These areas include residences, campgrounds, and recreational facilities closest to the proposed wellfield and power plant area. As stated on page 3-192 of the Draft EIS/EIR, the five sites identified as sensitive receptor sites in the Medicine Lake area include the campground north of Medicine Lake at Campsite No. 31 (Site 1), the small peninsula south of the boat ramp on the southeastern side of Medicine Lake (Site 2), homes and the picnic area south of Little Medicine Lake (Site 3), homes and picnic area south of Medicine Lake (Site 4), and the home on the southwest corner of Medicine Lake (Site 5).

Figure 3.14-1 illustrates the locations of sensitive receptor sites in relation to the proposed project area. This figure also depicts the general location of the residences that are "clustered" at the southeastern edge of Medicine Lake. The distances of the sensitive receptor sites in relation to the proposed project area can be determined by utilizing the map scale in the map legend of Figure 3.14-1. For instance, Site 4 is approximately 2.25 miles from the proposed project area. The scale provided in Figure 3.14-1 provides a reasonable estimation of sensitive receptor distances from the project area.

Comments AG.310 and AG.335 suggest that recent aerial photographs be consulted in order to determine sensitive land uses and receptors in the vicinity of the proposed project area. A variety of sources (including aerial photographs, USFS resource specialists, and other Forest personnel) were consulted to determine sensitive receptors. Public input received during the scoping process was also used, and site visits were conducted. The remoteness and undeveloped nature of the region limited the number of sensitive receptors in the project vicinity. Since Forest users could be present in the project area at any one given time, the entire project vicinity was considered a potential sensitive land use area.

As discussed in the response to "Comments—Adequacy of Noise Analysis," in order to protect their confidentiality, Native American tribes did not want their sensitive receptor sites identified. Noise-related impacts to Native American tribes are discussed and mitigation is identified, where appropriate, in Section 4.6 Traditional Cultural Values in the Draft EIS/EIR. An editorial error occurred in the last sentence of

the first paragraph on page 3-192 of the Draft EIS/EIR. This sentence has been changed as follows:

> "Sensitive receptors in the study area include recreational areas and seasonal residences at Medicine Lake, the community of Tionesta, and sites important to local tribal members (see Figure 3.14.1 and Figure 3.14.2~~, see Figure 3.6-1 for tribal sites~~)."

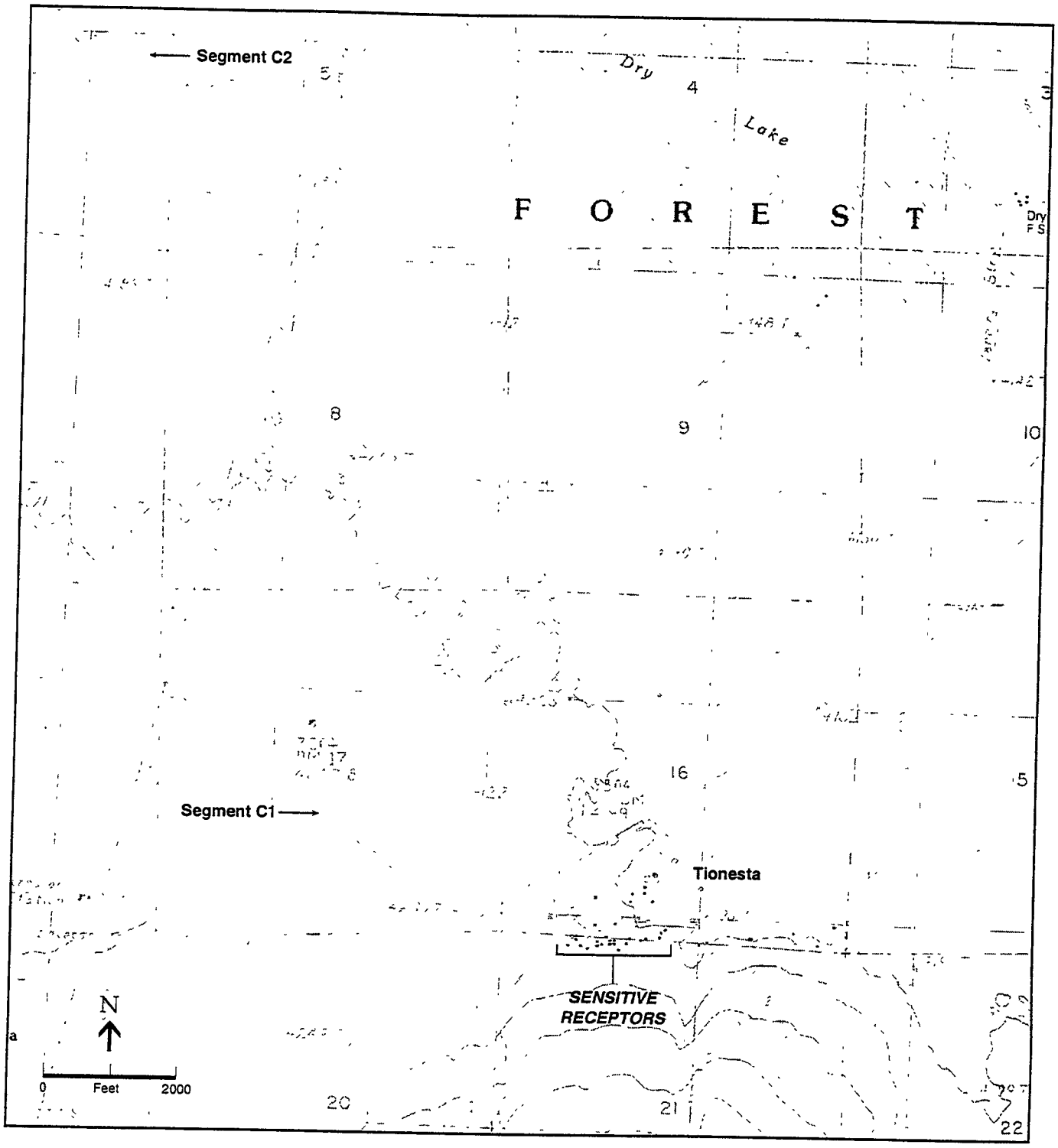
The referenced figure was removed at the request of the tribes to maintain confidentiality.

The term "cabins" as it appears in the Noise section of the Draft EIS/EIR, is synonymous with the term "residences" which appears in the Land Use and Recreation Section of the Draft EIS/EIR. As stated in the second paragraph on page 3-158 of the Draft EIS/EIR, the Medicine Lake recreation area includes three recreation residences (under special use permit with the USFS) and about 35 recreation residences located on private lands adjacent to the lake (see Figure 3.11-2). The private residences are clustered near the southern and southeastern edge of Medicine Lake. These residences are the "cabins" identified in~~identifiedin~~ Figure 3.14-1 on page 3-193 of the Draft EIS/EIR. Contrary to comment AG.335, all residences and campgrounds that would be potentially affected by project-related noise were accounted for in the noise analysis.

In response to comment AG.314, estimates of ambient noise levels were necessary at Sensitive Receptor Site 4, 5, and Tionesta. Due to their relative proximity to Sensitive Receptor Site 3, ambient noise levels at Sites 4 and 5 were estimated to be similar to sound levels at Site 3. Tionesta was assumed to have low ambient noise levels ranging from 25 to 45 dBA depending on the time of day, due to its general remoteness, and the small number of buildings that exist within the City's limits.

Figure 3.14-1 on page 3-193 of the Draft EIS/EIR is intended to show sensitive receptors at Medicine Lake, not Tionesta. Figure 3.14-2 has been added to Section 3.14, Noise of the Final EIS/EIR to clarify the location of sensitive receptors at Tionesta. The locations of Sensitive Receptor Sites 4 and 5 are discussed on page 3-192 of the Draft EIS/EIR. Sites 4 and 5 are also shown in Figure 3.14-1, but were inadvertently not included in the Figure's legend. Figure 3.14-1 has been revised to include Sites 4 and 5 in the legend. Regarding recreational uses in the vicinity, Figure 3.11-2 on page 3-155 of the Draft EIS/EIR illustrates existing uses in the Medicine Lake vicinity. The only official recreational use areas that occur in the immediate project vicinity are snowmobiling trails. Noise associated with the proposed project would not be heard over the characteristically extremely loud noises associated with snowmobiling.

Figure 3.14-2: Tionesta Sensitive Receptor Locations



SIGNIFICANCE CRITERIA

Comment—CEQA Appendix G Significance Criteria

AG.378 Page 4-257, paragraph 5. The EIS/EIR author misinterprets the text of Appendix G of the CEQA Guidelines. The EIS/EIR states: "..significant noise impacts would be expected to occur if:

... [2nd bullet] Project operations substantially increase noise levels in areas of sensitive receptors".

Appendix G actually states: "A project may be deemed to have a significant effect on the environment if it will: item (p) Increase substantially the ambient noise levels for adjoining areas." The key words here are " a project" and not "project operations". All facets of a project are to be included in the analysis of project impacts. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—CEQA Appendix G Significance Criteria

The term "project operations" which appears in the second bulleted item at the bottom of page 4-257 of the Draft EIS/EIR, refers to the entire project which includes each phase of the proposed project: construction, operation, and decommissioning. The noise analysis presented in the Draft EIS/EIR discusses each of these phases in detail and determines the effects of the noise levels associated with these phases. Therefore, all facets of the proposed project are included in the analysis presented in the Draft EIS/EIR.

Comment—Geothermal Resource Orders (GROs) Noise Standards

AG.375 Page 4-256, paragraph 3. The EIS/EIR refers to the GRO noise standard in this paragraph. The EIS/EIR uses this Leq level of 65 dBA to derive an Ldn of 72 dBA (the correct calculation would actually be 71 dBA). As previously stated, the two descriptors, Leq and Ldn, are not interchangeable and measure different noise impacts. The criteria defined here refer to Leq or ambient noise and not Ldn or 24-hour penalty-weighted community noise.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Geothermal Resource Orders (GROs) Noise Standards

As stated on page 4-256 of the Draft EIS/EIR, the GRO L_{dn} is an approximation. The precise value for average hourly noise exposure of 65 dBA (L_{eq}) for 24 hours, would have a resulting L_{dn} = 71.4 dBA. However, for the sake of clarity, the L_{dn} that appears on page 4-256 of the Draft EIS/EIR is revised to the following:

> "This GRO states that in the absence of more restrictive criteria, noise at 0.5 mile from major geothermal operation shall not exceed 65 dBA. This level on a 24-hour basis is equivalent to approximately Ldn ~~72~~ 71."

As discussed in the response to "Comments—Determination of Significant Impact," L_{eq} is used to provide some basis for evaluating noise which occurs during daytime hours (7:00 a.m. to 10:00 p.m.), for relatively short periods of time. Furthermore, it is common practice to use L_{eq} to evaluate relatively steady state noise levels from power plants. The noise analysis presented in the Draft EIS/EIR does not interchange L_{eq} and L_{dn} and provides definitions for both of these descriptors on pages 3-195 and 3-191, respectively. For further discussion on the differences between L_{dn} and L_{eq}, please refer to the response to "Comments—Definition of L_{eq}."

Comments—Applicability and Use of County Noise Standards

V.12 The EIR mistakenly minimizes the real impact of this project during operations with miscalculation and misstatement of local regulations.

"Noise associated with wellfield and power plant operation could result in significant impacts if users of forest lands are exposed to operational noise in excess of the Siskiyou County noise compatibility standard of 54 dBA Leq (60 Ldn). An exceedance of this standard could occur within approximately 3,200 feet of the wellfield and power plant site."

This conclusion is not supported by any calculation in the EIR. Furthermore, it is somewhat inaccurate if based upon a 6 dB reduction for every doubling of distance, and critically flawed when based upon a misreading of the Siskiyou County Noise Element. The 54 dBA noise contour would occur 3,400 feet away, and not 3,200 feet away:

LEVEL:	DISTANCE:	
66 dBA	850 feet (quoted from EIR, p. 4-261, ¶3)	
60 dBA	1700 feet	
54 dBA	3400 feet	0.64 miles
48 dBA	6800 feet	1.3 miles
42 dBA	13600 feet	2.6 miles
36 dBA	27200 feet	5.2 miles

Also, the value of 54 dBA is not Siskiyou County's noise compatibility standard upon which a significant impact should be rated. Rather, it is significantly lower than that in this quiet Medicine Lake rural area which is remote from large cities and from industrial activity and trucking. The County's Noise Element provides values, when adjusted, would be only about 40 dBA, as referenced below. This significant noise impact could occur as far away as 3 miles from the geothermal plant. There are homes closer to the plant than that at 2.2 miles according to the EIR which would therefore be exposed to significant levels of noise. This doesn't take into account the before mentioned unique features of the project vicinity which increase those noise levels even more.

THESE ARE THE SISKIYOU COUNTY GENERAL PLAN NOISE STANDARDS :

Noise Element Appendix p. 12 - Table A-6: "Noise level identified as requisite to protect the public health and welfare with an adequate margin of safety."

Outdoor activity: 55 dB(A) Ldn "Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use."

55 dBA Ldn, outdoor activity interference and annoyance.

Table A-10: "Corrections to be added to the measured community noise equivalent level (CNEL) to obtain normalized CNEL":

"Correction for Outdoor Residual Noise Level": (for summer operation) Quiet suburban or rural community (remote from large cities and from industrial activity and trucking). +10 dB CNEL

Type of correction	Description	Amount of correction to be added to Measured CNEL in dB
Correction for Outdoor Residual Noise Level	Quiet suburban or rural community (remote from large cities and from industrial activity and trucking).	+10 (dB)
Pure tone or impulse	...impulsive character present.	+5 (dB)

Besides the addition of +10 dB, the impulse sound adjustment factor of another +5 dB must also be included. The EIR identifies that there will be project generated noise of an impulsive character: "The clanging of drill pipes and highpressure air releases are expected to be audible." (EIR p. 4-260)

Therefore, because this is a quiet community and the project's noise will have an impulsive character capable of creating greater annoyance, the Siskiyou County General Plan Noise Element requires that 15 decibels be added to the EIR's estimated noise levels before those figures are compared with the Noise Element's other standards. The other standard shown above is 55 dBA Ldn, not 60 dB Ldn, as the EIR misquotes. Subtracting the correction factor, the correct measurement for General Plan compliance should have been: (55 - 15 =) 40 dB(A) Ldn. The EIR's purported limit of 60 dB(A) Ldn, is approximately 4 times louder and less restrictive than the Siskiyou County Noise Element's limit of 40 dB(A) Ldn, based upon the general theory that a 10 dB increase in noise level is perceived as a doubling in loudness. If the EIR overestimates these limits fourfold, then much reliance on its other conclusions is lost also.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

V.32 (Similarly, the EIR's determination of significance for noise impacts was its erroneous attempt to use the standards in the Siskiyou County General Plan Noise Element. The EIR never discussed the other issue of significance when this plant's noise, and that of future power plants nearby, noticeably or significantly exceed the current quiet ambient sound levels. These errors point to an abuse of discretion by the Lead Agency in failing to adequately assess the real world noise impacts, as opposed to limiting the identification of significance based merely upon some simple-minded misquote of local noise standards.).

(Carol Plank, Medicine Lake Citizens for Quality Environment)

AG.137 Also, the EIS/EIR states that because Siskiyou County does not have jurisdiction over national Forest lands, the Siskiyou County noise compatibility standards do not apply to these Federal lands. The same statement is made regarding Modoc County. (EIS/EIR, p. 4-256 to 4-257.) That is not correct. The federal regulations implementing the U.S. Geothermal Steam Act of 1970 provide that the operator shall comply with all federal and state standards relating to control of air, land, water and noise pollution. (43 C.F.R. § 3262.6.) Additionally, the Bureau of Land Management is required to coordinate its management activities with federal, state, and local land use planning and management programs. (43 USC § 1712(c)(9).) Finally, Geothermal Resource Order No. 4, item 11.C., states that absent more restrictive noise criteria, a lessee shall not exceed noise levels of 65 dBA. The Siskiyou and Modoc county noise compatibility standards provide these more restrictive criteria. Thus, Calpine must comply with the Siskiyou and Modoc County noise compatibility standards.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.318 The EIS/EIR impact assessment relies on inappropriate significance criteria. The principal area of noise impact for the proposed project is in Siskiyou County. All of the noise producing components of the project -- the power plant and well-drilling areas are entirely in Siskiyou County, although short-term noise from the transmission line construction may affect residential areas of Modoc County to the east. General Plan noise compatibility levels and noise policies could be applied to any sensitive receptor in Modoc County, but should not be used as significance criteria to assess noise impacts to recreational, open space and residential land use areas in Siskiyou County.

The impact area in Siskiyou County is primarily recreational open space. Open space areas of Siskiyou County have a median noise level of 53 dBA according to the General Plan Noise Element (page 50). Table 13 of the Siskiyou County Noise Element (page 54) identifies an Ldn of 50 dBA as acceptable for open space land use such as in the project vicinity. The acceptable noise level for residential areas of the County is an Ldn of 60 dBA.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.376 Page 4-256, paragraph 4. The EIS/EIR incorrectly concludes that, for the purposes of noise impact assessment, land use in the National Forest is most closely compatible to a neighborhood park, playground or residential area of a city or town. The actual land use described as an acceptable level for a 60 dBA in the Siskiyou County General Plan is not described as "park" but rather as "neighborhood park," which is a different type of land use altogether (Siskiyou County Noise Element page 54). The acceptable residential noise level of 60 dBA Ldn would apply to receptors in residential areas such as Tionesta and the developed portions of Medicine Lake. However, the low level and principally low-impact land uses in National Forests described in the EIS/EIR would conform more closely to "open space" land use compatible with an Ldn of 50 dBA.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.377 Page 4-256, paragraph 5. This paragraph describes compatibility standards from the Modoc County General Plan that would be relevant to the impact assessment. Modoc County apparently has no applicable standard for open space or natural areas that would apply to non-residential sensitive receptors for this project. The 70 dBA Ldn noise compatibility level for areas with active recreational uses would not apply to the low level and principally low-impact recreational uses in the National Forest. Also, the 70 dBA Ldn does not reflect any of the noise levels monitored for the EIS/EIR noise analysis. A 70 dBA Ldn would more likely be recorded at a water slide park than on a hiking trail.

The Modoc County General Plan Noise Element states that: "The County is a quiet place. Very few minor, intrusive noise sources either exist or are proposed for the area. The only issue of any significance related to noise is the need to maintain this valuable quality so absent in many cities" (page 128). This also indicates that the 70 dBA level is inappropriate. The EIS/EIR should use the more appropriate Siskiyou County standard, as discussed above under Summary Comment 10.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.379 Page 4-258, paragraph 3. The EIS/EIR applies Leq levels as significance criteria based on Ldn levels for dissimilar land uses. The EIS/EIR derives an Leq of 54 dBA from the General Plan community noise level of 60 Ldn for residential areas, neighborhood parks and playgrounds -- this is clearly not the land use type in the National Forest lands (see also comments for page 4-256, paragraphs 4 and 5).

The EIS/EIR converts the noise compatibility standard from the Siskiyou County General Plan from Ldn to Leq. The County standard is <u>not</u> 54 dBA but rather an Ldn of 60 dBA. These two noise levels are not interchangeable but apply to differing concepts -- ambient noise versus community noise. The impact of project noise should be based on significance criteria which address the CEQA impact of an substantial increase in ambient noise (Leq) apart from conformance with General Plan compatibility levels (Ldn).

If the reasoning of the EIS/EIR author were applied to the appropriate land use compatibility level for open space of an Ldn of 50 dBA , the derived Leq would be 44 dBA — a more appropriate Leq level to determine impacts given the low levels of ambient noise recorded for the EIS/EIR noise assessment.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.380 Page 4-262, paragraph 1. The conclusion of significant noise impact is based on General Plan standards that do not apply to typical National Forest land uses. The applicability of residential noise standards to forest lands is not justified (see comments for page 4-256, paragraphs 4 and 5). The impact area and sensitive receptors should be mapped to demonstrate the extent of impact (see Summary of Comments, items #1, #2, #7 and #8). Impacts are either significant or less than significant—there is no short-term significant impact (see comment for Page 4-260, paragraph 3).

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.381 Page 4-261, paragraph 3. The EIS/EIR applies the Leq of 54 dBA derived from the compatibility standard of 60 dBA Ldn for residential land use to assess impacts of the operational project. The significance criteria used are inappropriate for the assessment of noise impacts and do not conform from a jurisdictional, CEQA or land use standpoint (see comments for page 4-256, paragraphs 4 and 5; also comment 2a under Introductory Comments and 10. under Summary Comments).

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Applicability and Use of County Noise Standards

As stated on page 4-258 of the Draft EIS/EIR, the Siskiyou and Modoc County Noise Elements noise compatibility standards were used to assess noise impacts from the project on both public and private lands within the Klamath and Modoc National Forests. The Draft EIS/EIR also states that the county noise standards do not apply to Federal lands, but that these standards are used in the Draft EIS/EIR as the basis for evaluating impact significance under CEQA. The County Noise Elements were not misstated and are consisted with the noise elements promulgated in the Modoc County General Plan (Modoc County 1988) and the Siskiyou County General Plan (Siskiyou County 1978).

As discussed in the Draft EIS/EIR and the response to "Comments—Estimates of Operation Noise Levels," a great deal of recreational activity occurs in the general project region. On-site observations of the project vicinity revealed that motorized boat use occurs on Medicine Lake for water skiing and fishing. In addition, portable power generators were observed in the camping areas surrounding Medicine Lake and a night-time curfew on their use exists. Additionally, snowmobile use is prevalent in the immediate project vicinity and 225 miles of groomed snowmobile trails exist in the project vicinity. Therefore, since the project vicinity is an active recreational area it was determined that the maximum noise level of 60 dBA L_{dn} best describes the noise levels associated with the land uses in the area. This maximum noise level applies to parks, playgrounds, and residential uses. The maximum noise level of L_{dn}=50 dBA is consistent with passively-used open space (quiet or contemplation areas) according to the Counties' Noise Element standards. In order to be consistent with current land uses in the project area, the maximum noise level of L_{dn}=60 dBA is the most accurate noise level with which to assess the project's noise impacts. The Draft EIS/EIR thus is consistent with the Siskiyou County General Plan Noise Standard.

However, even if the maximum noise level of 50 dBA L_{dn} (the Siskiyou County Noise Standard for passively-used open spaces) was used in the noise analysis, the operation noise levels for the Schonchin picnic area and other sensitive receptor sites would still fall below this level. For example, the estimate of 18 dBA for power plant operation noise levels at the Schonchin picnic area would be increased by 10 dBA to account for this area being a quiet area, remote from a large industrial city, and increased by 5 dBA for the community having "no experience with intruding noise" (please refer to the Siskiyou County Noise Element Table A-10 in the Siskiyou County General Plan). Thus, the resulting level would be 33 dBA. Converting this level to a 24-hour average results in a L_{dn} of 40 dBA, 10 dBA below the Noise Standard's 50 dBA L_{dn}.

In response to comment V.32, the cumulative noise effect of the proposed project with other reasonably foreseeable projects in the area is discussed in the Draft EIS/EIR. As discussed in the Draft EIS/EIR, the Fourmile Hill and Telephone Flat geothermal projects are the only reasonably foreseeable geothermal projects at this time. For a discussion of cumulative noise effects, see Section 4.17, Cumulative Impacts in the Draft EIS/EIR and the response to comments in the Cumulative Effects Section of this document.

Comment AG.318 is correct in noting that the majority of "noise-producing components of the project" would occur in Siskiyou County. However, short-term noise from the construction of the proposed transmission line would potentially affect sensitive receptors in the Tionesta area of Modoc County. Thus, to assess noise impacts of the proposed project, the Siskiyou County General Plan Noise Standard of L_{dn}=60 dBA was used. However, it should be noted that for the noise analysis presented in the Draft EIS/EIR, the Modoc County Noise Standard of L_{dn}=60 dBA was applied to noise associated with the proposed transmission line construction in the Modoc County area, as opposed to that County's L_{dn}=70 dBA standard for active recreation areas such as water recreation areas, golf courses, and riding stables. (please see page 4-258 of the Draft EIS/EIR).

With response to comment AG.379, as discussed in the response to "Comments—Definition of L_{eq}," distinctions have been made between the two noise descriptors, L_{eq} and L_{dn}. Since L_{eq} standards apply to noise levels which occur for short periods of time and are restricted to daylight hours, it was necessary to use L_{dn} to describe effects of long-term noise levels from the proposed project because it takes into account the decrease in nighttime noise levels and the variations in noise levels over time.

As stated in the Draft EIS/EIR, there are no Federal noise standards or LRMP policies that are used by the Klamath and Modoc National Forests in addressing and evaluating noise (please see page 4-256 of the Draft EIS/EIR). Federal guidance for addressing noise effects from geothermal operations are contained in Geothermal Resource Operational Order (GRO) No. 4 (USGS 1980). The GRO states that in the absence of more restrictive criteria, noise at 0.5 mile from major geothermal operations shall not exceed 65 dBA. This level on a 24-hour basis is equivalent to approximately L_{dn}=72 dBA. However, as stated on page 4-258 of the Draft EIS/EIR, the Siskiyou and Modoc County Noise Elements noise compatibility standards were used to assess the noise impacts from the proposed project. As stated above and in the response to "Comments—Estimates of Operation Noise Levels," the Noise Element Standard that is most compatible with the current land uses of the proposed project area is L_{dn}=60 dBA. Please see the response to "Comments—Operational Noise Levels" for further information regarding the Noise Element Standards that were used in the noise analysis presented in the Draft EIS/EIR.

Comments—Determination of Significant Impact

AG.319 The basis for the determination of significant impact is never clearly established. CEQA defines a significant noise impact as a substantial increase in ambient noise. The EIS/EIR needs to identify what criteria will represent a significant increase. The EIS/EIR translates the Ldn compatibility standards from General Plans into Leq noise levels, for example the Ldn of 60 dBA becomes an Leq significance criteria of 54 dBA. There is no explanation of why the given Ldn levels for open space are not used as significance criteria and how or why Leq levels were derived. Ldn assigns a penalty to nighttime noise.

Leq describes time-vary noise with no penalty assigned. The standards are not interchangeable as each accounts for a different impact. Leqs can describe the range of noise levels produced by a project while Ldn describes the overall environment of a community.

Typically 5 dB is considered a perceptible increase in ambient noise. However in this study, the ambient noise levels for sensitive receptors presented are so low that a 5 dB increase could be below any threshold of community response. For this study, the threshold of increase should be selected, based on actual measurements in the field, to show the increase that would actually produce a perceptible increase in noise and/or a community response.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.359 Page 4-260, paragraph 5. This paragraph describes noise impacts to visitors to the National Forest. Noise levels on Route 49 are estimated at 62 dBA. Closer to the project site, noise levels are estimated between 68 dBA and 74 dBA. The EIS/EIR states: "These sounds are not expected to be particularly annoying to people." The EIS/EIR does not refer any significance criteria that define "annoyance to people." The conclusion also does not reflect impact significance as defined by CEQA and it does not conform with the land uses described for the sensitive receptor locations. See comments for Page 4-256, paragraphs 3 through 5, page 4-257, paragraph 5 and page 4-258, paragraph 3.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.385 Page 3-191, paragraph 5 states that "in terms of community response, it is generally valid that a change in noise level of at least 5 dBA is required before any noticeable change in community response would be expected." No citation is provided for this statistic. The 5 dBA increase in ambient noise identified by the EIS/EIR should be used as the threshold for significant impact or another standard should be identified, as discussed in Summary Comment 11 above.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Determination of Significant Impact

Significance criteria used in the noise analysis is presented on page 4-257 of the Draft EIS/EIR. In accordance with CEQA and NEPA, significant noise impacts would be expected to occur if:

- The project would generate noise levels that would conflict with local noise regulation
- Project operations substantially increase noise levels in areas of sensitive receptors
- The land uses proposed by the project are not compatible with ambient noise levels

Additionally, construction noise impacts of the project would be considered significant if:

- Construction activities would affect noise-sensitive receptors
- Expected noise levels would endanger the hearing of receptors near the construction site
- Construction activities would affect receptors during noise sensitive periods, at night for example

The significance criteria listed above are the basis for determinations of significant impact in the noise analysis presented in the Draft EIS/EIR.

Comment AG.319 states that the noise analysis presented in the Draft EIS/EIR translates the L_{dn} compatibility standards from the Siskiyou County General Plan into L_{eq} noise levels. It was necessary to convert L_{dn} to L_{eq} in some instances because the loudest noise levels associated with the proposed project would occur over short-time periods and would be restricted to daylight hours. As described in the Draft EIS/EIR and in the response to "Comments—CEQA Appendix G Significance Criteria," L_{dn} noise levels describe effects of long-term noise levels with a penalty assigned for nighttime noise, while L_{eq} is a steady state noise level, used for short-term noise events that are restricted to daylight hours. Therefore, to accurately assess noise impacts, the

county L_{dn} noise standard was converted to L_{eq}. It is appropriate to convert L_{dn} to L_{eq} because L_{eq} is the fundamental noise level metric used in calculating L_{dn}.

Comment AG.319 is correct in noting that ambient and project noise levels are so low that "a 5 dB increase could be below any threshold of community response." For example, the worst case of noise exposure during long-term and 24-hour concurrent well drilling and power plant operations is 37.3 dBA (L_{eq}) at the North Campgrounds (please see Table 4.14-3 on page 4-265 of the Draft EIS/EIR), when the ambient and operational noise levels are added logarithmically. If this noise occurs over a 24-hour period, the resulting L_{dn}=43.7 dB, whereas ambient level alone (37.0 dBA) on a 24-hour basis results in L_{dn}=43.4 dB.

However, there are no data permitting evaluation of such small differences in L_{dn}. Therefore it is better to evaluate noise level changes in terms of L_{eq} (as opposed to L_{dn}) when comparing project and ambient noise levels for different types of noise sources associated with geothermal projects.

There is no scientifically established criterion for evaluating annoyance associated with short-term noise exposure of Forest visitors. As discussed on page 4-260 of the Draft EIS/EIR, noise from steady drilling sounds like a low-frequency hum or a "rushing" sound. These sounds are not expected to be particularly annoying to people. This conclusion was based on experience at other geothermal drilling operations.

In response to comment AG.385, the text of the Draft EIS/EIR on page 3-191 has been changed to the following in order to site the appropriate reference:

> "In terms of community response, it is generally valid that a change in noise level of at least 5 dBA is required before any noticeable change in community response would be expected (Harris 1991)."

Reference:

Harris, C.M., et al. 1991. *Handbook of Acoustical Measurements and Noise Control.* 3rd edition. New York, NY.

NOISE SOURCES DURING CONSTRUCTION

Comments—Noise from Power Plant and Wellfield Construction

AG.347 Page 4-264, paragraph 1. This paragraph states that the wellfield and power plant construction noise would not exceed the GRO Order No. 4 limit of 65 dBA at 0.5 miles. However, other criteria such as county noise standards and CEQA criteria are not discussed. The noise should be evaluated under these standards too. Also, the stated noise level of "86 dBA at 50" appears here for the first time in the document without any references or documentation that explain how this figure was obtained.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.387 Page 4-258, paragraph 5. The EIS/EIR assigns a noise level of 83 dBA to each of four pieces of heavy equipment that would be used during construction, but it does not identify the source of the noise level data. It also does not explain its calculation of 83 dBA or present the composite noise level of more than one piece of equipment operating concurrently. The composite noise level is the relevant measurement needed to assess the noise impact. The EIS/EIR states that equipment would operate at idle for 50% of the time, but it does not give a noise level for idling equipment or cite any source for project operations. A reference should be cited for the estimate of 83 dBA that would be generated by these pieces of equipment. These are noise levels which can easily be obtained from manufacturers or other sources. The composite noise of operating equipment can then easily be calculated for a distance of 100 feet.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Noise from Power Plant and Wellfield Construction

As stated in the Draft EIS/EIR on pages 4-258 and 4-264, construction noise data presented in the Draft EIS/EIR are evaluated relative to the Siskiyou County Noise Element of L_{dn}=60 dBA (L_{eq}=54 dBA). The reference to the GRO Order No. 4 limit was included on page 4-264 of the Draft EIS/EIR in order to provide a relative comparison of maximum noise level limits.

As stated on page 4-257 of the Draft EIS/EIR, expected noise levels from well drilling and geothermal operations are based on noise levels measured at other existing geothermal operations, including The Geysers (G.S. Nolte & Associates 1986) and Coso KGRA (MHA 1988). As is standard with noise estimation methodology, the noise level estimates for the construction of a typical well pad or power plant were obtained by logarithmic addition. An assemblage of motorized construction equipment is stated to include four types of equipment, each of which would generate a maximum level of 83 dBA at a distance of 50 feet. The four types of equipment are listed on page 4-258 of the Draft EIS/EIR. The total noise level produced by this equipment would be 89.02 dBA at 50 feet, as indicated in the following equation:

$$89.02 \text{ dBA} + 10 \log 4 \text{ hours}/8 \text{ hours} = 89.02 - 3 = 86.02 \text{ dBA}$$

This total noise level is based on the assumptions that equipment would operate in idle half of the time, and that a maximum of three pieces of equipment would be used at any one time.

Comments—Noise from Well Drilling

H.31 Noise from well drilling will be going on every other year throughout the life of the project, and should have mitigation measures that would keep noise levels below background, and optimally inaudible within the Medicine Lake Caldera. *(Bill Dart, American Motorcyclist Association)*

AG.358 The EIS/EIR states that drilling noise is "like a low frequency hum or 'rushing' sound" but it never establishes a decibel level for drilling noise. The statement that "sounds are not expected to be particularly annoying to people" is completely unsupported. Additionally, the idea that people would be in the area only a short time reflects the impact that noise could have in driving them away. This is a significant impact. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.365 Page 4-258, paragraph 6. The EIS/EIR describes well-drilling activities but does not present noise levels for well drilling in its discussion on initial construction or infill. Well drilling would occur over a 36-month period and throughout the life of the project. Well drilling continues day and night for 25 to 90 days at a time, with noise generated at an elevation 40 feet above ground level. Noise levels are not assigned to well venting nor the possible reductions that would be achieved with the installation of a separator/muffler. Thus, impacts of these activities cannot be assessed.

The EIS/EIR should clearly map the area of potential noise impact both during construction and operation and identify sensitive receptors within the impact area.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.369 Page 4-264, paragraphs 3 and 4. The paragraph discusses the data shown in Table 4.14-2: Estimated Sound Levels from Well Drilling at Selected Receptor Locations, which presents octave band frequencies estimated for project impacts at receptor locations. However, until this point, the EIS/EIR had not included an analysis of the attenuating effects of barriers in reducing project noise. The EIS/EIR states that "an evaluation of octave band noise was conducted to determine whether such noise could be audible and potentially annoying." Paragraph 4 states "Noise barrier effects associated with terrain reduced the sound levels at all receptor locations but the reductions were least for these two wells." No further information on the analysis technique is presented. If the analysis is to include the effect of barriers in reducing noise, then this should have been done across the board and not introduced randomly in the middle of the analysis.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.370 Page 4-265, Table 4.14-2: Estimated Sound Levels from Well Drilling at Selected Receptor Locations is presented without sources. The octave band frequencies of well-drilling equipment are attenuated to the location of sensitive receptors calculated over unstated distances. No octave band information is

provided for the project impact area. No information is given as to how the octave band data was collected or whether the data represents project noise in combination with ambient noise.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Noise from Well Drilling

As stated in the response to "Comments—Determination of Significant Impact," there is no scientifically established criterion for evaluating annoyance associated with short-term noise exposure of Forest visitors. Thus, the statement on page 4-260 of the Draft EIS/EIR regarding drilling noise and its lack of annoyance to people was based on experience at other geothermal drilling operations.

Comment AG.358 misinterprets the statement made in the Draft EIS/EIR regarding Forest visitors being in the project area for brief periods of time. As discussed in the response to "Comments—Definition of Short-Term Impact," the assertion that the Draft EIS/EIR makes with respect to Forest visitors being in the project area for relatively brief periods of time refers to the activities Forest visitors engage in, not noise associated with the proposed project. General Forest visitors that would be present in the proposed project area would most likely be engaged in recreational activities such as snowmobiling, hunting, hiking, and water recreational activities. These activities are relatively short-term in nature, thus the Forest visitors engaging in these activities would be in the proposed project area for brief periods of time.

Drilling associated with geothermal projects generates a noise level of approximately L_{eq}=90 dBA at a distance of 50 feet from the center of the drilling operation. The Draft EIS/EIR presents noise levels from well drilling during initial construction and infill well drilling with respect to sensitive receptor sites at Medicine Lake. As shown in Table 4.14-1 on page 4-263 of the Draft EIS/EIR, the construction of two wells would result in L_{eq}=40 dBA at Sensitive Receptor Site 1 (North Campgrounds).

The Draft EIS/EIR noise analysis provides a worst-case estimate of sound levels associated with the proposed project. Therefore, noise levels were not estimated for equipment with separators or mufflers (noise reduction equipment) because this would incorrectly estimate worst-case sound levels produced by equipment that would be used in the proposed project. For a discussion of potential noise impacts associated with well venting, please see the response to "Comments—Noise from Well Testing and Venting."

Contrary to Comment AG.369, attenuation factors resulting from terrain and vegetative features are not introduced randomly in the Draft EIS/EIR noise analysis. As stated in the Draft EIS/EIR on page 4-257, a mathematical noise model was used to estimate expected noise levels produced by the proposed project. This noise model takes into account noise attenuation features associated with the terrain features of the existing environment. The noise model was used to estimate expected noise levels at sensitive receptor locations. As discussed on page 4-260 of the Draft EIS/EIR, potential noise impacts to Forest users were estimated using a straight line analysis which does not take into account noise reduction features. The straight line analysis was used in order to assess potential noise impacts to Forest users because it would not be efficient to assess noise levels for every location a Forest visitor might use in the entire project vicinity and have to take into account noise reduction features associated with the

particular terrain at each of these areas. It is more plausible to simply use a straight line analysis which assigns a decrease in 6 dBA with each doubling of distance.

The distances of sensitive receptor sites to the proposed project area can be obtained by using the map scale in Figure 3.14-1 on page 3-193 of the Draft EIS/EIR. For example, the distance of Sensitive Receptor Site 4 from the proposed project area is approximately 2.25 miles. As is evident from Table 4.14-3, ambient noise levels were not added to the overall noise levels produced by well drilling and power plant operations. A better comparison of potential noise effects is achieved when the overall levels produced by power plant operations and well drilling are compared with existing ambient noise levels. Table 4.14-3 shows that the sound levels from well drilling are, on average, 10.76 dB lower than ambient noise levels. By comparing ambient and proposed project noise levels, the Draft EIS/EIR gives a better example of potential noise effects.

Comments—Noise from Well Testing and Venting

A.61 The testing of geothermal wells prior to production can produce very loud noise of significant duration if proper silencing equipment is not used. The DEIS in various sections indicates that silencing equipment will be use during testing. The section on Noise (4.14) states that worst-case construction noise is incorporated into Table 4.14-4. It is unclear whether noise from testing is included. This should be specified in the FEIS. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

BV.2 When the wells were vented the noise was LOUD! For three weeks to a month *(Carlos DeRossett)*

Response—Noise from Well Testing and Venting

Section 4.14, Noise of the Draft EIS/EIR does not state that worst-case construction noise is incorporated into Table 4.14-4 of the Draft EIS/EIR. As the heading of this table states, Table 4.14.-4 addresses operational noise from only the power plant, not construction noise. As discussed on page 4-266 of the Draft EIS/EIR, this table does not show noise levels that would occur during power plant operation, in-fill well drilling, or testing activities. Noise levels that would occur during operation with in-fill well drilling are identified in Table 4.14-3 of the Draft EIS/EIR.

The noise from infill well testing during the operation phase would be expected to be similar to or slightly less than the noise from infill well drilling. As stated on page 4-266 of the Draft EIS/EIR, drilling of two wells simultaneously with power plant operation would result in the highest operational noise levels; this scenario was therefore used for the worst-case operational noise analysis in the Draft EIS/EIR. The Draft EIS/EIR therefore correctly analyzes the scenario with the potential to generate the greatest noise in order to determine project impacts during operation.

Regarding the inclusion of well testing in the analysis of construction noise, it is clearly stated in Section 4.14.2, "Noise Effects on Sensitive Receptors", on page 4-262 of the Draft EIS/EIR that the construction noise analysis in the document evaluates the following worst-case, maximum construction noise scenario:

- Well pad and power plant construction
- Well drilling and testing
- Transmission line pole erection and wire stringing

Comments—Noise from Transmission Line Construction

AG.356 Page 4-260, paragraph 4. The EIS/EIR refers to construction noise levels of 86 dBA. The criteria used to determine this noise level have not been explained.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.366 Page 4-259, paragraph 2. The EIR/EIR does not explain how it obtained the noise level of 86 dBA assigned to construction equipment. The assemblage of equipment producing the 86 dBA level is not even described. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Noise from Transmission Line Construction

As stated on page 4-259 of the Draft EIS/EIR, the equipment ensemble used by the construction crew during transmission line construction is expected to produce a noise level of 86 dBA at a distance of 50 feet from the center of activity. The construction equipment typically associated with transmission line construction includes bulldozers, front end loaders, and trucks. As stated in the response to "Comments—Noise from Power Plant and Wellfield Construction," the noise level estimates for multiple pieces of construction equipment were obtained by logarithmic addition. Please refer to that response for further detail.

Comment—Combined Effect of Construction Noise Sources

AG.368 Page 4-264, paragraph 2. The EIS/EIR presents an attenuated figure for well-drilling as if this activity could occur in a vacuum and without associated construction noise. Noise levels of project components should be presented at the standard 50 or 100 feet distance, should be annotated, and then calculated in combination with existing background noise and other activities which could occur simultaneously.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Combined Effect of Construction Noise Sources

Table 4.14-3 on page 4-265 of the Draft EIS/EIR presents the total noise levels at the receptors from concurrent well drilling and power plant operations. Providing unattenuated levels at 50 to 100 feet from the noise sources might be misinterpreted. Noise levels at the receptors which take into account attenuation with distance between the particular noise source and the noise receptor, and the noise reducing effects of intervening terrain and molecular absorption provide the most meaningful data to assess potential noise impacts at sensitive receptors and comply with local, state, and Federal regulations.

Comments—Potential Helicopter Noise During Construction

V.8 The EIR outright ignores helicopter noise because it claims that such noise levels are "speculative at best." This is total nonsense. The noise from helicopters is easily measured. If a specific type of helicopter hasn't yet been selected, then the EIR could reasonably use the worse case scenario among the likely types of helicopters used in such construction. If the noise impacts of helicopter use would be significant, then the EIR could suggest mitigations such that only a quieter helicopter is used, or that the flight path of helicopters not pass within a specified minimum distance of sensitive receptors. However, the EIR cannot legitimately dispose of its responsibility to examine and disclose such noise levels, nor to examine other construction alternatives in which helicopters aren't used. Without such information in the EIR, all the values provided in Table 4.14-1 are meaningless and greatly underestimated. CEQA requires that such information be disclosed even if it means that the noise consultant retained for this EIR actually has to do the homework, leave his office, go to an airport and take such measurements.
(Carol Plank, Medicine Lake Citizens for Quality Environment)

AG.345 Page 4-263, paragraph 2. The EIS/EIR author states that an assessment of impact of helicopter noise generated during transmission line construction would be speculative because the EIS/EIR author has no data. Estimates of noise impacts can be made by either sampling helicopter noise or consulting published sources. A project engineer could estimate the hourly number of trips required and likely trajectory during construction. In addition, a "worst case" analysis could be made by having a real helicopter fly directly over the Medicine Lake Campground and taking field measurements. The assessment of helicopter noise then would not be speculative. Instead, it would be based on meaningful data. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.346 Page 4-263, paragraph 3. After stating that an assessment of helicopter noise is "at best, speculative" the EIS/EIR then takes the liberty of concluding on the basis of no data whatsoever, that "helicopter noise would be most apparent and loudest at receptor locations nearest to ongoing construction," and that "helicopter noise would be loudest at the Northern Campgrounds (Site 1)." Such a conclusion, should be based on field measurements, as discussed for the previous paragraph, and not on speculation.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

BQ.32 There was also no assessment of the effects of helicopters, that would be used for the construction of the transmission lines, on the campground areas. *(S. Peder and Suzanna S. Cuneo)*

Response—Potential Helicopter Noise During Construction

The Draft EIS/EIR (pages 4-263 and 4-268) acknowledges the potential effects associated with helicopter noise during construction and estimates that helicopter noise levels would be the loudest in Tionesta when transmission line construction would occur in close proximity to the community and at receptor sites nearest to transmission line construction. The text of the Draft EIS/EIR in the first full paragraph on page 4-263 has been changed to include information regarding helicopter noise levels:

> "~~Because helicopters use a variety of routes at varying altitudes and because the helicopter type or types which may be used has not been specified, estimating their noise levels at various receptor locations would be at best speculative. Therefore, quantitative estimates of noise level are not provided.~~ The Bell Jet Ranger, a helicopter commonly used during tranmission line construction, produced noise levels of 76 to 85 dBA when the helicopter was 200 to 300 feet overhead of the receptor site (NWC 1986). These noise levels are similar to those created by other typical construction noise sources."

The noise associated with helicopters during construction would occur over very short time periods. The helicopter noise levels are within the range of construction noise sources considered. Neither the USFS nor Modoc County has a noise regulation governing short-term noise events. Helicopters would only be used for routine maintenance checks and stringing of the conductors along the transmission line. The agencies' preferred alternative, Alternative 6, would avoid transmission line construction in the Medicine Lake area.

Reference:

McClenahan & Hopkins Assoc. 1986. Environmental Assessment of the Proposed China Lake Joint Venture 28.5 Mile Devil's Kitchen to Inyokern High Voltage Transmission Line, China Lake Naval Weapons Center, Inyo and Kern Counties, California. Prepared for China Lake Joint Venture and the China Lake Weapons Center Public Works Dept. August 1986.

Comment—Hours of Construction

AG.331 Page 4-258, paragraph 5. The EIS/EIR states: "Construction is expected to be limited to daytime hours." However, the limitations placed on the project to help reduce the noise impact are listed in Mitigation Measure 4.14.2b which states that construction could occur daily, except Sundays and legal holidays, from 7:00 am until 10:00 pm. Thus, construction would not be limited to daytime hours.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

V.11 The EIR is based upon a stated expectation that construction will be limited to the daytime hours. As such, its conclusions are flawed. This project will be noisy 24 hours a day, seven days a week, for many months for each well. Some construction occurs at night, especially when scheduling pressures mandate it. The EIR doesn't even define those hours nor incorporate them into any mitigations as limitations. During summer months with early sunrises and hot midday temperatures, construction crews often like to begin noisy activities well before people in a recreational area even awake. Noise occurring at such early hours, especially before 7 am, would be much more of a significant environmental impact than this EIR apparently considers. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

Response—Hours of Construction

Construction would not occur before or extend beyond the limits stated in the Draft EIS/EIR. The only 24-hour construction operations associated with the proposed project are well drilling and venting. However, the drilling of two wells concurrently would result in a maximum noise level of 25 dBA at Sensitive Receptor Site 1 which is 12 dBA below ambient noise levels. Therefore, the noise levels associated with 24-hour well drilling would be below ambient and would not be audible. Mitigation measures are provided in the Draft EIS/EIR to restrict construction activities during noise sensitive periods, such as nighttime and weekends. As stated on page 4-267, construction of transmission line segment A1 (which occurs on the Medicine Lake Highlands) would occur between 7:00 a.m. and 10:00 p.m. Comment AG.331 references a sentence on page 4-258 of the Draft EIS/EIR that states "Construction is expected to be limited to daytime hours." The sentence has been revised as follows:

> "Construction will occur between the hours of 7:00 am and 10:00 pm due to the short construction period in the Highlands~~is expected to be limited to daytime hours~~."

Comment—Duration of Construction

AG.382 Power plant and wellfield construction, which are expected to last 18 to 36 months, should not be considered short term activities. Contrary to the statement of the EIS/EIR, noise threshold criteria are also applied to construction-related noise generation. Often, if these levels exceed compatibility standards, the project is then assessed with reference to the duration of the construction period and the limitations on hours and days imposed by ordinances, such as a grading ordinance or noise ordinance, in order to assess the degree of impact. An 18 to 36 month construction project (wellfields and power plant) is a vast stretch of the concept of the definition of short-term, particularly as well-drilling will continue during the life of the project.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Duration of Construction

Although total project construction may require 18 to 36 months, construction noise impacts are expected to be sporadic during this period. Once the walls of the power plant and its ancillary buildings are constructed, construction noise will occur inside and the noise levels at the receptors are expected to be reduced substantially (15 to 30 dBA). Drilling noise from the worst-case wells (P1 and P2) was evaluated and is the basis of the noise impact assessment. Well drilling noise, including testing of well flow, is expected to last up to 90 days. In the context of a total project life of up to 45 years, 90 days would be a short-term impact. Other wells may be drilled after worst-case wells are drilled and tested. These wells are farther from the receptors and their noise is expected to be reduced by terrain. Thus, their noise levels would be less than those shown in Table 4.14-3 on page 4-265 of the Draft EIS/EIR. Because noise levels from drilling the two worst-case wells concurrently are very low (20 to 26 dBA) and do not exceed ambient noise levels, providing noise data for every other well (with noise levels that would be less than the two worst-case wells) would not change the Draft EIS/EIRs conclusions regarding the project's potential noise impacts.

NOISE IMPACTS DURING CONSTRUCTION

Comments—Effects on General Forest Users

AG.355 Page 4-260, paragraph 3. The EIS/EIR concludes that:

> "The project impact on noise levels from project construction, operation, and decommissioning could result in short-term significant impacts to forest users that come in close proximity to the wellfield and power plant site or to the transmission line."

Conclusions regarding impact significance should be confined to adverse and unavoidable or less than significant. Short term impacts typically refer to impacts occurring over a short duration. The EIS/EIR author repeatedly uses the concept of short-term in reference to the sensitive receptor leaving an area in a short time because of annoying project impacts (see page 4-260 paragraph 6, page 4-261 paragraph 4, page 4-192, paragraph 1, and page 4-198, paragraph 3). The idea that individuals must leave an area due to project effects identifies a significant impact. If individuals actually leave the project area strictly because of noise, this should also be considered a significant impact.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.357 Page 4-260, paragraph 5. The EIS/EIR identifies motorists and hunters as potential sensitive receptors to construction noise. However, no information as to recreational use in the area, which may be affected by construction noise, is presented and the effect of the impact cannot be understood. For example, do bicyclists use the forest road or trail network? Are there fishing streams in the project vicinity? The

Comments—Effects on Receptors at Medicine Lake

H.29 After reading the sections on noise, I am still not clear on how much noise would reach the Medicine Lake area. Table 4. 14-1 says that ambient noise levels at all Medicine Lake receptor are three to 8 db below sound levels of construction from drilling 2 wells. This would indicate that project noise would be clearly audible from all test areas in The Medicine Lake basin, which would be unacceptable since it would last three construction seasons. Even the power plant construction alone would be 5 db above ambient levels at Little Medicine Lake, which would make it plainly audible. However, table 4. 14-3 indicates that well drilling and power plant operation would be 7 to 13 db below ambient noise, which seems inconsistent. Even if only one well is being drilled, cumulative noise would only be 3 db less than two wells. This needs to be clarified. *(Bill Dart, American Motorcyclist Association)*

AG.344 Page 4-263, Table 4.14-1. Table 4-14.1 purports to show sound levels from construction at selected receptor locations. The data presented in this table cannot be evaluated as reliable due to the following deficiencies in the analysis: 1) no noise level is ever given for well drilling equipment, 2) no noise level is ever given for combined activities during power plant construction, 3) no distances to receptors 1,2 and 3 from the well field and power plant are given, 4) no distances are given from receptors 3, 4 and 5 to proposed transmission lines, 5) no distinction is made between the impacts at locations 3, 4 and 5 even though the receptors would be at varying distances from the transmission line, 6) no documentation or assumptions to support the 86 dBA assigned to power line installation is presented, and 7) the ambient noise levels used for receptor locations are inaccurate.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effects on Receptors at Medicine Lake

The estimated noise levels associated with construction activities are included in Table 4.14-1 on page 4-263 of the Draft EIS/EIR. As stated on page 4-262 of the Draft EIS/EIR, the period of highest construction noise would occur during the summer of the second construction season when concurrent well pad and power plant construction, well drilling and testing, and transmission line construction would occur. At times during this construction season, construction noise levels would reach a maximum noise level of 57.2 dBA at Sensitive Receptor 3. This level is above ambient, and it exceeds the Siskiyou County Noise Standard by 2.8 dBA. However, mitigation measures have been prescribed on pages 4-267 to 4-268 of the Draft EIS/EIR to reduce impacts associated with construction noise. Selecting the preferred alternative, Alternative 6 would avoid transmission line construction in the Medicine Lake area and would reduce noise impacts in the area.

The noise levels associated with well drilling are included in Table 4.14-3 on page 4-265 of the Draft EIS/EIR. As stated in the response to "Comments—Noise from Well Drilling," the noise level from drilling is L_{eq}=90 dBA at 50 feet. In Table 4.14-3 concurrent drilling of two wells and power plant operation would result in a maximum noise level at Sensitive Receptor Site 3 of 23.0 dBA. This level is 10 dBA below ambient and would not be audible at Site 3.

The combined noise levels for construction are shown in the right-hand column of Table 4.14-1 under the heading title "Total Level." These levels combine the construction noise levels from two wells pads, the power plant, and the transmission line. The distances between sensitive receptor sites and the proposed power plant, wellfield area, and the transmission line can be estimated from the map scale located in the top right-hand corner of Figure 3.14-1 on page 3-193 of the Draft EIS/EIR.

Distinctions between the effects of noise associated with transmission line construction for Receptor Sites 3, 4, and 5 were not made because, based on distance from the proposed transmission line, the worst-case exposure of noise levels would be provided by estimating noise levels at Site 3. The estimates of construction noise levels associated

with transmission line construction at Sites 4 and 5 would be 58 dBA and 51.5 dBA, respectively.

Comments—Effects on Receptors at Tionesta

AG.350 Page 2-48. The EIS/EIR suggests that blasting may occur when installing the transmission line support structures. (EIS/EIR, p. 2-48.) The noise impacts from blasting should be identified. For example, the EIS/EIR should state whether sensitive receptors such as Tionesta residences or recreators would be affected. These receptors should be mapped in relation to the blasting. If blasting would affect sensitive receptors, then the EIS/EIR should discuss its blasting plan, the type of blasting, potential blasting noise levels, and notification measures prior to blasting. The EIS/EIR should also discuss mitigation measures such as pre-blast and post-blast surveys of homes, and control of blast vibration and airblast.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.351 Page 3-192, paragraph 1. The EIS/EIR identifies Tionesta as a sensitive receptor and refers to Figure 3.14-1 and Figure 3.6-1 for location of the sensitive receptors. Figure 3.14-1 does not show the location of Tionesta, which is found only with some difficulty in Figure 2.2-2. However, Figure 2.2-2 gives no idea of where the receptor locations in Tionesta are in relation to roads or the proposed project.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.352 Page 3-196, paragraph 1. This paragraph purports to describe the noise environment at the community of Tionesta. Tionesta is approximately 16 miles east of locations 1 and 2 sampled for noise for this EIS/EIR. Tionesta is 3 miles west of State Highway 139 and just south of Lava Beds National Monument Road according to the CSAA map "Northeastern California." The EIS/EIR (page 3-165) states that the transmission line would pass approximately 1500 feet from some point in this community. Without information about the location of the transmission in relation to the homes, it is impossible to determine whether the transmission line will have a significant noise impact on Tionesta residences.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.353 Page 4-268, paragraph 3. The EIS/EIR states that the impacts associated with initial construction of the transmission line and decommissioning would be considered a significant impact as project noise levels would exceed Modoc County noise standards during construction. However, this assessment of significance is inadequate because no substantiated data for the Tionesta area has been presented. There is no source information on the decibel levels used for construction equipment, no decibel level estimated for helicopter use, no ambient noise level for the Tionesta community, no map showing sensitive receptors in relation to the proposed transmission route, and no indication of the number of receptors that would be affected.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effects on Receptors at Tionesta

Blasting would not occur in the Tionesta vicinity. Any blasting that may be done would occur in remote, rugged areas, and would not be noticeably audible at Tionesta. It is important to note that blast noise is a very brief noise event (less than one second in duration) and thus, may be difficult to hear in a noisy background, and at the distances involved. It is doubtful that vibrations transmitted through the ground will be sufficient to be observed. The noise from this blasting would be occasional, sporadic, and temporary, and is considered to fall within the analysis of construction noise effects presented in the Draft EIS/EIR.

As stated in the response to "Comments—Adequacy of Noise Analysis," Figure 3.14-2 has been added to the EIS/EIR to clarify the locations of the sensitive noise receptors in the Tionesta area. The commentor is correct in noting that Figure 3.14-1 on page 3-192 does not depict the location of Tionesta. Due to the map scale, it would not have been practical to include Tionesta in this figure. On page 4-268 the Draft EIS/EIR states that the estimated noise level from transmission line construction in the vicinity of Tionesta would be about 61 dBA at the nearest residence, which is located approximately 1,500 feet from the line, and about 57 dBA at the farthest residences. This information is sufficient to calculate that the farthest receptors are approximately 2,400 feet from the transmission line.

On page 4-259 of the Draft EIS/EIR it states that the equipment ensemble used by each transmission line crew is assumed to produce a noise level of 86 dBA at a distance of 50 feet from the center of activity. As stated in the response to "Comments—Potential Helicopter Noise During Construction," the noise associated with helicopters during construction would occur over very short time periods and neither the USFS nor Modoc County has a noise regulation governing short-term noise events. The Draft EIS/EIR (page 4-268) does acknowledge the potential effects associated with helicopter noise during construction and estimates that helicopter noise levels would be the loudest in Tionesta when transmission line construction would occur in close proximity to the community.

NOISE SOURCES DURING OPERATION

Comments—Power Plant and Infill Well Drilling Noise

V.4 ¶2 The EIR also states that the plant's noise would not exceed the Federal noise limit of 65 dBA at 0.5 miles from the plant. However, no documentation of this conclusion is provided. No data and no calculations are evident in the EIR. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

AG.367 Page 4-259, paragraph 5. The EIS/EIR author states that in-fill well-drilling would be similar to construction period well-drilling. However, no noise levels were presented for construction well-drilling. The EIS/EIR should clearly identify the range of sensitive receptors and the impact area for noise associated with in-fill well-drilling and power plant operation.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.372 Page 4-266, paragraph 1. The first sentence states that "the primary source of noise from the proposed action would be the power plant," but the noise level of the power plant is not given in the EIS/EIR. The paragraph goes on to discuss that every two years infill wells would be drilled at the proposed well pads and that infill well drilling would last from 25 to 90 days. In discussing impacts to Medicine Lake area, the EIS/EIR states: "Once the wells are drilled, they generally produce relatively little noise." However, no discussion of operational geothermal well noise is ever presented in the EIS/EIR. Also, the EIS/EIR does not provide quantifiable information on noise reduction from insulation, even though information could be obtained from similar operations.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.388 Page 4-259, paragraph 4. The EIS/EIR states that it assumes an interior noise level of 85 dBA because it is the maximum level allowed by OSHA. The EIS/EIR does not state that this interior noise level is feasible to achieve with the equipment required for this project.

Exterior noise levels are relevant levels by which to assess environmental effects on receptors. However, no exterior noise levels are given nor are the noise levels of the project noise sources identified. The impacts of this facility cannot be assessed without establishing noise levels from a similar facility or similar assemblage of equipment.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

FK.7 SECTION 4.14.1 EFFECTS ON FOREST NOISE LEVELS Says that the County noise compatibility standard my be reached if a person comes within 2,100 feet of construction sites and within 3,200 ft of wellfields and plant operation sites. "Additionally, noise levels during operation would not endanger the hearing of forest visitors in these areas, nor would they occur during noise sensitive periods such as night." [I was not aware that this was a daytime power plant. Mr. Sharp indicated at the meetings, that the drilling operations would continue 24 hours per day all summer.] *(Charles F. Moss)*

GZ.2 It was bad enough when the wells were being dug. A thumping noise night and day. From what we understand, there will be noise day and night with these plants. At night it is so quiet you can hear a sneeze across the lake. Imagine what the plant noises will be like! *(Harry and Bettie Shott)*

IQ.14 Section 4.14, page 4-261, states "Noise levels during operations would not endanger the hearing of forest visitors in these areas, nor would they occur during noise sensitive periods such as night..." (emphasis added). This statement shows how disconnected the evaluation of the impacts of the project are from the actual site conditions and projected intrusions. While grateful that the project will not endanger a visitor's hearing, I am concerned that any noise will result in a significant disturbance. The latter portion of the statement suggests the power plant would shut down at night; however, it is doubtful this is what is actually planned. *(Phil Woodward)*

PH2.5 Like I say, I've worked on five geothermal power plants, I don't find the noise a problem, I don't find—in fact, I know they're not that noisy, once the construction is completed. *(Klamath Falls Public Hearing)*

Response—Power Plant and Infill Well Drilling Noise

Operational geothermal well noise is not discussed since it generally is low, perhaps 70 to 80 dBA at 50 feet, and is inconsequential at the distances involved in the present project. Pipeline noise also tends to be inconsequential if flow velocities are low or pipelines are oversized. The highest noise levels typically occur near valves. Because of the cold, these valves are expected to be tightly wrapped, and valve noise levels would be inconsequential at the distances between the wellfield and receptors. Moreover, pipelines are expected to be about four feet above ground so terrain noise barriers would be very effective.

A level of 85 dBA as an average throughout the turbine generator area of the power plant is achievable. Equipment used for the proposed project would ensure that sound levels within the interior of the power plant would be consistent with OSHA requirements.

In response to comment AG.367, noise levels for construction well drilling are presented in Tables 4.14-1 and 4.14-2 of the Draft EIS/EIR. Noise estimates, sensitive receptors, and the impact area from infill well drilling would be the same as those given for construction well drilling. The noise levels associated with well drilling during project operation are identified in Table 4.14-3 on page 4-265 of the Draft EIS/EIR.

Comments—Determination of Operational Noise Levels

AA.1 In reviewing the Draft EIR/EIS for the Fourmile Hill project, it is apparent that it greatly underestimates the noise impacts of this power plant project on the now quiet vicinity around the Medicine Lake area.

The estimated sound levels from these power plant operations are provided in Table 4 14-4. For example, at the Schonchin Picnic Area, the Draft EIR/EIS estimates an overall noise level from the project of 18 dB (A) LEQ. This picnic area is about 2-1/4 miles from the Fourmile Hill power plant site. This sound level estimate is not consistent with other information in the Draft EIR/EIS, in that it understates the likely noise levels heard at these recreational and residential areas.

Elsewhere, the Draft EIR/EIS states that noise levels would be about 66 dB (A) at 850 feet from the power plant when it is operating. (page 4-261, 3rd paragraph) Using the Draft EIR/EIS's estimate that this sound level decreases 6 dB (A) for each doubling of distance provides these noise values at other distances:

850′ = (0.16 miles): 66 dB (A) LEQ
1700′ = (0.32 miles): 60 dB (A) LEQ
3400′ = (0.64 miles): 54 dB (A) LEQ
6800′ = (1.28 miles): 48 dB (A) LEQ
13600′= (2.57 miles): 42 dB (A)LEQ
27200′ = (5.15 miles): 36 dB (A) LEQ

Therefore, the sound level at the Schonchin Picnic Area which is about 2-1/4 miles should be about 43 dB (A) LEQ by interpolation or mathematical calculation, not 18 dB (A) as claimed. The sound level at that location will be significantly louder than the Draft EIR/EIS estimates, or somewhere in the vicinity of five times louder as people would experience. That increase in sound level above what presently exists itself would create a significant environmental impact which this Draft EIR/EIS doesn't acknowledge. This is because the sound level now is in the range apparently of 20 to 30 dB (A). An increase of perhaps over 20 dB(A) would be discernible to all but the deaf, and a great nuisance and source of annoyance and anger.

A sound level of 43 dB (A) LEQ when corrected for increased night noise sensitivity would be equal to a 'day-night average' of 50 dB (A) CNEL. That project-related sound level would also be inconsistent with the Noise Element of the Siskiyou County General Plan which has limits when adjusted for quiet rural areas of only 45 dB (A) CNEL. If this power plant produced impact sounds, as the Draft EIR/EIS reveals, the County's standards require another adjustment of +5 dB to limit such maximum noise impacts to only 40 dB (A) CNEL. Yet the data in the Draft EIR/EIS provides evidence as shown above that at this picnic

area the noise level will be 50 dB (A) CNEL, considerably louder (twice as loud) as the General Plan allows. Inconsistency with the General Plan is considered by CEQA to be a significant environmental impact, yet the Draft EIR/EIS fails to acknowledge this fact.

Moreover, this environmental impact is not adequately mitigated to a less than significant level. Therefore CEQA requires that the Alternatives Analysis discussion of an EIR consider project alternatives which would be able to lessen such significant impacts. This Draft EIR/EIS does not consider and alternative sites for the Fourmile Hill project's location which would be farther from these sensitive locations, or would be behind some prominent geological feature so as to block such noise, and therefore it violates CEQA. The only alternatives provided are for power line location, but those alternative locations won't affect the noise from the power plant itself. *(Dale LaForest, Director, Mt. Shasta Tomorrow)*

AG.317 Project-generated noise is not shown in combination with ambient noise levels. Attenuated noise levels are depicted in the impact tables as occurring in a vacuum.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.326 Page 4-69, paragraph 1. The EIS/EIR author refers to primary sources of noise impacts as noise generated by the cooling tower fans and the sound of water falling through the baffles of the cooling tower. These noise sources and others used are not evaluated or described in the noise impact section 4.14. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.348 Page 4-266, paragraph 2. Impacts from operational noise are presented as attenuated noise occurring in a vacuum. Operation-related noise levels are not combined with existing ambient noise or other simultaneous noise-generating activities. The EIS/EIR does not provide distances used to calculate noise attenuation. If all 5 sensitive receptors are outside the impact area of noise, then this should be demonstrated by a map of the impact area and a concise assessment of the impact. Presenting frequency calculations and decibel levels for seemingly undetectable noise (as shown in Table 4.14-4) does not contribute to the impact analysis.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.349 Page 4-267, paragraph 1. The EIS/EIR author states: "Although potentially detectable at times, operational noise would not be considered a significant impact." However, the text does not explain which frequencies would be audible above ambient noise or how the overall noise level (last column) is derived in Figure 4.14-4. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.362 The EIS/EIR uses an attenuated Leq of 66 dBA at 850 feet for the operational project without establishing the source or noise levels of the project components. Given the attenuated 66 dBA, one can calculate that some project components would have to be generating 90.6 dBA at 50 feet. Is this the operational noise level the EIS/EIR author is using? If so, what is the source? Page 4-257, paragraph 1, states that expected noise levels are based on noise measured at similar facilities, but the EIS/EIR does not indicate that such sources were ever consulted.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.371 Page 4-256, Table 4.14-3: Estimated Sound Levels from Well Drilling and Power Plant Operations at Selected Receptor Locations. All comments for Page 4-263, Table 4.14-1 also apply to this table. One of the more critical errors of Table 4.14-3 is the separation of existing noise levels and operational noise levels from the column labeled Total Level. The column labeled "Total Level" is incorrect because ambient noise is not factored into the total noise. The table also fails to identify the distances used for attenuation or the noise levels at 50 feet or 100 feet from the noise source.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Determination of Operational Noise Levels

Comment AA.1 assumes that the operational noise levels for the Schonchin Picnic area were calculated solely on the basis of hemispheric spreading which assigns a 6 dB decrease for each doubling of distance between the noise source and the receiver. Estimates of operational noise levels based solely on hemispheric spreading only apply to operation noise levels and their effects on Forest users.

As described in the Draft EIS/EIR on page 4-257, the noise propagation model used in the operation noise analysis for Sensitive Receptor Sites 1 to 5 accounts for the distance between the noise source and receptor, molecular absorption of sound, and noise level reductions due to terrain between the noise source and the receiver. For the estimated noise level from power plant operation at the Schonchin Picnic area, approximately 5 dBA of noise reduction occurred as a result of molecular absorption of sound, and a reduction of 20 dBA occurred as a result of terrain characteristic of the area.

Comment AA.1 states that the Draft EIS/EIR violates CEQA because it does not consider alternatives for the proposed power plant and wellfield location. As discussed in the Draft EIR/EIS on page 2-60, there are no feasible alternative locations for the proposed power plant and wellfield on Calpine's lease that would reduce environmental effects. Geothermal facilities must be sited in areas of greatest resource potential because of the need for these facilities to be at a precise location in relation to the geothermal resource. Calpine has conducted geologic and geophysical studies that have identified the approximate drilling locations on their leases that are expected to offer the highest probability of encountering geothermal reservoir fractures and a commercially viable resource when utilized. Calpine consulted with the agencies in project planning to identify a power plant location with the least environmental effects (see also responses to "Comments—Alternatives Development"). The identification of only one feasible location for the power plant and wellfield is consistent with alternatives consideration discussed in the CEQA guidelines, which identifies geothermal power plants as an example of a project which there can be no feasible alternative location (CEQA Guidelines Section 15126(d)(5)(B)(2)).

Tables 4.14-1 and 4.14-3 on pages 4-263 and 4-265 of the Draft EIS/EIR show the ambient noise levels at the various receptors as well as the estimated noise levels associated with different phases of the project. The "Overall Levels" are shown in the right-hand column of Tables 4.14-2 and 4.14-4. These "Overall Levels" can be compared with the ambient levels in Tables 4.14-1 and 4.14-3. In other words, "attenuated noise levels" are not depicted "as occurring in a vacuum."

The sum of ambient noise and project noise levels would increase the ambient noise levels by small increments. For example, a 0.9 dB increase would occur at the Schonchin Picnic area from an ambient level of 33.0 dBA to a "combined" level of 33.9 dBA. Such small changes typically cannot be detected by human beings and are insignificant.

The overall noise levels (last columns) in Tables 4.14-2 and 4.14-4 were obtained by subtracting the appropriate A-weightings from each octave band level and logarithmically summing the remainders. Comparison of the octave band levels in Table 4.14-4 with the ambient octave band levels in Table 3.14-3 and the overall levels in the two tables indicates that the receptors are unlikely to hear power plant noise because it is typically well below the ambient levels. However, it is possible that when thermal inversions occur, if ambient drops appreciably and if the wind is light but coming from the northwest, some power plant noise may be audible at sensitive receptor sites. It is expected that the power plant noise would be difficult to identify or distinguish from the noise of wind in trees.

As stated in the Draft EIS/EIR on page 4-257, expected noise levels from well drilling and geothermal operations are based on noise measured at other geothermal energy operations. Please see the response to "Comments—Noise Levels of Primary Noise Generators" for further discussion of the noise levels associated with power plant operation.

Comment—Potential Noise from the Transmission Line

AG.262 The DEIR does not evaluate the impact of noise from the proposed transmission line on humans (Sec. 4.14) or wildlife (Sec. 4.8) because it claims that operation of the line would not generate any noise. (DEIR, p. 4-266.) This is not correct. It is well known that power transmission lines produce audible

noise, which has been characterized as a "constant hum" and measured at 63 dBA sound pressure level (Lp) below the lines. (A.S. Bommer and R.D. Bruce, The Current Level of Understanding into the Impact of Energy Industry Noise on Wildlife and Domestic Animals, Proceedings of Spring Environmental Noise Conference, Alberta Energy and Utilities Board, 1996, p. 10.) This noise is known to annoy humans and adversely affect the behavior of reindeer. (J.M. Lee, Jr. and D.B. Griffith, Transmission Line Audible Noise and Wildlife, In: J.L. Fletcher and R.G. Busnel (Eds.), Effects of Noise on Wildlife, Academic Press, New York, 1978, pp.105-167) The transmission line passes within 260 feet of the Medicine Lake Lava Flow and within 1200 feet of the North Campground at Medicine Lake, where sensitive receptors are located. (DEIR, p. 4-259, Fig. 3.7-2.) The DEIR should be revised to discuss and quantify transmission line noise and to propose mitigation measures, as appropriate.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Potential Noise from the Transmission Line

The Draft EIS/EIR states that the proposed transmission line would be approximately 1,200 feet from human noise receptors in the North Campgrounds and approximately 4,200 feet from the complex of residences at the southeast end of Medicine Lake (see page 4-259). The height of the transmission line is estimated to be approximately 70 feet above ground, allowing about 10 feet for line sag. The line is expected to radiate sound equally around its axis. Thus, the level of corona noise (noise associated with transmission lines) is calculated to be about 38 dBA near receptors in the North Campgrounds and about 27 dBA near the residences at the southeast end of Medicine Lake. The nearest residential receptor in Tionesta appears to be approximately 1,500 feet from the transmission line (page 4-268). At this distance, the estimated level of corona noise is about 36 dBA.

Ambient noise levels in the North Campgrounds are about 37 dBA and only about 1 dBA lower (quieter) than the estimated level from corona noise. Thus, it is doubtful that corona noise would be audible. In addition, since corona noise occurs during rainy periods, ambient noise levels are expected to increase several dBA because of the rain; this results in a decreased likelihood that corona noise would be audible. Ambient noise levels at the residences on the southeast end of Medicine Lake are about 36 dBA; corona noise at 27 dBA is unlikely to be audible. Since Tionesta appears to have a number of residences, ambient noise levels may be similar to those observed near the residences at the southeast end of Medicine Lake, or about 36 dBA, and approximately equal to the level of corona noise. With ambient noise level increasing with rain, corona noise should not be audible at the nearest residence in Tionesta. For a discussion of potential noise effects on wildlife, please refer to the response to "Comments—Effects of Noise on Wildlife" in the Wildlife Section of this document.

NOISE IMPACTS DURING OPERATION

Comment—Effects on Recreationalists Passing by on Route 49

AG.361 Page 4-261, paragraph 2. The EIS/EIR identifies visitors driving by on Route 49 as sensitive receptors who would probably hear project noise at an estimated 62 dBA (construction noise) or 66 dBA (operational noise). Actually, people in vehicles would hear only the louder noises their own vehicles would generate. The noise from the vehicles would be in the 60 to 70 dBA range (with windows open), which would tend to mask most project noise. Visitors that stop their cars, picnic, hike or bicycle on or near route 49 would hear project noise, but these sensitive receptors are not discussed.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Effects on Recreationalists Passing by on Route 49

Whether visitors are inside or outside of their automobiles would not affect noise exposures at the distances noted in the second paragraph of page 4-261 in the Draft EIS/EIR. Visitors who stop their cars, picnic, hike, or bicycle would be considered

typical Forest users. As described in the Draft EIS/EIR on page 4-261, a Forest visitor within approximately 3,200 feet of the wellfield and power plant during operation would be exposed to noise levels in excess of those outlined in the County noise standard. However, as stated in the Draft EIS/EIR, Forest visitors engage in relatively short-term activities in the vicinity of the proposed power plant and wellfield and would be exposed to operation noise levels for a short period of time. Therefore, the impact to Forest users would be considered a short-term significant effect. As described on page 4-262 of the Draft EIS/EIR, Mitigation Measures 4.14.2a through 4.14.2c are designed to reduce these effects.

NOISE DURING DECOMMISSIONING

Comments—Noise During Decommissioning

AG.373 Page 4-260, paragraph 1. The description of noise generated during decommissioning is dismissive and insufficient. The EIS/EIR states:

"As decommissioning activities would use similar equipment to that described above for construction at the wellfield and power plant site and along the transmission line, noise levels would be similar to those identified above for these sites."

The components involved in plant decommissioning should already been ascertained. Thus, noise generation can be estimated and characterized in the EIS/EIR.

Page 4-261, paragraph 5. The EIS/EIR states: "Project noise levels during decommissioning of the wellfield and power plant facilities and transmission line facilities, would be similar to those described for construction, as similar equipment would be used." This statement is inadequate. The EIS/EIR needs to provide information regarding the types of equipment, noise levels, and duration of impact in relation to receptor locations if the EIS/EIR intends to provide a real analysis of the impacts of decommissioning. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

AG.374 Page 4-267, paragraph 2. This paragraph states: "The noise effects of decommissioning the proposed facilities is expected to be less than noise levels and associated effects identified for construction of the proposed facilities because well drilling would not occur." However, noise levels during "construction" (estimated at 18 to 36 months) are considered a significant impact. Decommissioning noise levels may also be significant even if these levels are less than construction-related noise levels. The EIS/EIR's analysis does not describe potential noise sources nor the effects of these sources and thus, adds nothing to the noise analysis. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Noise During Decommissioning

As stated in the Draft EIS/EIR (see page 4-260) noise levels during decommissioning would be similar to those during construction. Therefore, noise level measurements for construction should be applied to decommissioning noise levels. For example, the same equipment described on page 4-258 of the Draft EIS/EIR, one large bulldozer, one scraper, a large diesel truck, etc. would be used during decommissioning and their maximum noise level would be 83 dBA half of the time. Table 4.14-1 on page 4-263 of the Draft EIS/EIR should be consulted in order to obtain noise levels associated with decommissioning in relation to sensitive receptor sites at Medicine Lake.

On page 4-267 of the Draft EIS/EIR it states that decommissioning noise would be a short-term significant impact during decommissioning of the transmission line near Medicine Lake. The time required to decommission the two worst-case wells and the power plant should require much less time than the 18 to 36 months suggested by the commentor, which is relevant to construction of the entire project. Thus, decommissioning these particular facilities would be a "short-term" impact.

POTENTIAL VIBRATION IMPACTS

Comment—Potential Vibration Impacts

AG.263 The DEIR does not discuss or evaluate the impact of vibration from Project construction and operation on humans and wildlife. It is well known that construction and operation of geothermal power plants creates vibration. In humans, vibration is known to cause back pain, kidney trouble, sacroiliac strain, injuries to cell and tissues, changes in blood pressure, and discomfort, including nausea and vertigo. (A.G. Jhaveri, Environmental Noise and Vibration Control at Geothermal Sites, pp. 1375- 1378.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Potential Vibration Impacts

The paper by Jhaveri has been reviewed. The paper reviewed is a research proposal, and it suggests that vibrations may occur and that research is necessary to determine the possible effects during geothermal development.

In the case of the Fourmile Hill project, the nearest receptors are at least 2.3 miles from the power plant and wellfield. At these distances, ground borne vibrations caused by construction, well drilling, and power plant operations should not exceed acceleration levels considered acceptable to residential receptors.

Perception of vibrations may occur during construction of limited segments of the transmission towers, but even here the residential receptors are more than 1,500 feet from the construction sites so that the vibration levels from mechanical equipment at residential receptors are expected to be both low and short-lived. These vibrations are not expected to be injurious to humans or buildings (Von Gierke 1991).

Reference:

Von Gierke, H.E. and W.D. Ward. 1991. *Handbook of Acoustical Measurements and Noise Control.* New York, NY.

ALTERNATIVES

Comment—Adequacy of Alternatives Analysis

AG.389 Page 3-196, paragraph 2. The discussion of the noise environment for the Alternative alignments is limited to one sentence -- "Existing ambient noise levels in the vicinity of each alternative and at sensitive receptors near each alternative are the same as described for the proposed action." It is not explained how this conclusion was reached.

Alternative alignments would be expected to have different sets of receptors. If this is not the case, then the EIS/EIR should clearly state that there are no recreational uses or permanent residences along the alternative alignments. The statement that the ambient noise levels are the same as those monitored in the Medicine Lake area is unsupported.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.390 Page 4-270 re: Alternative 2. The EIS/EIR states in paragraph 1 that there would be significant impacts with Alternative 2 to the Dry Lake area. The EIS/EIR does not identify the recepters, land use activities, or how many receptors would be affected in the Dry Lake area.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.391 Page 4-270 and 4-271 re: Alternative 3. Land use activities and the presence/absence of sensitive receptors for Alternative 3 are not discussed.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.392 Page 4-271 re: Alternative 4. Land use activities and the presence/absence of sensitive receptors for outside Tionesta or Medicine Lake are not discussed. Significant impacts to the Dry Lake area are not identified like they are in Alternative 2.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.393 Page 4-271 re: Alternative 5. The EIS/EIR does not differentiate between recreational use patterns for alternatives A1 and A3. No information is presented about the alternative route and the presence/absence of sensitive receptors.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.394 Page 4-272 re: Alternative 6. The EIS/EIR does not differentiate between forest usage for A1 and A3. No information is presented about the alternative route and the presence/absence of sensitive receptors. Significant impacts to the Dry Lake area are not identified.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Adequacy of Alternatives Analysis

Except for the segments of the transmission line that would occur near Medicine Lake and Tionesta (A1, A2, and C1), the transmission line segments that make up the alternative transmission line alignments discussed in the Draft EIS/EIR would be far removed from human receptors (please see Figure 2.3-1 on page 2-61 of the Draft EIS/EIR), other than identified traditional use sites. The effects of noise associated with the transmission line alternatives on traditional cultural values are addressed in the Draft EIS/EIR in Section 4.6, Traditional Cultural Values. Please also see responses to comments in the Traditional Cultural Values Section of this document.

MITIGATION MEASURES

Comments—Adequacy of Mitigation Measures

BQ.31 The draft EIS/EIR on page 4-262 finds that the noise of construction would provide a significant unavoidable impact. It is unclear how effective Mitigation Measures 4.14.2a through 4.14.2c would be in reducing this impact. Specifically how would Mitigation Measure 4.14.2c be controlled? What is the limitation on "nearby residences"; how would complaints be presented to Calpine and how timely must Calpine's response be? It is our concern that if the administrative process requires that complaints pass through Calpine, to the Forest Service office in Alturas and then a Forest Service official dispatched, with no identified time lines, this would not provide an effective enforcement of this measure.

(S. Peder and Suzanna S. Cuneo)

FP.16 Section 4.14 of the Draft EIS/EIR finds that the noise of construction would provide a significant unavoidable impact. Again, one of the reasons that people come to the Medicine Lake Highlands is due to the relatively unaffected natural quality of the area. Often, you can hear conversations going on on the other side of the Lake (over a ;mile away!). The recommended solution to recreational users bothered by the power plant is to move out of the vicinity of the area. This is truly an unacceptable "mitigation measure" for the project. Please provide additional mitigation proposals to deal with this issue.

(Eric T. Nelson)

Response—Adequacy of Mitigation Measures

Mitigation measures intended to reduce the impacts of project related noise are found on pages 4-267 to 4-268 of the Draft EIS/EIR. The Draft EIS/EIR does not state as one of its mitigation measures that recreational users should move out of the vicinity due to noise impacts associated with the proposed project. The mitigation measures outlined on pages 4-267 to 4-268 require noise control measures on construction equipment, limitations on construction hours, and site specific measures to respond to complaints from residences regarding project-related noise.

As stated in Mitigation Measure 4.14.2c, Calpine would implement site-specific methods to respond to complaints by residents regarding project-related noise. Such measures would include changing the location of stationary equipment, installing acoustic barriers around stationary construction noise sources, and rescheduling construction activity.

Comment—Mitigation Measures Associated with Transmission Line Construction

H.30 Transmission line construction noise would be the highest impact on the Medicine Lake Caldera, and additional mitigation measures should be specified. Mitigation measure 4.14.2a has soft language ("Impact tools should be shielded or shrouded", and "equipment should have a muffled exhaust") that must be changed to hard language ("Impact tools shall he shielded or shrouded" and "equipment shall be muffled") Mitigation measure 4.14.2b must be changed to limit construction activities to 7 PM in the evening instead of 10 PM. Another alternative that would confine transmission line construction activities to times when visitation is low, such as mid September to mid November should be considered if segment Al is built over our objections. *(Bill Dart, American Motorcyclist Association)*

Response—Mitigation Measures Associated with Transmission Line Construction

The comment states an opinion that the time constraint should be changed to 7:00 p.m. from 10 p.m. Due to seasonal constraints and the immediate nature of the proposed project, construction time allowance would be extended by three hours over the range suggested in the comment. It is anticipated that most of the transmission line construction would need to occur over the summer months due to the inclement weather associated with winters in the region. Therefore, construction during these months would need to be maximized by allowing for the construction time constraint of 10:00 p.m. to 7:00 a.m. The comment also states that the language used in Mitigation Measure 4.14.2a had "soft language." The language used in the mitigation measures presented in the Draft EIS/EIR is consistent with NEPA and CEQA Guidelines.

Comment—Mitigation Measures Associated with Operation

AG.364 The EIS/EIR states that "Mitigation Measure 4.14.2a through 4.14.2c, designed to reduce noise effects on sensitive receptors in the Medicine Lake and Tionesta area, would also reduce the forest noise levels in close proximity to the proposed well field and power plant site and along the transmission line." (P. 4-262.) This is very misleading as the aforementioned mitigation measures only apply to the construction and decommissioning periods of the project and not as to operations-related noise.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Mitigation Measures Associated with Operation

Operational noise levels would not be expected to be significant except when Forest visitors are relatively near the operational site. Mitigation Measure 4.14.2c, which includes shutting off of idling equipment would reduce noise levels produced by the power plant, reducing the potential impact to Forest visitors.

Comments—Enforcement of Mitigation Measures

AG.332 Page 4-267, Mitigation Measures. The mitigation measures presented here state that Calpine shall use feasible noise controls, limit construction times to Monday through Saturday from 7:00 am to 10:00 pm and respond to noise complaints during the construction period. The Forest Service is assigned the responsibility of monitoring the feasible noise controls but no performance standards are given that would be considered exceedances nor are any protocol for registering a complaint established. There is also no indication that the Forest Service will take on this monitoring responsibility. To be a feasible mitigation measure the measure must contain reasonable performance standards and be enforceable.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.354 Page 4-269, paragraph 3. Mitigation measures previously discussed are also applied to construction impacts in the Tionesta area. See also comments for page 4-267, Mitigation Measures.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

BQ.11 We would like more information about Mitigation Measure 4.6.3b How will the noise monitoring program function as it applies to Native Americans and would other interested parties be able to access that information? *(S. Peder and Suzanna S. Cuneo)*

Response—Enforcement of Mitigation Measures

All mitigation measures identified in the Draft EIS/EIR would be enforced by the lead agencies through the Mitigation Monitoring and Reporting Program (MMRP) included as Chapter 5 of the Draft EIS/EIR. Mitigation monitoring by the lead agencies is a

requirement of both NEQA and CEQA. Construction of the three towers of the transmission line near the Medicine Lake sensitive receptors would result in the highest noise levels for less than one week of total construction. If receptors are notified early of the duration of the noise, as described in Mitigation Measure 4.11.1a (page 4-194 of the Draft EIS/EIR), only a few, if any, complaints would be expected. If the agencies select the preferred alternative (Alternative 6) the impacts in the Medicine Lake and Tionesta area would be avoided.

The monitoring of noise would be the responsibility of the lead agencies. The lead agencies would be contacted in order to register a complaint. The mitigation measures described in the Draft EIS/EIR on pages 4-268 to 4-269 apply to all sensitive receptor locations and all phases of the project. Mitigation Measure 4.6.3b (see page 4-69 of the Draft EIS/EIR) states that prior to commencement of construction activities, Calpine and the USFS shall consult with the appropriate local tribes to determine which sites of tribal concern should be evaluated for noise effects, would be enforced by the lead agencies. For more information on mitigation enforcement, see the responses to comments in the MMRP Section of this document. Noise monitoring data would be available to interested parties.

3.16 Human Health and Safety

INTRODUCTION

This section provides responses to comments on human health and safety issues. The comments and responses are grouped under the following headings:

- Hazardous Materials
- Well Blowout Hazards
- Fire Hazards
- Electric and Magnetic Field Hazards
- Wellfield Facility Hazards
- Aircraft Hazards
- Threat of Disease
- Mitigation Measures

Under each of these headings, comments and their responses are grouped under more specific-headings.

HAZARDOUS MATERIALS

Comments—Accidental Release of Hazardous Materials

A.55 We commend the USFS and BLM for inclusion of inspection provisions for safe housekeeping practices in storage and handling of all hazardous materials on site, and particularly encourage frequent inspections during summer months when a larger visitor base is nearby. In addition to surrounding berms, wherever practicable, stored hazardous materials should be placed on liners or cement pads to avoid infiltration into the ground in event of spillage.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

AG.140 In addition to chlorine gas, the EIS/EIR describes a host of other highly toxic materials which will be transported, used, and stored during various phases of the Project. (EIS/EIR, pp. 4-275-282.) These materials are so toxic that they will require employees to wear goggles, respirators, and gloves. (EIS/EIR, p. 4-280.) Nevertheless, the EIS/EIR concludes that there will be no significant health and safety impacts from these materials because all applicable regulations will be followed. (EIS/EIR, p. 4-280.) As an extra precaution, the EIS/EIR recommends that hazardous materials plans be prepared and submitted to the relevant agencies at some point in the future. (EIS/EIR, p. 4-275 (Mitigation Measures 4.15.1a-4.15.1c.)

The EIS/EIR's finding that these impacts will be insignificant is not supported by substantial evidence. Despite the existence of regulations governing transportation, storage and use of hazardous materials, accidents still occur. The EIS/EIR acknowledges this:

The potential for accidents to occur cannot be completely eliminated, and the potential for irreversible damage from environmental accidents would exist throughout the life of the project. Examples of environmental accidents include potential trucking accidents that could release hazardous materials to the environment,... or chemical releases at the plant site from improper storage or handling of hazardous materials." (EIS/EIR p. 4-337.)

Even if these spills have a low probability of occurrence, their impacts must still be assessed in the EIS/EIR. According to the NEPA regulations, an EIS contain relevant information about reasonably foreseeable significant adverse effects if the costs of obtaining this information are not exhorbitant. (40 C.F.R. § 1502.22(b).) "'[R]easonably foreseeable' includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts... is within the rule of reason." (Ibid.)

Except for describing how certain spilled materials would be contained in bermed areas, the EIS/EIR is vague and dismissive regarding what risks the public (e.g., hikers, snowmobilers, hunters) would be exposed to if a spill does occur. (EIS/EIR, pp. 4-281-282.) Unlike Project employees, the public presumably would not have ready access to safety equipment such as goggles or respirators. (EIS/EIR, p. 4-280.) The EIS/EIR should discuss these risks in more detail so the public is informed of and can comment on these risks. *(Lizanne Reynolds, et al, on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

HT.13 What about accidents & spills of hazardous materials & geothermal fluids *(Louise Thompson)*

PH4.39 Does the proposed project include use of radioactive isotopes? *(Mount Shasta Public Hearing)*

PH4.57 Why are there hazardous materials signs posted at existing pads in the area? *(Mount Shasta Public Hearing)*

PH5.14 What about accidents and spills of hazardous materials and geothermal fluids? *(Medicine Lake Public Hearing)*

Response—Accidental Release of Hazardous Materials

The commendation of comment A.55 for the inclusion of inspection for safe housekeeping of on-site hazardous materials in the Draft EIS/EIR is noted. Regarding containment of hazardous materials in the unlikely event of a spill, the USFS and BLM consider the implementation of berms around on-site hazardous materials storage sites to be sufficient for containing possible spills. Where required by applicable regulations, on-site hazardous materials would also be stored on liners or cement pads.

Comment AG.140 addresses the potential for accidental releases of hazardous materials to result in a significant impact. The following response addresses the potential for a significant effect due to accidental spills from improper storage or handling of hazardous materials. Liquid chlorine is no longer proposed for use as a biocide for treatment of the circulating water at the cooling tower. Instead, sodium hypochlorite is proposed for cooling tower treatment. For a discussion of chlorine gas and sodium hypochlorite use, please see the response to "Comments—Chlorine Gas Storage and Handling." For a discussion of potential hazardous material releases during transport, see the response to "Comments—Hazardous Materials Transport." For a discussion of hazards due to the accidental release of geothermal fluids, see the response to "Comment—Well Blowouts." Potential environmental effects associated with accidental release of geothermal fluids are discussed in the Hydrology Section in the responses to "Comments—Effects to Groundwater from Accidental Geothermal Brine Spills" and "Comments—Effects to Surface Waters from Accidental Geothermal Brine Spills."

In response to Comment PH.439, the radioactive isotope tritium is occasionally used during reservoir tracer tests in very small quantities. Tritium would not be stored on site and would be delivered at the time of use under permit issued by the California Department of Health Services. As with all hazardous materials associated with the proposed project, tritium would be transported to the proposed project site by licensed hazardous materials transporters.

On-site storage and handling of hazardous materials is discussed under Impact 4.15.1 on pages 4-276 through 4-281 of the Draft EIS/EIR. Potential impacts associated with accidental releases and spills of hazardous materials are addressed and assessed under Impact 4.15.2 on pages 4-281 and 4-282 of the Draft EIS/EIR. There is substantial evidence presented in the Draft EIS/EIR that any accidental spills of hazardous materials (if they were to occur) would be quickly controlled, contained, and remedied, and that significant effects to the environment would be avoided. Impact 4.15.1 identifies the various control measures that would be implemented as part of the project whenever and wherever hazardous materials would be stored and used. These measures include appropriately-sized and constructed storage containers, as well as containment berms with sufficient capacity in the unlikely event of a spill. The project is designed to prevent any off-site releases of accidental spills.

In addition to the on-site control measures, a variety of hazardous materials safety, control, and emergency response plans would be prepared and implemented for the

project. These plans would be prepared as part of the project, and are not identified as mitigation. Examples of these plans that are discussed on page 4-278 of the Draft EIS/EIR include a Hazardous Materials Business Plan, a Spill Prevention and Countermeasure Plan, and a Hazardous Waste Control Plan. Other plans that would be prepared include:

- Emergency Medical Response and Evacuation Plan
- Fire Control Contingency Plan
- Blowout Contingency Plan
- Pipeline Contingency Plan
- Hydrogen Sulfide Contingency Plan
- Compliance Program to Limit Employee Exposure to Inorganic Arsenic
- SARA Title III Compliance Plan
- Hazard Communication Program

As discussed in the Draft EIS/EIR, these plans would be similar to the plans that are currently in place for Calpine's geothermal operations at The Geysers. These plans would ensure that any hazardous materials spills or releases are promptly and thoroughly responded to. These plans would also minimize the potential for health hazards, and ensure that any effects due to accidental hazardous materials spills or releases would be less than significant.

Implementation of Mitigation Measures 4.15.1a and 4.15.1b would also ensure that the probability of an accidental release of hazardous materials would be highly unlikely. These mitigation measures include the training of all plant personnel in the handling of hazardous materials, and would require Calpine to document appropriate material storage and handling procedures. In the unlikely event of a chemical spill, the comprehensive system of hazardous materials safety, control, and emergency response plans for the project would ensure that there would be no significant effect to human health and safety or the environment due to hazardous material spills.

Comment AG.140 is correct in noting that even with proposed control measures, contingency plans, and mitigation measures, accidental releases of hazardous materials could still occur. As discussed above, the potential for accidents is acknowledged and discussed under Impact 4.15.2 in the Draft EIS/EIR. It is not feasible or reasonable to offer a total guarantee that an accidental release would not happen at some point during project operation. However, the control measures proposed as part of the project and identified in the Draft EIS/EIR would greatly minimize the potential for an accidental release to occur. The contingency plans and mitigation measures would ensure prompt and complete remediation of any release, and minimize potential threats to human health and safety. This combination of measures would ensure that potential impacts from accidental releases of hazardous materials would result in less-than-significant levels.

The conclusion that accidental releases of hazardous materials would not result in significant effects is supported by Calpine's track record with its geothermal operations at The Geysers. Calpine has operated its West Ford Power Plant at The Geysers since July 1990. During this time, there have been only two accidental hazardous materials

releases. These releases involved the release of sodium hydroxide (NaOH) during a well blow down and condensate at an injection well. All of these releases were immediately contained and remedied, and no significant effects to human health and safety or the environment occurred.

The Draft EIS/EIR describes potential risks to recreationalists from accidental hazardous materials releases at a level of detail commensurate with the potential for this effect to occur. As discussed in the response to "Comments—Baseline Data" in the Land Use and Recreation Section, very little recreational activity actually occurs in the power plant and wellfield area. In addition, the new roads that would be developed at the wellfield would be gated and closed, which would minimize the potential for recreationalists to access project facilities and potentially be exposed to accidental hazardous materials releases.

The fence around the power plant and the berms around on-site hazardous materials storage sites make the threat of recreationalists coming into contact with hazardous materials extremely remote. The maximum quantities of potentially-hazardous materials stored on site at any one given time would be approximately 32,500 gallons. A spill off-site would be unlikely due to the containment berms. In the unlikely event of a spill, the hazardous material would be contained on site to a small area and immediately cleaned up. There would be no need for public use of safety or protective equipment. No significant exposure of recreationalists would be expected to occur. Sufficient information and details have been provided in the EIS/EIR to allow meaningful public comment on this topic.

Comment PH4.57 refers to the presence of hazardous materials signs posted at existing drill pads in the area. On page 4-276 of the Draft EIS/EIR it states that 8 substances used during drilling operations are considered hazardous, and include Unisteam, phosphoric acid, diethylene-triamine, and sodium hypochlorite. As stated above and in the Draft EIS/EIR, these materials are stored appropriately at well pads and are kept in spill control bermed areas which would prevent releases off site in the case of a container or chemical delivery line break.

Comment AG.140 misrepresents the discussion of protective equipment for employees on page 4-280 of the Draft EIS/EIR. Only five of the materials that would be used by the project (identified in Table 4.15-3 on page 4-277 of the Draft EIS/EIR) would be present in sufficient quantities to be considered "highly toxic." The use of goggles, respirators, and gloves by employees are identified as a prudent precautionary measure in order to afford maximum protection when handling any of the potentially hazardous materials at the plant site.

Comment AG.140 correctly quotes a portion of the discussion of potential environmental effects due to accidents in Section 4.21, Significant Irreversible Environmental Changes on pages 4-337 and 4-338 of the Draft EIS/EIR. However, the comment did not quote the remainder of the discussion on page 4-338, which reads:

> "All relevant Federal, state, and local procedures would be followed during construction, operation, and decommissioning of the proposed project, and proposed mitigation would be implemented to ensure that the potential for

> environmental accidents associated with the project would be minimal or nonexistent."

This discussion is intended to be a brief and concise summary of information and conclusions presented in other sections of the Draft EIS/EIR, such as in Section 4.15, Human Health and Safety. As discussed in the other sections, measures proposed as part of the project and identified as mitigation in the Draft EIS/EIR would ensure that significant environmental effects would not occur.

Regarding compliance with NEPA regulation 40 C.F.R. § 1502.22(b), an analysis of impacts beyond what is presented in the Draft EIS/EIR would be based on conjecture, and not within the rule of reason. The full text of 40 C.F.R. § 1502.22(b) reads:

> "For the purposes of this section, "reasonably foreseeable" includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason."

The analysis of potential spills is based on experience at other geothermal facilities and Calpine's experience at The Geysers. In accordance with NEPA and CEQA, the Draft EIS/EIR correctly notes the potential for accidental hazardous materials releases, identifies measures that would be implemented to ensure that no significant effects occur, and terminates discussion of this potential impact.

Comments—Chlorine Storage and Handling

A.54 The Proposed Action includes the potential use of various hazardous materials as listed in Table 4.15-3 of the DEIS. We are particularly concerned regarding use of chlorine. The FEIS should identify whether the chlorine will be brought on site and stored in gas form. If that is the case, alternatives to chlorine gas may be available and are strongly recommended. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

AG.139 The Project would use chlorine gas for cooling tower defouling. (EIS/EIR, pp. 2-29, 4-279.) Chlorine is an acute health hazard and highly toxic. (Ex. A, Comment 14.) This chlorine would be stored in a 1-ton metal cylinder. EIS/EIR, pp. 2-29, 4-279.) According to Dr. Fox, releases from chlorine cylinders are widely recognized to present probable, significant risks of upset. (Ex. A, Comment 14.) Thus, a risk of upset analysis is always performed when an industrial facility proposes using these types of chlorine cylinders. (Ibid.)

Modeling expert Robert Sears modeled a chlorine gas release to determine what health risks the public would be subjected to. (Ex. A, Comment 14 and Attached modeling results.) This modeling demonstrates that life-threatening exposures would occur at up to 1,800 feet from the release point. The exposure level which has been determined to be "immediately dangerous to life or health" would occur at up to 2,700 feet from the release. (Ibid.) Clearly, this constitutes a significant human health impact.

Here, the likelihood of an accident from a chlorine release would be exacerbated by the severe weather conditions at the Project site, as well as the presence of hunters in the area, whose bullets may puncture the cylinder. As Dr. Fox explains, the EIS/EIR should have analyzed these impacts. (Ibid.) Furthermore, inexpensive alternatives to the use of chlorine are readily available. (Ibid.) This mitigation measure should have been analyzed in the EIS/EIR as a method of avoiding this significant human health impact. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.255 The DEIR indicates that chlorine gas would be used as a biocide and stored in a 1-ton metal cylinder near the cooling tower. (DEIR, pp. 2-29, 4-279; Table 4.15-3). Chlorine is a powerful oxidant and severe irritant of the eyes,[1] nose, throat, and lining of the respiratory tract. Liquid chlorine will cause skin and eye burns on contact.

[1] G.D. Clayton and F.E. Clayton, Patty's Industrial Hygiene and Toxicology, 4th Ed., John Wiley & Sons, Inc., New York, Vol. II, Part F, 1994, pp 4484-4487.

Accidents involving chlorine cylinders are legendary. Piping, valves, and the cylinders themselves can leak or rupture,[2] releasing large amounts of this corrosive gas into the atmosphere. Chlorine was the biocide of choice historically. However, as the dangers associated with storage and handling of chlorine became known, on-site storage of chlorine has been gradually replaced by other alternatives, such as on-site chlorine generation and use of alternate chemicals. Today, chlorine cylinders are rarely proposed for new facilities subject to CEQA review because of the substantial hazards associated with their storage and use. Further, cheap and effective alternatives, such sodium hypochlorite, are readily available and eliminate these risks.

Although the DEIR concedes that chlorine is an acute health hazard and highly toxic (DEIR, Table 4.15-3), the DEIR fails to perform any analyses of its potential impact during an accidental release. These analyses are critically important because up to 19 workers would live on-site in a service and dormitory building (DEIR, p. 2-33) and could potentially be exposed to released chlorine. Further, recreators and wildlife would potentially be present in the vicinity of the Project.

Releases from chlorine cylinders are widely recognized as being both probable and significant and are always included in EIRs and Risk Management and Prevention Plans ("RMPPs"). Therefore, the accidental release from the proposed 1-ton chlorine cylinder was analyzed. Rob Sears used ALOHA Version 5.2 for Windows to model a chlorine release from a 1/2 inch valve at the top, middle, and bottom of a horizontal cylinder that is two-thirds full of chlorine. The length of the plume (i.e., the distance that gas of a given concentration would travel from the release point) was estimated for three exposure concentrations.

Emergency exposure limits have been established by a number of agencies and are routinely used as significance thresholds in accidental release modeling. The National Academy of Sciences has established a 60-minute emergency exposure limit of 3 ppm based on the concentration that produces nasal and eye irritation.[4] The National Institute for Occupational Safety ("NIOSH") and the Occupational Safety and Health Administration ("OSHA") has established an immediately dangerous to life or health ("IDLH") value for chlorine of 10 ppm. This is the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without experiencing any escape-impairing or irreversible health effects.[5] Finally, the AIHA has established emergency response planning guidelines for chlorine. The ERPG-3[6] for chlorine is 20 ppm and is the concentration above which life-threatening health effects can result.

The modeling for all three scenarios is included in Attachment D. The least severe impacts (smallest impact zone) occur for the hole at the top of the cylinder. For this scenario, a concentration of 3 ppm would be experienced by sensitive receptors up to 5,600 feet (1.7 km) from the release point. A concentration of 10 ppm would be experienced by sensitive receptors up to 2,700 feet (0.82 km) from the release point. A concentration of 20 ppm would be experienced up to 1,800 feet (0.54 km) from the release point. These concentrations could result in severe nasal and eye irritation, irreversible health impacts, and death in both on-site workers and nearby recreators and wildlife. This is a significant impact that was not discussed in the DEIR.

The DEIR should be revised to analyze the impact of releases from the chlorine cylinder on on-site workers/resident, recreators, and wildlife using a standard heavy gas dispersion model such as DEGADIS or ALOHA. The resulting significant impact should be mitigated by requiring the use of an alternate biocide. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

Response—Chlorine Storage and Handling

Concern regarding use of chlorine for the project is noted. At the time that the Draft EIS/EIR was released, Calpine planned on using chlorine as a biocide for treatment of the circulating water at the cooling tower to control algae growth (see page 2-29 of the Draft EIS/EIR). As discussed on page 4-279 of the Draft EIS/EIR, Calpine planned to

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[2] Compressed Gas Association, Inc., Handbook of Compressed Gases, 3rd Ed., 1990, pp. 317-318.

[3] G.C. White, Handbook of Chlorination and Alternative Disinfectants, 3rd Ed., 1992.

[4] National Research Council, Board on Toxicology and Environmental Health Hazards, Emergency and Continuous Exposure Limits for Selected Airborne Contaminants, Volume 2, October 1984, p. 7.

[5] G.V. Alexeeff, M.J. Lipsett, and K.W. Kizer, Problems Associated with the Use of Immediately Dangerous to Life and Health (IDLH) Values for Estimating the Hazard of Accidental Chemical Releases, American Industrial Hygiene Association Journal, v. 50, 1989, pp. 598-605.

[6] American Industrial Hygiene Association, Emergency Response Planning Guidelines ("ERPGs"), Chlorine, April 20, 1988.

store chlorine on site in a one-ton metal cylinder. Calpine had proposed storing chlorine as a liquid, not a gas (as assumed in comments AG.139 and AG.255). The modeling of an accidental chlorine release conducted by Mr. Sears appears to have assumed that the chlorine would be stored as a gas. Since storage as a gas was not the planned storage method, the modeling conducted by Mr. Sears is not relevant to the proposed project.

Releases of chlorine from chlorine cylinders at the plant site were considered neither probable nor significant in the Draft EIS/EIR. The safety measures and safe handling procedures identified in the Draft EIS/EIR would have minimized the potential for accidental release and risk to human health and safety (and wildlife) from the use of chlorine, and ensured that significant effects would not occur.

Although no significant effects from the use of chlorine were expected to occur, Calpine has reviewed the use of this material in order to address concerns and respond to public comments about the use of chlorine for the project. Based on this concern, Calpine has agreed to mitigate any potential effects from the use of chlorine by substituting sodium hypochlorite for chlorine for the treatment of circulating water at the cooling tower during project operation. Sodium hypochlorite was already identified in the Draft EIS/EIR as a material that would be used by the project proponent for drilling activities. The substitution of this material for circulating water treatment is not considered to be a significant change in the project nor in the materials that would be used for the project.

As identified in Table 4.15-3 on page 4-277 of the Draft EIS/EIR, sodium hypochlorite is a liquid bleach. This material has a hazardous classification of "Health Hazard - toxic." For treatment of the circulating water, sodium hypochlorite would be stored in dry form as commercial grade NaCl (common table salt). The salt would then be dissolved in a tank of water and the solution passed across electrodes powered by low voltage current resulting in a dilute solution of sodium hypochlorite. This dilute solution is stored only until it is injected with a metering pump into the cooling water system. The sodium hypochlorite solution would be stored in a container located in a metal shed near the cooling tower. This container would be located in a bermed area of sufficient capacity to contain any accidental spills that may occur. The potential on-site quantity of sodium hypochlorite that would be stored on site at any given time would be 200 gallons of a 0.8% solution. As discussed in the Draft EIS/EIR, the safety measures and safe-handling procedures would ensure that no significant effects would occur from the use of sodium hypochlorite. The information regarding the use of sodium hypochlorite for circulating water treatment has been added to Table 4.15-3 and the text of the EIS/EIR.

Comments—Hazardous Waste Production and Disposal

A.58 Applicability of any RCRA regulations to spent geothermal and/or cooling fluids and gray water should be discussed as well in the FEIS. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

AG.142 The Project will generate several hazardous wastes, including cooling tower sludges which usually contain hazardous levels of toxic metals such as mercury and arsenic. (Ex. A, Comment 15.) However, the EIS/EIR fails to identify, characterize, and discuss the impacts associate with wastes. (Ibid.) As with hazardous materials, the EIS/EIR cannot simply dismiss this potential impact on the basis that all applicable regulations will be followed. The EIS/EIR should have discussed the impacts associated with these wastes. (Ibid.) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.159 The EIS/EIR also fails as an information document because it fails to identify the specific statutes and regulations that will ensure that any public health risk is mitigated. For example, the EIS/EIR states that cooling tower sludge and sulfur cake will be evaluated and disposed of according to local, state, and

federal regulations. (Id. at pp. 4-306 to 4-307.) The EIS/EIR, however, does not describe these regulations. The lead agency should identify these regulations and provide specific details as to how any impacts can be mitigated or avoided. Without this information, the public and decisionmakers cannot properly assess sludge and sulfur cake disposal and determine whether the regulations will mitigate any potential impacts. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.256 The DEIR fails to identify, characterize, quantify, and generally discuss the hazardous wastes that would be generated by the Project and the methods that would be used to contain, transport, dispose, and minimize their production.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.258 Section 4.15.1, "Storage, Use, Transport, and Disposal of Hazardous Materials," suggests that this material is present, but it is not. This section identifies, characterizes, and quantifies hazardous chemicals that would be used at the site, but not the hazardous wastes that would be produced. Instead, it dismisses hazardous wastes by stating that wastes would be characterized and disposed in accordance with local regulations. (DEIR, pp. 4-278, 4-279.) Elsewhere, the DEIR lists and discusses several "solid wastes" without telling the reader that some of these are normally hazardous. (DEIR, pp. 2-32, 2-33.) This is misleading.

The Project would produce several wastes that are normally classified as hazardous under California regulations, and sent to Class I landfills. These include cooling tower sludge, production system scales, and sulfur. Sludges deposit in the bottom of cooling towers and must be periodically disposed. The DEIR indicates that 4 to 12 dry tons per year would accumulate, but suggests that it would consist of "dirt and particulates removed from the ambient air and also elemental sulfur and chelated iron compounds." (DEIR, p. 2-33.) The DEIR fails to mention that it is usually hazardous because it contains high concentrations of toxic metals such as mercury and arsenic. Mercury concentrations, for example, range from 0.02 to 0.2 percent. (Robertson et al. 1977, p. 1097 and 1978, p. 581.) Cooling tower sludges can be eliminated by using air cooling, as discussed in Comment 7.b.

Scales commonly form in production systems, particularly water dominated systems such as the Glass Mountain KGRA. In geothermal systems that have elevated arsenic levels, which this one apparently does (Comment 1.f), the arsenic accumulates in these scales and results in their classification as hazardous waste. (Suess and Wardlow 1993, p. 76.) Scale formation can be controlled to reduce this hazardous waste.

Finally, about 240 wet tons per year of sulfur cake would be produced by the Stretford hydrogen sulfide abatement process. (DEIR, p. 2-33.) The DEIR failed to disclose that this sulfur typically contains elevated concentrations of metals, including mercury and vanadium and that it is frequently classified as a hazardous waste. (Suess and Wardlow 1993, p. 76.) This hazardous waste can be eliminated by selecting a sulfur removal technology that does not produce a solid byproduct, such as the burner-scrubber unit being considered by the Project, or by purifying the sulfur and selling it as a byproduct.

In sum, this DEIR fails to disclose the hazardous nature of wastes that would be produced and fails to evaluate and require methods to minimize and recycle them. The DEIR should be revised to identify, characterize, quantify, and describe each hazardous waste that would potentially be produced. An engineering analysis should be performed for each to determine whether they can be reduced or recycled, considering, among others, the methods discussed here.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

PH4.58 Will the plant produce sulfur? How will the sulfur be handled? *(Mount Shasta Public Hearing)*

PH5.83 I haven't had a chance to read the EIS, but my question is, what types of wastes will be generated, and how are you going to handle those wastes? *(Medicine Lake Public Hearing)*

Response—Hazardous Waste Production and Disposal

In response to comments A.58 and AG.159, applicable regulations, including the Resource Conservation and Recovery Act (RCRA), are discussed on page 4-273 of the Draft EIS/EIR. As discussed on page 4-273, existing Federal and state regulations for human health and safety relate primarily to potential exposure to hazardous materials, therefore the California Code of Regulations Title 22 statutes are applicable to hazardous materials associated with the proposed project. Comment A.58 was one of

[7] R.E Suess and C.L. Wardlow, Geothermal Waste Issues in RCRA Reauthorization, Geothermal Resources Council Transactions, v 17, 1993, pp. 75-79.

[8] P.S. Thind, Environmental Characteristics and Occupational Hazards Associated with Abatement of Non-condensable Gases at the Geysers, Geothermal Resources Council Transactions, v. 13, 1989, pp. 101-104

three U.S. EPA comments (comments A.56, A.57, and A.58) that addressed Table 1.4-1 on page 1-10 of the Draft EIS/EIR. Table 1.4-1 focuses on required permits and approvals for the project, and is not intended to provide a summary of applicable regulations. These regulations are discussed in the appropriate technical sections throughout the Draft EIS/EIR. Sufficient information about RCRA applicability was provided in Section 4.15, Human Health and Safety.

The Draft EIS/EIR adequately and accurately discusses the potential for the proposed project to generate hazardous wastes, and does not offer misleading information about potential hazardous waste generation. The EIS/EIR also provides sufficient information to understand the hazardous nature of wastes that would be produced by the proposed project. All wastes that that would be generated during the construction, operation, and decommissioning phases of the project are addressed and assessed in the Draft EIS/EIR. These wastes are identified on pages 2-32 and 2-33 of the Draft EIS/EIR, and assessed in Section 4.15, Human Health and Safety. As discussed in the Draft EIS/EIR, liquid generated by the project (i.e., geothermal brine, excess steam condensate, and "gray" water) would be injected into the geothermal reservoir. Solid wastes generated by the project would include inert wastes associated with construction and maintenance, as well as the septic tank sludge. The following list summarizes potentially hazardous waste that would be generated by the project:

Potentially Hazardous Wastes	Volume	Expected Chemical Constituents
Cooling tower sludge	4-12 dry tons per year	Vanadium 10-15 ppm Arsenic 0.5-10 ppm Sulfur 120-160 ppm
Sulfur cake	240 wet tons per year	60% sulfur 40% water
Production system scales	10,000 pounds per year	Arsenic 4-8 ppm Hg less than 0.005 ppm Vanadium 0.10-4 ppm Lead 0.5-2.0 ppm

As discussed in the Draft EIS/EIR, Calpine would be responsible for testing and determining if solid waste generated by the proposed project meets any of the criteria listed in 40 CFR 261.20 for classification as a hazardous waste. Solid wastes associated with geothermal energy production are generally not considered hazardous wastes which are regulated under RCRA; however, geothermal waste streams could potentially be identified as California regulated wastes or "non-RCRA" hazardous wastes. All waste streams generated by the Fourmile Hill project would be analyzed by an approved laboratory and disposed of in accordance with local, state, and Federal regulations. All material classified as hazardous waste would be transported by a registered hazardous waste hauler to an approved hazardous waste disposal facility, and all 40 CFR regulations would apply. This method of disposing of potentially hazardous waste would be sufficient to ensure that no significant effect would result from these materials, if generated.

Regarding the potentially hazardous wastes specifically referenced in comments AG.258 and PH4.58 (i.e., cooling tower sludge, scales, and sulfur cake), appropriate technologies would be used to ensure that these waste products would be considered non-hazardous. These technologies have been successfully used by Calpine and other geothermal operators at geothermal operations throughout California (including The Geysers) to ensure that cooling tower sludge, scale, and sulfur cake meet the requirements for non-hazardous classification.

Examples of technologies that would be employed by Calpine include use of carbon filters for the cooling tower sludge to reduce concentrations of mercury and other potentially hazardous wastes. Calpine would also rewash the cooling tower sludge to reduce concentrations of vanadium. It should be noted that the content of sludge at Coso and The Geysers are not representative because the resource at Fourmile Hill is expected to have lower concentrations of most constituents compared to the geothermal resources at these locations. Regarding scale formation, Calpine would use scale-control materials to minimize the generation of this waste. The geothermal resource at Glass Mountain KGRA does not have elevated arsenic levels (see response to "Comments—Arsenic, Fluoride, Sulfate, and Ammonia Emissions" in the Air Quality Section).

The sulfur cake that would be generated by the proposed project would not be classified as hazardous. The ability to generate non-hazardous sulfur cake has been proven and demonstrated at other geothermal operations, such as Calpine's operations at The Geysers. This sulfur cake is often sold commercially as a soil amendment to chemical companies. Before the sulfur cake can be sold to these companies, it must meet the requirements for non-hazardous classification. Calpine would use the appropriate technologies for the proposed project to ensure that generated sulfur cake would be non-hazardous.

For a discussion of measures that would be performed in order to minimize and recycle hazardous wastes that would be generated by the proposed project, see the response to "Comments—Hazardous Waste Minimization and Recycling."

Comments—Hazardous Materials Transport

F.3 Truck wrecks. Materials and fuels transported to the project, materials transferred between sites and wastes hauled away for disposal off-site will be trucked over narrow mountainous roadways, sometimes in marginal weather conditions; there will be accidents involving these materials and causing their release. This issue is best resolved by pre-planned and disciplined traffic management and well-conceived communication and contingency planning.

(John R. Hannum, North Coast Regional Water Quality Control Board)

U.22 The Draft EIS/EIR has failed to properly address dangerous road condition that will exist within the Medicine Lake Highlands. The elevation and snow conditions will lead to numerous hazardous road conditions. The county and forest service roads that will be used are narrow, shoulderless, unimproved with sharp curves and in need of repairs. Year around accidents will occur, especially with the predicted 228 trips per day during the summer, with an additional 68 truck trips per day. (pg. 4-211 EIS/EIR). These figures do not include the 40,000 recreational users who will also be on the roads. Large quantities of hazardous materials and wastes will be transported to and from the power plant on these roads. Hazardous spills due to trucking accidents will occur. Please address these road and accident issues in writing.

(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

AG.106 Failure to Analyze Hazardous Materials Transportation Impacts

As discussed in more detail below, the EIS/EIR fails to properly analyze the Project's potential impacts from transportation of various hazardous wastes and materials. (See Health & Safety comments.) The EIS/EIR should be revised to include this information.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.141 Regarding hazardous materials transportation, the EIS/EIR states: "The transport of these materials on regional and forest roads would not be expected to result in exposure of the public to health and safety risks." (EIS/EIR, pp. 4-279-280.) The EIS/EIR fails to discuss whether and how these materials will be transported during the winter, when roads are covered with snow and ice (EIS/EIR, pp. 4-215-216), and what additional risks of upset these weather conditions could pose. As discussed in the Transportation section, above, these roads are narrow and cannot easily accommodate additional traffic.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

CG.1 I missed the deadline for comments. I lived in Calistoga 1982-1987. During that period, the Geyser people discovered they had to dispose of "sludge" which came up with the steam. This sludge had arsenic and heavy metals and had to be trucked out through Napa County to an approved waste disposal site. Not only was it an unforeseen consequence of steam production, there were spills and at least one traffic accident fatality during transport of sludge. The EIR should address this potential problem. *(Jim Evans)*

DI.6 5. Toxic waste would need to be trucked out the facility to be dumped elsewhere.
(Ana Holub and Richard Lucas)

FM.4 The power plants will generate wastes as hazardous materials come and go from the power plants.
(Ana Mulvaney)

Response—Hazardous Materials Transport

The Draft EIS/EIR provides an adequate analysis of potential impacts from transportation of hazardous wastes and materials, and the potential for truck accidents to occur is acknowledged and discussed in Section 4.15, Human Health and Safety of the Draft EIS/EIR. The majority of roads that would be used to access the plant site are sufficiently wide and straight enough to safely accommodate trucks transporting materials, fuels, or wastes. Implementation of Mitigation Measures 4.12.1a on page 4-213 of the Draft EIS/EIR would ensure that narrower roads in the project vicinity (i.e., Forest Roads 44N01 and 44N64) would be improved to safely accommodate all project-related traffic, including trucks transporting potentially hazardous materials. Implementation of Mitigation Measures 4.12.2a on page 4-213 of the Draft EIS/EIR would ensure that all roads that would be used by the project would be maintained for safe travel.

Calpine would work closely with the USFS to refine and implement a traffic management plan for the project. As discussed in Section 4.15, Human Health and Safety of the Draft EIS/EIR, transport of all hazardous materials (including materials, fuels, or wastes that could pose harm to the environment, if released) would only be conducted by licensed hazardous materials transporters. Approximately 1 to 5 hazardous materials trips per month would be required during construction, and 15 to 20 annual trips during operation. These transporters would be required to follow USFS speed limits and "rules of the road" when on Forest roads. These traffic management measures would serve to minimize the potential for truck accidents.

In order to ensure that roads used to access the power plant and wellfield facility are not damaged due to increased traffic as a result of the project, Calpine would be responsible for implementing or financing the USFS road maintenance plan for the area (see Mitigation Measure 4.12.2a). The risk to human health and safety as a result of hazardous materials transport would be low and less than significant because the proposed project would conform with applicable regulations, and would include appropriate road maintenance.

Implementation of Mitigation Measure 4.12.3a on page 4-214 of the Draft EIS/EIR would require Calpine to develop and implement a construction and decommissioning access plan. This plan would also be required during the operational phase of the

project for any heavy truck hauling. This plan includes avoidance of roads that are used primarily by recreationalists. If use of these roads cannot be avoided, then project-related vehicle trips would be prohibited during weekends and holidays. This schedule would minimize potential conflicts with recreationalists. Calpine would also be responsible for repairing pavement damaged or destroyed by project-related equipment.

In addition to traffic management measures, Material Safety and Data Sheets (MSDS) would be required for all types of transported materials. Disposal of hazardous materials and wastes would comply with all applicable local, state, and Federal regulations. Calpine's contingency and emergency response plans for the project (discussed in the response to "Comments—Accidental Release of Hazardous Materials") would ensure immediate and complete containment and remediation of any accidental spills that could occur during hazardous materials transport. These measures and requirements would minimize the potential for accidents related to hazardous materials transport, and would ensure that there would be a less-than-significant effect in the event of an accident.

The contingency plan for the project would ensure that no significant releases of materials, fuels, or wastes occur in the unlikely event of an accident, and that any released material, fuel, or waste is immediately and fully removed. The North Coast RWQCB would participate in the development of this plan to ensure that contingency measures for material, fuel, and waste transport meet with their approval. The Central Valley RWQCB would also be consulted regarding this plan.

As discussed in the Draft EIS/EIR, winter access to the site would be accomplished by utilizing USFS roads north and west of the power plant and wellfield facility (i.e., Primary Forest Route 15 or 77 to Forest Road 44N01 to Forest Road 44N64 to the wellfield). The USFS currently performs snow blowing and removal along Primary Forest Route 15 during the winter months. Calpine proposed to conduct snow blowing and removal as necessary on roads 44N01 and 44N64 to the wellfield. As part of normal operations, Calpine would plan on having an adequate supply of all materials (including potentially hazardous materials) stored on site for the duration of winter operations prior to the onset of winter weather. Transport of potentially hazardous materials during the winter months would therefore not be likely to occur. However, it is possible that a few trips during the winter months could occur. This minor traffic volume would not represent a significant human health and safety risk.

WELL BLOWOUT HAZARDS

Comments—Well Blowouts

A.50 According to the DEIS, risk of blowout is considered low due to anticipated formation conditions and planned preventative procedures. With regard to H_2S emissions associated with such an event, the FEIS should specifically include an emergency contingency plan to provide evacuation, if necessary, and emergency services. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

AG.144 Hazards From Well Blowouts/Geothermal Fluids

The EIS/EIR's discussion of health and safety risks from well blowouts and other releases of geothermal fluids is deficient in similar respects. (EIS/EIR, §§ 4.15.3, 4.15.4.) Despite the EIS/EIR's acknowledgement that well blowouts/releases could result in uncontrolled releases of extremely hot fluids "and emissions of toxic hydrogen sulfide gas to the ambient air," the health effects are deemed insignificant because the risks of blowouts/releases are considered low. (EIS/EIR, pp. 4-282, 4-284.) Despite the proffered control

measures and mitigation measures, blowouts may still occur. (See EIS/EIR, p. 4-337 (examples of potential accidents with the potential for irreversible environmental damage that cannot be completely eliminated include well blowouts).)

The EIS/EIR provides some limited information about worker risks, but does not address risks to the general public. (EIS/EIR, pp. 4-282-285.) The EIS/EIR should fully inform the public about what risks they could be exposed to if they are hiking, snowmobiling, or otherwise recreating in the vicinity of the well pads. For example, there is no discussion of how far the fluids and steam would travel during a blowout/release (e.g., would they remain inside the fenced areas around the well pad sumps and power plant?). *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

Y.53 Well blow-outs and other accidents known to be associated with geothermal development are not adequately evaluated or covered by the $100,000 bond. We understand that there has been a blow-out in the exploratory stages when two people lost their lives which is being hushed up. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

PH4.23 Concerned about well blowouts and uncontrolled releases of materials. *(Mount Shasta Public Hearing)*

PH5.74 Define the program for the plan for the development for well safety. *(Medicine Lake Public Hearing)*

Response—Well Blowouts

The potential for hazards due to well blowouts are discussed on pages 4-282 through 4-284 of the Draft EIS/EIR. Comment A.50 suggests that an emergency contingency plan identifying evacuation and emergency services be provided for the project to address hydrogen sulfide (H_2S) emissions in the unlikely event of a well blowout. As discussed on page 4-283 of the Draft EIS/EIR, a Blowout Contingency Plan would be prepared for the project. Several other contingency and emergency contingency plans would be prepared and implemented for the project (see the response to "Comments—Accidental Release of Hazardous Materials"). These plans include the following:

- Emergency Medical Response and Evacuation Plan
- Hydrogen Sulfide Contingency Plan
- Hazard Communication Plan

Implementation of these plans would ensure a less-than-significant effect to human health and safety from H_2S emissions in the unlikely event of a well blowout. These plans would be similar to the plans that are currently in place for Calpine's geothermal operations at The Geysers. In addition, given the relatively low levels of H_2S present in the geothermal resource (see the response to "Comments—H_2S Concentrations in the Geothermal Resource" in the Air Quality Section), significant H_2S emissions would not be anticipated to occur in the unlikely event of a well blowout.

In order to clarify the information that will be provided in the Blowout Contingency Plan, the following sentence has been added as the second-to-last sentence of the first full paragraph on page 4-283 of the EIS/EIR:

> "In addition, the Blowout Contingency Plan will identify proper evacuation and emergency service procedures to be implemented in the unlikely event of a well blowout, and will specifically identify measures to minimize and avoid H_2S exposure."

Regarding comment Y.53, there is no proposal to provide a $100,000 bond to cover well blowouts or other accidents. As discussed in the Draft EIS/EIR, Calpine would be responsible for immediate response, containment, and remediation of any well blowout or other accident. Comment Y.53 makes an unfounded and unsourced allegation that a well blowout occurred at some point during previous geothermal exploration activities,

that two people died during this blowout, and that this accident has been "hushed up." This alleged incident did not occur. Detailed records are kept of all geothermal exploration activities, and any injury or deaths would have been reported to the proper authorities.

The Draft EIS/EIR adequately addresses the potential for health and safety risks from well blowouts and other releases of geothermal fluids. As discussed on page 4-283 of the Draft EIS/EIR, the probability of a well blowout occurring is extremely low. Of the more than 2,000 geothermal wells reported to have been drilled, a total of 8 known geothermal blowouts have occurred. Four of the eight blowouts occurred at The Geysers facility in California, one at the Surprise Valley Project in California, one at the Cove Fort Project in Utah, one at the Puna Project in Hawaii, and one at the Stillwater Project in Nevada (Bureau of Land Management, et al 1998). Two of the four blowouts that occurred at The Geysers facility were a result of landslides and occurred before the use of directional drilling technology. Directional drilling allows for the siting of well pads on stable land and thus, prevents the occurrence of landslides and resultant geothermal well blowouts. The Surprise Valley blowout occurred during drilling without standard blowout prevention equipment. The blowouts at Surprise Valley, Cove Fort, and Stillwater occurred when pressurized reservoirs were encountered at shallow depths (Bureau of Land Management et al 1998).

The proposed project would conform with Geothermal Resource Operation (GRO) Orders and BLM geothermal drilling permit requirements. The GROs and permit requirements include stringent measurements to avoid well blowouts. Similar to the Telephone Flat Project, blowout prevention equipment (BOPE) would be used on each well drilled. The BOPE used would be required to have a pressure relief system that would allow for controlled flow of high pressure and temperature fluids at the surface. These measures have been established through years of geothermal field testing; and adherence to these measures would prevent well blowouts from occurring.

The GROs and permit requirements also require that immediate action be taken if an unexpected well blowout or geothermal fluid release occurs. If a well blowout occurs, the well would be shut in as quickly as possible and discharge would be directed to on-site sumps. A well blowout or other geothermal fluid release would be expected to be contained on site at the well pads, and no exposure of recreationalists that may happen to be in the area would occur. If the fluid were to go off the pad, they would be contained as specified in the Blowout Contingency Plan. Any off-pad flow would be minimal (due to control measures) and quickly absorbed into the porous soils surrounding the well pads. Surface waters and groundwater would not be affected in the unlikely event of a well blowout (see the responses to hydrology comments elsewhere in this document). These measures and other measures proposed as part of the project and identified as mitigation would almost completely eliminate the potential for well blowouts to occur, and would ensure that any well blowout or geothermal fluid releases would be immediately responded to and not pose a threat to human health and safety.

Regarding potential exposure of the general public to well blowouts and geothermal fluid releases, the Draft EIS/EIR describes potential risks to the public at a level of detail commensurate with the potential for this effect to occur. As discussed in the response to

"Comments—Background Data" in the Land Use and Recreation Section, very little recreational activity actually occurs in the power plant and wellfield area. In addition, the new roads that would be developed at the wellfield would be gated and closed, which would minimize the potential for the public to access project facilities and potentially be exposed to well blowouts or geothermal fluid releases.

Comment AG.144 is correct in noting that even with proposed control measures, contingency plans, and mitigation measures, well blowouts could still occur. In the unlikely event that a well blowout were to occur, workers could be exposed to hot fluids at a rate of up to 35,000 gallons per hour from such an event. As part of standard emergency response procedures, the area around the well would be closed to the public if a blowout were to occur. In accordance with NEPA and CEQA, the Draft EIS/EIR correctly notes the potential for well blowouts and their effects, identifies measures that would be implemented to ensure that no significant effects occur, and terminates discussion of the potential impact.

Reference:

Bureau of Land Management, et al. 1998. *Telephone Flat Geothermal Development Project Draft Environmental Impact Statement/Environmental Impact Report.*

FIRE HAZARDS

Comments—Potential for Wildfire Generation

AG.145 According to the EIS/EIR, a project has a significant human health and safety risk if it will "[c]reate or expose people to potential public health hazards." (EIS/EIR, p. 4-274.) For fires, the EIS/EIR establishes the following significance standard:

A significant fire hazard would be characterized as having the potential for moderate to severe public risk. This type of risk would include moderate to severe property damage or loss, or human injury or fatality. (EIS/EIR, pp. 4-274-275.)

The EIS/EIR identifies several ways in which the Project may cause fires, including welding and use of other construction-related equipment (e.g., drilling rigs, power tools, heavy equipment), burning of cleared vegetation, existence of transmission line (e.g., conductors touching ground, electrical arcs to vegetation, line breakages from severe weather conditions). (EIS/EIR, pp. 4-285-287, 4-290-292.)

"Escaped debris and slash burning fires are common causes" of human-induced fires in the Klamath National Forest. (Forest Service, Klamath National Forest Final Environmental Impact Statement: Land and Resource Management Plan (1994), p. 3-117.) Downed power lines could cause "potential fire damage which could result in immediate hazards to workers. Fire hazards could potentially threaten areas containing hazardous materials described above... Downed power lines would pose an increased fire risk in heavily forested and densely vegetated areas." (EIS/EIR, pp. 4-290-291.)

Compounding the problem is that many project facilities, including the well pads, plant site, and portions of the transmission line, are located in heavily forested areas with "high fire behavior potential." (EIS/EIR, pp. 4-287, 4-291.)

The EIS/EIR acknowledges that the Project could increase fires: "The potential for fire hazards to occur in the project vicinity could be increased during all phases of the project because the project would bring additional people, equipment, and machines into the project area." (EIS/EIR, p. 4-285.) Nonetheless, the EIS/EIR concludes the safety procedures and mitigation measures will reduce fire hazards to a less-than-significant level. (EIS/EIR, p. 4-287.) This conclusion is simply not credible.

The EIS/EIR asserts that safety procedures and mitigation measures "would minimize the potential for the plant site and transmission line to be subject to a significant risk of fire hazard." (EIS/EIR, p. 4-287) In other words, the Project will still increase fire risk. (See also EIS/EIR, p. 4-337 (examples of potential accidents with the potential for irreversible environmental damage that cannot be completely eliminated include a fire from a downed transmission line). Thus, according to the EIS/EIR's significance criteria, whether this increased risk is "significant" depends on whether Project-related fires could cause human injury or death. (EIS/EIR, pp. 4-274-275.)

According to Forest Service documents, some fires simply cannot be suppressed. For example, fires on steep slopes are a function of topography and "cannot be mitigated" because the slopes "accelerate fire spread and hinder fire control activities." (Forest Service, Klamath National Forest Final Environmental Impact Statement: Land and Resource Management Plan (1994), p. 3-117.) The transmission line will cross steep slopes. (EIS/EIR, pp. 4-11-12.) The potential slope instability problems in these areas of steep terrain (EIS/EIR, p. 4-11) could also increase the risk of downed power lines and, thus, fire risk.

Other fires are not responded to vigorously. The Forest Service has a fire suppression response strategy which guides the "initial response dispatch intensity." (Forest Service, Klamath National Forest Land and Resource Management Plan (1994), pp. 4-60-62.) This strategy is based on several factors, including safety, cost efficiency, and resource threats. (Id. at p. 4-60.) It is designed to prevent at least 90% of fire starts from escaping. (Id. at p. 4-62.) Thus, even if a Project-related fire could be suppressed, it may not be.

Moreover, the Project's transmission line could actually impede fire-fighting efforts by interfering with helicopter suppression techniques, which are often used in remote areas like the forest. (Ex. B, § 3.15.A.) The EIS/EIR failed to analyze this potential impact.

According to the EIS/EIR, 40,000 recreational users visit the Medicine Lake area each year; the Modoc National Forest has 200,000 recreational visits per year. (EIS/EIR, pp. 3-157-158.) Approximately 80% of the users are dispersed throughout the forest (i.e., not in specific recreational sites). (EIS/EIR, p. 3-158; see also EIS/EIR p. 3-170 (recreationalists frequently use roads to access remote parts of the Forest).) Thus, if a fire breaks out, there is a substantial likelihood that recreational users may be injured or killed, especially if the fire is in a remote area.

The facts are clear. The Project will increase fire risk over its approximately 50-year life. Not all of these fires can or will be suppressed. People are often in the nearby forest area. Thus, Project-related fires could cause human injury or death, which is a significant impact to human health and safety. The EIS/EIR should be revised to include this information and recirculated for public comment.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

N.20 18. The proposed project will consist of a 24 miles transmission corridor to transfer electricity produced at the geothermal power plant. Maintenance of the transmission corridor has the potential to cause wildfires as a result of the operations of the proposed project. We reference El Dorado County v. Pacific Gas and Electric Company.

The DEIS/EIR failed to disclose, evaluate, and mitigate the threat of wildfires caused by the operations and maintenance of the transmission line for the proposed project. The DEIS/EIR also failed to include fire control and prevention measures based on a detailed description of the transmission corridor.

(Robert J. Baiocci, Fall River Wild Trout Foundation)

Response—Potential for Wildfire Generation

The Draft EIS/EIR addresses the potential for the project to generate wildfires, and identifies the measures and actions that would be taken (both as part of the proposed project and as mitigation) to ensure that no significant effects related to fire hazards would occur. As stated in the Draft EIS/EIR, Calpine would equip all spark-emitting equipment with spark arrestors and would equip all exhaust stacks on all diesel or gasoline-driven equipment with mufflers in order to reduce fire risk induced by construction equipment (see pages 4-285 and 4-286 of the Draft EIS/EIR). Prior to commencement of construction, vegetation would be cleared in order to prevent the possibility of fire. Additional precautionary measures would be taken including the formulation of a fire contingency plan and the outfitting of all company and vendor vehicles with fire extinguishers, buckets, and shovels. These measures would ensure that potential for fire from construction-related equipment would not be considered significant.

As discussed in the Draft EIS/EIR cleared vegetation would be disposed of according to USFS specifications. In response to concerns about air emissions from controlled vegetative burning, this vegetative clearance method is no longer being proposed for the project (see responses to comments in the Air Quality Section of this document).

Fire risk impacts associated with the transmission line are addressed and assessed on pages 4-290 and 4-291 of the Draft EIS/EIR. In order to minimize the potential for fire due to downed transmission lines, Calpine would check the transmission line routinely to identify portions of the line that are damaged or in poor condition. If damaged or poor condition portions of the line are identified, Calpine would ensure that these areas are repaired. The same type of spark arrestors as used on construction equipment would be used on maintenance equipment; and, maintenance activities would generally not involve activities that could cause fires. Maintenance of the transmission corridor would, therefore, not have the potential to cause wildfires as a result of the project operations. Due to this regular inspection and maintenance, it is expected that the potential fire effects from downed power lines would be less than significant.

In order to minimize fire potential due to vegetation coming into contact with the transmission line, Calpine would conduct continued vegetative clearance and maintenance along the transmission line during project operation. The mechanical and structural design, selection of materials, and construction of the transmission line would take into account normal, as well as unusual structural loads that could cause conductors to break and as a result cause fire. If for some reason a conductor were to break, high-speed relay equipment would sense that condition and de-energize the line in about one-tenth of a second. This procedure has been a reliable safety measure, and has reduced the risk of fire from high voltage transmission lines to an extremely low level. With the implementation of the above fire prevention methods, the potential for fire hazards from transmission lines would be less than significant.

Through the use of planned safety procedures and proposed mitigation measures (specifically Mitigation Measures 4.15a through 4.15g on pages 4-287 and 4-288 of the Draft EIS/EIR), the potential for the plant site and transmission line to be subject to a significant risk of fire hazards would be minimized. By minimizing fire risk, people would not be exposed to human health and safety risks, and potential health hazards would be avoided. Therefore, the risk to human health and safety from potential fire risk would be less than significant. In the unlikely event a fire were to occur as a result of the proposed project, the USFS would implement a variety of fire detection and suppression methods (for a discussion of these methods, see pages 3-199 and 3-200 of the Draft EIS/EIR). Similar to all fires which occur on USFS lands (including lightening-induced fires and fires started by people), an "initial response dispatch intensity" strategy is employed. This plan requires the USFS to weigh several factors including safety and resource threats. If project-related fire would have the potential to threaten human health and safety, such a fire would be responded to with a variety of fire-suppression methods and equipment to ensure that the fire is controlled. Any project-related fires would therefore not be expected to cause human injury or death, and would not have a significant impact on human health and safety.

The transmission line would be designed and constructed to remain stable in sloped areas, and avoid the risk of downed power lines (and any associated fire risk). The transmission line would not impeded fire-suppression activities conducted by helicopter because the line is approximately 60 to 80 feet high, and is located at or below the level of the surrounding tree canopy. For a discussion of the potential for the transmission line to impede fire-fighting efforts by interfering with helicopter-

suppression techniques, see the response to "Comments—Interference With Fire Fighting".

Comment—Interference With Fire Fighting

AG.395 The EIS/EIR discusses transmission lines as a cause of fire but does not discuss the impacts of a transmission line on efforts to fight wild fires in the area. Fires in wildland areas with few roads and mountainous terrain are often fought using aircraft dropping water or fire-retardant chemicals. This is the practice of the USFS (e.g. in southern California) (*Devers-Serrano EIS/EIR (see Footnote*). The EIS/EIR needs to address whether there is aerial fire fighting practiced in the Klamath and Modoc National Forests, and if so, whether existence of a new transmission line would pose a hazard to fire-fighting aircraft or impede efforts (e.g. of the USFS or California Department of Forestry) to fight fires in the area of the line. The EIS/EIR should compare the project alternatives with respect to this potential hazard.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Interference With Fire Fighting

The Draft EIS/EIR does discuss aerial fire fighting practices pertaining to the Klamath and Modoc National Forests (discussed on pages 3-199 and 3-200 of the Draft EIS/EIR). These Forests maintain a variety of fire fighting and suppression equipment, including aircraft and helicopters.

The existence of the proposed transmission line would not interfere with or pose hazards to fire-fighting efforts in the project vicinity. The support structures would be the tallest structures associated with the line; these support structures would be approximately 60 to 80 feet in height (see page 2-41 of the Draft EIS/EIR). As discussed on pages 2-39 through 2-46 of the Draft EIS/EIR, the proposed transmission line would cross three distinct regions:

- Medicine Lake Highlands
- Transition
- Modoc Plateau

The Medicine Lake Highlands and Transition areas are remote and rugged areas, while the Modoc Plateau is relatively flat and more easily accessible. Aerial fire fighting is not typically used by the Forests in more easily accessible areas, such as the Modoc Plateau; in these areas, on-the-ground fire fighting techniques are used. Aerial fire fighting is used by the Forest as needed in remote and rugged areas, such as the Medicine Lake Highlands and Transition areas.

Trees in the Medicine Lake Highlands range in height from 50 to 75 feet tall, while trees in the Transition area range from 30 to 60 feet tall. In these areas, the transmission line poles would be at approximately the same height as the tree canopy. Helicopters and other fire–fighting aircrafts would avoid the transmission lines in the same manner that they would avoid the trees, by flying at a sufficient height over the tree canopy. The presence of the transmission lines in the Medicine Lake Highlands and Transition areas would not impede fire-fighting efforts by helicopter or other aircrafts, or pose any additional risks to these aircrafts.

There are several transmission lines that currently criss-cross the Modoc Plateau area. Many of these lines have support structures that are up to two times as tall as the support structures proposed for the Fourmile Hill transmission line. If it is ever necessary in the future to use helicopters or other fire-fighting aircrafts to suppress fires on the Modoc Plateau, the pilots of these aircraft would be alerted to the presence of the

multiple transmission lines on the Modoc Plateau and would be required to fly at a sufficient height to avoid these lines. The presence of the transmission line on the Modoc Plateau would not impede fire-fighting efforts by helicopter or other aircrafts or pose significant new risks to these aircrafts.

For all areas crossed by the transmission line, it is expected that all fire fighters would be familiar with the physical features of the area. These fire fighters would also be alerted to the presence of transmission lines in the area prior to a fire. The transmission lines would therefore not interfere with any fire-fighting efforts. For a discussion of differences between the project alternatives with respect to fire hazards, see the response to "Comment—Fire Hazard Differences Between Alternatives."

Comment—Fire Hazard Differences Between Alternatives

AG.150 The EIS/EIR's comparison of alternative transmission line routes as they related to human health and safety only addresses the electromagnetic fields ("EMF") issue. However, as discussed above, the various routes could have significant differences with respect to fire suppression capability and aircraft risk. The EIS/EIR should analyze and compare the merits of the various alternatives with respect to these issues.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Fire Hazard Differences Between Alternatives

All relevant potential human health and safety effects for all of the project alternatives are analyzed on pages 4-292 through 4-294 of the Draft EIS/EIR. The discussion of the alternatives focuses on potential human health and safety effects associated with the different transmission line routes since the power plant and wellfield facilities would be the same under all alternatives. The key human health and safety issues for the transmission line are fire risk and electric magnetic field (EMF) exposure. These issues are discussed as appropriate for each alternative on pages 4-292 through 4-294 of the Draft EIS/EIR.

Regarding fire-suppression capability and aircraft risk, there would be no significant difference between the alternative transmission line routes presented in the Draft EIS/EIR. As discussed on page 2-36 of the Draft EIS/EIR, the proposed transmission line would require a right-of-way width of 125 feet, regardless of the transmission line alternative chosen. This right-of-way width would be cleared of vegetation as necessary to minimize potential fire risk for the transmission line. Furthermore, the proposed transmission line would comply with all standards promulgated in the National Electric Safety Code and California General Order No. 95 (see page 2-43 of the Draft EIS/EIR). Regardless of the alternative chosen, safety measures which take into account the surrounding vegetation, topography, and fire potential of the area would be adhered to according to Federal and state regulations. The response to "Comment—Interference With Fire Fighting," above, explains why the presence of the transmission line would not interfere with fire suppression efforts or present a risk to fire-fighting aircrafts.

ELECTRIC AND MAGNETIC FIELD HAZARDS

Comments—EMF Hazards

PH5.32 On the transmission line and also in the drilling, will there be any ionizing or nonionizing radiation involved with any of this?
(Medicine Lake Public Hearing)

PH5.33 Well, the transmission lines, as you know, puts out ionizing radiation, EMFs; basically boils down to the same thing.
(Medicine Lake Public Hearing)

Response—EMF Hazards

The comments ask for information about different types of radiation that may be generated by the proposed project. Specifically, the comments request information about:

- Ionizing radiation, or electric and magnetic fields (EMFs), from the proposed transmission line
- Non-ionizing radiation, or radon, from proposed well drilling

Potential EMF hazards from the proposed transmission line are addressed under Impact 4.15.6 on pages 4-288 to 4-290 of the Draft EIS/EIR. As discussed on these pages, the EMFs generated by the transmission line would not result in any significant effects to human health and safety. For a discussion of potential effects due to potential radon emissions during well drilling, see the response to "Comments—Radon Emissions" in the Air Quality Section of this document.

WELLFIELD FACILITY HAZARDS

Comments—General Hazards

AG.146 Except for the sump areas, the Project's wellfield facilities will not be fenced to prevent access to recreational users. (EIS/EIR, p. 4-292.) According to Dr. Fox, these facilities will present significant health and safety hazards to Forest users. (Ex. A, Comment 16.) These facilities will be particularly hazardous in winter, when high snow levels may obscure visibility and lead to collisions with pipelines and other facilities. (Ibid.; EIS/EIR, p. 2-35.) There is a snowmobile trail which runs directly through the wellfield. (EIS/EIR, p. 3-160, Fig. 3.11-3.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.148 The EIS/EIR's conclusion that the wellfield facilities will not cause any significant health and safety impacts is not supported by the evidence. (Ex. A, Comment 16.) The EIS/EIR should be revised to fully analyze these health impacts and to mitigate or avoid these impacts.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.260 Although the DEIR concedes that the general wellfield area would not be fenced, it incomprehensibly concludes that this would not present a significant threat to human health and safety. (DEIR, p. 4-292.) The Project includes four production well pads and three injection well pads of 2.5 acres each, 1.5 miles of production and injection pipeline, and 1.85 miles of injection pipeline. (DEIR, p. 2-12.) According to the DEIR, none of these facilities except two small sumps on each of the well pads comprising 0.4 acres would be fenced. (DEIR, pp. 4-291, 4-292.) Therefore, the wells, other facilities on the well pad (pumps, diesel tank, generators, air compressor, pipe rack), and the insulated pipes would be accessible to the general public.

This not only places the facility at risk from either sabotage or accidental damage, but also endangers public health and safety. The pipelines would be placed on above-ground supports and elevated to an average of 4 feet above ground so that they are above expected snow levels. (DEIR, p. 2-19.) These pipelines sprawl across a large geographic area which is easily accessible by Forest Service roads 49 FS, 44N54, and 44N64, which criss-cross the site and are currently maintained by the Forest Service or will be maintained by Calpine in the winter. (DEIR, p. 2-21, Fig. 3.7-1.) In fact, 1.5 miles of pipeline parallel these access roads. (DEIR, p. 2-12.) There are two snowmobile parks within 5 miles of the site.[9] Snowmobiles and cross country skiers would have ready access to the site and could collide with Project facilities if the facilities are buried in the snow or during inclement weather. Alternatively, facilities may simply be overlooked by snowmobilers, skiers, and horseback riders who could collide with these facilities under ideal conditions because one does not expect to encounter them in pristine recreational areas. Curiosity-seekers could tamper with Project facilities, including valves and the well itself, and cause dangerous releases of steam and toxic gases that would present a substantial health hazard. Pressure relief valves venting steam and toxic gases outside of the fenced area could adversely affect recreators. Finally, even the DEIR concedes that hunters firing weapons could accidentally strike facilities.

These are clearly significant impacts by any objective measure. The DEIR should be revised to find a significant public health and safety impact from the presence of Project facilities and to require

[9] U.S. Forest Service, Modoc National Forest, Map (1/5" = 1 mi), 1993

mitigation. The entire facility, as defined in Figure 3.7-1, should be completely fenced to prevent unauthorized access to mitigate this impact.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

PH3.12 And then the super-heated steam comes up, goes through these pipelines. So that would mean that the exterior of the pipes get hot? *(Yreka Public Hearing)*

PH3.70 One other thing, this pipe you are putting in, are bullets going to go through similar-type lines? I have never seen a bullet puncture. The problem you have is you have got around three eighths pipe, round. The bullet is going to hit it and show— *(Yreka Public Hearing)*

PH4.35 How large will the area of restricted access be? *(Mount Shasta Public Hearing)*

Response—General Hazards

Evidence is presented in the Draft EIS/EIR that the potential for health risks from the presence of the proposed project facilities would be less than significant. Several safety measures are proposed as part of the project to ensure that no significant risk is posed to the public from the presence of the project. In addition, Mitigation Measures 4.15.8a and 4.15.8b are identified on pages 4-292 of the Draft EIS/EIR to further reduce the less-than-significant level of impact that would occur.

Potential risks to recreationalists from geothermal steam and hot water are discussed on page 4-292 of the Draft EIS/EIR. As discussed on this page and page 2-19 of the Draft EIS/EIR, geothermal fluid pipelines would be insulated as part of the proposed project. This insulation would serve to reduce heat loss from the pipelines, as well as to protect individuals who might inadvertently come into contact with the pipelines. Pipelines would be insulated in a manner similar to pipeline insulation at other geothermal facilities, such as Coso and The Geysers. Experience at these other geothermal fields demonstrates that the exterior temperature of the insulated pipelines are warm to the touch, but do not cause burns, scalding, or other harm. The provision of insulated pipelines would therefore reduce potential risks to recreationalists from coming into contact with pipelines to less-than-significant levels.

Comment AG.260 raises several issues related to potential health risks from the presence of the proposed project facilities:

- The potential for the public to access and potentially sabotage or tamper with wellfield facilities in such a way as to cause a significant effect to human health and safety
- The potential for horseback riders to collide with wellfield facilities in such a way as to cause a significant effect to human health and safety
- The potential for snowmobilers or cross-country skiers to collide with wellfield facilities in the winter in such a way as to cause a significant effect to human health and safety
- The potential for hunters to fire weapons and strike facilities in such a way as to cause a significant effect to human health and safety

As discussed in the Draft EIS/EIR, no significant effect to human health and safety would occur from these potential risks. The following information summarizes and clarifies analysis that was presented in the Draft EIS/EIR.

Sabotage and Tampering: Comment AG.260 correctly notes that all sumps at the proposed well pads would be fenced to prevent unauthorized access. In addition, the power plant and all major electrical facilities (including the proposed substation) would be fenced (see pages 4-191 and 4-292 of the Draft EIS/EIR). The fencing of these facilities

would be sufficient to ensure that no significant risk is posed to recreationalists that might pass through the area, and there is no need to fence the entire wellfield. As discussed in the response to "Comments—Background Data" in the Land Use and Recreation Section, very little recreational activity actually occurs in the power plant and wellfield area. New roads that would be developed at the wellfield would be gated and closed, which would minimize the potential for recreationalists to access project facilities.

Pumps, diesel tanks, generators, air compressors, and pipe racks would only be on site at well pads during drilling activities. During drilling activities, the drill rigs are staffed 24 hours per day. Project personnel would prevent unauthorized access to well pads during drilling activities. In addition, as discussed on page 4-291 of the Draft EIS/EIR, all construction sites (including the well pads) would be fenced during construction, thereby preventing access. Additional restricted access areas include the power plant, the substation, and all other major electrical facilities.

In addition to fencing, limiting access, and pipeline safety measures, project personnel would be present at the power plant site, well pads, and other project facilities on a regular basis. The presence of these personnel would discourage and likely prevent tampering with project facilities. These personnel would also have the ability to stop any individuals from tampering with project facilities, or to notify proper authorities of these illegal activities. In addition, Mitigation Measure 4.16.7e is identified on page 4-305 in Section 4.16 , Socioeconomics of the Draft EIS/EIR; this measure is intended to further reduce the less-than-significant effect that the project would have on police services. Implementation of Mitigation Measure 4.16.7e would ensure that a security company is available at the power plant and wellfield to protect project facilities from illegal sabotage.

In the event that someone gained access, avoided detection, was not stopped, and attempted to tamper with wellfield facilities in the manner suggested in comment AG.260, it is extremely unlikely that this person would be successful in the attempt. Wellfield valves would be locked when wells are in stand-by mode. The wells are continually monitored by operators in the power plant control room and any tampering with wellfield facilities would immediately be detected and investigated. Specialized tools and equipment are required to adjust or alter pressure relief valves, other types of valves, and the proposed wells. The specialized tools and equipment required to adjust these facilities are not commonly carried by recreationalists that might visit the project vicinity. Since people without the specialized tools would not be able to tamper with wellfield facilities, there is an extremely low probability that anyone could successfully tamper with wellfield facilities.

Contrary to the statements made in comment AG.260, the proposed production and injection pipelines would not be accessible by the public. The pipelines would be limited to a relatively small geographic area (primarily the eastern and southern portions of Section 28, as shown in Figure 2.2-3 on page 2-9 of the Draft EIS/EIR). Only two crossings of the area roads would allow access to the pipelines; there would be one crossing of 44N54, one crossing of 44N64, and no crossings of Forest Road 49. In addition, it should be noted that none of these roads are currently maintained (i.e., cleared) by the USFS or any other entity in the winter. If the proposed project is

approved and implemented, only one of these roads (44N64) would be maintained by Calpine in the winter to allow winter access to the power plant and wellfield (see page 2-21 of the Draft EIS/EIR). Neither Forest Road 49 nor 44N64 would be maintained in the winter.

Comment AG.260 is also incorrect in stating that 1.5 miles of pipeline would parallel Forest Road 49, 44N54, and 44N64. As shown in Figure 2.2-3, no portions of the proposed pipelines would parallel these roads. The 1.5 miles of pipeline mentioned in comment AG.260 appears to be referring to information provided in Table 2.2-1 on page 2-12 of the Draft EIS/EIR. This table shows that 1.5 miles of pipeline would be installed along proposed new access roads. As discussed earlier in this response, new roads that would be developed at the wellfield would be gated and closed and would not be accessible to the public. This would prevent access to the 1.5 miles of pipeline that would parallel new access roads.

The above measures and factors would ensure that potential health risks from the presence of the proposed project facilities due to sabotage or tampering is prevented or stopped before any significant effects occur. The level of analysis provided in the Draft EIS/EIR for this potential effect is appropriate given the speculative nature of the impact and the measures that would be enacted to prevent public access to the power plant and wellfield facilities and to stop an attempted sabotage and tampering.

Horseback Rider Collisions: No significant human health and safety effects would be expected to occur due to horseback rider collisions with wellfield facilities. These facilities would be located in areas that are fairly heavily Forested, and any horseback riders in the vicinity of the wellfield would need to pick their way through the Forest. These riders would therefore not travel at speeds that could result in human health and safety effects due to collisions with wellfield facilities. In addition, pipelines would be elevated to an average of four feet above ground and would be readily visible to horseback riders in the area. These riders would therefore be able to spot and avoid wellfield facilities before any collision could occur.

In order to increase awareness of the public (including horseback riders) about the proposed wellfield and to make sure these facilities are not overlooked, Mitigation Measure 4.15.8a is identified on page 4-292 of the Draft EIS/EIR. Implementation of this mitigation measure would require the posting of public notices at access points to the wellfield and power plant area. These notices would alert recreationalists that they are about to enter an area of active geothermal facilities and activities, and would identify the potential risks associated with the area.

To ensure that recreationalists are fully aware of geothermal facilities and activities, the USFS would also post notices, as described above, at Klamath and Modoc National Forest district ranger offices, as well as at campgrounds, picnic areas, and snowmobile parks in the project vicinity. Mitigation Measure 4.15.8a has been revised to reflect this additional posting. The combination of the factors preventing horseback rider collisions with wellfield facilities and implementation of Mitigation Measure 4.15.8a would ensure that no significant human health and safety effects would occur.

Snowmobiler and Cross-Country Skier Collisions: No significant human health and safety effects would be expected to occur due to snowmobilers or cross-country skier

collisions with wellfield facilities during the winter months. As described above in the discussion of horseback rider collisions, there are major constraints in the wellfield vicinity that would prevent snowmobilers and skiers from gaining sufficient speed to have an unavoidable collision resulting in human health safety effects. The slow speeds of snowmobilers and skiers in the wellfield vicinity due to Forest densities would allow these types of recreationalists to spot and avoid wellfield facilities before any collisions could occur. In addition, snowmobilers would primarily stay on groomed trails in the project vicinity, which would not overlap with proposed facilities except at one location (see discussion below).

Comment AG.260 also raises the potential for snowmobilers and skiers to collide with wellfield facilities that are buried in snow, or collide with these facilities during inclement weather. If the facilities are buried in the snow, snowmobilers and skiers would be able to travel over the facilities, and no significant effects to human health and safety would occur. During inclement weather, the slow speeds of winter recreationalists would allow wellfield facilities to be spotted and avoided before any collisions could occur. In the severest of weather conditions (such as "white-out" conditions), winter recreationalists would be expected to go sufficiently slow or stop due to the potential to run into trees, rocks, and other existing hazards. This caution would allow snowmobilers and skiers to spot and avoid wellfield facilities just like they would avoid trees, rocks, and other existing hazards.

Implementation of the proposed project would result in one location where wellfield facilities would overlap with an existing snowmobile trail. As discussed on pages 4-197 through 4-199 in Section 4.11, Land Use and Recreation of the Draft EIS/EIR, this existing groomed trail follows 44N54 through the wellfield area. The proposed access road to the plant site would cross this trail (see Figure 2.2-3 in the Draft EIS/EIR), and would contribute to a less-than-significant effect on snowmobiling in the area. The cold injection line crossing of Forest Route 44N54 would be placed in a conduit that would pass under this road, and would not interfere with snowmobile use of 44N54. In order to clarify this information, the following sentence has been added as the last sentence of the first paragraph on page 2-20 of the Draft EIS/EIR:

> "At the cold injection line crossing of Forest Route 44N54 (see Figure 2.2-3), this line would be placed in a conduit that would pass under the road."

In addition, the second paragraph on page 4-198 has been revised as follows:

> "The plowing of Forest Road 44N01 would preclude the use of this road as a snowmobile trail, which would be an adverse effect. In addition, plowing of the power plant access route would create an interruption in the snowmobile trail along Forest Road 44N54 at the intersection of this road and the access road as snowmobiles would not be able to cross the plowed intersection. <u>The proposed cold injection line that would cross Forest Road 44N54 at this location would be placed underground and would therefore not interrupt this route.</u> The interruption of this snowmobile trail <u>by the access road</u> would therefore be an adverse impact <u>that can be mitigated.</u>"

In order to eliminate hazards at the intersection of the access road and Forest Road 44N54, Mitigation Measure 4.11.4a is identified on page 4-199 of the Draft EIS/EIR. This measure would ensure that no significant human health and safety effects to

snowmobilers would occur at this location. In order to clarify this mitigation, the following revisions have been made:

> "4.11.4a Calpine shall sign the intersection of the ~~cold pipeline~~ access road to the plant site with Forest Road 44N54 and feather ~~the~~ this crossing for snowmobiles."

As described above in the discussion of horseback rider collisions, notices about the geothermal facilities and activities and potential risks to recreationalists would be posted with implementation of Mitigation Measures 4.15.8a. These notices would be posted at access points to the wellfield and power plant area, the Klamath and Modoc National Forest district offices, and campgrounds, picnic areas, and snowmobile parks in the project vicinity. These notices would ensure that recreationalists are fully aware of geothermal facilities and activities, and that no significant human health and safety effects would occur due to snowmobiler or skier collisions with wellfield facilities.

Weapons Damage: Comment AG.260 is correct in noting that there would be the potential for hunters to fire weapons in the wellfield area and strike wellfield facilities; this possibility is discussed on page 4-292 of the Draft EIS/EIR. However, as discussed on this page, only a limited amount of hunting is currently conducted in the wellfield area. With the presence of the project facilities, hunting activities on the wellfield area would be expected to be even more limited since hunters tend to prefer more isolated and remote locations in which to hunt. The construction materials of the proposed wellfield facilities would limit the potential for these facilities to be affected by fired weapons. The majority of these facilities would be constructed of heavy-gauge steel that would require extremely high caliber weaponry (higher than the caliber of weapon used by hunters) to damage or penetrate facilities. In the unlikely event of a weapon puncture, the pipes are covered with insulation and the fluid pressure inside of the pipes is low, therefore a bullet puncture would not cause an explosive rupture of the piping. Due to these factors, the risk of human health and safety effects due to weapons damage of project facilities would be considered less than significant.

In order to completely avoid potential human health and safety effects due to weapons, Mitigation Measure 4.15.8b is identified on page 4-292 of the Draft EIS/EIR. This mitigation measure requires the posting of no shooting signs in the vicinity of the wellfield and power plant area. In addition, as discussed on page 1-8 of the Draft EIS/EIR, one of the actions that would be taken by the USFS as a result of USFS authorization of the proposed project would be to issue a Forest Order prohibiting the use of firearms in the wellfield and power plant vicinity. The issuance of this Forest Order and implementation of Mitigation Measure 4.15.8b would eliminate the potential for human health and safety impacts due to weapons damage of project facilities. These actions would also eliminate the potential for injury to project personnel from weapon fire.

Comments—Winter Hazards Associated with Wellfield Facilities

AG.147 Winter maintenance of these wellfield facilities may also result in significant health risks to workers and the public. (Ex. A, Comment 17.) According to Dr. Fox, the maintenance procedures described in the EIS/EIR are not adequate to ensure ready access to the facilities in the event of an emergency. (Ibid.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.261 The wellfield will require periodic access during winters for maintenance and for responding to emergencies. Winters are severe in the area and the snowpack is up to 4 feet thick. The DEIR indicates that in the wellfield, snow would be allowed to accumulate over all wellfield equipment, which would

be marked with stanchions to serve as navigational aids in snowdrifts. Personnel would access the site with sno-cats and snowmobiles, excavate the area, and fix the facilities. (DEIR, pp. 2-35, 2-36.)

This is not adequate to assure ready access and is not consistent with practices normally used in areas with severe winter weather. Maintenance and emergency response will require that boom cranes and other heavy equipment be brought into the wellfield. These cannot be transported on sno-cats and snowmobiles. Further, in an emergency, rapid access to the wellhead and supporting facilities would be required. Excavation of the wellhead would unnecessarily delay response and could result in significant environmental and safety impacts.

The DEIR should be modified to find a significant worker and public safety impact from the failure to have adequate procedures to respond to emergencies and require mitigation to reduce this impact. Service roads into the wellfields should be maintained throughout the winter. The wellhead should be covered with a moveable enclosure to allow rapid access to facilities.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Winter Hazards Associated with Wellfield Facilities

The proposed winter maintenance and emergency response procedures identified in the Draft EIS/EIR are appropriate for the proposed project area, and would be sufficient to ensure that no significant effects to human health and safety occur. Contrary to the statement made in comment AG.261, maintenance and emergency response activities would not normally require that boom cranes and other heavy equipment be brought into the wellfield. As discussed in the Draft EIS/EIR, project personnel would utilize sno-cats and snowmobiles (kept on site) to access any areas requiring maintenance or emergency repair. Maintenance and emergency repair equipment would also be kept on site, and the sno-cats and snowmobiles would be capable of transporting this equipment to any area requiring work.

In the event that an unexpected, major emergency repair is required during the winter months and heavy equipment (such as boom cranes) is required, equipment could be brought to the wellfield. As discussed in the response to "Comments—Hazardous Materials Transport", Forest Route 15 or 77 and Forest Roads 44N01 and 44N64 would be maintained during the winter, and would be used to access the power plant and wellfield area. This access route would allow ready and easy access of any emergency response vehicles and heavy equipment to the power plant and wellfield area in the winter. A route within the wellfield would then be cleared to allow access of the heavy equipment to the area needing repair. However, the use of heavy equipment at the wellfield during the winter months is not anticipated at this time, and there would be no need to keep all access and service roads in the wellfield maintained and cleared throughout the winter.

The proposed winter emergency response procedures identified in the Draft EIS/EIR would allow rapid access to wellfield facilities, including the wellhead and supporting facilities. Excavation of the wellfield facilities would be accomplished by several emergency workers, thus ensuring rapid response to any facility requiring repair. The use of moveable enclosures would not allow for more rapid access to the wellheads. These types of enclosures would still need to be cleared of snow, which would not reduce response time. Use of these enclosures would also pose an additional problem of excessive weight on top of the enclosure due to snow accumulation, which could result in the collapse of the enclosure. Adequate procedures to respond to emergencies identified in the Draft EIS/EIR, and the emergency response measures outlined in the Draft EIS/EIR would be sufficient to ensure that human health and safety effects due to winter maintenance and emergency response would be less than significant.

AIRCRAFT HAZARDS

Comment—Aircraft Hazards

AG.396 Transmission lines are a well-known hazard to aircraft, especially small civil aviation aircraft. In addition, airplane collisions with power lines are a well-known source of fires in both urban and wildland areas. The EIS/EIR needs to address what aircraft (in addition to the helicopters mentioned) are likely to be in the area, and whether there are any air strips (public or private) in the vicinity of the transmission line corridors for which the transmission line could pose a hazard to aircraft during takeoffs or landings. The EIS/EIR should compare the project alternatives with respect to this potential hazard.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Aircraft Hazards

The proposed transmission line would not pose a hazard to aircraft, and would not be expected to cause fires from airplane collisions with power lines. In addition, there would be no difference in potential risks between the alternative transmission line routes evaluated in the Draft EIS/EIR.

As discussed above in the response to "Comment—Interference With Fire Fighting", the proposed transmission line would not exceed 80 feet in height. The line would either be located in areas where it would be at approximately the same height as the surrounding tree canopy, or where it would be surrounded by other existing transmission lines that have support structures up to two times as tall as the support structures proposed for the Fourmile Hill transmission line. Since aircraft currently fly at sufficient altitude to avoid trees and existing transmission lines, aircraft would also fly at sufficient altitude to avoid the proposed transmission line. A discussion of the type of aircraft that may be in the area would be irrelevant to the analysis of the proposed project.

The proposed transmission line would also be shown on aeronautical maps of the area. Under FAA regulations, all pilots are required to carry these maps for these areas through which they will be traveling. Pilots would therefore be fully aware of the presence of the proposed transmission line.

Due to these factors, the proposed transmission line route (or any of the alternative routes) would not be a hazard to aircraft flying through the area. Since aircraft would not be expected to collide with the transmission line, there would be no risk of fires being started. In addition, there are no public or private airstrips in the immediate vicinity of any of the transmission line segments. The proposed transmission line route (and the alternative routes) would therefore not pose a hazard to aircraft during takeoffs or landings; and, there would be no effect to human health and safety.

THREAT OF DISEASE

Comment—Threat of Disease

AG.149 During the scoping process, the NPS indicated that "[h]antavirus and bubonic plague vectors are known to exist in the immediate area." (Ex. I, Turnbull scoping comments.) Thus, the NPS urged the lead agencies to assess the risks posed to workers from these hazards and to evaluate precautionary measures in the EIS/EIR. (Ibid.)

One of the significance standards for impacts to human health and safety is whether the Project will "[e]xpose people to potential health hazards." (EIS/EIR, p. 4-274.) The Project will employ hundreds of construction workers who may be exposed to hantavirus and bubonic plague, which are serious and potentially fatal diseases. Despite the concerns of the NPS and the known presence of these health risks, the EIS/EIR fails to evaluate or mitigate this impact. This information should be included in the EIS/EIR and the document recirculated for public comment. Without this information, there is insufficient evidence to support the EIS/EIR's conclusion that the Project will not cause any significant health and

safety impacts. (EIS/EIR, § 4.15.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Threat of Disease

The possibility of hantavirus and bubonic plague exposure of workers was considered during the Draft EIS/EIR preparation stage. It is acknowledged that hantavirus and bubonic plague are known to exist in the project region. There have been few recorded cases of hantavirus and bubonic plague infection cases in the proposed project area, thus the probability of workers coming into contact with these diseases is extremely low, and workers would not be expected to contract either of these diseases. Therefore, contraction of hantavirus and bubonic plague was not considered to be an effect of the proposed project. Since this would not be a project effect, there is no need to recirculate a revised Draft EIS/EIR with this information. The following discussion provides information about hantavirus and bubonic plague, and why there would be no expected effect to workers from these diseases.

Hantavirus: Hantavirus is a disease associated with exposure to deer mice. This disease can be contracted by exposure to deer mice droppings or handling of infected mice. In the majority of hantavirus cases in California, the victim has lived in a rodent-infested dwelling. According to the Vector-Borne Disease Section of the California Department of Public Health, there has been a total of only one recorded hantavirus case in Modoc and Siskiyou counties in the past 17 years. There have been no documented cases of hantavirus infection associated with construction projects in either Modoc or Siskiyou counties, or anywhere in the entire state of California (Fritz 1998).

Due to the rare occurrences of hantavirus cases in Modoc and Siskiyou counties and the absence of construction-related cases, workers for the proposed project would not be expected to be exposed to and contract hantavirus. Therefore, there would be no effect to human health and safety from potential exposure to hantavirus.

Bubonic Plague: Bubonic plague is a disease associated with mass die-offs of rodents and is endemic to ground squirrels, wood rats, and chipmunks. According to the Vector-Borne Disease Section of the California Department of Public Health, there have been a total of only eight recorded cases of bubonic plague infection in Modoc and Siskiyou counties over the past 58 years. Five of these cases occurred during the 1940s when ready medical access and treatment were unavailable. The three other cases were associated with cat bites and fleas from domestic animals. There have been no documented cases of bubonic plague infection associated with construction projects in either Modoc or Siskiyou counties (Smith 1998).

Due to the rare occurrence of bubonic plague cases in Modoc and Siskiyou counties and the absence of construction-related cases, workers for the proposed project would not be expected to be exposed to and contract bubonic plague. Therefore, there would be no effect to human health and safety from potential exposure to bubonic plague.

References:

Fritz, Curtis. 1998. State Veterinarian, Vector-Borne Disease Section, California Department of Public Health. Personal communication. March 18, 1998.

Smith, Charles. 1998. Regional Veterinarian, Vector-Borne Disease Section, California Department of Public Health. Personal communication. March 18, 1998.

MITIGATION MEASURES

Comment—Monitoring, Inspection, and Mitigation Procedures

A.51 The FEIS should provide additional detail regarding monitoring, inspection and mitigation procedures to ensure the proper use of tools and equipment and that proper construction procedures are followed. For instance, the FEIS should describe what procedures and materials would be used in drilling, construction and closure of all wells to guard against corrosion and other anticipated hazards or difficulties encountered (e.g. use of low carbon steel).

(Deanna M. Wieman, U.S. Environmental Protection Agency)

Response—Monitoring, Inspection, and Mitigation Procedures

The Draft EIS/EIR provides general information regarding monitoring, inspection and mitigation procedures to ensure the proper use of equipment and construction methods. Calpine would comply with OSHA requirements for worker safety. As discussed in the Draft EIS/EIR, Calpine would instruct all construction personnel on the proper use of tools and equipment as a standard procedure. The USFS/BLM would inspect operations and maintain compliance with the GROs, which will ensure that construction sites are regularly monitored and inspected during the construction period for proper operations.

The Draft EIS/EIR includes a draft Mitigation and Monitoring Reporting Plan (MMRP) for the project (Chapter 5 of the Draft EIS/EIR). The MMRP identifies specific steps for monitoring and inspecting the implementation of identified mitigation measures. Implementation of various safety and contingency plans for the project (such as the fire prevention and suppression plan and the hazardous materials plan) would also ensure that emergency procedures are followed in the unlikely event that a hazard occurs.

The BLM would be responsible for enforcing compliance with the GROs during well drilling, construction and closure. Compliance with the GROs (as discussed in Chapter 2 of the Draft EIS/EIR) would ensure that proper procedures and materials are used to guard against corrosion and other potential hazards and difficulties. For a detailed discussion of procedures and materials to be used in drilling, construction, and closure of the proposed geothermal wells, see the responses to "Comments—Well Casing Program and Potential for Casing Rupture" in the Hydrology Section.

Comments—Waste Minimization and Recycling

AG.143 The EIS/EIR also failed to discuss measures for mitigating the impacts of these hazardous wastes. (Ex, A, Comment 15.) As Dr. Fox explains, State and federal laws require waste minimization and recycling, where feasible. (Ibid.) The EIS/EIR should be revised to discuss these impacts and methods of mitigating these impacts. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.158 The EIS/EIR states that Calpine will establish a waste reduction program to minimize the solid waste stream going to the landfill. (EIS/EIR, Mitigation measure 4.16.9a, p. 4-307.) The EIR should provide sufficient details about this program that that the public and decisionmakers can evaluate it and determine if it adequately mitigates the Project's impacts.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.257 The DEIR also fails to acknowledge that there are regulations that require waste minimization and recycling, where feasible. Both RCRA and the California Hazardous Waste Management Act encourage waste minimization and recycling (42 U.S.C. Sec. 6902(8), Health and Safety Code Sec. 25179.4(a) and (b).) This information must be included in an EIR so potential impacts can be identified and mitigation incorporated into the project.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al)

AG.259 The DEIR must be revised to include a mitigation measure that requires waste minimization and recycling on an on-going basis.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

Response—Waste Minimization and Recycling

On-going waste minimization and recycling for the project is adequately addressed in the Draft EIS/EIR and there is no need to revise the EIS/EIR text regarding this issue. As discussed on pages 4-306 and 4-307 in Section 4.16, Socioeconomics of the Draft EIS/EIR, the project would generate less-than-significant levels of various wastes that would be disposed of at existing landfills in the region. Mitigation Measure 4.16.9a is identified on page 4-307 of the Draft EIS/EIR to address waste generation. This mitigation measure would require the establishment of an on-going waste reduction program for the project to minimize the amount of waste requiring disposal at landfills. As part of this program, recycling options for project-generated waste would also be identified. This program would address both non-hazardous and potentially hazardous wastes (such as cooling tower sludge and sulfur cake).

It should be noted that neither RCRA nor the California Hazardous Waste Management Act include a mandatory requirement for waste minimization and recycling. As stated in comment AG.257, waste minimization and recycling is only encouraged and only where feasible. Calpine would comply with the intent of RCRA and the California Hazardous Waste Management Act for waste minimization and recycling. Implementation of Mitigation Measure 4.16.9a would further this compliance.

3.17 Socioeconomics

INTRODUCTION

This section provides responses to comments on socioeconomic issues. The comments and responses are grouped under the following headings:

- General
- Employment
- Short-Term Housing
- Effects on Minority and Low-Income Populations
- Property Values
- Effects on Tourism
- Public Services
- Solid Waste Disposal
- Wastewater Disposal
- Public Finance

Under each of these headings, comments and their responses are grouped under more specific headings.

GENERAL

Comment—General

AG.151 The EIS/EIR fails as an informational document because it does not adequately identify and discuss the Project's socioeconomic impacts. There is no basis to conclude that the Project will not have a significant impact in this area. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

Response—General

The analysis of socioeconomic effects has been prepared to be consistent with CEQA Guidelines, including CEQA Guidelines Section 15131. Significance criteria for socioeconomic effects are identified on page 4-295 of the Draft EIS/EIR. These criteria are based on CEQA Guidelines, Appendix G, and capacity levels established by various public services and facilities providers in the proposed project area. As stated in the Draft EIS/EIR, impacts to socioeconomics would be considered significant if the proposed action would:

- Induce substantial growth or concentration of population
- Displace a large number of people
- Substantially decrease property values in the vicinity
- Require an extension of a sewer trunk line with capacity to serve other new development
- Increase demand for existing public services and facilities resulting in exceedance of existing or planned future capacities
- Disproportionately affect minority or low-income populations
- Cause substantial increases in electricity prices

Consistent with Federal and state regulations, the Draft EIS/EIR discusses the above significance criteria in relation to the proposed project in detail, and uses these criteria as the basis of the impact discussion.

EMPLOYMENT

Comments—Local Employment Opportunities

AG.152 The EIS/EIR fails to provide sufficient information supporting its assertion that the Project will draw on the local work force. The Project will create approximately 160 temporary construction jobs and 19 permanent jobs. (EIS/EIR, p. 4-297.) The EIS/EIR states that up to fifty percent of the temporary construction work force is expected to be drawn from the local area. (Ibid.) The EIS/EIR provides the 1990 unemployment rates for Siskiyou and Modoc counties, but it is unclear how these rates translate into an available local work force. (Id. at pp. 3-207 to 3-208.) This Project will require skilled construction workers (id. at p. 4-297) and the applicant may have to search outside the local labor market for employees with these skills. Thus, there is no basis for the EIS/EIR's assertion that it will create local jobs.

The lead agency should provide data that would allow evaluation of the EIS/EIR's assertion. For example, the EIR should indicate whether the local workers possess the necessary skills for employment. It should identify how the applicant expects to draw on this labor pool. Additionally, the applicant should set a minimum goal for the hiring of local laborers. It should also identify an outreach program should it fail to meet its hiring goals. Without this information, the EIS/EIR's assertion that fifty percent of the work force will be comprised of local workers is merely conclusory and lacks an adequate factual basis. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

PH1.5 I can say that I asked this question before, and asked specifically what local people would be employed, and was informed that in fact other than during construction, possibly local people, but that this would be very high tech and it was highly unlikely any local people would be hired. *(Dorris Public Hearing)*

PH1.31 And what I asked about was what I felt like was important to people here. And the jobs issue was one of them, and to what degree this would actually benefit the area from which this power is supposedly going to be generated. And I never have received anything other than very general kinds of statements on those issues. *(Dorris Public Hearing)*

PH4.60 Will local residents be hired? *(Mount Shasta Public Hearing)*

Response—Local Employment Opportunities

Potential effects of the proposed project on employment are discussed under Impact 4.16.2 on page 4-297 of the Draft EIS/EIR. As discussed on this page and summarized in comment AG.152, the project would result in short-term increases in employment during construction and long-term increases during operation.

During the 33-month construction period, a maximum of 160 temporary construction employees (both skilled and unskilled) would be present at any one time. It is expected that up to 50 percent of these workers would be drawn from the local area, with the remaining 50 percent of the jobs filled by individuals from outside the region. The proposed project would therefore be expected to create up to 80 temporary positions for local workers. This expectation is based on Calpine's stated goal (as expressed to the lead agencies, and at public scoping meetings and public hearings) of hiring up to 50 percent of its construction work force locally. However, even if this goal is not met, there would be no change in the conclusion that the project would be expected to have a beneficial effect on employment since it would be generating jobs. During the operation phase of the project, 19 permanent jobs would be available. Approximately one-third of these positions would be expected to be filled from within the company. The remaining two-thirds of the positions (approximately 13 positions) would be filled from outside the company. As stated in the Draft EIS/EIR, Calpine would advertise regionally to make local workers aware of available positions. A detailed analysis of skill-matching and unemployed worker availability, as suggested by the comment, is therefore not

necessary. In addition, identification of a minimum goal for hiring, and an outreach program is not required by, or relevant to, the employment evaluation in the Draft EIS/EIR.

SHORT-TERM HOUSING

Comment—Short-term Housing

AG.153 The EIS/EIR's discussion of housing is also inadequate. The EIS/EIR states that sufficient temporary housing is available for 160 temporary employees. (Id. at p. 4-298.) It describes RV parks, low-cost motels, and rental housing as sources of temporary housing. Although the EIS/EIR identifies the number of local RV parks, many construction workers may not have access to an RV. The EIR/EIS does not indicate if there are sufficient low-cost motels to accommodate demand. Also, finding short-term rentals can be difficult as many landlords prefer long-term leases or may substantially increase the rent on short-term rentals. These issues should be addressed in more detail so that the public and decisionmakers can fully assess the Project's impacts on temporary housing.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Short-term Housing

As stated above in the response to "Comment—Local Employment Opportunities," the proposed project would create approximately 80 temporary positions for workers who would be moving to the area. Therefore, there would be the need for 80 temporary housing accommodations. It is anticipated that the majority of short-term construction workers would seek temporary housing in nearby RV parks, low-cost motels, or in rental housing. As stated on page 4-298 in the Draft EIS/EIR, there are 1,066 available housing units in Modoc County, 3,045 available housing units in Siskiyou County, and 625 available housing units in Klamath Falls. Thus, a total of 4,736 available housing units exist in the project vicinity. There are also 39 RV parks in the project region, as well as numerous motels.

The 4,736 available housing units, 39 RV parks, and numerous motels would be expected to easily accommodate the 80 temporary construction workers associated with the proposed project. Even if all 160 construction workers temporarily relocated from outside of the area to the project region, these workers would be easily accommodated by the existing available housing, RV parks, and motels. There is, therefore, ample short-term housing available to workers associated with the proposed project, and the project would not have a significant impact on temporary housing in the area. In addition, the rental fees associated with short-term housing would be expected to provide a net benefit to the local economy.

As stated in the Draft EIS/EIR on page 4-299, the implementation of Mitigation Measure 4.16.3a would help to inform project workers about short-term housing opportunities by providing a bulletin board in the construction office that would display the locations and costs of local short-term housing.

EFFECTS ON MINORITY AND LOW-INCOME POPULATIONS

Comment—Effects on Local American Indians

AG.163 The EIS/EIR admits that the Project would have a significant unavoidable impact on minority and low-income populations, due to its disproportionate effect on local American Indians, but it fails to proffer adequate mitigation measures that will reduce the Project's impacts. (EIS/EIR, pp. 4-299; 4-301.) The EIS/EIR proposes mitigation measures 4.6.1d, 4.6.2a-b, and 4.6.3a-b to reduce the Project's impacts on tribal use and spiritual values. (Id. at p. 4-301.) These mitigation measures are inadequate for several reasons.

First, mitigation measures 4.6.1d and 4.6.2b are not described in the measures listed in Section 5 (Mitigation Monitoring and Reporting Program) or Section 4.6 (Traditional Cultural Values). Thus, it is unclear if these measures actually are included in the EIS/EIR, what these measures are, and how they may mitigate the Project's impacts. Second, mitigation measures 4.6.3a-b are inadequate for the reasons discussed in the comments on Traditional Cultural Values.

Absent information about potential mitigation measures, the lead agency cannot find that the Project's avoidable impacts would be mitigated to insignificance. Even if impacts cannot be mitigated to insignificance, the EIR/EIS should provide feasible mitigation that will at least reduce these impacts on Native American culture.

In sum, the proposed mitigation measures are inadequate to reduce the Project's effects on socioeconomic issues. These measures should be revised to address these deficiencies.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Effects on Local American Indians

The Draft EIS/EIR identifies feasible mitigation measures to reduce impacts to minority and low-income populations that could be affected by the project (i.e., American Indian tribes). Extensive efforts were made (including consultations and interviews with tribal members) to identify mitigation measures to reduce potential project effects on American Indian tribes. Mitigation Measures 4.6.2a, 4.6.3a, and 4.6.3b would involve various means to reduce significant project-related noise and physical-disturbance impacts to the American Indians. As discussed on page 4-301 of the Draft EIS/EIR, the project effect on American Indian tribes would be considered an unavoidable significant effect, even with mitigation. For a discussion of the adequacy of mitigation measures to reduce effects to traditional cultural values see the response to "Comments—Adequacy of Mitigation Measures" in the Traditional Cultural Values Section in this document.

An editorial error occurred in the first paragraph on page 4-301 of the Draft EIS/EIR. The paragraph has been corrected as follows:

> "Implementation of Mitigation Measures ~~4.6.1d,~~ 4.6.2a, ~~and 4.6.2b and~~ 4.6.3a, 4.6.3b, and 4.6.7a would reduce project impacts on traditional cultural values and on the American Indian tribal communities."

PROPERTY VALUES

Comments—Potential Effects on Property Values at Tionesta

A.18 In considering the placement of an additional power line near the community of Tionesta, the DEIS should not dismiss potential socioeconomic or cumulative impacts of this proposed action just because there are five existing transmission line corridors (pg. 4-301).

(Deanna M. Wieman, U.S. Environmental Protection Agency)

AJ.7 6.) Page 3-208. It is stated that approximately 15 homes are located in Tionesta and that property values of these homes range from $50,000 - $60,000. This is a low estimate of the number of homes. The property values are way off. The upper limit is low by a factor of 3 to 5, depending upon appraisal approach. This housing and lodging summary fails to note that there are two RV parks in Tionesta.

(Larry Hearne, et al., Tionesta Residents)

Response—Effects on Property Values in Tionesta

The Draft EIS/EIR evaluates the project's potential effects on property values at Tionesta. The determination that the addition of another transmission line in the Tionesta area (where there are already multiple existing transmission lines) would not significantly affect Tionesta property values was based primarily on the less-than-significant effect of the project on visual quality, air quality, noise, and human health

and safety at Tionesta, as well as knowledge about the lack of socioeconomic impacts from existing transmission lines in other rural areas.

All Tionesta residences are located at least 1,500 feet from the proposed transmission line. The presence of the project transmission line in the area would not significantly affect views at Tionesta or cause a nuisance for Tionesta residents, and would not be expected to affect demand for Tionesta property. It is therefore reasonable to conclude that the transmission line would not be expected to adversely affect Tionesta property values.

If the proposed Telephone Flat project were approved and built, it would be required to use the same transmission line as the proposed Fourmile Hill project in the vicinity of Tionesta. The cumulative effects from development of both projects on Tionesta property values would therefore be the same as described for the proposed project.

There have been several recent studies that support the conclusion that placement of transmission lines in rural areas, such as Tionesta, do not significantly affect property values. These studies are summarized in *The Effects of Overhead Transmission Lines on Property Values* (Kroll and Priestley 1992). One of these studies was a 1985 study of suburban and rural areas of residential Montana. This study determined that no adjustment to market price was necessary for properties encumbered by, or in view of, a proposed 500-kV transmission line. In a 1990 study of suburban and residential properties in Montana, 50 percent of those residents living within one mile of a 500-kV transmission line felt there was a no negative effect on property values, while only five percent of residents living one to three miles from the transmission line felt there was a negative effect on property values.

Potential effects of overhead electrical transmission lines on property values were also discussed in the *Sierra Pacific Power Company Alturas Transmission Line Project Final EIS/EIR* (CPUC and BLM 1995). Based on a survey of rural County Assessor's Offices conducted for this project, there was no evidence of a measurable impact of transmission lines on nearby residential property values. As part of the survey, property values of residences in the city of Alturas that are located about 200 to 400 feet of a 230-kV transmission line were evaluated. This transmission line was installed approximately five years before the survey was conducted. The survey found that property values of the Alturas residences did not decrease as a result of the presence of this transmission line.

In Truckee, research indicated that the property value of a home and lot 600 feet from a transmission line would be two to four percent greater than the property value of a comparable home and lot directly underneath the transmission line. This difference is negligible, and would not be considered a significant effect due to transmission line presence (CPUC and BLM 1995). It should be noted that the residences at Tionesta would be located at much greater distances from the proposed transmission line than residences in the Alturas and Truckee studies. Thus, any effect on property values that may occur in Tionesta would be expected to be even less than the negligible effects experienced in Alturas and Truckee.

In response to comment AJ.7, information regarding property values in Tionesta was obtained through personal communication with Rick Hironemus, Director of Public

Works for the Modoc County Public Works Department (please see Draft EIS/EIR pages 4-301 and 7-18). The opinion expressed in comment AJ.7 that the property value estimate of $50,000 to $60,000 might be off by a factor of three to five is noted. As a point of clarification, the two RV parks in the Tionesta area mentioned in comment AJ.7 were included in the total number of RV parks in Modoc County discussed on page 4-298 of the Draft EIS/EIR.

References:

CPUC and BLM (California Public Utilities Commission and U.S. Bureau of Land Management). 1995. Sierra Pacific Power Company Alturas Transmission Line Project, Final Environmental Impact Report/Environmental Impact Statement. Prepared by Aspen Environmental Group.

Kroll, Cynthia A. and Thomas Priestley. 1992. *The Effects of Overhead Transmission lines on Property Values.* Prepared for the Edison Electric Institute Siting and Environmental Planning Task Force. July 1992.

Comments—Effects on Property Values in the Medicine Lake Area

AG.161 The EIS/EIR's discussion of the Project's impacts on Medicine Lake property values is inadequate and contradictory. Medicine Lake is "located at the visual and topographic center of the Caldera." (EIS/EIR, p. 3-124.) It has no telephone or electricity service lines serving the basin. (Ibid..) These characteristics "create a strong sense of place and remoteness to the lake and its' [sic] immediate environs." (Ibid.) With the exception of a few structures, "there is an overall intactness to the lake's character." (Ibid.) Thus, property owners experience, and have sought out, the area's pristine quality, rural character, and untainted vistas. Impairment of these qualities will diminish property values.

The Project would introduce a number of adverse impacts to the Medicine Lake area. EIS/EIR admits that construction of the transmission line near Medicine Lake and Tionesta would be both visible and audible. (Id. at p. 4-301.) During operations, the transmission line would be visible from Medicine Lake properties. (Id at p. 4-302.) Steam plumes from the power plant are would be visible and may contribute to "possible negative visitor perceptions." (Id. at p. 4-193.) The area would experience increased truck traffic on forest roads during the three years of construction. Helicopter noise would be audible during transmission line construction and transmission line maintenance (Id. at pp. 4-263, 4-266.) The project would introduce noise related to plant operations and periodic in-fill well-drilling. (Id. at p. 4-193.)

The EIS/EIR claims that views of the transmission line from Medicine Lake would not be considered a significant visual effect and refers the reader to the discussion in Section 4.9 (Visual Resources) to support its claim. (Id. at p. 4-302.) To the contrary, Section 4.9 emphatically states that the Project's impact would be significant and unavoidable. "The visibility of well venting and cooling tower steam plumes and transmission line facilities and right-of-way clearance for segment A1 from KOPS 2, 3, and 5, however, is considered a significant unavoidable impact as no mitigation is available that would remove these project features from view." (Id. at pp. 4-156 to 4-161 (emphasis added).) Further, the visibility of the steam plumes would "contribute to the overall modification of the visual characteristics of the Medicine Lake area as seen from these KOPS" and the transmission line would create "a high level of visual contrast." (Id. at p. 4-161.) "Therefore, with mitigation the visibility of segment A1 of the transmission line would result in a significant unavoidable impact as the visibility of both the transmission line and steam plumes would impact the overall visual characteristics of the Medicine Lake area." (Id. at p. 4-162 (emphasis added).)

Nonetheless, the EIS/EIR asserts that the transmission lines visibility is not expected to affect property values near Medicine Lake. (Id. at p. 4-302.) The EIS/EIR offers no basis for this assumption. Indeed, as discussed above, the EIS/EIR's discussion in section 4.9 contradicts its later evaluation of the Project's impact on property values. The EIS/EIR should provide data supporting its conclusion and explain its contradictory statements. Absent such information, it appears that the Project will significantly affect property values in the Medicine Lake area.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AN.2 You people have not given any consideration to the property values in the basin at all. *(John Aquila)*

BQ.6 On page 4-301 of the draft EIS/EIR it is stated that this project will not affect Medicine Lake property values. We did not see where in the draft EIS/EIR there is a justification for this statement; on the contrary homeowners from Medicine Lake have been very concerned about the negative impact of this project. Please provide a written response how this statement was developed and how this project

intends to compensate those property owners whose property has been diminished in value because of this project. *(S. Peder and Suzanna S. Cuneo, et al.)*

FL.1 The following comments are meant to apply, not only to the proposed Telephone Flat project, but to each and every proposed Geothermal Development in the vicinity of Medicine Lake.

As a property owner at Medicine Lake, I am extremely concerned with the effect that the proposed geothermal plants will have on the property values in the Medicine Lake Highlands. I am sure that you can understand, that should there be a noxious odor, or a offensive noise emitted, it would greatly effect the desirability of this pristine property.

As a Real Estate Broker for over 25 years, I can assure you that there would be little interest in moving to this area if any of these thing occur. I have attended two of the public hearings on the Telephone Flat Project, and none of the officials representing the projects, have been able to state that there would not be a noticeable sulfur odor nor an objectionable sound emitted. As a matter of fact, I found them to be very vague and deceptive in their response to these questions. *(Doris H. Moss)*

FP.17 The Draft EIS/EIR states that there will be no significant affect to property values in the Medicine Lake area (Page 4-301). The reasoning given is that there supposedly will be no significant effects to noise or visual quality in the area, property values in the Medicine Lake area should remain the same. This statement is contradicted by the evidence presented in sections on the proposed powerline and power plant throughout the document! Our question is – Do most people want to own cabins and recreate in an area of two and possibly six power plants? The reason that people come to Medicine Lake is to get away from man-made craziness and relax in a more natural and pristine location. The addition of one (and possibly six) powerplants (and associated development and use) will definitely effect the natural resources of the area and the reason to recreate here. Please re-evaluate the "no impact" designation to property values as a result of the proposed power plant and include a written justification in the Final EIS/EIR. *(Eric T. Nelson)*

GC.2 As a property owner at Medicine Lake, and a licensed Real Estate agent in the Mt. Shasta area, the proposed project will have an adverse effect on property values in the Medicine Lake Highlands. Medicine Lake can be difficult to market for a variety of reasons:

1. Not accessible year round.
2. The cost of building because of hauling distance.
3. County Health Department restrictions.
4. Siskiyou County Building Department restrictions.

People who have purchased property in the Medicine Lake area have done so at great expense. For many it has been an investment for future generations to enjoy. *(Carole Plank)*

GC.4 On Page 4-301 of the draft EIS/EIR it is stated this project will have no effect on Medicine Lake property values. I do not see where in the draft EIS/EIR there is justification for this statement. On the contrary homeowners from Medicine Lake have been very concerned about the negative impact of this project.

Please provide a written response as to how this statement was developed and how this project intends to compensate the property owners whose property has been diminished in value as a result of this project. *(Carole Plank)*

GC.7 I have no experience with the affect of geothermal plants on market values of properties similar to the Medicine Lake summer home area. But, it is my experience appraising properties since 1973 that any activity which may produce noise, smells or increased traffic in an area with summer cabins such as the Medicine Lake area, would probably decrease the overall market appeal and values after such activity was started. *(Carole Plank)*

PH3.95 I know my property is going to go down. *(Yreka Public Hearing)*

PH3.96 Has anybody looked to see that maybe our property values are going to go down? Instead of looking at this beautiful wilderness, a little cloud and power line and clearcut to look at? *(Yreka Public Hearing)*

PH3.97 I am a real estate salesperson working out of Mt. Shasta. I can guarantee you, our property values are going down. We are not going to be able to give the property away. *(Yreka Public Hearing)*

Response—Potential Effects on Property Values at Medicine Lake

As discussed in the response to "Comments—Potential Effects on Property Values in Tionesta," the determination that the proposed transmission line would not have a significant effect on property values was based on the potential environmental effects of the project, as well as known effects of existing transmission lines in other rural areas. As stated in the Draft EIS/EIR, construction of segment A1 of the proposed transmission line would be visible and audible to properties near Medicine Lake (see

page 4-301 of the Draft EIS/EIR). However, these construction activities would occur over a short-time period, and it is anticipated that these impacts would have a less-than-significant effect on property values in the Medicine Lake area. The text of the last two sentences of the fifth paragraph on page 4-301 of the Draft EIR/EIS have been revised as follows to clarify this point:

> "Construction of the proposed transmission line near Medicine Lake (segment A1) would be visible to properties near Medicine Lake, and could be audible. However, construction activities at this location would occur in an extremely short period (about three weeks), and would ~~not~~ be expected to ~~affect~~ have a less-than-significant effect on Medicine Lake property values."

It is acknowledged that the conclusion of significance for potential visual effects of the project on Medicine Lake on page 4-302 of the Draft EIS/EIR is inconsistent with the conclusion presented in Section 4.9, Visual Resources. However, this inconsistency is not considered to be a major flaw in the analysis, and does not alter the conclusion on page 4-302 of the Draft EIS/EIR regarding potential effects to property values at Medicine Lake. In order to correct this inconsistency, and clarify the potential for effects to Medicine Lake property values, the second paragraph on page 4-302 of the Draft EIS/EIR has been revised as follows:

> "At Medicine Lake, a portion of transmission line segment A1 would be visible. The tops of transmission line support structures, and the line itself would be visible from properties at this location. As discussed in Section 4.9, Visual Resources, views of the transmission line from Medicine Lake would ~~not~~ be considered a significant and unavoidable visual effect, even after mitigation. However, previous surveys of the effect of transmission lines on property values in rural areas indicate that the presence of the transmission line would not have a noticeable effect on Medicine Lake property values (Kroll and Priestley 1992; CPUC and BLM 1995). Operation of the proposed action would therefore ~~not~~ be expected to have a less-than-significant effect on ~~affect~~ property values at Medicine Lake."

The proposed power plant and wellfield would be located more than three miles from the Medicine Lake area. As stated on page 4-170 of the Draft EIS/EIR, steam plumes produced by the cooling towers associated with the proposed power plant would be ephemeral, would depend on wind direction and intensity, and would occur during the winter when there are few visitors in the Medicine Lake area. Therefore, it is not expected that periodic steam plumes released at a distance of three miles from the Medicine Lake area would have a negative effect on property values in the area.

As discussed in the Section 3.12, Transportation, of the Draft EIS/EIR, road use limitations for construction vehicles and equipment would be implemented during the summer months in order to avoid potential traffic conflicts with recreationalists and homeowners in the Medicine Lake area (see pages 4-213 to 4-215). Furthermore, increases in traffic associated with the project would only occur during the three years of the construction phase of the proposed project. Therefore, it is unlikely that a short-term increase in traffic would result in decreases in property values.

Helicopters would not be used during construction of the proposed transmission line in the Medicine Lake area. Therefore, it is not necessary to discuss the potential impacts helicopter noise would have on property values in the Medicine Lake area. Contrary to

comment AG.161, the project would not introduce noise from plant operations and periodic in-fill well drilling in the Medicine Lake area. As described in the Draft EIS/EIR, these activities would only be encountered within the immediate wellfield and power plant area. As stated above, Medicine Lake is more than three miles from the proposed wellfield and plant site and therefore would not be effected by these activities.

The Draft EIS/EIR analyzes all aspects of the proposed project that have the potential to impact property values in the Medicine Lake area. This analysis includes detailed discussions of potential effects to the Medicine Lake area from visual, noise, recreation, air quality, and transportation issues associated with the proposed project. This analysis determined that the impacts associated with these issues would not have a significant impact on the Medicine Lake area, and with the exception if transmission line visibility, any potential impacts on the area could be mitigated to a less-than-significant level. Thus, it was concluded that the proposed project would not reduce property values in the Medicine Lake area.

It should be noted that Alternative 6 has been identified in this Final EIS/EIR as the lead agencies' preferred alternative. Alternative 6 uses segment A3 instead of segments A1 and A2, and would therefore avoid the unavoidable significant visual effect of the proposed action (Alternative 1) at Medicine Lake. In addition, Alternative 6 would use segment C2 instead of C1 near Tionesta, routing the transmission line approximately two miles further north of the community of Tionesta. Implementation of Alternative 6 would likely further reduce potential effects to property values at Medicine Lake and Tionesta in comparison to Alternative 1.

EFFECTS ON TOURISM

Comments—Effects on Tourism

A.63 According to the DEIS, the Medicine Lake Highlands, exhibits a clear demographic trend of increased recreational use (section 3.11). An estimated 40,000 recreationalists visit the area each year (pg. 3-157). However, under "Socioeconomic Impacts," no significant (negative) impacts are noted from the proposed Fourmile Hill operations or the possible future operation at Telephone Flat. We feel that the concurrent operation and/or construction of two power plants, with related noise, steam plumes, visible night lights (Telephone Flat), and a possible backdrop of a transmission line to the north of Medicine Lake, could have a significant and long term negative impact on recreational use and tourism in the area. The project(s) therefore could have a negative influence on the economic base of Siskiyou and Modoc Counties if people choose to stay away because of the proposed commercial development. The FEIS should include a section describing potential negative socioeconomic impacts from the Proposed Action, and carefully document methodology and assumptions.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

BX.4 And, here in California we receive $80 billion per annum based on international and national visitation to our state and national parks and forests. This makes the highlands part of an economic attraction which brings in more money than any other endeavor. Tourism is the biggest business in the State of California, in the U.S. and the world.

(Dean H. duVernet)

BZ.4 I've been a Park Ranger Naturalist and I understand our moral obligation to be guardians of this planet, but I also realize that tourism is the largest, most long-term sustainable business on Earth, in the U.S. and in California; and oil and geothermal extraction revenues, logging money, grazing payments and beef and sheep revenues and even the money made from California's agriculture all pale in comparison to tourism!! We receive $80 billion per annum here in California based mostly on international and national visitation to our state and national parks and forests!!!

(Dean H. duVernet)

EF.1 As an owner of a large B&B in Mt. Shasta I am constantly in contact with tourists in our area and since we have lost so much revenue from logging it is very important to preserve our wilderness type area to attract more tourists. It would be a crying shame to put this generating plant in an area as beautiful and wild as Medicine Lake Basin.

(Bill Larsen)

FD.3 Another concern is that this project is a "negative" type project. An analogy would be the prison that was proposed here. Any development of that type should be avoided. We need to increase tourism to bolster our impacted economy. A similar project proposed on the Island of Hawaii some time ago, was abandoned due to the many public concerns.

What do we have to sell to attract tourists to our area? The mountain, along with the beautiful, pristine country and atmosphere that so impresses visitors. While this may seem of minor concern, it is important to consider since we are talking about tourism, the largest, most desired industry for this area.

(H. K. "Bud" Miller)

Response—Effects on Tourism

The concerns of the comments regarding potential effects of the project on tourism are noted. As discussed in Section 4.11, Land Use and Recreation, and on pages 4-321 and 4-322 of the Draft EIS/EIR, it is not expected that the proposed project (either by itself or in combination with the Telephone Flat project) would have a significant impact on recreation or tourism in the area. While the projects would introduce geothermal power plants and a transmission line in the Highlands, these uses would occupy an extremely small area of the Highlands. In addition, geothermal wells already exist in the area, and the proposed project would simply build upon these existing uses. The majority of the Highlands would be unaffected by the proposed projects, and recreation use and tourism would be expected to continue (or possibly increase) at current levels.

Since the proposed project would not be expected to affect recreation, it would not be reasonable to expect the project to have a negative impact on tourism. Therefore it would also not be reasonable to expect that the project would have a negative influence on the economic base of Siskiyou or Modoc Counties due to people (i.e., recreationalists) choosing to "stay away." Any attempt to predict such changes would be highly speculative.

The proposed project would benefit the surrounding area by providing employment in an economically depressed region, and by generating tax revenues and royalties for the State and Siskiyou County. As stated in the Draft EIS/EIR, property tax payments to Siskiyou County over the first 20 years of the proposed project are estimated to be approximately $40 million (refer to page 4-308 of the Draft EIS/EIR). Furthermore, public revenue generated through royalties to the Federal government would total $15 to $20 million during the first 20 years of the project. Fifty percent of these royalties would be passed on to the State, and 40 percent would be passed to the county of origin. Thus, Siskiyou County would receive estimated revenues of $50,000 to $300,000 annually (see page 4-308 of the Draft EIS/EIR).

PUBLIC SERVICES

Comment—General Effects on Public Services

AG.160 The EIS/EIR repeatedly concludes that many potential impacts are insignificant, but provides no data to support its conclusions. Absent such information, the EIS/EIR fails as an informational document. Additionally, proposed mitigation measures fail to mitigate the Project's impacts to insignificance. Given that the EIS/EIR admits that the Project's impacts will be adverse and the proposed mitigation measures are inadequate, there is no basis to conclude that the Project will not have a significant impact.

The EIS/EIR states that the Project may result in an increased demand for police, fire protection, and emergency services, and thus have an adverse impact. (EIS/EIR, p. 4-303.) For example, the Project would increase demand for police services in the winter months. (Ibid.) Also, the increased potential for fire may adversely affect existing services. (Id. at pp. 4-303 to 4-304.) Nonetheless, the EIS/EIR assumes that this impact would be insignificant. (Id. at p. 4-303.) The EIS/EIR fails to provide any facts and analysis that would allow an independent evaluation of its conclusion. Without this information, the public and decisionmakers cannot determine whether the impacts are significant.

Proposed mitigation measure 4.16.7d, which requires Calpine to ensure that at least one person is trained in basic emergency aid during each of the Project's phases, fails to reduce the Project's impacts on public services. (Id. at p. 4-305.) This measure is inadequate because it is unclear whether only one worker will be trained. If so, the EIS/EIR does not contain any provisions for the worker's illness, incapacity, or vacation. Hence, to fully ensure the safety of the facility and environs, several workers should be trained in emergency aid. Absent adequate mitigation, the lead agency cannot find that the Project's impact on public services are insignificant.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—General Effects on Public Services

As stated in the Draft EIS/EIR on page 4-303, the proposed project may increase demand for police, fire protection, and emergency services. The impacts of these increases would be adverse, but not significant. The Draft EIS/EIR proposes several mitigation measures in order to reduce potential impacts to public services in the project area. These mitigation measures include establishing an emergency response facility at the plant site to assist the USFS fire organizations in emergency response, implementing a comprehensive safety program at the plant facility which would include safety training for all plant personnel, and hiring a private security company that would supply security guards at the power plant facility (see page 4-305 of the Draft EIS/EIR).

The commentor expresses concern that Mitigation Measure 4.16.7d fails to reduce the proposed project's impacts on public services (see page 4-305 of the Draft EIS/EIR). Collectively, the mitigation measures proposed in the Draft EIS/EIR will reduce the project's impacts on public services. Furthermore, Mitigation Measure 4.16.7d would provide for the training of at least one employee in basic emergency medical aid (such as wound treatment, bandaging, and CPR) during each of the three project phases in order to respond to potential on-site injuries. This mitigation measure would ensure that "at least one" person would be trained in basic emergency medical treatment. Therefore, at a minimum, one person would be trained in basic medical training at any given time during the project. However, the training would be offered on a project-wide basis, thus it is anticipated that several employees would be trained in basic emergency medical aid, and would be qualified to respond to potential on-site injuries. Please see the responses to "Comments—Effects on Police Services," "Comments—Effects on Fire Protection Services," and "Comment—Effects on Emergency Services" for further information on the project's potential effects on these public services.

Comments—Effects on Police Services

BQ.22 Homeowners in the Medicine Lake area have enjoyed a reasonable degree of security, for their cabins, during the winter months do to the remote location of the lake and snow cover. With the addition of the project and associated roads this security will be lost. The draft EIS/EIR does not address the cost to Siskiyou County for increased sheriffs patrol activity and the potential losses incurred by homeowner by theft or vandalism as the result of increased accessibility resulting from highway development.

(S. Peder and Suzanna S. Cuneo, et al.)

HT.11 How will cabin area be policed during winter & spring months when cabin owners are absent But the additional roads and snowplowing will allow widespread travel by outsiders - could result in vandalism.

(Louise Thompson)

FP.18 The proposed project will also include winter maintenance of roads not traditionally kept open. As outlined on page 2-21, increased traffic and use of these roads will occur in the winter. The majority of cabins at Medicine Lake are used only in the summer months, and are left unsecured in the winter because there is no access due to the high volume of snow. The project will open roads currently unavailable for use. Please address in the Final EIS/EIR how the project proponents will ensure the security of the Medicine Lake cabins due to the increased access and vehicular traffic during winter months.

(Eric T. Nelson)

PH5.12 How well will the cabin area be policed during winter and spring months when cabin owners are absent but the additional roads and snowplowing will allow widespread travel by outsiders; could result in vandalism.
(Medicine Lake Public Hearing)

Responses—Effects on Police Services

As stated in the Draft EIS/EIR, current levels of police services in the Medicine Lake area during the months of June through October would be sufficient to accommodate a temporary influx of 160 construction workers to the area. During the final year of construction, 75 construction workers would be working at the power plant and wellfield area during the winter months.

Access to the Medicine Lake area would be extremely limited in the winter months. The only roads that would be kept open during the winter that are traditionally not kept open would be Forest Roads 44N01 and 44N64. Forest Roads 44N01 and 44N64 do not provide access to the Medicine Lake area. These roads only extend to the proposed project site and would not provide a means for accessing the Medicine Lake area in the winter months. Thus, the maintenance of Forest Roads 44N01 and 44N64 would not provide increased access and vehicular traffic into the Medicine Lake area in the winter months. Access methods to the Medicine Lake area in the winter would be the same regardless of the implementation of the proposed project.

Due to the inaccessibility into the Medicine Lake area in the winter, it would not be necessary to increase police patrol in this area. It is not anticipated that homeowners would experience higher rates of vandalism and theft with implementation of the proposed project due to inaccessibility in the winter months, and the current, adequate level of police patrol in the summer months (June to October).

Comment—Effects on Fire Protection Services

AG.154 The EIS/EIR fails to fully evaluate the ability of agencies to respond to structural fires. It notes that the U.S. Forest Service, California Department of Forestry, and National Park Service are primarily equipped to fight wildland fires, but have limited capacity to fight structural fires. (EIS/EIR, p. 3-211.) Although Siskiyou and Modoc counties can provide some structural fire-fighting services (ibid.), it is unclear whether these services are sufficient. The Tulelake Multi-County Fire District, located in Modoc County, has one firehouse in the Newell area. (Ibid.) Without more information, the lead agency cannot evaluate this issue and propose necessary mitigation measures.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Effects on Fire Protection Services

As stated in the Draft EIS/EIR, measures have been proposed to reduce potential occurrences of fire associated with the proposed project. The plant facility would be constructed with required hydrants, sprinklers, and a deluge system. In addition, a fire contingency plan would be implemented, and all personnel would be familiar with this plan in case of a fire (see page 4-304 of the Draft EIS/EIR). Furthermore, Mitigation Measure 4.16.7a provides for the establishment of an emergency response facility at the plant site to assist the USFS fire organizations in emergency response. The facility would include the equipment necessary to provide a first response to emergency situations at the plant site until the arrival of the USFS fire organizations (see page 4-305 of the Draft EIS/EIR).

The Draft EIS/EIR states that the USFS provides fire-fighting services on the Klamath and Modoc National Forests. The USFS fire-fighting program focuses primarily on wildland fires, but it also has a limited capacity to fight structural fires. The USFS has

cooperative agreements with the National Park Service and California Department of Forestry (CDF) to provide additional fire-fighting services. Furthermore, Siskiyou and Modoc Counties would provide additional fire-fighting services in the case of structural fires in the Forest. If a structural fire were to occur, it would most likely be located at the power plant site. The power plant site would occupy 10.5 acres (including a 50-foot fire break) and would easily be contained by the fire-fighting efforts provided by the Klamath and Modoc National Forests, the National Park Service, the California Department of Forestry, and Siskiyou and Modoc Counties. For further discussion on the less-than-significant effect the proposed project would have an fire protection services, please see the response to "Comments—Wildfire Generation" in the Human Health and Safety Section.

Comment—Effects on Emergency Services

AG.155 Additionally, the EIS/EIR states that the Project would have an adverse effect on emergency services because Project-related injuries may increase the demand for emergency services. (Id. at p. 4-304.) The EIS/EIR states the impact is insignificant, but affords no basis for its conclusion. (Ibid.) The EIS/EIR should provide injury rates at comparable facilities, such as the Geyers, that will allow a determination of whether the impact on emergency services is significant.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Effects on Emergency Services

As stated in the Draft EIR/EIS on page 4-304, injuries related to construction activities may increase the demand for emergency services in the project area. Due to the uncertainty of the type or frequency of injuries requiring emergency services, it is not possible to predict at this time the demand for emergency services associated with project construction. However, in order to respond to potential emergencies, Calpine would have a full complement of first aid equipment at the construction sites. Due to the remoteness of the proposed project area, Calpine would assume responsibility for the transport of any injured personnel to hospitals or other treatment facilities. Vehicles would be available for transport of injured personnel, and Calpine would secure a helicopter to transport injured personnel, if necessary. A detailed Emergency Contingency Plan would be prepared by Calpine. This plan would detail all emergency response measures for the project. For additional information regarding worker safety, see the response to "Comments—Accidental Releases of Hazardous Materials" in the Human Health and Safety Section.

During Calpine's eight years of operations at The Geysers, there have been a total of three injuries (40 Calpine employees are involved with operations at The Geysers) which have required emergency services, and it is anticipated that the proposed project would have a similar safety record. Calpine's planned measures for accident and injury prevention would reduce the need for emergency services. Thus, it was determined that the proposed project would have an adverse, but not significant, effect on emergency services in the area.

SOLID WASTE DISPOSAL

Comments—Solid Waste Disposal

AG.156 The EIS/EIR also fails to provide sufficient information regarding solid waste disposal. The Project will generate trash, mud sacks, oil, cardboard, excess concrete, scrap lumber, paper, plastic packaging, construction debris, septic waste, cooling tower sludge, and sulfur cake during construction and operations. (EIS/EIR, pp. 2-17, 2-32, 4-306.) Cooling tower sludge and sulfur cake would have to be disposed of in accordance with local, and federal regulations. (Id. at pp. 4-306 to 4-307.) The EIS/EIR

identifies three Class III landfills located in Siskiyou County and five Class II landfills located in Modoc County. (Id. at p. 3-213.) The closest landfill, which is in Tulelake in Siskiyou County, is slated for closure in 2001. (Ibid.) The EIS/EIR states that these landfills have sufficient capacity to accommodate the Project's solid waste and that the Project would not have a significant effect on landfill capacities. (Id. at p. 4-306.) This discussion is inadequate for several reasons.

First, the EIS/EIR never quantifies the landfill capacities, which makes it impossible to assess whether the landfills have sufficient capacity to accommodate the Project's solid waste. Second, the EIS/EIR also fails to provide information about the landfill's distance from the Project site. Thus, it is impossible to assess whether it is feasible or realistic for the Project to utilize all of the landfills. Additionally, hauling solid waste over long distances may have other environmental effects that should be evaluated (e.g., public safety hazards from accidents, roadway degradation, impacts on air quality). Finally, the EIS/EIR does not provide all of the landfill closure dates. If several landfills close during the Project's 45-year life, then the Project's solid waste disposal may have a significant impact. Hence, the lead agency should provide more information about the Project's effect on solid waste disposal. Without this information, the public and decisionmakers cannot assess the Project's impact.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.157 The EIS/EIR also fails to discuss potential impacts associated with storage, transportation, and disposal of potentially hazardous wastes generated by the Project. This includes cooling tower sludge (4 to 12 dry tons per year), and sulfur byproducts from the H2S abatement system (240 wet tons per year if Stretford system used). (EIS/EIR, p. 2-33.) The EIS/EIR acknowledges that there are no Class I landfills (for non-RCRA toxic wastes) or hazardous waste treatment facilities in either Siskiyou County or Modoc County. Thus these wastes must be shipped elsewhere for treatment. (EIS/EIR, p. 3-213.) Yet, the EIS/EIR fails to address these wastes in its analysis of effects on solid waste disposal facilities. (EIS/EIR, ß 4.16.9.) These impacts should be addressed and included in the EIS/EIR.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Solid Waste Disposal

It is anticipated that the majority of non-hazardous solid waste produced by the proposed project would occur during the construction and drilling phases. As stated in the Draft EIS/EIR on pages 2-17 and 2-32, the construction and drilling phases of the project would produce excess mud sacks, rags, cardboard, concrete, scrap lumber, paper, and plastic packaging that would require disposal. However, solid waste disposal of these materials would only be necessary during the construction and drilling phases of the project. These phases would occur during the first three years of the proposed project. The above materials would be disposed of in Class II and/or Class III landfills, depending on the composition of the waste produced.

As stated in the Draft EIS/EIR, three Class III landfills are located within Siskiyou County. The locations of these landfills include Mt. Shasta, Tulelake, and Yreka. Contrary to comment AG.156, distances from the proposed project area to the various landfills can be determined by using Figure 2.2-1 of the Draft EIS/EIR. Using Figure 2.2-1, the Tulelake landfill is located approximately 25 miles from the proposed power plant and wellfield area. Comment AG.156 is correct in noting that the Tulelake landfill is scheduled for closure in the Year 2001. However, Siskiyou County is currently pursuing a plan to expand the Tulelake landfill and postpone closure. If the Tulelake landfill closes despite the County's plan, then Class III solid waste produced by the proposed project would be disposed of at the Yreka landfill, located 43 miles from the project site.

Five Class II landfills exist in Modoc County. The closest of these landfills to the project site is the Alturas landfill, located approximately 60 miles from the proposed power plant and wellfield area. Class II solid waste produced by the proposed project would be disposed of in the Alturas landfill.

As stated in the Draft EIS/EIR on page 2-213, the Yreka landfill has a projected closure date of 2109, and the Alturas landfill has a projected life of more than 100 years. Thus, it is anticipated that the solid waste produced over the three-year construction phase of the project would not exceed capacities of the landfills, which when combined, have a projected life of more than 211 years.

Regarding the potentially hazardous wastes referenced in comment AG.157 (cooling tower sludge and sulfur by-products), appropriate technologies would be used to ensure that these waste products would be considered non-hazardous. Examples of these technologies include the use of carbon filters for the cooling tower sludge to reduce concentrations of mercury and other potentially hazardous wastes, and the rewashing of cooling tower sludge to reduce concentrations of vanadium. These technologies have been successfully used by Calpine and other geothermal operators at geothermal operations throughout California to ensure that cooling tower sludge and sulfur by-products meet the requirements for non-hazardous classification (refer to the response to "Comments—Hazardous Waste Production and Disposal" in the Human Health and Safety Section for additional information). Thus, with implementation of these technologies, the cooling tower sludge and sulfur by-products would be considered non-hazardous, and any sludge or by-products requiring disposal would be disposed of at the five Class II landfills located in Modoc County. These landfills have adequate capacity to accommodate these wastes.

WASTEWATER DISPOSAL

Comments—Effects on Wastewater Treatment

PH3.105 How 'bout sewage? What are you going to do with that? *(Yreka Public Hearing)*

PH3.106 You are going to pump your sewage into the well? *(Yreka Public Hearing)*

Response—Effects on Wastewater Treatment

As discussed on pages 2-32 to 2-33 and 4-305 to 4-306 of the Draft EIS/EIR, human waste sewage generated at the proposed power plant would be collected in an on-site septic tank, and treated through an on-site septic system. The septic tank sludge and effluent that would be generated would be removed approximately once a year during the summer months by a licensed commercial septic tank pumping service. The sludge and effluent would then be disposed of in accordance with applicable regulations.

The proposed project would also generate "gray" water, which is domestic water not associated with the septic system. This wastewater would be injected along with spent geothermal brine into the geothermal reservoir through the geothermal injection wells. This method of disposal for gray water is a standard practice at other geothermal fields such as The Geysers and Coso. The casing and cementing procedures for the geothermal injection wells would ensure no contamination of the shallow groundwater in the area from this wastewater (for more information on well casing procedures, see the response to "Comments—Well Casing Program and Potential for Casing Rupture" in the Hydrology Section of this document). All wastewater disposal would be conducted in accordance with BLM regulations, and would meet the requirements of the EPA's Underground Injection Control (UIC) program.

PUBLIC FINANCE

Comments—Potential Economic Benefits of the Project

EW.5 The developer will be required to pay a royalty of 10% of the gross value of this steam. This royalty will be paid to the Federal Government and half of this royalty will be returned to the State and County of origin. This project will generate more revenue per year for the Federal, State and County governments then the entire timber receipts of the Klamath National Forest for 1997. With the significant decline in timber revenues from the National Forest, this project will help to offset the negative impacts of lost of timber revenues on Siskiyou County and the Federal treasury. *(David W. McClain)*

HY.9 On page 3-214, Table 3.16-3: Sources of Public Finance in 1995-1996 didn't show one ounce of evidence of economic benefits of this project for the local communities. Again, there has to be returns on public finance to show that what you stated in your purpose and needs are indeed true. Otherwise this project is just another way of digging a black hole into the taxpayers' pockets. *(Alice Tseng)*

PH1.32 Supposedly Siskiyou County is going to benefit in some ways; I haven't heard anybody tell me exactly in any way I am interested. I mean, after all, we all know how we feel about the water going to Los Angeles. *(Dorris Public Hearing)*

PH3.94 How much is Siskiyou County going to make on this deal? How much do they get paid? *(Yreka Public Hearing)*

PH4.59 What are the public benefits of the project to the local counties and residents? *(Mount Shasta Public Hearing)*

PH5.80 I read an article in the Alturas paper on March 31st, and I'm kind of curious to see if it's accurate. And I hope it's not a bunch of baloney. I'd like to read it and see if it is. I wanted to mention also that our company, we are one of the major tax payers, and probably the largest employer in Modoc County, except for the Forest Service, but—so I'm conscious of taxes very much. One of the things that—we're always looking for help too. I just want to know if this is true, it's written in the paper, it says, "The decision whether to allow construction of the plant could come later this year. Calpine states the plant will employ nineteen people. The company would pay an estimated 1.3 million in property taxes and another twenty to twenty-five million in royalties to the federal government. One half of those funds would be returned to the State of California, and forty percent would be distributed to the county where the power plant and transmission lines are located." So I just run some basic calculations. I thought that this area, if this is true, could benefit by probably five to seven, eight million a year from this in taxes; is that true or not? *(Medicine Lake Public Hearing)*

PH5.100 I was asking about this concern of how much money our area is going to get out of it, so I tried to, in my calculations on what was recommended—was written in the paper. If you break it down to over twenty years per year, the property tax would bring about sixty-five thousand a year for the entire area. I guess that would be Siskiyou County. And probably the power line going through Modoc, too, some. And the royalty would—according to the—based on four million royalty for a portion, would amount to about twenty-two hundred—thousand a year. So it's—I was hoping that was all one year, but it's twenty years. Makes not quite so much. *(Medicine Lake Public Hearing)*

Response—Potential Economic Benefits of the Project

Comment EW.5 is noted. In response to comment HY.9, Table 3.16-3 depicts sources of revenues for Siskiyou and Modoc Counties before implementation of the proposed project. On page 4-308 of the Draft EIS/EIR, it states that during the operational phase of the project, the State and Siskiyou County would receive revenues from the project as a result of property taxes paid by Calpine. Estimated property taxes for the project would be based on the capital costs of the project, and would be approximately $1.3 million per year for the first five years of project operations, with a gradual decline in subsequent years. Property tax payments to Siskiyou County over the first 20 years of the project are estimated to be $20 million.

Public revenue would also be generated through royalties paid to the Federal government. Current estimates are that Federal royalty payments for the proposed project would total $15 to $20 million during the first 20 years of the project. Currently, 50 percent of these royalties are retained by the Federal government, and 50 percent are passed on to the state of origin. Of the state's portion, 40 percent is returned to the county of origin. The royalty sharing would result in an estimated revenue to Siskiyou County from Federal royalties of $3 million to $5 million over 20 years, approximately

$50,000 to $300,000 annually. The project, therefore, would provide economic benefits for the local economies and communities.

3.18 Cumulative Effects

INTRODUCTION

This section provides responses to comments on issues related to cumulative effects. The comments and responses are grouped under the following headings:

- Cumulative Projects
- Cumulative Effects

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

CUMULATIVE PROJECTS

Comments—Reasonably Foreseeable Geothermal Development

A.4 Our objections also incorporate issues raised by the proposed construction of at least one additional geothermal powerplant/wellfield (Telephone Flat), including the uncertainty of actual life of operations for either proposed project, and associated cumulative impacts. EPA views these two actions as similar actions in keeping with 40 CFR 1508.25(a)(3). Accordingly, we suggest that they be addressed in a single EIS. An Agency, according to 1508.25, should do so "...when the best way to assess adequately the combined impacts of similar actions or reasonable alternatives ... is to treat them in a single impact statement."

Similarly CEQ's Forty Most Asked Questions (24b) encourages area-wide or overview EISs "...when similar actions, viewed with other reasonably foreseeable or proposed agency actions, share common timing or geography. For example when a variety of energy projects may be located in a single watershed..." EPA also references comments made by California Energy Company (comment letter dated December 4, 1996 addressing the Fourmile Hill Area Geothermal Exploration Project EA), proponents of the Telephone Flat project, which strongly endorsed' combining environmental documents for "complete evaluation of environmental consequences.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

D.7 While the Draft EIR/EIS does address the cumulative effects from both the Fourmile Hill Geothermal project and the associated Telephone Flat project, the Draft EIR/EIS should also include the environmental repercussions of full buildout of the KGRA. The Draft EIR/EIS indicated that the potential geothermal resource was originally estimated at 500 MW of electric power. An analysis of the cumulative environmental impacts of meeting this target should be addressed. This should include the amount of habitat that would be affected if future power plants, well pads, road construction, etc., would be built if the 500 MW target was met. *(Richard L. Elliott, California Department of Fish and Game)*

T.5 The project files contain numerous pieces of correspondence, some dating back to 1979, that warn the BLM and USFS to do a comprehensive environmental review of commercially developing the Glass Mountain KGRA. Potential geothermal developers and private citizens alike pressed for cumulative, full build-out projections and reviews. *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

T.7 In addition, CalEnergy and a third, unidentified party are known to be planning other geothermal energy plants at Telephone Flat and elsewhere in the Glass Mountain KGRA. Finally, transmission line capacity is intentionally being proposed to accommodate additional future, but unanalyzed, power production (please see DEIS/EIR pp. 2-37 and 2-38).

(Linda L. Blum, Medicine Lake Citizens for Quality Environment)

T.14 Cumulative effects of all known and reasonably foreseeable geothermal energy developments in the Glass Mountain KGRA have still not been disclosed and evaluated.

(Linda L. Blum, Medicine Lake Citizens for Quality Environment)

U.25 The cumulative effects of all proposed and possible future geothermal developments within the Glass Mtn. KGRA must be addressed. A full disclosure and analysis of the environmental consequences must be made. Cumulative significant impacts will occur with each new proposed project. Future developments must not be piecemealed, their impacts must be addressed now. According to the Draft EIS/EIR, the cumulative effects of the Calpine and CalEnergy geothermal projects are not considered significant. How can that be, when TWICE the impacts on the environment, on the wildlife, on cultural resources and on every aspect of the Medicine Lake Highlands will occur?

(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)

V.25 Moreover, when other proposed and likely geothermal power plants are in operation, the cumulative impacts of their emissions may be even greater, but the EIR doesn't consider those cumulative impacts.
(Carol Plank, Medicine Lake Citizens for Quality Environment)

W.2 They are not talking about two power plants-in reality it will be six and possibly more.
(Carole Plank, Medicine Lake Citizens for Quality Environment)

Y.11 The proposed development appears to be a "foot-in-the-door" project which would usher in at least two and possibly five other geothermal projects, with a cumulative effect of industrializing the Medicine Lake Highlands and creating urban levels of visual, noise, water and air pollution as well as acres and miles of industrial blight. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AD.26 5. Cumulative effects of the proposed action with other foreseeable geothermal projects, including but not limited to the Telephone Flat project and a third development that is admittedly in the works, are not adequately analyzed in the EIS/EIR. Since the six leases awarded in the 1980s are not merely exploratory but are clearly preliminary to project development, the cumulative effects of all six leases should be analyzed in a master EIS/EIR. *(Floyd J. Buckskin, Pit River Tribe)*

AD.28 The 1984 EA states that the area has the potential for ten geothermal plants... Adequate analysis would indicate that the impacts, far from being "insignificant" (even for one plant they are not insignificant), would radically change the character, setting, biological and climatic make-up of the Medicine Lake Highlands and the Dry Lake area. The overall change would be from an area that is largely pristine and in its natural state, to an industrial area with miles and hundreds of acres of transmission lines, pipelines, plants parking lots, well pads, roads, etc. As a result of this grave omission, the discussions of the impacts of the proposed Fourmile Hill project on plants and wildlife, on water and air quality, on the Native American cultural character and setting, on visual quality, and on recreation, are inadequate and misleading. This amounts to avoidance of full disclosure of the significance of the effects and their impacts on the environment. *(Floyd J. Buckskin, Pit River Tribe)*

AG.12 The EIS/EIR is rife with references to expansion of geothermal production in the Glass Mountain KGRA. The EIS/EIR states that the geothermal resource has been estimated to have the potential to produce 500 MW of electricity over a 30-year period. (EIS/EIR, p. 2-38.) The scoping process has already begun for CalEnergy's proposed 48 MW generation plant. (EIS/EIR, p. 4-311.) And both Calpine and CalEnergy have publicly stated that, if the resource proves out, they will expand their geothermal production capacities.

The EIS/EIR states that development of the KGRA's 500 MW potential "is not considered to be reasonably foreseeable at this time." (EIS/EIR, p. 2-38.) This is based on the fact that only two projects totaling 90 MW are currently under consideration. (Ibid.) But other references in the EIS/EIR indicate that significant expansion is, in fact, reasonably foreseeable.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.15 Failure to analyze the potential impacts associated with all reasonably foreseeable production activities violates CEQA's mandate that environmental review not be circumvented by chopping projects into little pieces. The fact that the other projects are not as defined as Calpine's is no justification for failing to analyze these impacts. (See, e.g., City of Antioch v. City Council (1986) 187 Cal.App.3d 1325 [232 Cal.Rptr.507] (the lack of specific development proposals does not negate the fact that installing major infrastructure has growth-inducing effects that should be analyzed; EIR would simply be less specific and more focused on secondary impacts than an EIR prepared for a specific proposal).)

The EIS/EIR should be revised to evaluate all reasonably foreseeable production activity within the Glass Mountain KGRA. Otherwise, the public and agency decisionmakers may not know the full impacts of this development until it is too late.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.168 "Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time." (14 CCR § 15355(b).) Because of this potential additive effect, "[t]he full environmental impact of a proposed... action cannot be gauged in a vacuum." (Whitman v. Board of Supervisors of Ventura County (1979) 88 Cal.App.3d 397, 408 [151 Cal.Rptr. 866] (quoting Akers v. Resor (W.D. Tenn. 1978) 443 F.Supp. 1355, 1360.) For these reasons, NEPA and CEQA require an EIR to discuss a Project's potential cumulative impacts when combined with past, present, and reasonably anticipated future projects. (40 C.F.R. § 1508.7; Cal. Pub. Res. Code § 21083(b), 14 CCR §§ 15130(b), 15355(b).)

A cumulative impact analysis must contain the following elements:

Either:

A list of past, present, and reasonably anticipated future projects producing related or cumulative impacts, including those projects outside the control of the agency, or

A summary of projections contained in an adopted general plan or related planning document which is designed to evaluate regional or area-wide conditions...;

A summary of the expected environmental effects to be produced by those projects with specific reference to additional information stating where that information is available; and

A reasonable analysis of the cumulative impacts of the relevant projects. An EIR shall examine reasonable options for mitigating or avoiding any significant cumulative effects of a proposed project. (14 CCR § 15130(b).)

CEQA's cumulative impact analysis requirement must be interpreted to afford the fullest possible protection to the environment. (Citizens to Preserve the Ojai v. Board of Supervisors (1985) 176 Cal.App.3d 421, 431-32, 222 Cal.Rptr. 247; Kings County Farm Bureau v. City of Hanford (1990) 221 Cal.App.3d 692, 720, 270 Cal.Rptr. 650.)

The courts have vigorously enforced the obligation to consider cumulative impacts. As the court stated in Citizens to Preserve the Ojai v. County of Ventura (1985) 176 Cal.App.3d 421, 431 [222 Cal.Rptr. 247], quoting San Franciscans for Reasonable Growth v. City and County of San Francisco (1984) 151 Cal.App.3d 61, 79 [198 Cal.Rptr. 634]:

[I]t is vitally important that an EIR avoid minimizing the cumulative impacts. Rather, it must reflect a conscientious effort to provide public agencies and the general public with adequate and relevant detailed information about them." [Citation.] A cumulative impact analysis which understates information concerning the severity and significance of cumulative impacts impedes meaningful public discussion and skews the decisionmaker's perspective concerning the environmental consequences of a project, the necessity for mitigation measures, and the appropriateness of project approval. [Citation.] An inadequate cumulative impact analysis does not demonstrate to an apprehensive citizenry that the governmental decisionmaker has in fact fully analyzed and considered the environmental consequences of its action.

A lead agency must find that a project may have a significant effect on the environment if "[t]he possible effects of a project are individually limited but cumulatively considerable." (Cal. Pub. Res. Code § 21083(b); see also 14 CCR § 15065(c).) The fact that a particular project's incremental impact is not significant, or is relatively small when compared to the greater overall problem, does not mean the project does not have significant cumulative impacts. This theory was rejected in Kings County because it would "allow the approval of projects which, when taken in isolation, appear insignificant, but when viewed together, appear startling." (221 Cal.App.3d at pp. 720-21.) The proper standard for a cumulative impacts analysis is whether the impacts are "collectively significant." (Id. at p. 721, citing 14 CCR § 15355.)

Nor does uncertainly about a Project's potential cumulative impacts excuse the lead agency from analyzing those impacts. (Terminal Plaza Corp. v. City and County of San Francisco (1986) 177 Cal.App.3d 892, 904-905 [223 Cal.Rptr. 379].) As previously discussed, an agency must use its best efforts to discover and disclose all information reasonably possible. (14 CCR § 15144.)

Even if the lead agency finds that there are no significant cumulative impacts, the EIS/EIR must explain the basis for that conclusion. (Terminal Plaza., 177 Cal.App.3d at pp. 904-905.)

As discussed above under the project Piecemealing comments, the EIS/EIR fails to adequately inform the public and the agency decisionmakers about cumulative impacts from full development of the Glass Mountain KGRA. The EIS/EIR recognizes that an adequate discussion of cumulative impacts requires an analysis of all past, present and reasonably anticipated future projects. (EIS/EIR, p. 4-310.) The EIS/EIR also acknowledges that future development of the geothermal resource beyond the level formally proposed by Calpine and CalEnergy projects is reasonably foreseeable. (See comments in section III, above.) Nevertheless, the 48 MW CalEnergy project is the only other geothermal project deemed "reasonably foreseeable" and analyzed in the EIS/EIR's cumulative impact section. (EIS/EIR, Table 4.17-1, p. 4-311.) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.169 The failure to analyze these reasonably foreseeable future geothermal projects violates NEPA and CEQA. The EIS/EIR should be revised to analyze 300 MW of production, at a minimum. (See Ex. B, § 2.0; Ex. C, Comments 2, 3, 4 (the transmission line's 145 MW "effective capacity" could easily be brought up to the 300 MW design capacity or, alternatively, the plants could simply shut down when the transmission grid became overloaded).) Section 4.18 of the EIS/EIR, which discusses the Project's growth-inducing impacts, identifies many of the issues that the cumulative impact analysis should have discussed. (EIS/EIR, § 4.18, pp. 4-330-332.)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.268 The project description appears not to include the reasonably foreseeable cumulative project which could involve upgrading or building a second line parallel to the existing BPA Malin-Warner line in order to carry the increased load.

The Draft EIS/EIR states (p. 2-38):

The geothermal resource at the Glass Mountain KGRA was initially calculated to have the potential to produce an estimated 550 MW of electric power."

"reasonably foreseeable projects (in the Glass Mountain KGRA) would generate an estimated total net electrical power output of 90 megawatts"

"The Proposed transmission line would have an effective capacity of 145 MW, although it would have a design capacity of 300 MW to the tie-in with the BPA Malin-Warner line. The reason that the effective capacity of the proposed transmission line would be limited to 145 MW is due to limitations in electrical loading capabilities of the BPA Malin-Warner transmission line."

"If the electric load on the proposed transmission line were to be increased to over 145 MW, the combination of this load with moderate wintertime south-to-north power flow conditions would cause the PacficCorp transmission line system to become unstable. Since moderate wintertime conditions occur much more frequently than heavy wintertime conditions, system instability would occur much more frequently with higher electric loads".

The combination of these points suggest that full development of the Glass Mountain KGRA geothermal resource is reasonably foreseeable and could require upgrading or duplication (doubling) of the Malin-Warner transmission line. This development would have far greater impacts than the transmission line associated only with the current Fourmile Hill project. The EIS/EIR should address the impacts of building another transmission line in the BPA Malin-Warner corridor.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AI.5 We also ask that you examine all reasonable foreseeable actions in selecting the final transmission routes. For example, the upcoming EIS process for the Telephone Flat identifies another potential project that could present interconnection issues with the preferred routes for the Four Mile Hill project. Taken together, is the preferred route for the Four Mile Hill project also a route that minimizes impacts when a subsequent project is developed? *(Rachel Shimshak and Peter West, Renewable Northwest project)*

AR.2 (2) You have not addressed the total impact of six plants, not just Fourmile and Telephone Flats, at an average of 640 acres per plant (not counting transmission lines) that comes to a total of 3,840 acres.

(Marcia Barrow)

BP.5 3) The Draft EIS/EIR is totally inadequate as it fails to address the cumulative environmental effects of the development of geothermal power within the Medicine Lake area.

Although Calpine's project proposal is to construct only one 49.9MW power plant, the project requests approval for the construction of a transmission line that can serve up to six 49.9 MW plants. The Draft EIS/EIR does not even attempt to address the potential environmental impact of several plants, all in operation concurrently. This assessment must be done in order to accurately assess the cost of development of geothermal power in this environmental sensitive area.

(S. Peder and Suzanna S. Cuneo, et al.)

DI.2 1. Cumulative effects were not studied in the Draft EIS/EIR. What would the impact of up to six power plants be on all aspects of the environment in the Medicine Lake Highlands? We do not know!

(Ana Holub and Richard Lucas)

DT.4 Second: The Draft EIS/EIR does not sufficiently account for the cumulative damage to the Medicine Lake region that will result from the planned development of multiple geothermal power plants in the area. In light of the fact that there are at least two more power plants planned for the Medicine Lake area, the Forest Service, Bureau of Land Management, and other oversight agencies should more fully disclose the combined effect that these plants will have on the region. *(Carolyn D. Jones)*

EB.2 From what I've read, there seems to be some question about the full extent of the development. I've read that there may be as many as six generating plants. If this is the case, then the environmental impact report should cover them all and development should not be allowed to start until it is determined that the area will not be damaged. *(Harry Kraft)*

FP.24 The geothermal resource in the KGRA is not going anywhere in the near future. It would behoove the public to do a more thorough job in analyzing the true size and effects of all proposed development associated with the KGRA, that is what the "spirit of NEPA and CEQA" refers to, is it not?

(Eric T. Nelson and Martha Spencer)

HA.6 2. CUMULATIVE EFFECTS: The interim scoping report for the proposed action on Page 25 states, the transmission line voltage of 230 KW was selected to accommodate potential future development in the Glass Mountain KGRA. (Footnote: the lower voltage may not adequately accommodate with future development). A 230 KW transmission line can accommodate six power plants. The Fourmile Hill project is the first, Telephone Flat is next, and at the August 30th, meeting at Medicine Lake, you admitted that Mt. Hoffman was already on the drawing board. Now we are up to three! By not addressing this capability the whole EIR/EIS is in direct violations of NEPA Code: 1508.7, Cumulative Impact, and CEQA Code: 15165. Not one section in the EIS/EIR addresses the total cumulative effects of the foreseeable future. *(James Shott)*

HF.17 Page S-12: Cumulative Effects: the ES rightly concludes that "The project could result in significant cumulative effects through the potential for conflicts with religious use of the area by local tribal members. The temporary noise and air quality effects from project construction could be cumulatively

significant if they overlapped with other projects, such as the proposed CalEnergy Telephone Geothermal project." This is a major weakness of the whole ES and EIR/EIS: there is no comprehensive study of the cumulative impact of the many (up to 6) different geothermal projects being considered for the Medicine Lake Highlands. I am all too familiar with what has happened to the region of the Geysers Geothermal Projects north of San Francisco: the cumulative effects have destroyed the ecological integrity and original beauty of that once pristine area. Yet at least the proximity of the Geysers to the San Francisco Bay Area can provide some justification for its development. There is no similar justification for developing the Medicine Lake Highlands, which lie hundreds of miles from the nearest metropolitan area and represent on of the last pristine volcanic-geothermal-ecological complexes in the country. *(Daniel T. Spencer)*

HK.2 My largest concern with the project revolves around the scope and potential for the total immersion of the Glass Mountain Unit Area Leaseholdings into a conglomeration of future geothermal power production sites. The Environmental Impact Statement does not address the fact that Calpine and Cal Energy have in the past shared ownership interest in several geothermal lease holdings. The fact the Calpine would draw up plans for a transmission line with the capacity to carry 5 geothermal power plants of similar design and size demonstrates a clear necessity to consider the total potential development of the Medicine Lake highlands. The fact that Calpine would even propose a transmission line that would cut in front of Glass Mountain, skirt the Northeast shore of Medicine Lake and conveniently connect with the Cal Energy site is galling. *(Marshall Staunton)*

HU.2 Unfortunately, the cumulative effects of all potential geothermal development within thw Medicine Lake Highlands have not been analyzed as required by NEPA & CEQA. The USFS & BLM are piecemealing in one power plant at a time while the transmission line being built has the potential to carry the output of 6 power plants. *(Louise Thompson)*

IB.6 The Draft EIR/EIS does refer to a forthcoming CalEnergy Telephone Flat proposal, but it appears that many more geothermal development proposals may be forthcoming in the future, and the cumulative impacts of these future proposals have not been evaluated in the Draft EIR/EIS. *(Wayne Verrill)*

IE.1 Concerned people of Siskiyou County, where are you? Have you heard about the proposed geothermal development in Medicine Lake Highlands? They are not talking about two proposed power plants but six or more. *(Alysa Waring)*

II.1 In regard to the Fourmile Hill and Telephone Flat Geothermal Projects within the Medicine Lake Highlands. I am a homeowner at Medicine Lake and very concerned about the effects of the projects upon the Medicine Lake area.

I don't feel enough study has been made by the USFS/BLM at this time on the effects of the power plants and the potential geothermal development within the Medicine Lake area. If one power plants built, in a short time there will be several. *(Vivian Wells)*

IM.6 Once started, the pressure to maximize the geothermal potential to the limit of what the 21 mile transmission line could carry would increase. Other leaseholders would find it increasingly attractive. If the line could accomodate six 48MW plants and they were built the whole area would be devastated, cut up with pipelines, lighted towers, vapor plumes, concrete pads, wells, drilling deposit ponds, fences, firebreak transmission lines and roads.

Since the present EIS/EIR finds less than significant impacts on water and air quality and species-habitat reduction, and suggests people can recreate elsewhere if they are bothered (Sec. 4.11) it leads me to question what impacts would be significant and unacceptable. How much noise of well drilling for up to three years for each 48MW plant would be unacceptable? Is ten or twenty years of construction for six projects likely? Acceptable? *(Brenda Willey)*

IQ.3 The effects of this project are of particular concern in light of current plans for at least one and possibly two other companies to establish geothermal projects in the area. *(Phil Woodward)*

PH3.52 I understand they are actually a proposal for six plants, each under 50 megawatts apiece in that area. And I would like to know if that is true. *(Yreka Public Hearing)*

PH3.53 I was told today that there—that is, they expected to build six plants of this magnitude, which is just under 50 megawatts. And the reason why they are limited to 50 megawatts is because if they go higher, they get into a regulatory agency that may look a little less favorable upon the project. *(Yreka Public Hearing)*

PH3.54 It appears that it is estimated that there is about 500 megawatts of geothermal power there. That's what I read in that document. Can anybody comment on that? *(Yreka Public Hearing)*

PH3.55 So if you did develop the 500 megawatts, you would essentially have ten plants of this size, right? *(Yreka Public Hearing)*

PH3.80 So if you are going to do three to 500—500 into 1300, this is a third as big as The Geysers if you do the total development? *(Yreka Public Hearing)*

PH3.81 There is a potential for 500 megawatts. The conclusion is that that power will be needed into the next century and it probably will be. *(Yreka Public Hearing)*

PH3.82 What cumulative effects of several power plants are included in this Fourmile EIS/EIR? *(Yreka Public Hearing)*

PH3.83 So all the significant impacts, et cetera, are based on the two projects? *(Yreka Public Hearing)*

PH3.84 And I think that there ought to be a further look. I think that there ought to be a potential look at cumulative effects for the 300 possible megawatt number and see if we come up with a significant amount and whatever your other unmitigated impacts are. Because, you know, I just don't think it—it doesn't sound reasonable to me that you are going to put in this huge transmission line that will carry 300 milliwatts—megawatts, whatever it is, and then you are going to stop. It is like going, "Oh, you know, we've already done all this work. We have got to utilize it to its fullest." It is such an expensive resource, anyhow, to produce. So I think that this—you have to look at that. *(Yreka Public Hearing)*

PH5.30 I don't know how the process works, Forest Service accepting this or that, approving—is this accepted for one plant or—in the future it's as if they're stating the possibility is up to six plants; do they have to go through this process for each plant. *(Medicine Lake Public Hearing)*

PH5.38 The question is geothermal and the quantity and amount of geothermal leases in the Glass Mountain area. These holdings—looks like several have been explored, and it relates back to the total potential of the area. I was wondering if you could explain a little about the total potential for the area, if you explored with Cal Energy, it looks like there's seventy-five percent Calpine, twenty-five percent CICI and CECI; ownership on some is Calpine, fifty, CECI fifty percent on others. And I realize that that may be changing, but I'd like you to elaborate. Because I guess my concern goes to the phalanx of the potential plant sites that maybe out there; if one plant goes—and in the back of my mind I'm very concerned about more than one. *(Medicine Lake Public Hearing)*

PH5.95 Basically my biggest objection is that, you know, putting the transmission line in is going to allow for the building of additional power plants and, you know, at least six, as these guys said, and—if not more. And to me, you know, the need for—at this point that process is not supposed to be piecemeal, it's supposed to consider all cumulative impacts. When you talk about that, it's analogous to allowing a developer to put a road into a place, and, "We're going—only going to build on the two lots at the end of the cul-de-sac," when, you know, in reality I think the whole thing is going to be built out. You have to consider the impacts of six of these things at least, if not, you know, if not more, if in reality that's a goal down the road. Unless the Forest Service or BLM or whoever is going to say they are going to look at these plans and say they're not going to allow development within these sections. Because the map shows that there's potential for lease development in the whole KGRA area. And this transmission line is going to allow for development. So it's not following the NEPA process to just say we're only talking about one power plant. *(Medicine Lake Public Hearing)*

PH5.99 What we really need is you redo your book with the Forest Service. And now you guys got three hundred megawatt power plants or a power line; you can put six plants in. Do your study with all six plants, that's what everybody is getting at, instead of doing it one at a time. Because once—you know, we all know what's going to happen. I think you guys should go back to the drawing board, redo your book, and let's look at the whole overall project. If you're letting them go with one corridor and power the whole thing, let's just quit beating the bushes. Do the whole thing, and then we'll review it. *(Medicine Lake Public Hearing)*

Response—Reasonably Foreseeable Geothermal Development

The preceding comments raise several concerns about the identification, determination, and discussion of cumulative projects contained in the Draft EIS/EIR. These comments mainly address the issue of reasonably foreseeable geothermal development at the Glass Mountain KGRA. Many of the comments also raise other issues related to the cumulative analysis. The following response provides a comprehensive discussion of these issues and concerns, with references to other responses where appropriate. The issues and concerns are addressed in this response under the following headings:

- Requirements for Cumulative Analyses
- Adequacy of the Fourmile Hill Cumulative Analysis
- Reasons Why Additional Geothermal Development is not Reasonably Foreseeable
- Problems with Speculation on Additional Geothermal Development
- Other Concerns About the Cumulative Analysis

- Conclusion

Requirements for Cumulative Analyses

Both NEPA and CEQA provide that "reasonably foreseeable" projects that have the potential to generate significant environmental impacts in conjunction with the proposed project must be addressed in the project's EIS or EIR. While NEPA does not provide specific guidance on the definition of reasonably foreseeable, CEQA does provide such guidance. CEQA Guidelines Section 15130(b) requires that an EIR base its cumulative impact analysis on either a list of past, present, and reasonably foreseeable future projects, or on projections contained in a General Plan or related regional planning document. Use of either method is acceptable, and is a discretionary choice of the lead agency.

For the analysis of cumulative effects for the Fourmile Hill project, the "list" method was chosen by the lead agencies. When this method is used, CEQA indicates that the following types of projects are reasonably foreseeable for a cumulative analysis and must be discussed in an EIR:

- Approved projects under construction
- Approved related projects not yet under construction
- Unapproved projects currently under environmental review with related impacts or which result in significant cumulative impacts

The CEQA Guidelines also state that "[w]hile foreseeing the unforeseeable is not possible, an agency must use its best efforts to find out and disclose all that it reasonably can" (CEQA Guidelines Section 15144). This guidance has generally been interpreted to require inclusion in an EIR of what might be reasonably expected under the circumstances.

Adequacy of the Fourmile Hill Cumulative Analysis

The cumulative effects of the proposed Fourmile Hill project were addressed in the Draft EIS/EIR as fully as possible at the time of the preparation of the Draft document. The lead agencies made reasonable efforts to discover and disclose all reasonably foreseeable projects in preparing the cumulative analysis for the Fourmile Hill project. In accordance with CEQA, reasonably foreseeable projects included all approved projects and projects under environmental review at the time of Draft EIR preparation. This approach also meets the requirements under NEPA for cumulative analyses of projects.

As discussed in the Draft EIS/EIR, the Fourmile Hill and Telephone Flat projects are the only reasonably foreseeable geothermal development projects in the Glass Mountain KGRA at this time; no other geothermal power plant development projects are proposed or approved at this time. The Telephone Flat Geothermal Project EIS/EIR and environmental impact analysis was not available at the time of Fourmile Hill Draft EIS/EIR preparation, which limited the information accessible concerning that project. For more information on the cumulative effects of the Telephone Flat project, see the response to "Comment—Cumulative Effects of the Telephone Flat Project" later in this section.

Reasons Why Additional Geothermal Development is Not Reasonably Foreseeable
Reasonably foreseeable projects addressed in the cumulative section of the Draft EIS/EIR are identified in Table 4.17-1 on page 4-311 of the Draft EIS/EIR. As stated above, the only reasonably foreseeable geothermal development projects are the Fourmile Hill and Telephone Flat projects. Several of the comments note factors that could, on their surface, indicate that geothermal development in addition to these two projects could occur, and that additional geothermal development should be considered in the cumulative analysis. These factors include:

- The USGS resource estimate of 550 MW of potential for the geothermal resource
- The 300-MW transmission line capacity
- The large leaseholdings of the developers
- The BPA options on additional power output (if it should become available) contemplated in the Calpine and CalEnergy draft power purchase agreements
- The existence of previously approved (but not drilled) exploration wells that are outside the areas currently proposed for development.

It is acknowledged that there is the possibility of additional geothermal development in the area due to these factors. However, any attempt to analyze cumulative effects beyond the two proposed geothermal development projects would be speculative for a variety of reasons. The following discussion summarizes those reasons, by factor presented above.

Estimate of Geothermal Resource Capacity: As discussed on page 2-38 of the Draft EIS/EIR, the estimated 550 MW electrical potential of the Glass Mountain geothermal system is not certain, and this estimate should not be relied upon when discussing the ultimate capacity of the geothermal system. This estimate was an "order of magnitude" estimate with considerable uncertainty that was generated by the USFS (using USGS methodology) in 1984. The estimate was based on extremely limited geologic and geophysical data, and many assumptions went into generating the estimate.

BPA's experience at the Vale and Newberry KGRAs in Oregon casts doubt on the reliability of USGS estimates of electrical potential, including the estimated 550 MW electrical potential of the Glass Mountain geothermal system. In its Circular 790, the USGS estimated the electrical potential of the Vale KGRA as 870 MW, and the Newberry KGRA as 740 MW. However, attempts to locate geothermal reservoirs that could support commercial development at both KGRAs have been unsuccessful to date. At Vale, the potential resource is now considered to be fully explored, and has been determined to be unsuitable for power production. The BPA's experience at the Vale and Newberry KGRAs are examples of the overestimation of electrical potential that can occur before the resource is actually tested and verified. This experience shows that USGS electrical potential estimates for the Glass Mountain KGRA, which were based on limited data, were likely not accurate.

As the Draft EIS/EIR states, there is currently very little known about the actual electrical potential of the Glass Mountain geothermal system, and there is no reliable evidence that the system has a 550 MW capacity. There is the potential that the actual electrical capacity of the system could be substantially less than 550 MW. In fact, it has

not yet been proven that the geothermal system can even support the proposed Fourmile Hill project.

Reservoir characteristics are inherently unknown until long-term flow tests are performed on production wells. The uncertainty about actual electrical potential of the lease (and the KGRA) is the basis for Calpine's proposed phased approach to project development. Calpine proposes to drill and test previously approved confirmation wells during the first year of project construction and prior to the construction of any other project facilities. This approach was designed to ensure that a commercially viable resource exists prior to beginning power plant or transmission line construction. The confirmation wells to be drilled by Calpine would provide this information prior to initiating construction of the proposed power plant or transmission line. Further discussion of this issue is provided in the response to "Comments—Well Testing, Design, and Maintenance" in the Alternatives, Including the Proposed Action Section.

The 550 MW estimated capacity of the geothermal resource is therefore unsubstantiated at this time, and the actual capacity could be less than this estimate. Until the capacity of the resource is determined through confirmation drilling and other exploration activities, the actual capacity of the resource will remain unknown. There is therefore no basis for assuming that 550 MW would be developed at the KGRA, or for analyzing the impacts of 550 MW of development.

Proposed Transmission Line Capacity: Although the proposed transmission line would have a design capacity of 300 MW, the line would not be capable of carrying this load; and the proposed transmission line would have an effective capacity of only 145 MW (see the response to "Comments—Transmission Line Design and Capacity" in the Alternatives, Including the Proposed Action Section). The line could therefore not accommodate six 50 MW power plants, as suggested by several of the comments, and discussion of the cumulative effects of six power plants is not warranted.

It is acknowledged that there would still be some excess transmission line capacity even with development of both the Fourmile Hill and Telephone Flat geothermal projects. However, no geothermal development projects have been proposed to use this excess capacity, and this additional development is not reasonably foreseeable because:

(1) There is no additional planned or proposed geothermal development in the KGRA. Both Calpine and CalEnergy have stated they have no plans for expansion or further development at this time.

(2) None of the other lessees outside the KGRA have indicated they will submit Plans of Exploration or Utilization.

(3) There is very little market demand for geothermal power (see the discussion on the geothermal power market under "BPA Options to Purchase Additional Power Output" below).

As described above, the Fourmile Hill and Telephone Flat projects are the only reasonably foreseeable geothermal development projects for the purposes of the cumulative analysis. There is therefore no need to address the cumulative impacts of upgrading the BPA Malin-Warner transmission line in this EIS/EIR due to development of additional geothermal development projects.

If it is demonstrated (through successful confirmation and exploration drilling) that a commercially viable geothermal resource exists at the KGRA, and that the resource has sufficient capacity to support geothermal development in addition to the Fourmile Hill and Telephone Flat projects, and there is sufficient expected market demand, there is the potential that additional geothermal development could be proposed that would utilize the excess capacity of the proposed transmission line. This development could occur in the form of expansions of the currently proposed geothermal development projects, or through the development of new geothermal facilities. Any additional development would be analyzed in a future environmental document. The document would include a cumulative impact analysis and would be subject to public review. This issue was addressed in the Draft EIS/EIR in Section 4.18, Growth-Inducing Impacts, since it is considered to be a potential growth-inducement issue. This issue was not addressed in the Section 4.17, Cumulative Effects of the Draft EIS/EIR since geothermal development in addition to the Fourmile Hill and Telephone Flat projects is not reasonably foreseeable at this time.

Leaseholdings in the Glass Mountain Unit Area: Calpine and CalEnergy currently hold all of the geothermal leases in the Glass Mountain Unit Area. Each of these companies therefore has relatively large leaseholdings. As part of the process of identifying cumulative projects for the Draft EIS/EIR, the lead agencies asked these two companies if they had plans for future development within the Unit Area. Both companies stated they have no plans for additional development at this time.

Geothermal leases outside the Glass Mountain Unit Area but within the Glass Mountain KGRA are held by several companies, including Calpine and CalEnergy. As discussed above, Calpine and CalEnergy have no plans for additional development at this time None of the other lease-holding companies have initiated any exploration activities in the last 10 years, and there is no basis for assuming that they would propose activities in the near future, given the current lack of a market for geothermal power. Preliminary exploration activities previously conducted at the KGRA indicate that the Fourmile Hill and Telephone Flat project areas have the greatest potential for finding a commercially viable geothermal resource.

As noted by several of the comments, it is acknowledged that Calpine had previously contemplated geothermal development on its leases in the vicinity of Mt. Hoffman. Calpine rejected the Mt. Hoffman location for the proposed project for various reasons, and no specific development plans for a Mt. Hoffman location were ever developed by the company. Geothermal development at Mt. Hoffman is therefore not considered reasonably foreseeable at this time (see the response to "Comments—Potential for a Mt. Hoffman Project" later in this section).

Since neither Calpine nor CalEnergy is envisioning additional geothermal development and these two companies hold all of the geothermal leases at the Glass Mountain Unit Area, additional geothermal development in the Unit Area is not reasonably foreseeable at this time.

BPA Options to Purchase Additional Power Output: The BPA currently has draft power purchase agreements with both of the leaseholders at the KGRA (Calpine and CalEnergy). These draft agreements provide BPA with options to purchase additional

power output from these power providers if it should become available in the future. However, neither Calpine nor CalEnergy have plans at this time for additional geothermal power development (see the responses to comments above under "Leaseholdings in the Glass Mountain Unit Area").

Regarding market conditions for geothermal power, electricity generation from geothermal resources generally costs more than generation from traditional fossil fuel or hydroelectric sources. The market for geothermal energy has been based in part on the need to reduce the nation's dependency on imported fossil fuels, produce electricity from energy sources with reduced effects to air quality, and to produce power from renewable sources. The Standard Offer 4 contracts (a type of contract issued by utilities for renewable power generation) temporarily increased the demand for renewable power.

With the decline in prices of natural gas and oil, the cost differential between traditional power sources and geothermal sources has increased. This differential has reduced the current demand for geothermal power. Deregulation in the utility market in California has not yet shown a significant increase in demand for "green" power sources, such as geothermal.

Neither Calpine nor CalEnergy currently foresee additional demand for geothermal energy from the Glass Mountain KGRA due to market conditions. The companies expect that there is sufficient demand for the geothermal power from the two currently proposed projects. However, there is not sufficient demand to merit development of any additional geothermal projects. If market conditions were to improve and additional geothermal development projects proposed, any future applications for development would be addressed in future environmental documentation for these projects. This environmental documentation would be based on specific project proposals at specific locations, allowing the lead agencies to provide a specific analysis of the effects of any future projects.

While the market for geothermal power may increase in the future, the market is currently limited, and there are very few power sales contracts available for geothermal power at this time. These market conditions are another factor that has lead the lead agencies to conclude that additional geothermal development in the KGRA is currently not reasonable foreseeable.

Previously Approved (but not Drilled) Exploration Wells: As discussed in the Chapter 1 of the Draft EIS/EIR, there have been two recent exploration projects that have been approved but not yet been initiated at the Glass Mountain KGRA. These projects are:

- The Fourmile Hill Geothermal Exploration Project (approved in April 1996)
- The Glass Mountain Unit Geothermal Exploration Project (approved in August 1995)

The exploration wells included as part of the Fourmile Hill Geothermal Exploration Project have been incorporated into the Fourmile Hill Geothermal Development Project (the subject of this EIS/EIR). The exploration wells that were approved as part of the Glass Mountain Unit Geothermal Exploration Project are considered to be part of the

Telephone Flat Geothermal Development Project, even though not all of the exploration wells were proposed to supply steam to the Telephone Flat project. Some of the exploration wells are located outside of the Telephone Flat project area. Some of the wells are in the vicinity of Mt. Hoffman (see the response to "Comments—Potential for a Mt. Hoffman Project" later in this section for information on the location of these wells).

The mere existence of approved but not yet been initiated exploration wells outside of the Telephone Flat project area does not indicate that additional geothermal power plant development would occur. The geothermal companies may never decide to drill these wells for the following reasons:

- It is determined through the two proposed projects that the geothermal resource does not have sufficient capacity for additional geothermal development
- Sufficient market demand for additional geothermal development does not materialize
- The companies decide they do not want to allocate their resources to drilling these wells

Even if these exploration wells are drilled, it does not necessarily follow that power plant development will occur. The wells may prove to be unsuccessful in tapping the resource, or there may be insufficient fluid flow at the well locations to merit utilization. It would therefore be speculative to assume that additional geothermal development would occur because there are approved exploration wells outside of the Telephone Flat project area that are not yet drilled.

While additional geothermal development due to these exploration wells is considered to be speculative, the construction, drilling, and testing of these wells is reasonably foreseeable. Drilling and testing of these wells was considered in the analysis of the Telephone Flat project in Section 4.17, Cumulative Effects of the Draft EIS/EIR. The cumulative analysis has been revised to clarify the relationship of the Glass Mountain exploration project to the Telephone Flat project (see the response to "Comments—Potential for a Mt. Hoffman Project" later in this section).

Problems with Speculation About Additional Geothermal Development

Although speculation about additional geothermal development is possible, such speculation is inherently problematic. Environmental review of speculative project types, sizes, and locations likely would result in only hypothetical environmental effects. Environmental effects from future geothermal development projects could be similar to those described in this EIS/EIR and the Telephone Flat EIS/EIR. However, the actual type of effects and the level of significance of these effects would depend upon:

- The location of the proposed facilities
- The type of power plant, cooling tower, and transmission line proposed
- The size of the power plant and acreage required for well pads, roads, pipelines, and transmission line
- The proximity to sensitive resources, such as Medicine Lake, traditional cultural use sites, sensitive species habitat, and recreational areas

- The visibility of the project from key observation points

Additional geothermal development could occur through expansions of the two currently proposed geothermal development projects or through the development of new geothermal facilities. However, future development is not reasonably foreseeable for reasons stated above. The number of variables related to the nature and location of additional development makes this speculative environmental review of limited use.

Other Concerns About the Cumulative Analysis

Scope of Analysis: The Draft EIS/EIR addresses all reasonably foreseeable geothermal development. The analysis of potential geothermal development is therefore not "piecemealed," as suggested in some comments. In addition, the Draft EIS/EIR addresses the entire Calpine project, and has not piecemealed the analysis of the proposed project. The two proposed geothermal projects are separate and distinct projects that are not interdependent. Each of the two projects could proceed independently of the other. If the Fourmile Hill project was not developed, the Telephone Flat project would build the transmission line, as analyzed in the Telephone Flat EIS/EIR.

If additional geothermal development is proposed at some point in the future, this development would be subject to environmental review, and would be required to address the cumulative effect of the additional geothermal development in the Medicine Lake Highlands. At that time, more might be known about the extent and commercial capacity of the geothermal resource. This understanding of the geothermal resource and the electricity market conditions might allow for a different conclusion regarding reasonably foreseeable development. However, at this time, only the two proposed geothermal development projects are reasonably foreseeable, and the Draft EIS/EIR addresses the cumulative effects of the development.

Cumulative Effects: Since the Fourmile Hill and Telephone Flat projects are the only reasonably foreseeable geothermal development projects in the Glass Mountain KGRA at this time, the Draft EIS/EIR provided an analysis of the cumulative effects of these two geothermal projects (and other reasonably foreseeable non-geothermal projects) in Section 4.17, Cumulative Effects. These two geothermal development projects would affect a total cumulative acreage of approximately 600 acres. As stated on page 2-12 of the Draft EIS/EIR, the Fourmile Hill power plant and wellfield facilities would occupy an area of about 49.7 acres.

Significance Cumulative Impacts: The cumulative impact analysis contained in the Draft EIS/EIR (as well as the Draft EIS/EIR for the Telephone Flat project) show that there would be temporary significant cumulative impacts from noise and dust generated from construction. The only unavoidable long-term significant cumulative effect would be on traditional cultural values (and the related environmental justice impact described in Socioeconomics). More information on the impacts of the cumulative projects is provided in Section 4.17, Cumulative Effects of the Draft EIS/EIR and the Responses to Comments later in this section under "Cumulative Effects".

The greatest potential for cumulative impacts would result if the proposed Fourmile Hill transmission line route (Alternative 1) was selected, and development of the two

projects overlapped. These potential cumulative impacts would be avoided if Alternative 6 (the agencies' preferred alternative) is selected; the Alternative 6 transmission line route avoids Medicine Lake and is routed to the north. Alternative 6 would reduce or avoid these significant cumulative impacts.

As a point of clarification, Sections 4.2 through 4.16 of the Draft EIS/EIR address only the implementation of the Fourmile Hill project (and its alternative), and the potential for significant impacts from this project. These sections also contain mitigation measures intended to reduce the environmental effects of the project to levels below significance, where possible. CEQA requires that significant environmental effects be identified and evaluated, and that mitigation be identified to reduce or avoid these effects (with the goal of reducing these effects to levels below significance). The cumulative effects of the Fourmile Hill and Telephone Flat projects are addressed in Section 4.17, Cumulative Effects of the Draft EIS/EIR.

Transmission Line Routing Cumulative Impacts: The proposed transmission line route (Alternative 1) and alternative transmission line routes (Alternatives 2 through 6) were selected primarily to avoid sensitive environmental resources and reduced or eliminated environmental effects. The routes were also selected to allow for the possible interconnection of a transmission line from the Telephone Flat project to the proposed Fourmile Hill transmission line with a minimum of cumulative environmental impacts. Although the Telephone Flat project had not yet been proposed at the time that the Fourmile Hill transmission line routes were selected, preliminary discussions between CalEnergy and the lead agencies had been held about the Telephone Flat project, and this project was formally proposed prior to release of the Fourmile Hill Draft EIS/EIR.

Whether the proposed or alternative transmission line routes would accommodate additional geothermal development that has not been proposed (if it occurs) while minimizing cumulative environmental impacts is unknown at this time. The environmental effects of connecting transmission lines from these speculative future projects would depend on the location of these projects, as well as the routing of any interconnection lines. However, if additional geothermal development is proposed at some point in the future, the lead agencies would seek to site the development and route any interconnection lines in such as way that environmental effects are minimized.

Conclusion

No geothermal development other than the Fourmile Hill and Telephone Flat projects is currently proposed at the KGRA. The potential location, size, and resource effects of any additional geothermal development (if it is proposed in the future) is unknown at this time. For the cumulative impact analysis contained in the Draft EIS/EIR, the proposed Fourmile Hill and Telephone Flat projects were determined to be the only reasonably foreseeable geothermal development projects at the Glass Mountain KGRA. This determination remains valid for this Final EIS/EIR. Evaluation of additional geothermal development at the KGRA beyond the two proposed projects was determined by the lead agencies to be remote and speculative at this time for the following reasons:

- The capacity and commercial viability of the geothermal reservoir (and its ability to accommodate the Fourmile Hill and Telephone Flat projects, or additional geothermal development) is unknown at this time
- The limited excess capacity of the proposed transmission line does not necessarily mean that additional geothermal development would occur, since the primary constraint is the identification and capacity of the geothermal reservoir and the power sales market
- The only two active leaseholders in the KGRA (Calpine and CalEnergy) have both stated that they have no plans for additional development in the KGRA
- While BPA's draft power purchase agreements with Calpine and CalEnergy allow options on additional power output if it becomes available, these geothermal companies have no plans for additional development, and market conditions do not support such development
- The mere existence of approved but not yet been initiated exploration wells outside of the Telephone Flat project area does not indicate that additional geothermal development would occur
- The current market for geothermal power does not warrant further development.

If additional geothermal development is proposed at some point in the future, the development would be subject to environmental review and documentation. This documentation would be required to address the cumulative effect of any additional geothermal development in the Medicine Lake Highlands in site-specific documents.

Comments—Potential for a Mt. Hoffman Project

V.14 CEQA requires the cumulative impacts of other foreseeable geothermal power plants to be discussed and analyzed in this EIR. While the EIR discloses the Telephone Flat geothermal power plant currently under environmental review, it makes no mention of the nearby proposed Mt. Hoffman geothermal power plant which is on the drawing board and is also under consideration. As such, this EIR is inadequate.

CEQA Guidelines §15130. (b)

The discussion of cumulative impacts shall reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great detail as is provided of the effects attributable to the project alone. The discussion should be guided by the standards of practicality and reasonableness. The following elements are necessary to an adequate discussion of cumulative impacts:

(1) Either: (A) A list of past, present, and reasonably anticipated future projects producing related or cumulative impacts, including those projects outside the control of the agency, ...

(2) A summary of the expected environmental effects to be produced by those projects with specific reference to additional information stating where that information is available, and

(3) A reasonable analysis of the cumulative impacts of the relevant projects. An EIR shall examine reasonable options for mitigating or avoiding all significant cumulative effects of a proposed project.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

EH.1 As concerned citizens of Siskiyou County, we urge you to make sure that the cumulative impacts of the Four Mile Hill, Telephone Flat and Mt. Hoffman projects be addressed in any EIS/EIR.

(Kobi Ledor and Casey Kim)

IE.8 Along with Fourmile Hill and Telephone Flat sites, Mt. Hoffman is also being considered. Where will it stop?

(Alysa Waring)

IM.1 The cumulative impacts of the Fourmile Hill, Telephone Flat and projected Mt. Hoffman geothermal projects and any other existing leases in the Highlands must be addressed in any complete EIS/EIR.

(Brenda Willey)

Response—Potential for a Mt. Hoffman Project

A Mt. Hoffman geothermal development project has not been proposed and is not under consideration, and no specific development plans for a Mt. Hoffman geothermal project location were ever developed by Calpine or any other geothermal company.

Geothermal development at Mt. Hoffman is therefore not considered reasonably foreseeable at this time, and analysis of such development has not been included in the cumulative analysis in the EIS/EIR for the Fourmile Hill project.

It is acknowledged that Calpine had at one time contemplated geothermal development on its leases in the vicinity of Mt. Hoffman instead of at the currently proposed Fourmile Hill area. However, Calpine decided not to pursue geothermal development on its Mt. Hoffman leases for various reasons. The primary reason was that Calpine had a divided interest with CalEnergy on these leases, and Calpine did not want to consider or attempt to undertake a project on lease holdings that could be subject to potential encumbrances from CalEnergy. Calpine decided to propose and pursue geothermal development on leases where they had exclusive rights to develop, and could avoid encumbrances from CalEnergy (i.e., the leases where the Fourmile Hill project is proposed). The Mt. Hoffman leases are now exclusively under Calpine's control; however, no development on the leases is planned.

If additional geothermal development is proposed at Mt. Hoffman at some time in the future, this development would be subject to environmental review under both NEPA and CEQA, and appropriate environmental documentation would be prepared. The cumulative effects of all reasonably foreseeable geothermal development projects (at the time the environmental analysis for additional development is prepared) would be addressed in future environmental documentation.

Although additional geothermal development at Mt. Hoffman is considered to be speculative, there is the potential that exploration activities could occur in the Mt. Hoffman vicinity. In August 1995, the Glass Mountain Unit Geothermal Exploration Project was approved. Although this project was approved, it has not yet been implemented. This project included:

- Three deep exploration wells located northeast of Medicine Lake on the flanks of Mt. Hoffman (well pads 58-6, 18-32, and 46-32)
- Two deep exploration wells located southeast of Medicine Lake near Telephone Flat (well pads 13-18 and 56-18)
- Four temperature core hole wells located south and southwest of Medicine Lake (well pads 42-13TCH, 11-24TCH, 15-15TCH, and 63-20TCH)
- One temperature core hole well located east of Medicine Lake (well pad 34-8TCH)

At the time the Draft EIS/EIR was prepared, all of these wells were considered to have been included as part of the Telephone Flat project (similar to how all of the exploration wells included in the Fourmile Hill Geothermal Exploration Project became part of the Fourmile Hill Geothermal Development Project). The discussion of the Telephone Flat project and its cumulative impacts in the Draft EIS/EIR reflected implementation of these wells as part of the Telephone Flat project.

Subsequent to release of the Fourmile Hill Draft EIS/EIR in July 1997, more specific information about the Telephone Flat project became available with the completion of the Telephone Flat Draft EIS/EIR. This information provided quantification of the amount of surface disturbance that would occur as a result of the Telephone Flat

project, and clarified that two of the 10 approved exploration wells (deep exploration wells 13-18 and 56-18) had been incorporated into the Telephone Flat project.

The discussion of the Telephone Flat project on page 4-312 through 4-314 of the Draft EIS/EIR has been revised to clarify acreages of surface disturbance and the relationship of the approved exploration wells to the Telephone Flat project (for corresponding revisions to the discussion of cumulative effects in Section 4.17, see the responses to comments later in this section):

> "**CalEnergy Telephone Flat Geothermal Development Project**
>
> In July 1996, CalEnergy Company, Inc. submitted a Plan of Utilization (POU) to the BLM for the proposed Telephone Flat Geothermal Development Project on the Modoc National Forest in Modoc County, California (CalEnergy 1996). This POU was subsequently revised at the direction of the BLM and USFS, and a Draft EIS/EIR for this geothermal development project was released in May 1998 (BLM et al. 1998). The Telephone Flat geothermal project described in the ~~revised POU~~ Draft EIS/EIR would consist of constructing, operating, and maintaining a 48-MW geothermal power plant, with associated geothermal production and injection wells, well pads, roads, interconnected geothermal fluid pipelines, and an accompanying 3-mile 230-kV transmission line ~~(CalEnergy 1996)~~(BLM et al. 1998). The proposed Telephone Flat project would result in a total surface disturbance of approximately 171.6 to 173.4 acres, depending on which of two alternative transmission line routes would be selected.
>
> The proposed power plant area for ~~this~~ the Telephone Flat project would be located about 4.5 miles southeast of the proposed Fourmile Hill geothermal power plant. Figure 4.17-1 illustrates the location of this project in relationship to the Fourmile Hill project. A description of the proposed wellfield and power plant facilities and the transmission line route for the Telephone Flat geothermal project is presented below.
>
> **Wellfield and Power Plant Facilities:** The proposed CalEnergy wellfield and power plant site would be located within the Glass Mountain KGRA on Federal geothermal leases CA12371 and CA12372, approximately 1.5 miles southeast of Medicine Lake. The power plant facility would occupy approximately ~~18.5~~ 15.2 acres within the Medicine Lake caldera. In addition, the proposed well pads, pipelines, and new access roads would occupy about 140.9 acres. The wellfield and power plant facilities would therefore occupy a total of approximately 156.1 acres. The primary characteristics of the wellfield and power plant for the CalEnergy project are summarized below:
>
> - Geothermal fluids would be produced from 10 to 12 production well pads. One production well would initially be drilled at each pad, and additional wells may be drilled at these pads over the life of the project as required.
> - Approximately 3 to 5 injection wells would be needed to allow for injection of excess geothermal fluids, cooling tower blow down, and other plant effluents into the geothermal reservoir.
> - Geothermal fluids would be transported to the proposed power plant and injection wells via cross-country pipelines.
> - The proposed double-flash power plant would use geothermal fluids produced from the production wells to generate an average of 48 MW of electricity.
> - Electricity generated by the power plant would be directed to on-site transformers, where it would be converted to the appropriate line voltage and fed into the proposed transmission line.

Prior to proposal of the Telephone Flat Geothermal Development Project, CalEnergy had obtained approval for exploration wells in the Telephone Flat and Mt. Hoffman vicinity through the Glass Mountain Unit Geothermal Exploration Project. These wells were approved in August 1995, but have not yet been drilled. The location of these wells are identified in the Glass Mountain Unit Geothermal Exploration Project EA/IS (BLM et al. 1995). The exploration wells included five deep exploration wells (well pads 13-18, 56-18, 58-6, 18-32, and 46-32) and five temperature core hole wells (well pads 34-8TCH, 42-13TCH, 11-24TCH, 15-15TCH, and 63-20TCH). The deep exploration well pads would each occupy approximately 5.51 acres, and the temperature core hole well pads would each occupy approximately 0.15 acres. 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. The project also included about approximately 2,600 feet of new access roads and improvements to about 8,150 feet of existing access roads. Total surface disturbance was estimated at approximately 29.6 acres.

Two of the exploration wells have been incorporated into the Telephone Flat project (deep exploration wells 13-18 and 56-18). For the purposes of this cumulative analysis, the remaining eight wells and associated roads have also been included as part of the Telephone Flat project. These components would occupy approximately 18.6 acres. The combination of wellfield facilities included as part of the Telephone Flat project and the Glass Mountain exploration wells would therefore result in a total surface disturbance of about 174.7 acres.

Transmission Line: ~~CalEnergy's revised POU includes~~ The Draft EIS/EIR for the Telephone Flat project identifies two alternative 230-kV "tap" transmission lines to the proposed Fourmile Hill transmission line that would deliver the net output of electricity from the proposed CalEnergy power plant to the Fourmile Hill transmission line for transmission to the BPA Malin-Warner line. Each of CalEnergy's alternative tap lines is approximately 3 miles in length. One of CalEnergy's alternative tap lines (identified as transmission line D1) heads directly north from CalEnergy's proposed Telephone Flat plant site to a connection with segment A2 of the proposed Fourmile Hill transmission line. Line D1 would affect approximately 15.5 acres. The other alternative tap line (identified as transmission line D2) heads directly east from the Telephone Flat plant site to a connection with alternative transmission line segment B2. Line D2 would affect approximately 17.3 acres. Implementation of the Telephone Flat project would involve construction of only one of these alternative tap lines.

As discussed in Section 2.2 of this EIS/EIR, the USFS has stated that only one utility corridor would be developed out of the Glass Mountain KGRA for all reasonably foreseeable geothermal power generation at the KGRA. For the purposes of this cumulative analysis, it is assumed that both the Fourmile Hill and Telephone Flat geothermal projects would be approved, and would follow the same utility corridor out of the Glass Mountain KGRA. Since the Fourmile Hill project is farther along in the environmental review process, it is also assumed that the Fourmile Hill project would be approved and implemented before the Telephone Flat project. It is likely that the construction of the CalEnergy Telephone Flat project would overlap with construction of the Fourmile Hill project, as the CalEnergy project is proposed to begin in 1998 or 1999."

CUMULATIVE EFFECTS

Comments—Cumulative Effects of Telephone Flat Project

A.40 EPA has serious reservations regarding cumulative impacts which could result from a second proposed geothermal operation (Telephone Flat). Under CFR 1508.27(b)(6), the intensity of an impact is defined in the context of effects of the proposed action on future actions and setting of precedent.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

H.3 We also question why the cumulative impacts of the Telephone Flat project were not addressed more completely. *(Bill Dart, American Motorcyclist Association)*

AA.2 The Draft EIR/EIS is also required to examine cumulative impacts of other proposed projects such as the Telephone Flat Geothermal Plant proposed nearby. When cumulative impacts might be significant, an EIR must reveal this, must attempt to mitigate them, and must look at project alternatives if they can't be mitigated to less-than-significant. This Draft EIR/EIS fails to do that. Instead, it declares that such cumulative impacts are insignificant without providing any calculations to support its conclusion. Accordingly, the Draft EIR/EIS violates CEQA requirements.

For example, from the homes at the south-east side of Medicine Lake, the Telephone Flat Geothermal Plant will be about 1.1 miles away. If it is as loud as the Fourmile Hill plant, it's noise level at those cabins' location using the above analysis of distance reduction will be about 49 dB (A) LEQ. Similarly the Fourmile Hill project is about 3.5 miles from these cabins and will generate about 40 dB (A) LEQ. The cumulative total of just these two power plants will be about 50 dB (A) LEQ. Other power plants which are proposed in the Medicine Lake area would increase these levels even more. This cumulative sound level for both power plants operating at the same time of 50 dB (A) LEQ when corrected for increased night noise sensitivity would be equal to a 'day-night average of 56 dB (A) CNEL. That combined noise level is in excess of the Siskiyou county General Plan maximum allowable limit of 55 dB(A) even without the 15 dB corrections for quiet rural areas and impact sounds. Therefore, the cumulative impacts of both are significant if left unmitigated and the Draft EIR/EIS is erroneous to claim otherwise. For this reason, the Draft EIR/EIS is legally inadequate and the project should not be approved.
(Dale LaForest, Mount Shasta Tomorrow)

AD.29 The EIS/EIR does not disclose, consider or evaluate the cumulative effects on visual quality, hydrology, wildlife, air quality, cultural resources, plants or any of the cumulatively affected environment.
(Floyd J. Buckskin, Pit River Tribe)

AG.181 While the EIS/EIR purports to consider the cumulative impacts associated with the CalEnergy project, this analysis is superficial. (EIS/EIR, § 4.17.) The impacts to the various resource areas are discussed in a cursory fashion, and all impacts except traditional cultural values are dismissed as less than significant. As these comments indicate, the Calpine project will cause several significant impacts, by itself. Thus, the cumulative impacts of the Calpine project, in combination with these other projects, will causes even greater impacts.

The EIS/EIR should be revised to contain a more analytical and genuine discussion of these cumulative impacts, and should be recirculated so that the public has the opportunity to review and comment on these significant impacts. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

BP.6 Secondly the Draft EIS/EIR does not address the cumulative environmental effects of the Calpine project and the proposed Cal Energy Telephone Flats project. Given that Calpine's own project description states that the permitting process will assess possible impacts of both its project and those proposed within the vicinity, any environmental analysis should jointly assess the impact of both projects. In fact, the only way to properly assess the impact of geothermal development within the Medicine Lake caldera and surrounding areas would be for the lead agencies to consolidate and coordinate the environmental review process for all potential project permits. Piecemeal environmental review of individual projects is meaningless and in violation of both CEQA and NEPA. *(S. Peder and Suzanna S. Cuneo, et al.)*

BQ.36 The Fourmile Hill project is the first of two geothermal projects that are actively being developed in the Glass Mountain KGRA. These two projects will use the same transmission line and be physically less than five miles apart. Yet the Draft EIS/EIR presents very little factual information on the cumulative impacts of these two projects. It is our contention that these projects should be evaluated together and that all models for air and water quality, noise and visual effects fully evaluate the additive effects of these projects. A more unified approach for the development of the Glass Mountain KGRA would be to do test well development at both sites (Fourmile Hill and Telephone Flats), both of which have test well approval. After analysis of the known resource then a final EIS/EIR can be developed that gives an accurate indication of the overall effect of geothermal development in this area. It is difficult to believe that a Draft EIS/EIR for a single project covers more than 800 pages, and finds significant environmental concerns, but a similar project less than 5 miles away will not have a significant cumulative impact. We believe that the Draft EIS/EIR has deliberately minimized the cumulative impacts in order to make the Fourmile Hill project more acceptable. *(S. Peder and Suzanna S. Cuneo, et al.)*

FP.21 The Draft EIS/EIR for Fourmile Hill takes over 800 pages to discuss the potential effects of this project. Of this 800+ pages approximately four paragraphs are dedicated to the potential cumulative effects (pages 4-312 and 4-314) of another project proposal (CalEnergy's Telephone Flat) of equal size! Doesn't this seem a little out of balance? *(Eric T. Nelson and Martha Spencer)*

PH4.24 The cumulative effects of the Telephone Flat project are not discussed in the document. *(Mount Shasta Public Hearing)*

Response—Cumulative Effects of Telephone Flat Project

The Draft EIS/EIR does provide an analysis of the cumulative effects of the Telephone Flat project. The Telephone Flat project is identified as a cumulative project in Table 4.17-1 on page 4-311 of the Draft EIS/EIR, and is discussed on page 4-312 through 4-314 of the Draft EIS/EIR. The cumulative effects of the Telephone Flat project (and other cumulative projects including the Fourmile Hill project) are discussed by environmental parameter on pages 4-315 through 4-326 of the Draft EIS/EIR. The cumulative effects of the proposed project and other cumulative projects on visual quality, hydrology, wildlife, air quality, cultural resources, and vegetation are discussed on these pages.

The cumulative impact analysis in the Draft EIS/EIR was prepared based on information available at the time the Fourmile Hill EIS/EIR was prepared, and reflected information about reasonably foreseeable cumulative geothermal projects that was known at that time. The analysis of cumulative geothermal impacts was based on knowledge of the effects of:

- Geothermal development associated with the Fourmile Hill project
- Existing exploratory wells and pads
- Geothermal development proposed by the CalEnergy Plan of Utilization for the Telephone Flat project

The environmental review of the Telephone Flat project had not yet been completed at the time of release of the Fourmile Hill Draft EIS/EIR in July 1997. The detailed analysis of environmental effects of the Telephone Flat project (and therefore the cumulative effects in conjunction with the Fourmile Hill project) had not been completed. The cumulative analysis in the Fourmile Hill EIS/EIR therefore provided a qualitative discussion of potential cumulative effects of these projects, based on knowledge of the effects of geothermal development and general information about sensitive environmental resources in the Telephone Flat vicinity.

Subsequent to release of the Fourmile Hill Draft EIS/EIR, the environmental analysis for the Telephone Flat project was completed and presented in the Telephone Flat Draft EIS/EIR (BLM et al. 1998). The Telephone Flat Draft EIS/EIR provides a quantitative analysis of the proposed Telephone Flat project. The analysis of cumulative effects in the Fourmile Hill EIS/EIR has been updated to reflect this quantitative information where appropriate (see the response to comments on cumulative effects by environmental parameter later in this section). See the response to "Comments—Cumulative Hydrology Effects" later in this section regarding the combined effects of the Fourmile Hill and Telephone Flat projects on hydrogeology, hydrology, and water quality.

Table 4.17-2 below provides a comparison of the individual and cumulative impacts associated with the Fourmile Hill and Telephone Flat geothermal projects. The impacts

Table 4.17-2: Comparison of Individual and Cumulative Impacts of the Fourmile Hill and Telephone Flat Geothermal Projects

	Fourmile Hill		Telephone Flat		
Affected Environment	**Before Mitigation**	**After Mitigation**	**Before Mitigation**	**After Mitigation**	**Cumulative Effect After Mitigation**
Geology and Soils	—	—	—	—	—
Hydrology and Geothermal	—	—	—	—	—
Vegetation	+	(—)	+	(—)	(—)
Wildlife	+	(—)	+	(—)	(—)
Air Quality	S*	S*	—	—	S*
Cultural Resources	+	(—)	+	(—)	(—)
Traditional Cultural Values	S	S	S	S	S
Noise	S	S	S	S	S
Visual Quality	+	(—)	—	—	—
Land Use and Recreation	—	—	+	(—)	—
Transportation	—	—	—	—	—
Socioeconomics	S	S	S	S	S
Human Health and Safety	—	—	—	—	—

Notes:

— Below significant level of impact

\+ Potentially significant impact

(—) Mitigated to below level of significance

S Significant, unavoidable adverse impact

* There are expected to be short-term PM_{10} impacts in close proximity to construction activities.

SOURCE: MHA Environmental Consulting, Inc. and Telephone Flat Draft EIS/EIR 1998

Note: This table has also been added to Section 4.17, Cumulative Impacts, in Volume I of the Final EIS/EIR.

are grouped into pre- and post-mitigation levels for each of the various affected environments as presented in the Fourmile Hill Draft EIS/EIR.

The quantitative information from the Telephone Flat Draft EIS/EIR further supports the conclusions regarding cumulative impacts contained in the Fourmile Hill EIS/EIR. This quantitative information has not resulted in any changes to the determination of cumulative effects, or the level of significance of any of these effects.

The precedent for geothermal development in the Medicine Lake Highlands was established through the BLM and USFS decisions to issue geothermal leases and by the geothermal exploration that has occurred in the Highlands. The Telephone Flat project would be a separate undertaking based on separate approvals. The development of the Telephone Flat project is not contingent on the approval of the Fourmile Hill project. For more information on the separate environmental processes for each of these projects, see the response to "Comments—One EIS for the Geothermal Projects" in the NEPA/CEQA Issues section.

At present, there is no additional reasonably foreseeable geothermal development at the Glass Mountain KGRA, and discussion of the potential environmental impacts of geothermal development other than the two currently proposed geothermal development projects would be speculative (see the response to "Comments—Reasonably Foreseeable Geothermal Development" earlier in this section).

Regarding cumulative noise impacts, operation of the Fourmile Hill and Telephone Flat power plants would not be expected to result in a significant cumulative impact. Comment AA.2 makes reference to an estimation of noise reduction provided in comment AA.1. This estimation does not account for molecular absorption of sound and noise reduction due to terrain and vegetative features, which further reduce noise levels (see the response to "Comment—Determination of Operational Noise Levels" in the Noise Section for comment AA.1 and more information on the noise propagation modeling that was conducted). As shown in Table 4.14-4 on page 4-267 of the Draft EIS/EIR, noise levels from operation of the Fourmile Hill power plant would be approximately 11 dBA L_{eq} at the homes on the southeast side of Medicine Lake. The Telephone Flat Draft EIS/EIR indicates that noise levels from operation of the Telephone Flat power plant would be approximately 28 dBA L_{eq} at the homes on the southeast side of Medicine Lake (BLM et al. 1998). The combined noise effect of these two project during operation would therefore be around 29 or 30 dBA L_{eq}. This cumulative noise level would not exceed any applicable noise standards (even with any additional weighting of the sound), and would be considered a less-than-significant impact.

Comments—Cumulative Hydrology Effects

A.28 The EPA recommends that the FEIS consider, in more detail, the combined impacts and potential direct, indirect, and cumulative impacts of both the Proposed Action and the possible Telephone Flat project on the hydrogeology, hydrology and water quality of the affected environment. A pooling of resources and possible groundwater modeling should be considered.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.44 The DEIS notes a projected net loss of fluids from operations totaling 475,000 pounds per hour. Assuming standard temperature and pressure conditions, this would equate to about 1500 acre feet per year. The cumulative impact analysis should describe any anticipated or potential significant environmental impacts to recharge areas of the geothermal system with regard to water or biologic

resources. Both geothermal projects should be included in the analysis. The EPA finds the section on cumulative impacts -- hydrology (pg. 4-316), especially insufficient. The statement, "The geothermal reservoir is not believed to be connected to regional groundwater systems" is particularly troublesome and unsubstantiated. The only way that this would be possible is if the fluids come from connate brines. A source region for the geothermal system is not identified. The FEIS should show why the geothermal system could not be recharged from the Medicine Lake Highlands. According to studies by Lawrence Livermore Laboratories (Rose and Davisson, 1996 and Davisson, 1997), the Fall River springs have a magmatic CO_2 signature, suggesting a connection between geothermal and fresh waters. For further information, we defer to Lawrence Livermore Laboratories which has indicated that it wishes to provide its own comments to the DEIS. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

N.6 Hydrology - Fall River Watershed Cumulative Impacts Not Disclosed and Evaluated Resulting From the Fourmile Hill Geothermal Development project and the Telephone Flat Geothermal project

9. The DEIS/EIR is deficient because it did not disclose, evaluate; and mitigate the cumulative impacts to the human environment resulting from the proposed Fourmile Hill Development project and the proposed Telephone Flat Geothermal project. The U.S. Forest Service and the U.S. Bureau of Land Management are piecemealing two projects. NEPA requires that cumulative impacts are disclosed and evaluated. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

N.8 As stated beforehand, the hydrology information and data in the DEIS/EIR is grossly deficient and failed to provide scientific evidence as a result of supporting studies that the proposed Fourmile Hill Geothermal project and the proposed Telephone Flat Geothermal project will not have cumulative effects to the surface and subsurface (underflow) flows of the Fall River Watershed, and any other spring sources. It is our understanding the hydrologic system controlling the Fall River springs is extremely sensitive to any perturbation in the greater region influencing the springs and that the alteration to the groundwater regime in the summit area of Medicine Lake Volcano will negatively impact the Fall River springs.

The DEIS/EIR failed to disclose and evaluate the direct, indirect, and cumulative impacts to the Fall River springs and other spring sources as a result of the proposed project.

The DEIS/EIR did not disclose and evaluate with careful evaluation via professional verification whether the proposed Fourmile Hill Geothermal project and the proposed Telephone Flat Geothermal project will have cumulative impacts to the natural Fall River springs and other natural spring sources.
(Robert J. Baiocci, Fall River Wild Trout Foundation)

S.2 Although, the Fourmile Hill is only one small project, the total energy potential of this area and the cumulative effect of additional power plant development over the years increases the potential for possible impact to the Fall River Springs. As we have discussed in the past, we feel the most important issue in regards to proposed geothermal development in the Medicine Lake region is the connection between the shallow fresh water and the deep geothermal system. Our report demonstrates that there is a connection with respect to carbon dioxide.
(M. Lee Davisson and Timothy P. Rose, Lawrence Livermore National Laboratory)

AG.170 The EIS/EIR should be revised to include a sufficient cumulative impact analysis and recirculated for public review and comment. The following examples are illustrative of how the EIS/EIR fails to properly assess cumulative impacts. This list is not intended to be all-inclusive.

The EIS/EIR fails as an informational document because it does not provide sufficient information about cumulative impacts on hydrologic resources. One flaw is that the EIS/EIR acknowledges that cumulative projects would place increased demands on Arnica Sink well water. (EIS/EIR, p. 4-316.) Nonetheless, the EIS/EIR concludes that any cumulative impact is not significant because there is a sufficient groundwater supply for all the projects. (Ibid.) However, as discussed in the hydrology comments, the EIS/EIR has severely underestimated the Project's impacts on groundwater recharge, and consequently, on Arnica Sink and local surface waters. By itself, the project will significantly affect groundwater supplies and local surface waters. This significant impact will be compounded by the other projects. Thus, the EIS/EIR should reevaluate the cumulative projects' effects on hydrology so that the public and decisionmakers have sufficient information to evaluate the cumulative effects of these projects and mitigation measures. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.171 Another flaw is that the EIS/EIR states that air emissions from the Calpine and CalEnergy projects would not affect water quality because pollutants would not be expected to exceed existing regulatory levels. (Ibid.) However, as discussed in the comments on hydrology, the Project's air emissions will have a significant impact on water quality. In particular, the project will elevate arsenic, mercury, and boron levels and acid deposition above significance standards. Thus, the project by itself will have a significant effect on Medicine Lake water quality. Accordingly, the EIS/EIR should discuss how this impact will be compounded by the CalEnergy project and other potential future projects, and propose appropriate mitigation measures.

Thus, the EIS/EIR's conclusion that cumulative impacts to hydrologic resources will be insignificant is based on unsupported assumptions, inadequate information, and insufficient mitigation measures.

Without an adequate analysis of the Project's cumulative impacts, the Project's full environmental effect cannot be assessed and mitigation measures evaluated.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

FK.5 4.3.7 EFFECTS OF AIR EMISSION ON WATER QUALITY page 4-34 "Operations" page 4-35 and 36, table 4.3-3 [This table represents an "extremely conservative model" of the contaminations that can be expected in Medicine Lake after 45 years and is said to have No Significant Effect. As an example, the amount of arsenic to be expected is .012 milligrams per liter. The EPA established Maximum Contaminant Level is .05 mg/l. If we consider the accumulative effect of a potential 6 projects, the expected arsenic concentration would be .072 and would be approximately 40% above the EPA allowable. What assurances do we have that any mitigation measures will be taken before any irreversible damage has occurred. This problem is also listed under SECTION 4.19 UNAVOIDABLE ADVERSE EFFECTS. This EIR/EIS is remiss in not addressing the accumulative effect of the likely construction of more than one plant. *(Charles F. Moss)*

Response—Cumulative Hydrology Effects

The potential direct and indirect hydrogeology, hydrology, and water-quality impacts of the Fourmile Hill project are considered in the Draft EIS/EIR in Section 4.3, Hydrology. Additional supporting data are provided in the Hydrology responses to comments in this Final EIS/EIR. As summarized in Table S-5, the EIS/EIR concludes that the proposed project or its alternatives would have either no effect or a less-than-significant effect on hydrologic resources.

The discussion of potential impacts in Section 4.3 of the EIS/EIR is based on numerous studies that were conducted for this project or conducted by others for the Telephone Flat project. All of these studies were conducted by qualified hydrogeologists and experts in the field of the hydrology and/or geothermal reservoirs. The hydrologic analyses in the EIS/EIR were conducted by a qualified hydrogeologist with the third-party independent consultant. The analysis in the Draft EIS/EIR was also based on the hydrogeologist's experience with effects of geothermal development at other KGRAs. The conclusions regarding the potential for effects to the Fall River Mills area were reached by the third-party environmental consultant, BLM, USFS, USGS , and a hydrologist (Bredehoeft 1997b) hired by a landowner in the Fall River Mills area.

The proposed phased approach to implementing the proposed project (i.e., exploration and testing before development) would allow for the collection of additional geothermal and groundwater data prior to actual project development. This approach allows for the comparison of actual and expected conditions. If any of the assumptions upon which conclusions in the EIS/EIR are based are proven to be invalid and could result in the potential for significant effects to water resources, contingency measures would be enacted to either correct the problem or provide mitigation. These measures are spelled out in the mitigation measures contained in the EIS/EIR. See response to "Comment—Adequacy of Hydrology Analysis" in the Hydrology Section for more discussion of this issue.

The Draft EIS/EIRs for both the Fourmile Hill project and the Telephone Flat project address the potential impacts on groundwater resources associated with their development and operation. The cumulative analysis in the Telephone Flat Draft EIS/EIR is consistent with the conclusions reached in the Fourmile Hill Draft EIS/EIR regarding the potential cumulative impacts of water withdrawals on local and regional groundwater.

The Telephone Flat Draft EIS/EIR concludes that the maximum use of shallow groundwater for the two projects would occur during the first year of each project,

when the majority of the wells would be drilled. As discussed on page 4-8 of the Telephone Flat Draft EIS/EIR, the first year maximum annual use of shallow groundwater would be 49.8 ac-ft for the Telephone Flat project, and 65.3 ac-ft of water for the Fourmile Hill Project. If development occurred at the same time for the two projects, the cumulative groundwater use would be approximately 115 ac-ft. This amount of water is less than one-half of one percent of the average groundwater recharge (annualized and corrected for evaporation) into the Medicine Lake Basin (23,123 ac-ft/yr). This cumulative water use would not have an adverse or significant effect on groundwater availability within the Medicine Lake Basin (BLM et al. 1998).

Comment A.44 correctly notes that the Fourmile Hill project would be expected to result in a net loss of about 475,000 pounds per hour (lbs/hr) of geothermal fluids (based on production of approximately 2.9 million lbs/hr of geothermal fluids, and injection of about 2.4 million lbs/hr back into the geothermal reservoir). As discussed on page 3.2-37 of the Telephone Flat Draft EIS/EIR, the Telephone Flat project would be expected to result in a net loss of about 600,000 lbs/hr of geothermal fluids (based on production of approximately 3.3 million lbs/hr of geothermal fluids, and injection of about 2.7 million lbs/hr back into the geothermal reservoir). The cumulative net loss of geothermal fluids due to the two proposed projects would therefore be approximately 1,075,000 lbs/hr. This loss would not be expected to significantly reduce the life expectancy of the geothermal reservoir, and would therefore be considered a less-than-significant cumulative effect.

The loss of these fluids would not be expected to affect any recharge areas with respect to water or biologic resources. An impermeable layer between the shallow groundwater and the geothermal reservoir has been documented in well logs for wells across the Medicine Lake Highlands, and recharge of the geothermal system from groundwater is not expected to occur. This issue is discussed further in responses to "Comments—Separation of Local Groundwater and the Geothermal Reservoir" and "Comments—Potential Groundwater Depletion due to Geothermal Fluid Use," both in the Hydrology Section of this document.

Several comments raise concerns about the potential for a hydrologic connection between the project site and the Fall River springs and the potential for cumulative impacts to the springs. The springs at Fall River were discussed in the Draft EIS/EIR on page 3-26 and 3-27. The potential for effects to the Fall River springs were addressed under Impact 4.3.1 on pages 4-24 and 4-25 of the Draft EIS/EIR, and Impact 4.3.6 on page 4-34 of the Draft EIS/EIR. The response to "Comments—Potential Effect to Fall River Springs" in the Hydrology Section provides an extensive discussion of potential effects to Fall River springs (the response also addresses the CO_2 data cited in comments A.44 and S.2). As discussed in the Draft EIS/EIR and the referenced response to comments, there would be no adverse effect to water quality or water quantity at the Fall River springs from project activities. Even with a conservative assumption that all geothermal fluid extraction by the project resulted in a direct reduction in flows at Fall River springs (which is not expected or likely to happen), these flows would be reduced by a maximum of 0.18 percent. This flow reduction would not be considered significant.

The cumulative projects would also not be expected to have a significant effect on flows at Fall River springs. Based on information about the Telephone Flat project in the

Telephone Flat Draft EIS/EIR, the two projects could reduce flows at Fall River springs by a maximum of 0.34 to 0.39 percent (using the same conservative assumption described above). This extremely low level of flow reduction at the springs would not be considered significant.

Comment AG.170 asserts that the Fourmile Hill project has severely underestimated the project's impacts on groundwater recharge, including at Arnica Sink. As explained on page 4-26 of the Draft EIS/EIR, the effects of water withdrawals on groundwater recharge at Arnica Sink and in other areas of the Medicine Lake caldera would not be significant after mitigation. For a discussion of these issues, see the following responses to comments in the Hydrology Section:

- Calculation of Groundwater Recharge
- Potential Groundwater Depletion at Arnica Sink from Groundwater Use
- Potential Groundwater Depletion at the Project Site from Groundwater Use

Comment AG.171 asserts that the Fourmile Hill project has underestimated the effects of project air emissions on water quality and that these effects would be significant. Depositional effects on water quality are analyzed on pages 4-34 through 4-38 of the Draft EIS/EIR. This section includes a quantitative analysis of the effects of deposited air emissions on Medicine Lake water quality over the life of the project. This analysis presents a "worst-case" scenario for depositional effects on water quality due to Medicine Lake's proximity to the proposed power plant and its location downwind of the power plant. In addition, Medicine Lake is an area of particular concern because of its value as a natural resource and recreation area, and its value to Native Americans. The analysis of effects on Medicine Lake utilized a very conservative set of assumptions that greatly exaggerated the proposed project's effects on water quality. Even with these conservative assumptions, the depositional analysis concluded that no safe drinking water standard would be exceeded over the life of the project, including standards for boron and arsenic.

Since publication of the Draft EIS/EIR, the estimated emissions from the proposed project have been revised. These revisions are described and explained in the responses to comments in the Air Quality Section. Because the estimates of air emissions from the proposed project have been revised, the analysis of deposition of emissions on surface waters has been revised. See response to "Comments—General Depositional Effects on Surface Waters" in the Hydrology Section for more discussion of this issue and the revised estimates of depositional effects to Medicine Lake. Although the data have been updated, the original conclusions in the Draft EIS/EIR have not changed.

Estimates of project air emissions of arsenic, mercury, boron, and acid-forming pollutants were revised since publication of the Draft EIS/EIR. The estimated emissions of these pollutants did not change substantially, with the exception of mercury. Moreover, the conclusions in the Draft EIS/EIR regarding the significance of these emissions also did not change. For more discussion of these pollutants, see the following responses to comments in the Hydrology Section:

- Effect of Arsenic Deposition on Surface Waters
- Effect of Mercury Deposition on Surface Waters

- Effect of Boron Deposition on Surface Waters
- Effects of Acid Deposition on Surface Waters

Comment FK.5 estimates cumulative impacts to water quality from air emissions based on the assumption that six projects similar to the proposed Fourmile Hill project would be built. As discussed in the response to "Comments—Reasonably Foreseeable Geothermal Development" earlier in this section, the proposed Fourmile Hill and Telephone Flat projects are the only reasonably foreseeable geothermal development at the Glass Mountain KGRA at this time. The cumulative analysis for the Fourmile Hill project therefore addresses cumulative impacts to water quality from air emissions from these two projects (as well as other identified cumulative projects). There is no basis for assuming that six geothermal development projects would be implemented at the KGRA, and an analysis of the cumulative impacts to water quality from air emissions from six geothermal development projects is not warranted.

Comments—Cumulative Cultural Resources Effects

AG.172 The EIS/EIR's discussion of cumulative impacts to cultural resources is inadequate because the EIS/EIR fails to fully explain the basis for its conclusion or propose adequate mitigation measures. (Citizens to Preserve the Ojai v. County of Ventura (1985) 176 Cal.App.3d 421, 432.) The EIS/EIR's finding that there would no significant impact to cultural resources is inconsistent with its admission that "the project region is largely undeveloped and likely contains a large number of undiscovered cultural resources..." (EIS/EIR, p. 4-317.) Because there may be a large number of undiscovered culturally valuable sites, it appears that the cumulative projects' chances of disturbing these resources would be even greater. Additionally, as discussed in the comments on Cultural Resources, the EIS/EIR has failed to provide sufficient information to evaluate the Project's impacts on cultural resources. Accordingly, its discussion cannot serve as the basis for a discussion of cumulative impacts. The EIS/EIR should provide a reasonable analysis of the Project's impacts in connection with other projects so that the public and decisionmakers can fully assess these cumulative impacts.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.173 Also, the EIS/EIR states that cumulative impacts to cultural resources are not expected to be significant because a mitigation program, similar to the one proposed for the project, would be sufficient to reduce any adverse impacts to these resources. (Id. at p. 4-317.) However, as discussed in the comments on cultural resources, the proposed mitigation measures are insufficient to reduce this Project's impacts on cultural resources. Thus, a similar mitigation program also would fail to reduce cumulative impacts to these resources. Absent adequate mitigation measures, the lead agency has no basis for concluding that there will be no cumulative impact on cultural resources.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Cumulative Cultural Resources Effects

The Draft EIS/EIR addresses cumulative impacts on cultural resources on page 4-317, stating that any potential impacts would be mitigated in accordance with Mitigation Measures 4.5.1a through 4.5.lj (pages 4-55 through 5-57) to avoid significant adverse impacts. Thus, potential cumulative impacts are not expected to be significant. This conclusion is based on the analysis in the Draft EIS/EIR, and the defined mitigation measures. Please see the Responses to Comments on Cultural Resources for a discussion of the adequacy of the impact analysis and mitigation measures.

The mitigation measures referenced on page 4-317 of the Draft EIS/EIR include protocols and procedures to be followed that would avoid or substantially reduce impacts on cultural resources. These measures are based on experience with resources in the area and have been shown to be effective in mitigating impacts. Construction would be monitored for any potential impacts on existing and undiscovered cultural resources. If such impacts are possible, the USFS, with the aid of a qualified archaeologist, would examine the site, and attempt to re-route the

project. Mitigation Measure 4.5.1a states that a survey would be conducted prior to ground disturbance to ensure that no unidentified cultural resource sites exist within the selected transmission line route.

Subsurface cultural resource sites have been sample surveyed along the transmission line routes. However, the Draft EIS/EIR acknowledges that the potential for unidentified cultural resource sites does exist. The proposed mitigation measures in Section 4.5, Cultural Resources, in the Draft EIS/EIR address this potential by requiring avoidance of sites identified after the more intensive survey is conducted. If the site cannot be avoided, the measure calls for evaluation under the NRHP to determine its eligibility for listing as a cultural resources site. Once evaluated, effects can be mitigated by the data recovery methods, etc. detailed in the mitigation measure. Mitigation of potentially affected sites is anticipated to be adequate to avoid significant effects.

Archaeological deposits that include human remains or objects considered "cultural items" according to the Native American Graves Protection and Repatriation Act (NAGPRA) shall be treated according to NAGPRA regulations. See response to "Comments—Timing of Surveys" in the Cultural Resources Section for a discussion of the decision-making process for selecting a transmission line route.

The Draft EIS/EIR for the Telephone Flat project provides further analysis of potential cumulative impacts from the two projects on cultural resources. In Section 4.3.5 of that document, it is stated that no significant impacts are expected to occur to known cultural resources, but that there may be impacts to unrecorded cultural resources. That project's Alternative Power Plant Site B might have slightly greater impacts on cultural resources and would require an archaeological field inventory. This section of the Telephone Flat Draft EIS/EIR provides a mitigation measure designed to reduce any potential impacts to below a level of significance. Both the Fourmile Hill and Telephone Flat project will avoid or substantially lessen any significant impacts to cultural resources. Thus, the cumulative impact of both projects is considered less than significant.

Comments—Cumulative Traditional Cultural Values Effects

A.42 Cumulative impacts are of particular concern in addressing the objections to the project by northeast California Indian tribes. For instance, what would be the possible effects on tribal culture if the operating life of the commercial facilities was significantly extended?
(Deanna M. Wieman, U.S. Environmental Protection Agency)

N.12 The DEIS/EIR did not disclose, evaluate, and mitigate the cumulative impacts to established religious uses of traditional cultural values of both the Klamath and Modoc National Forests resulting from the proposed project and other existing projects, and future projects. NEPA requires that cumulative impacts are disclosed and evaluated. The DEIS/EIR is deficient without this information and evaluation.
(Robert J. Baiocci, Fall River Wild Trout Foundation)

PH4.26 The EIS/EIR ignores cumulative effects to Native American values in the area. The NEPA requires that cumulative effects on tribes be addressed. *(Mount Shasta Public Hearing)*

Response—Cumulative Traditional Cultural Values Effects

Section 4.17 (page 4-317) of the Draft EIS/EIR evaluates of the potential cumulative impacts on traditional cultural values for both the Klamath and Modoc Forests. The direct, indirect, and cumulative effects of the proposed project were described and analyzed based on the information collected through interviews with local tribal

members (Theodoratus et al. 1998). The EIS/EIR indicates that the two projects could potentially have a significant adverse impact on traditional cultural uses in the area. Noise increases and temporary dust might occur at sites used by tribal members. The visual quality of Forest landscapes used by local American Indian tribes would be affected. Mitigation measures have been proposed to reduce these possible impacts, although they would remain cumulatively significant. The proposed project would not prevent access to traditional sites, would not prevent tribal members from conducting traditional practices, and would not prevent the religious use of the traditional cultural values of the Klamath or Modoc National Forests.

The Telephone Flat Draft EIS/EIR also provides a discussion of the potential impacts on traditional cultural values (titled "Native American Values") on pages 4-15 through 4-16. This section concludes that together the projects would diminish or alter the traditional cultural values of the Medicine Lake Highlands area, and that the impact is significant and unavoidable.

It would be remote and speculative to consider potential effects on tribal culture due to an extension of the project lifespan since such an extension is not proposed or envisioned (and therefore not reasonably foreseeable) at this time. Cumulative impacts to traditional cultural values from reasonably foreseeable projects (including the Telephone Flat project) are addressed in Section 4.17 of the Draft EIS/EIR.

Any additional geothermal project in the Medicine Lake Highlands would likely be considered a significant effect by the tribes. The actual effects to the tribes and/or tribal members would depend in part on the location and extent of future development. Facilities located in close proximity to traditional use sites or highly visible in the Highlands landscape would have greater effects. The effects of future cumulative projects would be addressed in environmental review under NEPA (and CEQA for some projects). The project is defined to have a 45-year lifespan. Potential effects on tribal culture due to an extension of the project lifespan (if proposed at some future date) would be subject to environmental review under NEPA and CEQA. The effects of extending the life of the project would be similar to those described in the EIS/EIR.

Reference:

Theodoratus, Dr. Dorothea, Geri Emberson, and Dr. Thomas Jackson. 1998. *Medicine Lake Highland and Timber Mountain Areas Ethnographic Report for the Calpine Fourmile Hill Geothermal Development Project, Siskiyou and Modoc Counties, California.* Prepared for MHA Environmental Consulting, Inc. for the Calpine Fourmile Hill Geothermal Development Project EIS/EIR.

Comments—Cumulative Vegetation Effects

J.8 In addition, stating that "avoidance" of rare plant populations will be sufficient mitigation for cumulative effects from the project, is inadequate and unscientific. Cumulative effects are the effects from loss of habitat which can occur from all phases of road, power plant, and transmission line construction, chemical and dust pollution which can result in the slow decline and eventual loss plant populations, or the loss of pollination vectors, microclimate changes and subsequent habitat conversion, and weed invasion. Please provide scientific documentation for the rationale for determining direct, indirect, and cumulative effects for all these species. *(Vivian Parker, California Native Plant Society)*

AG.174 The EIS/EIR fails to provide an adequate analysis of the Project's cumulative vegetation impacts. The EIS/EIR acknowledges that cumulative projects would potentially disturb or remove approximately 28,000 acres of vegetated land. (EIS/EIR, p. 4-318.) Nonetheless, the EIS/EIR concludes that the project

and the CalEnergy project would not significantly contribute to total cumulative vegetation loss because vegetation removal would only constitute approximately two percent of the total disturbed acreage. (Ibid.) The EIS/EIR's analysis fails to recognize that the issue is not the Project's percentage contribution to total vegetation loss, but whether any vegetation loss is significant in light of the existing environment. (See, e.g., Kings County, 221 Cal.App.3d at p. 718; see also 14 CCR § 15355 (individually minor projects can contribute to cumulative impacts).)

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.175 The EIS/EIR finds that the cumulative projects would not have a significant impact upon seral stage red fir forest and/or sensitive plant species because the projects' mitigation measures would reduce any adverse impacts to these species. (Id. at p. 4-318 to 4-319.) However, the EIS/EIR's statement concerning mitigation measures is totally unsupported. Given the Project's own inadequate mitigation measures and the possibility that the other projects' undetermined mitigation measures may be inadequate, there is no basis for the lead agency to conclude that the potential mitigation measures would be sufficient to alleviate the significant impacts.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.176 The EIS/EIR also states that geothermal emissions will not significantly affect vegetation. (Id. at p. 4-319.) As discussed in the comments on vegetation, however, toxic metals such as boron, fluorine, bromine, lithium, and barium will have a significant adverse effect on local vegetation. The CalEnergy project probably will have similar impacts. The EIS/EIR should consider the cumulative impacts of these two geothermal projects and other foreseeable projects on vegetation and evaluate mitigation measures.

By understating information regarding the severity and significance of cumulative impacts, the EIS/EIR impedes meaningful review of the Project's environmental consequences. Thus, the EIS/EIR is deficient as an informational document.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Cumulative Vegetation Effects

Both the Fourmile Hill project and the Telephone Flat project Draft EIS/EIR address the potential cumulative impacts on vegetation in the region. Section 4.17 of the Fourmile Hill Draft EIS/EIR, and Section 4.3.3.1 of the Telephone Flat Draft EIS/EIR describe of the possible impacts to vegetation, and mitigation measures designed to minimize these impacts.

Comment J.8 requests scientific documentation for the rationale for determining direct, indirect, and cumulative effects to special-status plants. This issue is addressed in depth in the Vegetation section of this document. It should be noted, however, that proposed mitigation measures for the project include floristic surveys, preconstruction surveys, and the routing of project facilities around sensitive areas. See response to "Comment—Vegetation Section Adequacy" for a discussion of the rationale for determining direct and indirect effects to special-status plants.

The Draft EIS/EIR addressed the cumulative effects to special-status plants on page 4-319. Mitigation measures requiring floristic surveys to USFS protocol, preconstruction surveys, and routing of project facilities around sensitive habitat areas would mitigate potential impacts to a less-than-significant level.

The Telephone Flat project may have the potential to affect four special-status plant species: sugar stick, Bogg's Lake hedge hyssop, ash penstemon, and Hall's sedge. Mitigation is defined to avoid significant effects to these species. The Fourmile Hill project is not expected to impact significantly any special-status plants. Therefore, the proposed project and the Telephone Flat project would not contribute to cumulatively significant impacts to special-status plants. If other projects were proposed in the area, they would require separate environmental review that would include the analysis of effects to special-status plants. It is likely that these other projects would also require avoidance and mitigation of adverse and significant effects to special-status plant species.

Comment J.8 also states that avoidance mitigation is not sufficient to adequately mitigate for impacts to rare plant habitat. Under CEQA and NEPA, avoidance is considered adequate mitigation to offset direct environmental impacts. Both CEQA and NEPA define mitigation to include "Avoiding the impact altogether by not taking a certain action or parts of an action" (CEQA: Public Resources Code Sections 21083 and 21087; NEPA: 40 CFR Section 1508.20).

Comment J.8 also requests documentation of the potential indirect impacts of the project to rare plant populations. Specifically, the comments cites potential impacts from chemical and dust pollution, which could affect plant populations indirectly through changes in pollinators, microclimate, or through weed invasion.

As stated on page 3-83 of the Draft EIS/EIR (Table 3.7-3), four special-status plants were observed in the project area. Two of these species (Hall's sedge and sugar stick) were found in the power plant and wellfield area; the other two (gray penstemon and volcanic daisy) were found along the transmission line routes (B1 and C1). The locations of populations of Hall's sedge and sugar stick are shown in Figure 3.7-1, as revised in the Final EIS/EIR. As shown in this figure, no populations of these species occur near proposed roads (i.e., new roads), where dust impacts would be greatest. One population of sugar stick occurs within approximately 300 feet of an existing road that would be improved. The other populations of these two species occur up to 500 feet away from existing roads. It is acknowledged that dust would increase along existing roads as a result of this project. However, adverse dust impacts would be restricted to areas close to the road. Because of their proximity to existing roads, two populations of special-status plants, one of each species, could be adversely affected by dust from traffic generated by the project. Impacts to these two populations are not considered significant because:

- The population of Hall's sedge near the existing road is very small, and
- Sugar stick is a USFS survey and manage species and is not listed by the state or federal government (or by CNPS) as rare or endangered. Therefore, impacts to this species are not considered significant under CEQA or NEPA.

Impacts to gray penstemon and volcanic daisy populations from dust pollution would not be significant. Populations of these species are found along the transmission line routes. Traffic increases from the proposed project would be minimal along existing roads and new access roads. Project-related vehicles would travel these roads only during inspection and maintenance of these lines, which would occur only a few times per year.

Comment J.8 also asserts that there may be indirect impacts to special-status plants through impacts to pollinators. As stated in response to "Comment—Mitigation for Impacts to Special-Status Plants" in the Vegetation Section, this concern about effects to pollinators is based on two assumptions: (1) there are pollinators that are critical to the persistence of these species-status plants, and (2) these pollinators would be adversely affected by the proposed project. There is no evidence that either Hall's sedge or sugar stick rely on specialized pollinators. Indeed, sedges tend to be wind-pollinated and plants in the family that includes sugar stick (Ericaceae) tend to rely on a wide variety of generalist pollinators. Therefore, there would be no adverse

effects on pollinators of these species from this project. For a discussion of the potential effects of weed invasion and mitigation proposed, see response to "Comments—Effects of Exotic Species" in the Vegetation Section.

It is projected that the Telephone Flat project would remove or disturb approximately 188.9 acres of vegetation (depending on the transmission line alternative that is selected). The power plant, well pads, geothermal pipelines and wellfield roads of the Fourmile Hill project are projected to disturb approximately 50 acres of vegetation (see Table 2.2-1 on page 2-12 of the Draft EIS/EIR). The proposed transmission line would result in the removal of or disturbance to an additional 339 acres (see Table 2.2-3 on page 2-44 of the Draft EIS/EIR). Thus, the cumulative impacts of the two geothermal projects would result in the removal of or disturbance to up to 578 acres of vegetation. See Table 4.17-2a, Habitat Disturbance Associated with the Fourmile Hill Project and the Telephone Flat Project, for information concerning potential impacts of the two projects on specific vegetation community types.

As stated in the Fourmile Hill Draft EIS/EIR on page 4-318, other projects that could occur in the region are expected to remove or disturb approximately 28,000 acres of vegetation in the Klamath National Forest. The Klamath National Forest includes 1,680,000 acres of Federal lands, which represents approximately 1.6% of the total acreage. Page 4-314 of the Draft EIS/EIR gives a breakdown of the potential projects in the Klamath National Forest. The locations of these forecasted timber harvests are not known at this time. Therefore, the impacts of these harvests cannot be evaluated at this time.

The environmental impacts of each timber sale (and subsequent harvest) will be evaluated under NEPA through the preparation of an Environmental Assessment or an EIS. During this preparation of the NEPA document, USFS staff would evaluate the potential environmental impacts of the timber sale on issues similar to those considered in this EIS/EIR, including vegetation and wildlife. If sensitive species may be present in the area of the timber sale, a Biological Assessment or Biological Evaluation may be prepared in accordance with the requirements of the USFWS and USFS, respectively. The Biological Assessment and Biological Evaluation would examine in detail the project's effects on sensitive species. If warranted, mitigation would be designed to reduce the impacts of these timber sales. Mitigation could include reducing the scale of the timber harvest or moving it to a less sensitive area.

Comment AG.174 asserts that the Draft EIS/EIR fails to analyze whether any vegetation loss is significant in light of this cumulative loss of vegetation. Additional loss of vegetation in the area is not expected to create significant cumulative impacts. Five mitigation measures (4.7.3a, 4.7.3b, 4.7.4a, 4.7.4b, and 4.7.4c) are proposed to offset the potentially adverse impacts to special-status plants and to sensitive plant communities. After mitigation, the impacts to these resources would be reduced to a level below significance. All other impacts to vegetation are considered not significant; thus, no further mitigation is required.

Table 4.17-2a: Habitat Disturbance Associated with the Fourmile Hill Project and the Telephone Flat Project (in acres)

	Fourmile Hill	Telephone Flat	Cumulative Disturbance
Power Plant and Wellfield			
Lodgepole Pine Forest	26.0	25.9	51.9
Red Fir Forest	1.0	5.5	6.5
Red Fir -Lodgepole Pine Forest/Upper Montane Mixed Conifer Forest[1]	22.0	115.6	137.6
Ponderosa Pine Forest	0.0	0.0	0.0
Lower Montane Mixed Conifer Forest	0.0	0.0	0.0
Juniper Woodland	0.0	0.0	0.0
Big Sagebrush Scrub	0.0	0.0	0.0
Rabbitbrush Scrub	0.0	0.0	0.0
Meadow	0.0	0.0	0.0
Herbaceous	0.3	0.0	0.3
Rock Outcropping	0.4	0.0	0.4
Ponderosa Pine Plantation	0.0	0.0	0.0
Agricultural	0.0	0.0	0.0
Disturbed	0.0	9.1	9.1
Transmission Line[2]			
Lodgepole Pine Forest	140.6	4.0	144.6
Red Fir Forest	20.7	0.7	21.4
Red Fir -Lodgepole Pine Forest / Upper Montane Mixed Conifer Forest	62.7	28.1	90.8
Ponderosa Pine Forest	26.6	0.0	26.6
Lower Montane Mixed Conifer Forest	25.6	0.0	25.6
Juniper Woodland	13.7	0.0	13.7
Big Sagebrush Scrub	7.5	0.0	7.5
Rabbitbrush Scrub	14.9	0.0	14.9
Meadow	2.3	0.0	2.3
Herbaceous	2.5	0.0	2.5
Rock Outcropping	0.0	0.0	0.0
Ponderosa Pine Plantation	20.4	0.0	20.4
Agricultural	0.0	0.0	0.0
Disturbed	1.3	0.0	1.3
TOTAL DISTURBANCE	**388.5**	**188.9**	**577.4**

Notes:

1 The former vegetation type is used in the Telephone Flat Draft EIS/EIR; the latter is used in the Fourmile Hill Draft EIS/EIR. These types are roughly equivalent.

2 Includes transmission line access roads and transmission line substation.

For further discussion of the adequacy of the mitigation measures proposed in the Draft EIS/EIR to avoid or reduce impacts to vegetation (including special-status plants and sensitive plant communities), see the following responses to comments in the Vegetation Section:

- General Vegetation Mitigation
- Mitigation for Impacts to Special-Status Plants
- Pre-Construction Survey Mitigation
- Mitigation for Impacts to Late-Seral Forest and General Wildlife Habitat

Comment AG.176 states that the Draft EIS/EIR should consider the cumulative impacts of emissions from the Fourmile Hill project and the Telephone Flat project on vegetation. As discussed in the Fourmile Hill Draft EIS/EIR on pages 4-89 through 4-93, impacts to vegetation from project emissions from the Fourmile Hill power plant and wellfield would not be significant. Further justification for this conclusion is provided in the following responses to comments in the Vegetation Section:

- Effects of All Emissions on Vegetation
- Effects of Well Venting on Vegetation
- Effects of Hydrogen Sulfide Emissions on Vegetation
- Effects of Boron Emissions on Vegetation
- Effects of Fluorine Emissions on Vegetation
- Effects of Lithium Emissions on Vegetation
- Effects of Barium and Strontium Emissions on Vegetation

The Telephone Flat project would have emissions rates similar to that which would occur at Fourmile Hill, and would not have a significant adverse effect on vegetation. Adverse impacts to vegetation from project emissions would be restricted to the region immediately adjacent to each project's power plant. Thus, there would be no opportunity for emissions from the two projects to overlap or interact to adversely affect vegetation. The cumulative effect to vegetation from the two projects would not be significant as the two areas of potential effect are small. See Section 4.3.4 of the Telephone Flat Draft EIS/EIR for further discussion of the cumulative effects of emissions.

Comments—Cumulative Wildlife Effects

B.4 The 300 MW design capacity and 145 MW effective capacity of the transmission lines proposed for the proposed project are significantly greater than required to transfer electrical power from a 49.9 MW plant to the proposed substation, suggesting that other geothermal development projects are planned for the Glass Mountain KGRA. Indeed, on page 2-37, the Draft EIS/EIR, states: "...the USFS expressed a preference that the proposed transmission line for the project be designed to accommodate not only the net electrical power output of 44.9 MW from the proposed project, but also reasonably foreseeable geothermal power generation that could occur at the Glass Mountain KGRA." This information suggests that the proposed action may be interrelated or interdependent with other future actions. The section 7 implementing regulations require that Federal agencies consider the "...direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action...". Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

In addition, failure to analyze and disclose the potential environmental effects of such foreseeable future power development in the KGRA is inconsistent with the requirements of the National Environmental Policy Act of 1969, as amended (NEPA), to consider cumulative impacts of an action. As defined in the

Council on Environmental Quality regulations for implementation of NEPA, cumulative impact is the "...impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." The Service recommends that the Draft EIS/EIR be revised to include a complete analysis and disclosure of the effects of future development of the Glass Mountain KGRA on federally listed endangered and threatened species and Federal species of concern. Federal species of concern are those species that may be endangered or threatened but for which enough biological information has not been gathered to support listing at this time.

(Ronald A. Iverson, U.S. Fish and Wildlife Service)

N.26 The DEIS/EIR failed to disclose and evaluate the cumulative impacts and losses to special-status species habitat resulting from the proposed Fourmile Hill Geothermal project, the proposed Telephone Hill Geothermal project, and other activities approved by the U.S. Forest Service and the U.S. Bureau of Land Management. The DEIS/EIR is deficient without this cumulative impact analysis.

(Robert J. Baiocci, Fall River Wild Trout Foundation)

N.27 The DEIS/EIR also failed to disclose and evaluate the cumulative impacts and losses to special-status species habitat resulting from the proposed transmission corridor and the BPA's Malin-Warner transmission corridor. The DEIS/EIR is deficient without this cumulative impact analysis.

(Robert J. Baiocci, Fall River Wild Trout Foundation)

N.31 The DEIS/EIR failed to disclose and evaluate the potential adverse cumulative impacts which adversely kill or injure threatened and endangered species, special-status bird species, and birds in general as a result electrocution and collision with the transmission lines resulting from the Fourmile Hill Geothermal project, Telephone Hill Geothermal project, and the existing Malin-Warner transmission lines. The DEIS/EIR is deficient for failing to disclose and evaluate

(Robert J. Baiocci, Fall River Wild Trout Foundation)

AG.177 The EIS/EIR acknowledges that the projects could result in cumulative impacts to wildlife habitat and special status species. (EIS/EIR, p. 4-319.) Nonetheless, the EIS/EIR asserts that these cumulative impacts are insignificant. The EIS/EIR's analysis is flawed for several reasons. First, the EIS/EIR states that the Calpine and CalEnergy projects' contribution to the loss of 28,000 acres would be insignificant because it would be only a "minor contribution" to the total affected acres. (Ibid.) This analysis fails to recognize that cumulative impacts can result from individually minor, but cumulatively significant, projects over time. (14 CCR § 15355; see also Ex. D (noise and pipeline impacts on wildlife).) Further, without adequate information regarding the relative value of the habitat, there is no basis for the lead agency to conclude that habitat loss would be insignificant.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.178 Second, the EIS/EIR asserts that mitigation measures would reduce any cumulative impacts to insignificance. (Id. at p. 4-320.) As discussed in the wildlife section, however, the proposed mitigation measures are inadequate. Also, the EIS/EIR's assumption that the other projects will incorporate adequate mitigation measures is wholly unsupported by any evidence. Without adequate mitigation, there is no basis for the lead agency to conclude the project will not contribute to cumulatively significant impacts to wildlife.

Hence, the EIS/EIR is deficient because it fails to adequately analyze Project's cumulative impacts on wildlife and propose appropriate mitigation measures.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Cumulative Wildlife Effects

Comment B.4 states that the USFS desire to have one corridor accommodate more than one project suggests that the proposed Fourmile Hill and Telephone Flat projects are interrelated; this is not the case. The Telephone Flat project is not part of the Fourmile Hill project and is not dependent on the Fourmile Hill project, and vice-versa. Therefore, the projects are not interdependent. Similar to the Fourmile Hill proposal, the Telephone Flat project includes a proposed transmission line (largely following routes analyzed in the Fourmile Hill EIS/EIR). These two geothermal projects are proposed by separate private companies under different schedules. If the Fourmile Hill project is not built, CalEnergy would build the transmission line for the Telephone Flat project. The two projects are not interdependent. Each project has independent utility apart from the other. Each project could operate independently if the other project did not go forward.

The Draft EIS/EIR for the Fourmile Hill project has addressed all foreseeable development in the Glass Mountain KGRA. As indicated in response to "Comments—Reasonably Foreseeable Geothermal Development," the only other geothermal project planned in the region is the Telephone Flat project. The design capacity of the transmission lines has been devised to avoid line shut-downs due to surges and other irregularities in transmission. While additional electrical transmissions could be carried along this line, there are no foreseeable additional geothermal development projects in this region. The Draft EIS/EIR has therefore analyzed and disclosed all known and potential effects of foreseeable development in the Glass Mountain KGRA area. Accordingly, it is not practicable for the EIS/EIR for the Fourmile Hill project to analyze the possible impacts of speculative and unknown geothermal projects on Federally listed endangered and threatened species.

The Draft EIS/EIR discloses and evaluates the cumulative impacts and losses to special-status species habitat resulting from the proposed Fourmile Hill project on pages 4-319 and 4-320. The Draft EIS/EIR indicates that there may be some cumulative impacts to special-status wildlife species through habitat degradation or disturbance. The amount of habitat that would be affected would be identical to that discussed in the response to "Comments—Cumulative Vegetation Effects."

As described in the EIS/EIR in Section 4.8, Wildlife, there is the potential for significant adverse impacts to special-status wildlife. However, mitigation proposed in this section and in responses to comments in the Wildlife Section would reduce these potential impacts to levels below significance.

Potential impacts on special-status wildlife have been identified for the Telephone Flat project on pages 3.3-63 through 3.3-65 of the Draft EIS/EIR for this project. As described in this section, some impacts to special-status wildlife would be significant without mitigation. Mitigation is identified in the Draft EIS/EIR for Telephone Flat to reduce all impacts to special-status wildlife to a level below significance.

The cumulative impacts associated with the development of the two projects are not expected to be greater than the additive effects of the projects. Effects from the Fourmile Hill project are not predicted to interact with those from the Telephone Flat project to produce a multiplicative effect. In addition, mitigation measures have been designed for both projects to reduce these potential impacts to levels below significance (see Fourmile Hill Draft EIS/EIR pages 4-122 through 4-124 and Telephone Flat Draft EIS/EIR Section 3.3.3). Thus, with the implementation of mitigation measures proposed for each geothermal project, cumulative impacts to special-status wildlife and to general wildlife habitat would be less than significant.

Comments N.27 and N.31 state that the impacts of BPA's Malin-Warner transmission corridor should be addressed in the Fourmile Hill EIS/EIR. In the vicinity of the proposed project, the Malin-Warner line passes through northern juniper woodland, which is dominated by northern (or western) juniper (*Juniperus occidentalis*). Vegetation cover within this habitat type is generally sparse. Based on aerial photographs of the area, junipers within the Malin-Warner corridor have been cleared. However, shrubs and grasses within this corridor remain. The Fourmile Hill project would disturb up to 11 acres of this vegetation type (depending on the alternative that is selected). This

disturbance would result in similar impacts to that which occurred under the Malin-Warner line: clearing of junipers where necessary and clearing of shrubs and grasses only for access roads. The disturbance or removal of 11 acres of this habitat type would not be considered a significant cumulative effect because this habitat type is abundant on the Modoc Plateau and is not considered sensitive. Moreover, removal of up to 11 acres of this habitat type would not significantly affect sensitive wildlife species because of the abundance of this habitat type in the area.

Comment N.31 expresses concern about the potential cumulative effects of bird collisions and electrocutions on the existing and proposed transmission lines. The effects of the proposed project on the chance of bird collisions is discussed in response to "Comment—Effects of Transmission Lines on Birds" in the Wildlife Section. As discussed in this response, the proposed project would not significantly increase the chance of bird collisions in the project area due to the design of the transmission line and the number and types of birds in the area. For the same reasons, the proposed transmission line for the Telephone Flat project would not significantly increase the chance of bird collisions (the proposed transmission line for Telephone Flat is almost the same as the proposed line for Fourmile Hill). There have been no recorded bird injuries or deaths due to collisions with the Malin-Warner line in the project vicinity (T. Ratcliff, Modoc National Forest, personal communication, 1998).

Moreover, deaths are not anticipated because the design of the existing and proposed transmission lines precludes bird electrocution. For a bird to be electrocuted, it must come in contact with two wires simultaneously, either (1) two energized conductors or (2) a groundwire and a conductor. On the proposed transmission lines and on the Malin-Warner line, all conductors and groundwires are spaced far enough apart so that it is (or would be) impossible for even the largest bird (bald eagle) to contact two wires simultaneously.

Comment AG.177 requests information regarding the relative value of the wildlife habitat in the project area. The value of wildlife habitat in the project area is discussed in Section 4.8 of the EIS/EIR, Wildlife. Further information on the relative value of the wildlife habitat in the region can be found in the responses to comments in the Wildlife Section and in the Biological Assessment that has been prepared for this project (the Biological Assessment is available for review by the public at the USFS office in Alturas, California).

Comment AG.178 states that mitigation proposed in the Draft EIS/EIR to reduce impacts to wildlife is inadequate. Twenty-one mitigation measures are proposed in Section 4.8 of the Draft EIS/EIR to avoid or minimize impacts to wildlife. Many of these mitigation measures are designed to reduce potential impacts to specific special-status species; other measures are designed to reduce impacts to habitat that is used by a variety of wildlife (e.g., late-seral Forests). Some of the mitigation measures proposed in the Draft EIS/EIR have been modified, and several new mitigation measures have been added (see responses to comments in the Wildlife Section for these changes and additions). These revisions and additions further reduce effects below significance.

See also responses to the following comments in the Wildlife Section (the comment addressed by each section is noted in parentheses), listed in their order of appearance:

- Wildlife Section Adequacy (AG.177, AG.178)
- General Impacts to Special-Status Wildlife (N.26, N.27, N.31, AG.177, AG.178)
- Effects of Transmission Lines on Birds (N.27, N.31)
- Bald Eagle (N.27, N.31)
- Osprey (N.27, N.31)
- General Wildlife Mitigation (N.26, N.27, N.31, AG.177, AG.178)

Comment AG.178 also asserts that the assumption in the Draft EIS/EIR that the other projects would incorporate adequate mitigation measures is wholly unsupported by any evidence. As stated earlier in this section, other cumulative projects in the region that may have cumulative effects would be required to undergo an environmental review under state or Federal law. In accordance with this review, as required by law, the projects would have to incorporate mitigation measures to reduce impacts (including those to special-status wildlife). Because of this process, it is reasonable to assume that other projects would adopt mitigation measures that would reduce or avoid impacts to special-status wildlife. Mitigation proposed for the Telephone Flat project to reduce impacts to special-status wildlife is described in the Draft EIS/EIR for this project.

Comments—Cumulative Visual Resources Effects

H.26 The cumulative impacts of this project combined with the Telephone Flat project must be examined more closely, since Telephone Flat has much more potential for light emissions in the Medicine Lake Caldera, the most sensitive area. The power plant and well drilling at Telephone Flat would contribute a significant amount of light pollution, especially well drilling, which, if a similar plan is adopted, would occur every other year throughout the project life. *(Bill Dart, American Motorcyclist Association)*

AD.37 Sites 4, 5, and 16 are sites that may not have any significant visual impact from any and all of the Fourmile Hill project (except the night time visibility). All the other sites would have some steam plume visibility both day and night from cumulative effects from Fourmile Hill, Telephone Flat and other projects if developed. *(Floyd J. Buckskin, Pit River Tribe)*

Response—Cumulative Visual Resources Effects

The Fourmile Hill Draft EIS/EIR states that the Fourmile Hill and Telephone Flat projects would create a significant cumulative visual effect that would be unavoidable. Selection of the proposed alternative (i.e., Alternative 1) for the Fourmile Hill project would result in significant, cumulative visual effects. However, the lead agencies' preferred alternative (Alternative 6) would avoid significant visual effects, and would also have a less-than-significant cumulative visual effect. There is no additional reasonably foreseeable geothermal development in the region in addition to the two present projects (see discussion in responses to "Comments—Reasonably Foreseeable Geothermal Development," above). It should be added that no other development in the area is proposed at present which would contribute to impacts to visual quality.

Comment H.26 expresses concern about the potential for light emissions in the Medicine Lake caldera from the Telephone Flat project. According to the Telephone Flat Draft EIS/EIR, the construction at the power plant, wellfields, and transmission lines would cause short-term visual effects below the level of significance. The Telephone Flat Draft EIS/EIR provides measures to reduce these impacts, if deemed necessary by

the USFS. See page 3.8-14 of the Telephone Flat Draft EIS/EIR for additional information.

Comment AD.37 expresses concern about cumulative plume visibility in the area. At present, the Fourmile Hill Project and the Telephone Flat Project are the only proposed geothermal projects in the Medicine Lake Region. Thus, only plumes from these two projects may impact visual quality. The visibility of the cooling tower plumes from the two projects is considered a less than significant impact. The Fourmile Hill Draft EIS/EIR provides several mitigation measures designed to minimize plume visibility. Mitigation Measure 4.9.2a provides that well venting would be conducted to minimize steam plume visibility, while Mitigation Measure 4.9.2b provides that the cooling towers would be designed to minimize steam plume visibility. The Telephone Flat Draft EIS/EIR provides no mitigation measures to reduce steam plume visibility. For further information on the visual impacts from steam plumes from the Fourmile Hill project, please sees the responses to "Comments—Visual Impact of Steam Plumes" in the Visual Quality Section of this document.

Comment—Cumulative Recreation Effects

H.21 In addition to failing to identify the significant negative impact of road plowing on winter recreation, the document failed to address the cumulative impact of this project combined with the Telephone Flat project. If both projects were to approved with snow plowing included, several other groomed snowmobile routes in the Arnica Sink-Glass Mountain-Lyons Peak-Forest Route 97 vicinity would be either wiped out or crossed. The two projects combined would have a huge negative impact on the existing already approved snowmobile route network. The Telephone Flat project would be especially egregious since it would penetrate the Medicine Lake Caldera and violate its pristine winter condition. Snow depths are typically much deeper at the higher elevations, which attracts higher amounts of snowmobile use, allows easier cross-country travel, but compounds both the safety hazard, due to higher berms dropping into deeper road cuts, and the expense to keep roads open in the deeper snow depths encountered with the Medicine Lake Caldera. The cumulative impact of this project combined with the Telephone Flat project must be addressed and mitigated in the final EIS/EIR.
(Bill Dart, American Motorcyclist Association)

Response—Cumulative Recreation Effects

Both the Fourmile Hill and the Telephone Flat Draft EIS/EIRs address the potential effects of the projects on snowmobile trails and other forms of recreation in the area. The Fourmile Hill Draft EIS/EIR states that no significant adverse recreational impacts would be expected, based on project design and mitigation. The Draft EIS/EIR for the Telephone Flat provides additional discussion of cumulative effects on snowmobiling in Section 4.3.10. In this section, the Draft EIS/EIR states that the Telephone Flat project would result in the snowplowing of a designated snowmobile trail and the possibility of unsafe snow conditions over geothermal pipelines. The Telephone Flat Draft EIS/EIR further states that these impacts would be less than significant following mitigation efforts. The cumulative effects would therefore be less-than-significant.

Comments—Cumulative Air Quality Effects

A.45 We commend the USFS and BLM for discussing the California and National Ambient Air Quality Standards (NAAQS). The DEIS notes that a PSD permit will not be required for the project because it is not considered a major source. Furthermore, according to the DEIS, concurrent production at the Telephone Flat geothermal operation is not anticipated to create an exceedence of NAAQS. In order to substantiate this statement, EPA recommends an inclusion of a table listing estimated average emissions of criteria pollutants for Telephone Flat, similar to the included table for the proposed action (Table 4.13-3). *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

AO.3 We keep hearing that the steam releases only have 2% of this and that, but never has the accumulation of all the plants over a 45 year term ever been mentioned. *(Mildred J. Aquila)*

BE.7 There need's to be a complete new EIR report showing the continual accumulation of pollution from five or six of these plant's in the Medicine Lake area. If these projects are even going to be considered in the future.
(Paul Carter, Jr.)

Response—Cumulative Air Quality Effects

The estimated average emissions of criteria pollutants for the proposed Telephone Flat project has been prepared based on information in the Telephone Flat Draft EIS/EIR

The cumulative effects of the projects are addressed in both the Fourmile Hill and the Telephone Flat Draft EIS/EIRs. The long-term average impacts of the two projects are expected to be additive downwind of each project. For example, the annual average cumulative impacts for the two projects at the Medicine Lake cabins would be equal to the sum of the annual average impacts estimated for each project individually. However, none of the estimated annual average impacts for either project is close to the relevant ambient air quality standard, and the sum of the estimated impacts for the two projects also will not violate any ambient air standard. Mitigation measures for each project should effectively reduce any potentially significant impacts below the level of significance.

Data collected on wind distribution patterns in the region indicate that the emissions from the proposed projects would overlap (and thus could potentially have additive effects) only rarely. Based on data collected over one year, winds directed from the Telephone Flat site to the Fourmile Hill site occur 4.3% of the time; winds directed in the reverse direction occur about 1% of the time. The concentration of the majority of pollutants from the proposed project (except for PM_{10}, NO_2, and H_2S) are predicted to be below 50% of the corresponding California and National ambient air quality standards. Thus, even during conditions in which emissions from the proposed projects overlap, the cumulative impacts of the two projects would not exceed the relevant air-quality standards for any of those pollutants. Furthermore, the effects to vegetation from air emissions are predicted to be greatest immediately adjacent to the power plant. Thus, the impact of each plant on vegetation is insignificant.

In response to comment BE.7, only two geothermal development projects are planned in the Medicine Lake region. There is presently no planned development of other geothermal plants in the area (see responses to "Comments—Reasonably Foreseeable Geothermal Development"). In addition, there are no non-geothermal projects proposed in the region at present. The only possible sources of cumulative impacts to air quality are the two geothermal projects discussed in these responses to comments. The impacts to Medicine Lake from each proposed project is less than significant and would not adversely affect Medicine Lake. The cumulative effect, while additive, would still be less than significant.

Comments—Cumulative Noise Effects

H.32 The cumulative impact of this project combined with the Telephone Flat project needs better analysis, since without Telephone Flat, there is no need to route any power lines through the Medicine Lake Caldera.
(Bill Dart, American Motorcyclist Association)

V.15 The EIR indicates that the noise levels from various sensitive receiver locations, as measured in L_{eq} equivalent values from this plant at the homes on the southeast side of Medicine Lake would have these values:

EIR'S PREDICTED NOISE LEVELS FROM FOURMILE HILL POWER PLANT

	Well Drilling	Plant Operations	Drilling and Plant
1. North Campgrounds	25 dB L_{eq}	13 dB L_{eq}	25.3 dB L_{eq}
2. Homes at SE end of Medicine Lake	20 dB L_{eq}	11 dB L_{eq}	22.3 dB L_{eq}
4. Schonchin Picnic Area	26 dB L_{eq}	18 dB L_{eq}	26.6 dB L_{eq}

If the Fourmile project produces a sound level of 26.6 dBA at 2.2 miles, then it is reasonable to assume that the similarly sized Telephone Flat Geothermal Plant might also produce the same amount of noise at that distance. It would produce at least 6 dBA more noise at half that distance of 1.1 miles, which would be at Least 32.6 dBA. This calculation is based upon the EIR estimation of a 6 dBA increase for each halving of distance for lack of any better actual measurements in the EIR.

The EIR states that Telephone Flat Geothermal Plant will be about 1.5 miles southeast of Medicine Lake. Inconsistently however, the EIR map (Figure 4.17-1) shows that Telephone Flat Geothermal Plant and wellfield to be only about 6,00U feet or 1.1 miles to the east from the nearest cabins on the east side of Medicine Lake. This error in the EIR should be corrected. Moreover, behind the Telephone Flat Geothermal Plant is a prominent mountain slope which would tend to amplify facility noise by reflecting it westwards towards Medicine Lake. Those errors in the EIR tend to falsely minimize the impacts of this cumulatively foreseeable geothermal plant project.

(Carol Plank, Medicine Lake Citizens for Quality Environment)

V.16 The location of a third power plant the proposed Mt. Hoffman Geothermal Power plant apparently now on the drawing boards is not disclosed in the EIR. It however has been disclosed in open discussion with government officials. However, the USGS maps of the area indicate two geothermal wells in the vicinity of Mt. Hoffman. (see attached map, previous page, Exhibit "A") For lack of any more accurate information from the BLM, the USFS or the private companies involved, either one of these Mt. Hoffman locations is about equidistant from the group of sensitive noise receptors around Medicine Lake. They are a out 2.0 miles from the center of Medicine Lake itself. Until more accurate information is made public, we will assume that one of these designated geothermal wells is the site of the proposed Mt. Hoffman power plant currently being designed.

The cumulative impacts of all three of these geothermal plants, when in operation at the same time, appear to be significant. The EIR is silent on the magnitude of such cumulative impacts however. Using the little data which is available, and applying the standard distance attenuation principles used in the EIR, along with standard calculational means to add cumulative noise levels together, we have compelling evidence that their combined noise levels would be in excess of Siskiyou County Noise Element limits for this quiet, rural community. Without a doubt, their combined noise limits would be significantly louder than the existing quiet ambient noise levels. The EIR fails to adequately analyze this cumulative increase in noise levels. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

V.18 So the question remains, how much higher will the noise levels be when the power plants are operating and drilling is occurring than these current quiet nighttime conditions? The EIR fails to answer this critical question. We will attempt to provide an answer, based upon what has so far been revealed. The important point is that even with what is known, the calculations reveal that these cumulative projects' noise levels will be noticeably greater and a significant environmental impact for which this EIR offers inadequate mitigation. The calculations below show that these cumulative all-day, all-night impacts could be as much as perhaps 20 dBA greater than existing noise levels at nighttime! Such industrialization of a peaceful quiet community must be disclosed in this EIR, yet it hasn't been done yet.

ESTIMATION OF OTHER POWER PLANT NOISE LEVELS AS HEARD AT MEDICINE LAKE SENSITIVE LOCATIONS

It is possible to roughly estimate the loudness of the other foreseeable geothermal plants as heard at various points around Medicine Lake based upon what the EIR has disclosed about the Fourmile Hill project. The public would have an easier time independently examining such related impacts if the EIR preparer had provided the actual measurements of a facility such as is proposed... and as CEQA requires. Perhaps those actual measurements were deliberately omitted to obscure the full impact of this project? Baring such solid measurements though, these following calculations will have to suffice.

The loudness of a given noise source as calculated at a different location can be estimated by this standard acoustical formula:

$$dB2 = db1 — 10 \times a \times \text{Log}\ (R2 \div R1)$$

dB1: original noise measurement

dB2: calculated noise level at different location

a: factor to account for characteristics of noise source and intervening territory
R1: original distance
R2: new distance

The locations of both the second Telephone Flat Geothermal Plant and the assumed location for the third Mt. Hoffman Geothermal Plant are shown on the attached map. The distances to sensitive receptors around Medicine Lake was taken from this Map. Then using the formula above, noise levels were calculated of each during operation and drilling using the information from this EIR and are shown below:

CUMULATIVE NOISE LEVELS FROM DRILLING AND OPERATION (in decibels (dBA), both L_{eq} as used in EIR and L_{CNEL} — (Day-Night Average) as used in General Plan, which are typically 6 to 7 dB higher)

(Not including helicopter noise, construction noise, sound reflections off nearby mountain slopes, increases in noise travel over open water, and the louder "C"-weighting scale to account for low frequency of geothermal power plant noise and lesser atmospheric attenuation)

	Fourmile Hill Geothermal Plant's Noise	Telephone Flat Geothermal Plant's Noise	Mt. Hoffman Geothermal Plant's Noise	Cumulative Noise (of all 3 power plants)
1.NorthMed. Lake Campgrounds	25.3 (@2.8miles)	32.6 (@ 1.1 miles)	32.6 (@ 1.1 miles)	36.0 L_{eq} 42.7 L_{CNEL}
2. Homes at SE end of Medicine Lake	22.3 (@ 3.5 miles)	32.6 (@ 1.1 miles)	29.9 (@ 1.5 miles)	34.7 L_{eq} 41.4 L_{CNEL}
4.Schonchin Picnic Area	26.6 (@ 2.2 miles)	25.1 (@ 2.6 miles)	25.1 (@ 2.6 miles)	30.4 L_{eq} 37.1 L_{CNEL}

[NOTE: The L_{CNEL} noise measurements include an adjustment adding 5 dB for the hours from 7 pm to 10 pm and adding 10 dB from 10 pm to 7 am to account for increased noise sensitivity during evening and nighttime hours.]

What is striking about these calculations is that Medicine Lake will be exposed to even louder noise levels from the second Telephone Flat Geothermal plant which will be closer to it than the current one. The EIR should have revealed this but didn't. By not disclosing it in this EIR, it appears that the private companies or the Lead Agency is attempting to get a foot in the door, and then once some noise increases are already approved, introduce even louder ones later. This may be true also for the Mt. Hoffman geothermal plant. For example, the campgrounds at the northeast side of Medicine Lake may be exposed to as much as 25.3 dBA from the Fourmile Hill plant, but as much as 32.6 dBA from either of the 2nd or 3rd power plants. Either of them will sound more than twice as loud from the campgrounds as The Fourmile Hill plant will. Why wasn't this disclosed?

CUMULATIVE ADDITION OF NOISE LEVELS

Once the loudness of each is determined, then they can be "added" together to figure out how loud all three power plants will be if drilling wells and operating at the same time. The fourth column above adds cumulatively the noise levels from each of these three proposed power plants, using this common acoustical formula:

Cumulative dB = 10 x log [10 EXP(0.1 x dB1) + 10 EXP(0.1 x dB2) + 10 EXP(0.1 x dB3)]

Values of us to 36 dBA L_{eq} are estimated therefore from these cumulative noise levels. Even as to instantaneous measurements, 36 dBA would be significantly louder than the current mid to low 20's dBA currently existing. This increase would constitute a significant cumulative environmental impact and should have been disclosed in this EIR. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

V.20 The campground and the cabins at the east side of Medicine Lake may therefore be exposed to 42.7 and 41.4 dBA L_{CNEL} levels of noise, which exceeds the General Plan's 40 dBA L_{CNEL} standards after adjustment for this quiet rural setting as referenced above. Therefore, if the cumulative impacts of all three power plants would create noise levels in excess of the General Plan standards, this would be a significant environmental impact which requires disclosure and mitigation The EIR fails to do this and is therefore legally inadequate. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

V.21 Even if the Mt. Hoffman power plant or other yet undisclosed power plants aren't built, the cumulative impacts of both the Telephone Flat Geothermal Plant and the Fourmile I ill plant will create noise levels which exceed the Siskiyou County General Plan Noise Element's adjusted acceptable value of 40 dB(A) L_{CNEL} for some locations of sensitive receivers. In particular, the campgrounds at the north side of Medicine Lake will be exposed to in excess of 40 dB(A) L_{CNEL} when both power plants are operating and drilling wells, as shown in the following table:

CUMULATIVE NOISE LEVELS FROM DRILLING AND OPERATION (in decibels (dBA), both L_{eq} as used in EIR and L_{CNEL} —(Day-Night Average) as used in General Plan, which are typically 6 to 7 dB higher)

(Not including helicopter noise, construction noise, sound reflections off nearby mountain slopes, increases in noise travel over open water, and the louder "C"-weighting scale to account for low frequency of geothermal power plant noise and lesser atmospheric attenuation)

	Fourmile Hill Geothermal Plant's Noise	Telephone Flat Geothermal Plant's Noise	~~Mt. Hoffman Geothermal Plant's Noise~~	Cumulative Noise (of both power plants)
1. North Med. Lake Campgrounds	25.3 (@ 2.8 miles)	32.6 (@ 1.1 miles)		33.4 L_{eq} 40.1 L_{CNEL}
2. Homes at SE end of Medicine Lake	22.3 (@ 3.5 miles)	32.6 (@ 1.1 miles)		33.0 L_{eq} 39.7 L_{CNEL}
4. Schonchin Picnic Area	26.6 (@ 2.2 miles)	25.1 (@ 2.6 miles)		28.9 L_{eq} 35.7 L_{CNEL}

[NOTE: The L_{CNEL} noise measurements include an adjustment adding 5 dB for the hours from 7 pm to 10 pm and adding 10 dB from 10 pm to 7 am to account for increased noise sensitivity during evening and nighttime hours.]

The EIR also fails to disclose or analyze just these two power plants' cumulative noise levels. At the campgrounds, their combined totals appear to be inconsistent with the General Plan's 40 dBA limitation.

It should be further noted that if the proper "C"-weighted noise scale had been used in the EIR or in the above calculations, these predicted cumulative totals would be about 7 dB higher yet, not including geographic characteristics which could increase the noise levels even further.

Clearly, the EIR underestimates the total impact of these projects, and in doing so, violated CEQA requirements. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

AG.179 The EIS/EIR acknowledges that construction of this project and CalEnergy's project at Telephone Flat could result in significant cumulative noise impacts at Medicine Lake. (EIS/EIR, p. 4-324.) Drilling noise also would be audible in the lake area. (Id. at p. 4-325.) Timber-related projects may result in cumulatively adverse impacts, depending on the noise receptors in the area. (Ibid.) However, as discussed in the comments on noise, the EIS/EIR's noise analysis is so fundamentally flawed that it is impossible to assess the Project's own impacts on noise resources. Thus, without an adequate noise analysis, the lead agency cannot propose adequate measures to mitigate significant cumulative impacts. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

Response—Cumulative Noise Effects

Both the Fourmile Hill and the Telephone Flat Draft EIS/EIRs analyze the potential cumulative noise impacts associated with the development of the two projects. The Fourmile Hill Draft EIS/EIR discusses the potential effects from the Telephone Flat Project to the degree possible given the information available at the time of Draft EIS/EIR preparation. Information contained in the Telephone Flat Draft EIS/EIR does not change the conclusion concerning cumulative noise impacts articulated in the Fourmile Hill Draft EIS/EIR.

Comment H.32 asserts incorrectly that the routing of the Fourmile Hill transmission line is dependent on the Telephone Flat project. The Fourmile Hill transmission line defined in Alternatives 5 and 6 could also serve the Telephone Flat project. The Fourmile Hill project is not dependent upon or interrelated to the Telephone Flat project. The Fourmile Hill project could proceed whether or not the Telephone Flat project proceeds (and vice versa). The agencies' preferred alternative (Alternative 6) would avoid the

projected effects at Medicine Lake because the transmission line would be routed to the north of Medicine Lake and outside the caldera.

In response to comment V.15, the potential cumulative noise impacts generated by the two projects in the Medicine Lake area would be additive to sensitive receptors only if the construction and decommissioning phases of transmission line Segment A1 for the Fourmile Hill Project were to overlap with noise from well drilling of the Telephone Flat Project. However, sound waves are not strictly additive. Increased noise outputs from two sources do not add directly to one another, but rather interact in a logarithmic fashion. Thus, noise levels at sensitive receptors at Medicine Lake would not increase as hypothesized in the comments, but rather would increase only slightly. Mitigation measures set forth in the noise sections of the Fourmile Hill and the Telephone Flat Project would reduce potential cumulative noise impacts in the area.

As discussed in the Draft EIS/EIR and in the responses to "Comments—Noise Modeling and Sampling" and "Comments—Inclusion of All Possible Noise Sources" in the Noise Section of this document, a noise propagation model was used by an acoustical engineer to estimate project-related noise levels at Medicine Lake sensitive receptor sites. The 6 dBA increase for each doubling of distance referred to in comment V.15 and used by the commentor to estimate noise levels associated with the Telephone Flat project, applies to project-related noise levels on Forest users. For further information regarding noise estimation, please see the responses to "Comments—Noise Modeling and Sampling" and "Comments—Inclusion of All Possible Noise Sources" in the Noise Section of this document.

Comment V.15 also notes that the Draft EIS/EIR states that the Telephone Flat geothermal plant would be approximately 1.5 miles southeast of Medicine Lake. Figure 3.7.1 in the Telephone Flat Draft EIS/EIR indicates that the plant would be about 1.6 miles from Medicine Lake. Figure 4.17-1 in the Draft EIS/EIR shows an incorrect location for the Telephone Flat power plant. The figure has been corrected. This change does not affect the conclusions concerning noise impacts.

Comment V.15 states that the mountain will "amplify facility noise" if the mountain is close to the noise source relative to the distance between the noise source and the receptor, (the distance to the mountain must be less than 70% the distance between source and receptor), and if the mountainside facing the facility is steep and devoid of foliage and trees. In any case, the expected amplification under normal conditions is not expected to exceed 3 dB, which represents a minimal increase in noise level. For further information, see: Edison Electric Institute, Electric Power Plant Environmental Noise Guide, 2nd Edition, 1984, Vol. 1.

Comment V.16 references a "proposed Mt. Hoffman project." There is no proposed or planned Mt. Hoffman project. There are only two geothermal development projects planned for the region (Fourmile Hill and Telephone Flat). Although Calpine had originally identified the Mt. Hoffman area as a potential power plant site, it rejected it for a number of reasons (see responses to "Comments—Potential for a Mt. Hoffman Project"). Because development in this location is speculative at best, the cumulative noise impact therefore only analyzes the effects of the two known projects.

The noise model used in the noise analysis takes into account molecular absorption of sound, terrain and vegetative features, and distance between noise source and receptor. Therefore if noise levels were estimated for the Telephone Flat project using this noise propagation model, expected noise levels would most likely be lower than those levels presented in comment V.18 due to noise attenuation factors. However, even if it were assumed that the noise levels presented in comment V.18 are accurate estimates of project related noise levels associated with the Telephone Flat project, the projected noise levels would be below the Siskiyou County Noise Standard and would not constitute a long-term significant impact. As discussed above, due to the nature of sound waves, noise levels for both projects would be added together logarithmically resulting in combined noise levels that are below the Siskiyou County Noise Standard of L_{eq}=53.6 dBA (L_{dn}=60 dBA, CNEL=60.3dBA) for "actively used playgrounds, neighborhood parks..." and all residential uses. The combined noise levels are also below log=43.6 dBA (ldn=50dBA, CNEL=50.3 dBA) which is the standard if one assumes that the Medicine Lake area is used primarily for "quiet contemplation."

It is projected that noise would be audible at all of the sensitive receptor sites in the area during construction. If the loudest construction events of the Telephone Flat project occur concurrently with construction of the transmission line segment nearest to Medicine Lake, the small increase in noise levels, relative to transmission line construction noise alone, would be less than significant at the noise receptors, as shown in Table 4.17-3 below. Transmission line construction noise is dominant because the total noise level increases only a fraction of a decibel when the other noise levels are added to the transmission noise level. However, this cumulative noise effect would be avoided if Alternative 6, the agencies' preferred alternative, is selected.

Table 4.17-3: Estimated Noise Levels ($dBAL_{eq}$) During Concurrent Construction of Worst-Case Periods of the Fourmile Hill and Telephone Flat Projects

Receptor Location	Fourmile Hill Transmission Line	Telephone Flat Nearest Well Pad	Telephone Flat Drilling	Total Noise Level
North campgrounds	62	47	35	62.1
Residences at southeast end of Medicine Lake	52	43	31	52.5

SOURCE: BLM et al. 1998

Noise associated with construction of the well pads nearest to the receptors is expected to be louder than the noise of well drilling. However, the two noisiest events—construction of the nearest segment of the transmission line and of the nearest well

pad—are expected to be short-lived (about one week in duration) and would occur during the daytime hours only. The impact is considered less than significant.

Comment V.20 applies the Siskiyou County General Plan Noise Standard of L_{dn}=40 dBA to the noise analysis presented in the comment. As stated in the Draft EIS/EIR and in the response to "Comments—Applicability of County Noise Standards", the county noise standard used in the Draft EIS/EIRs noise analysis is L_{eq}=54 dBA (L_{dn}=60 dBA). The noise standard referred to in comment V.20 is consistent with passively-used open space (quiet contemplation areas) according to the County's Noise Element standards. Due to the amount of recreational use in the Medicine Lake area, the appropriate noise standard for the area is L_{eq}=54 dBA (L_{dn}=60 dBA). Please refer to responses to "Comments— Applicability of County Noise Standards" and "Comments—Use of County Noise Standards" for further information regarding county noise standards used in the Draft EIS/EIR's noise analysis. The commentor has misinterpreted the table in the County's General Plan. The "corrections" are added to the measured or estimated noise level from the project rather than being added to the Land Use Compatibility Standard (Table 13, p. 54).

In response to comment V.21 concerning the use of "C"-weighting, there may be an increase in dB levels, but such an increase would likely not be 7 dB. The commentor's suggestion that the higher C-weighted estimates can be compared directly with the lower A-weighted County Noise Standard is incorrect. In order to make such a comparison, the County's Noise Standard would also have to be C-weighted, and its noise limits would be higher. In addition, if the standard were C-weighted, the ambient noise measurements would also have to have been C-weighted and they also would have been higher than the A-weighted values reported in the EIS/EIR.

See Section 4.3.7 of the Telephone Flat Draft EIS/EIR and pages 4-324 to 4-325 of the Fourmile Hill Draft EIS/EIR for further discussion of cumulative noise effects.

Comment—Cumulative Socioeconomic Effects

AG.180 The EIS/EIR finds that the project, in combination with the other projects, would not contribute to significant cumulative impacts on socioeconomic resources. As discussed in the comments on socioeconomics, however, the EIS/EIR lacks even sufficient information to assess the significance of the Project's own impacts. The EIS/EIR's analysis of cumulative socioeconomic impacts is similarly flawed. Also, the EIS/EIR's proposed mitigation measures are inadequate to reduce the Project's impacts on socioeconomics. Accordingly, there is no basis for the lead agency to conclude that the projects will not cumulatively and significantly affect these resources.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Cumulative Socioeconomic Effects

Please see the Socioeconomics section for responses to comments on the adequacy of the analysis of socioeconomic impacts. Both the Fourmile Hill Draft EIS/EIR and the Telephone Flat EIS/EIR state that there would be socioeconomic effects if the projects are constructed. Both documents state that there would be significant and unavoidable effects on the Native American minority population in the Medicine Lake Highlands area. These disproportionate effects are deemed "environmental justice" effects pursuant to the President Clinton's 1994 "Executive Order on Federal Actions to Address Environmental Justice in minority Populations and Low-Income Populations." Further discussion of this provision may be found on pages 4-299 through 4-300 of the Fourmile Hill Draft EIS/EIR.

Socioeconomic impacts of the two projects would be additive if the project construction and operation phases overlap. Particularly, increased employment would generate housing demand, fiscal benefit to Siskiyou County, and additional development of commercial facilities. None of these socioeconomic effects other than the environmental justice effects, however, are expected to result in cumulative effects above the level of significance.

CalEnergy has entered into an MOU with the Klamath Tribes designed to mitigate possible disproportionate impacts on the Native American minority population in the area. In addition, the Telephone Flat Draft EIS/EIR sets forth several measures (page 3.12.21) that might be implemented, if deemed necessary, in order to reduce possible impacts to property values of parcels adjacent to the Telephone Flat project site.

3.19 Other Statutory Sections

INTRODUCTION

This section provides responses to comments on issues related to other statutory sections. The comments and responses are grouped under the following headings:

- Growth-Inducing Impacts
- Short-Term Use Versus Long-Term Productivity
- Significant Irreversible Environmental Changes

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

GROWTH-INDUCING IMPACTS

Comments—Growth-Inducing Impacts

B.5 The Draft EIS/EIR does not fully disclose the indirect effects to federally listed species of supplying additional electrical power to the Bonneville Power Administration and Pacific Northwest Power service areas. The draft document should be revised to analyze the effects to federally listed species, outside the immediate location of the proposed action, that result from future actions (residential or industrial construction, for example) made possible by the additional power supplied by the Fourmile Hill Geothermal Development Project. *(Ronald A. Iverson, U.S. Fish and Wildlife Service)*

PH3.6 How many houses will this power provide electricity to? *(Yreka Public Hearing)*

Response—Growth-Inducing Impacts

NEPA and CEQA require that an EIS/EIR discuss the foreseeable indirect effects related to growth-inducing aspects of the action and could occur at a later time (40 CFR Section 1502.16; CEQA Guidelines Section 1508.8(b)). Furthermore, CEQA requires a discussion of the ways in which a proposed project could directly or indirectly foster or remove obstacles to economic, population, or housing growth in the surrounding environment.

The Draft EIS/EIR discusses the potential growth-inducing impacts in Section 4.18, including:

- The population and employment growth resulting from the direct and indirect employment needed to construct and operate the proposed project.
- The population growth and possible additional industrial and commercial development in the region resulting from the availability of additional power generated by the proposed project.
- The induced growth and development of other geothermal facilities at the Medicine Lake KGRA resulting from the success of the project and the presence of a transmission line to transmit power to the regional grid.

As discussed on page 4-330 of the Draft EIS/EIR, the project would supply 44.9 MW of power which could meet the electricity needs of an equivalent of 22,500 households. The power could also serve industrial, commercial, or any other land use that requires electricity. However, the additional power generated by the proposed project would not be expected to cause noticeable future development resulting in indirect effects (including effects to Federally listed wildlife species). As discussed on page 4-330 of the Draft EIS/EIR, the power generated by the proposed project would be incorporated into the existing power distribution system to meet present and future loads.

If additional development results, it would be highly speculative to attempt to determine the location and form of such development. As described in the electricity generated by the proposed action would be fed into the regional power grid and dispersed throughout the Pacific Northwest. The potential additional households, and the attendant industrial and commercial development that could be supported by the proposed project, would be expected to be distributed throughout established communities that are served by the existing power grid system.

According to the project description (Section 2.2 of the Draft EIS/EIR), the proposed Fourmile Hill project includes a 24.7-mile transmission line that would have a capacity of 145 MW. The capacity would accommodate the 44.9 MW net electrical output projected for the Fourmile Hill Project, as well as the additional Telephone Flat geothermal project that is proposed. At present, the only other facility planned is the CalEnergy Telephone Flat project, which is projected to generate 48 MW of electric power. The amount of power added to the distribution grid by this project would be negligible since the proposed project would be extremely small by utility standards. The project's 44.9 MW is insignificant when compared to the BPA's existing power supply of 15,740 MW, and the Pacific Northwest's supply of 36,819 MW (BPA 1996; DOE 1997).

The proposed project therefore has limited potential to result in additional development. It is doubtful whether any development would be induced by the construction of the Fourmile facility, since its relative power output is minimal by utility standards. In addition, the project will not require that the existing BPA transmission lines be upgraded. The analysis of potential effects in the Fourmile Hill EIS/EIR (including effects to Federally listed wildlife species) from possible additional development would be highly speculative. However, it is possible that growth would be induced if the project created a substantial number of new jobs, brought an influx of money, or if energy generated by the project created a local economic advantage.

In addition, any project-generated development proposed in habitat of Federally listed wildlife species would require appropriate environmental review under NEPA (and any applicable local environmental regulations), and would require coordination with either the USFWS or NMFS regarding potential effect to these species. Sections 4.7 and 4.8 describe in detail the potential impacts on vegetation and wildlife in the region caused by the proposed project.

SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY

Comments—Short-Term Use Versus Long-Term Productivity

AG.33 The EIS/EIR also relies on the renewability of the geothermal resource to conclude that there will be no short-term use at the expense of long-term productivity (§ 4.20, pp. 4-335-337) or significant irreversible environmental changes (§ 4.21, p. 4-337). These conclusions are questionable without a proper assessment of the Project's impact on the geothermal reservoir.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.133 Section 4.20 of the EIS/EIR concludes that the Project does not involve any short-term use at the expense of long-term productivity because, among other things, the Project will have lower emissions of air pollutants than traditional power generation sources. (EIS/EIR, p. 4-335.) This conclusion should be revisited in light of Dr. Fox's analysis.

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

FJ.5 The very short term gains of such a project can in no way compare to the long-term (or permanent loss) of wildlife, natural beauty and use of the land as a ceremonial site of many area tribes. *(Carolyn J. Mosher)*

FO.5 Personally, I do not believe that it is the legal mandate of public agencies to promote projects of private gain on public lands when the costs are permanent and significant and the benefits are minor. This certainly appears to be the case here. There is NO way that the relatively meager amount of energy produced over the life of these proposed projects (at such a significant distance from any metropolitan area), even begins to counter the adverse biological, cultural, and recreational costs of these projects. Our public (and private) lands are already littered with these types of boondoggles; let us learn from previous lessons and not make the same mistakes over again. *(Eric T. Nelson)*

HA.5 I. PURPOSE AND NEED At the August 30th, public hearing at Medicine Lake, Mr. Sharp, you informed the general public that the proposed action was a pilot project for the BPA. You stated that BPA consumers were surveyed and a certain percentage conveyed they would prefer a renewable resource producing electrical power for them. In the final EIS/EIR please discuss the justification of a pilot project in relationship to the issue of short term productivity to long term adverse effects to the environment and region. CEQA 15126(E)

What was the percentage of consumers surveyed that stated they wanted this type of resource? Why wasn't this discussed in the EIR/EIS? Were the consumers aware of the type of area this resource would be developed in? Geothermal energy has a higher cost than other energy sources, such as natural gas or coal. Page 2-79. In general, geothermal energy is second in cost to nuclear power. Has the BPA consumers been informed of this, and do they realize that they could be stuck with stranded investment charges. Please give a written response to these questions. *(James Shott)*

HE.4 2. The short-term economic gain and the needed large-scale infrastructure development needed to support it do not justify the potential and likely damage to both the unique ecological balance of the Medicine Lake area and the long history of low-impact recreational use. As I am sure you are well aware, Medicine Lake is home to a unique ecological-geological assemblage that includes nesting bald eagles, osprey, and spotted owls, many migratory birds, and larger threatened (in California) species such as mountain lions, black bears, pine martens, and bobcats. As a teacher of Native American religious studies, I am aware of the sacred values of this area to its Native American forebearers as well. *(Daniel T. Spencer)*

HH.2 It seems the short-term gain on the geothermal development would be significantly less than the overall long-term and short-term environmental damage done to this area. *(Lucinda Spencer)*

Response—Short-Term Use Versus Long-Term Productivity

Both NEPA and CEQA require that an EIS/EIR discuss the relationship between short-term uses of man's environment and the maintenance and enhancement of longer-term productivity. 40 CFR Section 1502.16; CEQA Guidelines Section 15126(e). Accordingly, the Draft EIS/EIR addresses this comparison between short-term use and long-term productivity in Section 4.20, Short-Term Use Versus Long-Term Productivity. This comparison is based in part on the analyses of potential effects of the project discussed throughout Chapter 4 of the Draft EIS/EIR. These analyses included a proper assessment of the project's impacts on the geothermal reservoir (see the responses to comments in the Geothermal Resources section of this document), as well as biological, cultural, and recreational resources. The expected long-term advantage of reduced air emissions from geothermal development in comparison to traditional fossil-fuel power generation sources remains valid, even in light of comments received on the Draft EIS/EIR.

Geothermal energy is generally considered a renewable resource. The Northwest Power Act (U.S. Congress Northwest Power Planning and Conservation Act of 1980, P.L. 96-501) provides for the encouragement of renewable resources within the Pacific Northwest and authorizes the BPA to acquire resources that have the potential for providing cost-effective service to the region. Within this mandate, the BPA prepared the Resource Program EIS, which evaluates the environmental impacts of various resource types, and adopted the Emphasize Conservation Alternative. The Fourmile Hill Geothermal Project would fit within the objectives of this plan as a renewable resource for the region (see Section 1.2, Purpose and Need, of the Draft EIS/EIR, and

the responses to comments in the Introduction and Purpose and Need Section of this document for further information).

Generally, geothermal energy is considered "renewable " because of its limited impact on its predicate natural resource. While this conclusion has been criticized for failing to consider long-term use of the underlying resource, it remains that the proposed project is planned to last for 45 years. The resource utilization during this period is minimal in comparison to the reservoir capacity. In addition, the reservoir is capable of regeneration both during this period, and following abandonment of the proposed project. Accordingly, the BPA and other Federal and state authorities have concluded that the proposed project is a potentially viable renewable energy project. The proposed project is anticipated to be a model geothermal project with minimal long-term adverse environmental impacts when compared to more conventional energy resources. The short-term development and the long-term utilization of the geothermal resource are not expected to create long-term adverse environmental effects to the geothermal resource.

Furthermore, as described in Section 4.20 of the Draft EIS/EIR, other adverse environmental impacts of the project would be minimal. The proposed project would supply power into the BPA and Pacific Northwest power transmission system. The roughly 45 MW of power generation would meet the needs of an estimated 22,500 families throughout the system. This power generation would cause minimal environmental impacts in comparison to the long-term benefits. The project would provide power from a renewable source with significantly lower levels of air pollution than traditional energy sources for a projected 45-year period. Furthermore, considerable mitigation measures have been devised and planned in order to reduce any possible adverse environmental effects.

In addition, the project would have a minimal footprint in comparison to the energy that it would generate. Section 4.20 sets out the basic long-term environmental effects of the proposed project associated with the establishment of wellfields, power plant, transmission line utility corridor, and substation on previously undeveloped land. The long-term losses to wildlife, and natural beauty would be minimal, while the project would provide a stable source of energy with relatively low levels of pollution. The proposed project is not expected to create significant long-term restrictions on land use in the area. Existing uses, including recreational, residential, timber harvesting, grazing, and mining would not be significantly restricted by the project. Native American ceremonial use of the region would not be restricted by the proposed project.

Finally, as described in Section 4.15 of the Draft EIS/EIR, the project is not expected to pose long-term health risks. A Hazardous Materials Business Plan would be prepared for the project (see Section 4.15, Human Health and Safety), which would include safety, storage, and disposal guidelines for any hazardous materials. Also, the additional electro-magnetic fields (EMFs) created by the transmission line would not present any long-term health threats. The EMF levels from the project would be equal to or less than those from household appliances for residents of the area. Recreational users of the nearby vicinity might temporarily experience slightly elevated EMF levels, but the sporadic nature and short duration of such exposure will not pose any health threats.

In response to comment HA.5, the following points are made to clarify the discussion of potential demand for renewable energy that was held at the August 30, 1997 public meeting at Medicine Lake:

- It was stated that consumers in general (not only BPA consumers) in the western U.S. have been surveyed for potential use of renewable energy if offered. These surveys have largely been conducted in conjunction with the deregulation of the electrical utility industry to gauge potential consumer interest in renewable energy, and their willingness to pay more for such energy.
- Various surveys have reported varying levels of interest in renewable energy, and the willingness to pay a little more for this type of energy. Interest levels have ranged from 2% to 30%.
- Surveys of interest in renewable energy have not identified specific sources or locations of renewable energy since this was not the intent of these surveys.

In summary, the project would allow BPA to gain hands-on experience with the integration and operation of a commercial scale geothermal plant. BPA believes the long-term benefits of renewable resources like geothermal may be attractive in the future. The economic and social benefits of providing a commodity to the power industry with relatively low environmental impacts, the creation of employment opportunities, and the increased taxes and revenues from the project are positive effects of the project.

SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES

Comment—Significant Irreversible Environmental Changes

AG.134 The EIS/EIR also concludes that there will be no significant, irreversible environmental changes from the Project. (EIS/EIR, § 4.21, p. 4-337.) However, Dr. Fox's calculations demonstrate that air emissions from the Project (e.g., arsenic, mercury, boron, acids) will cause significant impacts to Medicine Lake and other surface water bodies. (Ex. A, Comment 8.) These emissions could cause long-term impairment of these water bodies and their associated biota. Section 4.21 should be revised to analyze these potential impacts.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Significant Irreversible Environmental Changes

The Draft EIS/EIR addresses the effects of air emissions from the project on surrounding water bodies in 4.3.7, Effects of Air Emissions on Water Quality. The Draft EIS/EIR provides a detailed analysis of the potential emissions that could affect the water quality of the surrounding water bodies, including comprehensive information on wind studies, projected air emissions quantities based on conservative modeling, and possible mitigation measures for controlling air emissions. This information has been further supported in the responses to comments in the Air Quality Section of this document.

According to the depositional analysis contained in Section 4.3 of the Draft EIS/EIR, the concentrations of arsenic, antimony, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel and selenium in the upper two feet of lake water, after 45 years of accumulation, would all be significantly below regulatory limits for drinking water based on EPA-established Maximum contaminant Levels (MCLs) or Suggested No-Adverse-Response Levels (SNARLs) (Table 4.3-3). Thus, air emissions represent a less than significant environmental impact on the surrounding water bodies, including Medicine Lake. Also, the continuing mitigation measures provide an

additional preventative mechanism to ensure water quality standards. The deposition is not expected to affect related biota.

Having obtained the background concentrations of constituents for Medicine Lake, Calpine has repeated the depositional analysis as provided for in the mitigation measures for air emissions effects on water quality. Fur further discussion of this, please see response to "Comment—General Depositional Effects on Surface Waters" and subsequent responses in the Hydrology Section.

3.20 Mitigation Monitoring and Reporting Program

INTRODUCTION

This section provides responses to comments on issues related to the Mitigation Monitoring and Reporting Program (MMRP).

COMMENTS AND RESPONSES

Comment—Request for Clarification

AI.6 We would also ask that you clarify and identify the type and amount of mitigation for the limited impacts from project development. We believe that there must be opportunities in the Klamath and Modoc Forests to fully mitigate for the direct impacts of building the geothermal project. Working with the environmentalists and developers, there is an opportunity to leverage this project into something that creates a net improvement in habitat protection of the forests or nearby wildlife areas.

(Rachel Shimshak and Peter West, Renewable Northwest Project)

Response—Request for Clarification

Mitigation to avoid or reduce the impacts of the proposed project is found throughout Chapter 4 of the EIS/EIR. All of these proposed mitigation measures are summarized in Chapter 5 in the table found on pages 5-3 through 5-42 of the Final EIS/EIR. This table provides a draft of the MMRP for the project. (Note that, by law, the MMRP is in draft form until it is adopted by the lead agency after considering the final EIR.)Several of the mitigation measures proposed in the Draft EIS/EIR have been revised in the Final EIS/EIR. These revisions are reflected in the table in Chapter 5. Several mitigation measures have also been added since publication of the Draft EIS/EIR. These additional mitigation measures are discussed in the appropriate responses for the applicable environmental parameters, and have been incorporated into Chapter 5.

The comment also states the desire to use the mitigation measures to create a net improvement in habitat protection. As described in Sections 4.7 and 4.8 in the EIS/EIR (Vegetation and Wildlife, respectively), mitigation is proposed to avoid or reduce impacts to wildlife and plants and their habitats, including Forests. These mitigation measures are designed to comply with the requirements of NEPA and CEQA. NEPA and CEQA require that project impacts be avoided or reduced through mitigation. In certain cases, regulatory agencies may require the restoration of more habitat than the amount affected by the project in order to adequately mitigate impacts. However, this type of mitigation approach is not required for the proposed project.

Comment—Mitigation Monitoring

DB.6 All of those responsible for oversight under MMRP, such as hydrologists, biologists, archaeologists, botanists and others, must be selected by and paid by the USFS, not Calpine. Calpine should then reimburse the USFS for the cost of these consultants. The consultants must also have the power to shut down the project if there are violations of the MMRP during construction, or after.

Having these consultants paid by Calpine puts them in the untenable position of risking their jobs if they find and report violations. Not everyone has the courage to be a whistle-blower. If these consultants are responsible only to the USFS, and therefore only to us, the owners of the land, there is a much better chance of the MMRP being properly implemented.

(Stan Haye)

Response—Mitigation Monitoring

The qualified specialists who would conduct the monitoring and reporting for the project would be chosen under the direction of the lead agencies, the USFS, BLM, BPA, or SCAPCD, as appropriate. Calpine may recommend specialists for a particular task, but the selection would be approved by the lead agencies. Technical monitors would be

paid by either Calpine or the USFS, but would be under the direction of the lead agencies at all times.

The consultants would not have the power to shut down the project if there were violations of the MMRP. As described in the Draft EIS/EIR, the USFS and BLM would have the authority to order all, or a portion of, Calpine's operations to stop if there were any violations resulting in a significant environmental effect. This direction might be based on data provided by consultants, but the consultants would confer with the USFS, the BLM, and Calpine before any action would be taken. This approach will ensure that the MMRP is properly implemented.

Comments—Enforcement of Mitigation

EP.2 The developers of the Lake and Napa counties geothermal fields fulfilled all the necessary environmental requirements (EIR, etc.), but no authority was put into place to patrol and cite offenders. As a result the surrounding communities suffered from the lowered air and water quality. The communities often suffered from disagreeable and toxic quantities of hydrogen sulfide in the air ...a well known toxic gas.

Several concerned citizen groups formed to challenge the developers, insisting that the geothermal fields adhere to required controls. No action was ever taken. In my experience the developers were less than considerate of citizens complaints.

In view of past performances of the geothermal industry, it would seem prudent to curtail development of Fourmile Geothermal Project until all the facts can be investigated. *(Maurice J. Maggiora, et al.)*

PH3.78 Calpine will—are you planning in this day and age—I know you have made probably— probably made big steps forward and in going into an area, but are you are planning on making the same mess you have made in the Geysers? I worked for PG&E in '71, '72, '73, and I worked in the Geysers. Is the impact on the land going to be as bad as what it is down there? *(Yreka Public Hearing)*

Response—Enforcement of Mitigation

Any past experiences in mitigation monitoring, reporting, and enforcement at The Geysers Known Geothermal Resources Area (KGRA) (the Lake and Napa County geothermal fields referred to in the comments) should not be viewed as indicative or representative of the mitigation efforts that would occur for the proposed action at the Glass Mountain KGRA. Much of the geothermal power development at The Geysers occurred prior to the enactment of NEPA and CEQA in the early 1970s. In addition, the majority of this development occurred prior to the enactment of State Assembly Bill AB 3180 in 1988. As discussed on page 5-1 of the Draft EIS/EIR, this Assembly Bill was enacted by the California State Legislature to ensure that mitigation measures adopted through the CEQA process are implemented in a timely manner and in accordance with the terms of project approval. Most of the geothermal development at The Geysers therefore occurred before the existence of regulations requiring mitigation monitoring, reporting, and enforcement.

4: RESPONSES TO NEPA/CEQA ISSUES COMMENTS

4: RESPONSES TO NEPA/CEQA ISSUES COMMENTS

4.1 Introduction

This chapter provides responses to comments on issues related to the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) processes for the proposed project. Each comment in this chapter (as well as other chapters) of this document was considered without regard to the author's location, occupation, or lifestyle. Each comment will be considered by decision-makers in determining whether to approve the project.

The comments and responses in this chapter are grouped under the following headings:

- NEPA/CEQA Adequacy
- EIS/EIR Approach
- Draft EIS/EIR Public Involvement
- Plan to Act Against Project Approval

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

4.2 NEPA/CEQA Issues

NEPA/CEQA ADEQUACY

Comments—Adequacy Concurrence

E.1 I have had the opportunity to review the Draft EIS/EIR for the Fourmile Hill Geothermal Project and find that the analysis provided appears to be thorough and well documented.
(Richard D. Barnum, Siskiyou County Planning Department)

E.3 As you are aware, the Administrative Draft of this document was also separately reviewed for adequacy by a legal consultant. Upon conducting my independent review of the document, I noted that the comments and suggestions provided by the critique were reflected in the Draft document as well.
(Richard D. Barnum, Siskiyou County Planning Department)

Response—Adequacy Concurrence

The opinion of the Siskiyou County Planning Department regarding the adequacy of the Draft EIS/EIR is noted. As noted in comment E.3, an independent legal firm was retained by the Siskiyou County Air Pollution Control District (APCD) to assist the APCD in ensuring CEQA compliance. The input of the law firm was incorporated into the Draft EIS/EIR under the direction of the lead agencies for the project.

Comments—General Adequacy Criticisms

F.24 In summary, we find that this DRAFT EIR/EIS does not thoroughly describe the "setting" into which the project will be imposed, it does not disclose the composition of wastes which will be emitted into the environs of the project and does not assess the impacts of those emissions. We believe that this DRAFT must be revised to include disclosure and analysis of the effects of all environmental emissions and their transport and fate. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

H.2 Additionally, the document did not address at all some negative impacts. *(Bill Dart, American Motorcyclist Association)*

M.11 Unless the foregoing concerns are explicitly addressed in a rigorous, thorough, and scientific manner, we believe that the Draft EIS/EIR will be incomplete and will not satisfy the many laws which have required its preparation. We suggest that a comprehensive analysis of the foregoing is mandated under the law and request that such an analysis be considered within the final EIS/EIR before any permits are issued. *(Rick Poore, et al., Fall River Resource Conservation District)*

N.37 28. As stated above, the DEIS/EIS is grossly deficient and is violation of the National Environmental Policy Act and the California Environmental Quality Act and Its Guidelines. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

T.10 Pursuant to Section 102(2)(c) and other requirements of the Federal National Environmental Policy Act (NEPA), the U.S. Bureau of Land Management and the US Forest Service have duties and responsibilities as lead Federal agencies to ensure that the EIS/EIR is in full compliance with NEPA and its requirements. Full and fair disclosures of relevant information, professional and scientific integrity of work, mitigation or avoidance of adverse effects, and comprehensive scope of analyses are all part of fulfilling NEPA's purpose. Duties and responsibilities of the Siskiyou County Air Pollution Control District to regulate air emissions and protect air quality fall under the California Environmental Quality Act (CEQA) and its implementing guidelines for public disclosure of not only the potential adverse environmental effects, but also of the maximum possible mitigating measures available. The DEIS/EIR falls far short of meeting NEPA and CEQA requirements. *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

T.18 The DEIS/EIR is fundamentally flawed in its approach to impacts analysis in that it fails to disclose the potential environmental effects that could result from geothermal development at Fourmile Hill, including equipment failures and accidents. Instead, the DEIS/EIR limits its impact analysis to the intended mitigated levels of effects to critical environmental resources. The potential unmitigated effects, however, could ramify throughout the local ecosystem. These need to be investigated and analyzed in the EIS/EIR. *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

T.21 Therefore it is the recommendation of the Medicine Lake Citizens for Quality Environment that the EIS/EIR not be finalized until fundamental informational and analytical deficiencies have been cured. Alternatively, BLM and USFS could justifiably decide to adopt the "No Action" alternative on the basis of its being the environmentally preferable alternative as of the current state of knowledge. *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

V.1 Medicine Lake Citizens for Quality Environment is a group of concerned citizens who live, utilize recreational facilities and campgrounds, or own property in the vicinity of Medicine Lake and this proposed project. As such, we submit these additional comments out of concern that the EIR/EIS for this project is inadequate. (For simplicity, we will henceforth use the term "EIR" in place of "EIR/EIS").

The California Environmental Quality Act's (CEQA) overriding and primary goal is to protect the environment. (Public Resources Code 21000-21002.) Under CEQA, all public agencies must use their regulator authority to ensure "that major consideration is given to preventing environmental damage, while providing a decent home and satisfying living environment for every Californian. (Public Resources Code §21000(g)).

One of CEQA's fundamental purposes is to inform decision makers and the public about potential significant effects of proposed projects. 14 CCR 15002(a)(l). To that end, CEQA establishes procedural and substantive requirements for Environmental Impact Reports. Whether environmental review of a project is sufficient under CEQA depends on whether the document meets those substantive and

procedural requirements. The primary question is whether the document is sufficiently informative and the conclusions therein supported by substantial evidence.

Based on our review of the EIR, we must conclude the EIR is plainly inadequate under the law. The EIR fails to comply with the letter and spirit of CEQA's provisions.

Cumulatively, the issues raised in these comments establish the need for substantial changes to the EIR. For example, the document contains many unsupported and unsubstantiated conclusions. Thorough analysis of project impacts and complete disclosure of the underlying basis for that analysis and the resulting conclusions is required by law. Thus, substantial modification of the document is required, followed by recirculation of the EIR. The public is entitled to a clear description and explanation of the impacts associated with the Fourmile Hill project. The EIR, as written, does not meet CEQA's requirements and is legally vulnerable. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

Y.22 For all its voluminous pages, charts, maps and analyses, the DEIS/EIR contains serious deficiencies in providing actually tested scientific information.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

Y.57 Throughout the draft EIS/EIR minimizes the significance of impacts without substantiating their findings, thus avoiding more stringent analysis and mitigation measures. The impacts of large quantities of hazardous materials and wastes going to and from power plants during summer months when visitors come to the area or during winter months when dangerous road conditions prevail; the potential chance for accidents, leaks, accidents, seismic activity, and many other aspects of this proposed development are passed off as insignificant to avoid full analysis.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AE.4 They have not sufficiently tested the potential hazards to water, air and life according to law.
(Arnold Wilkes, Pit River Tribe)

AG.3 We have reviewed the draft environmental impact statement/environmental impact report ("EIS/EIR") for the Fourmile Hill Geothermal Development Project ("Project") and submit the following comments on behalf of the Unions and the above-named individuals. In sum, the EIS/EIR fails to properly analyze and mitigate the Project's impacts on geology/soils, hydrology, geothermal resources, cultural resources, Native American culture, vegetation, wildlife, visual quality, land use and recreation, air quality, noise, human health and safety, socioeconomics, and transmission system reliability. The EIS/EIR's analyses of cumulative impacts and Project alternatives also fail to meet the standards of CEQA and NEPA. Thus, the EIS/EIR does not fulfill its function as an information and decisionmaking document. These issues are discussed more fully in later sections of these comments.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.138 The EIS/EIR should be revised and recirculated so that the public and decisionmakers can fully evaluate the Project's impacts and proposed mitigation measures.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.187 As the foregoing analysis indicates, the EIS/EIR fails to comply with the requirements of NEPA and CEQA in several respects. It improperly "piecemeals" the Project by failing to consider impacts associated with all reasonably foreseeable geothermal development, it fails to properly analyze impacts and feasible mitigation measures for numerous environmental resources, it fails to properly assess the Project's cumulative impacts, and fails to evaluate a reasonable range of Project alternatives. On the whole, the EIS/EIR is patently deficient. These errors must be remedied, and the EIS/EIR recirculated for public review and comment.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.266 The purpose of an EIS or EIR is to inform the public about the significant impacts of a project; this document fails to provide that information. For example, the EIS/EIR fails to provide sufficient information about wildlife and vegetation that will be affected by the project. The EIS/EIR's findings that the project will not significantly affect the environment are unsupported by adequate data. The EIS/EIR repeatedly proposes vague and unenforceable mitigation measures and it proposes mitigation that actually constitutes deferred impact assessment.

These failings are rampant throughout every section of the document we reviewed. Many specific examples are given below under our discussion of the individual resources. The lack of a valid understanding of the difference between significant and less-than-significant impacts in the document renders its list of mitigation measures essentially worthless. We believe the document must be substantially revised and re-circulated for public review.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.397 The foregoing comments make it clear that the present EIS/EIR is fraught with deficiencies and contradictory statements. There is insufficient information presented to discriminate significant from less-than-significant effects of the major project components on cultural resources, traditional cultural values, vegetation, wildlife, visual quality, land use and recreation, noise, and human health and safety. The proposed mitigation measures are inadequate and are not related to realistic, quantitative standards of significance. There is inadequate information presented to determine which alternative or alternatives

are environmentally superior to the proposed action, and whether the preference for particular alternatives is based on significant effects.

The EIS/EIR in its present form presents inadequate information for the public or lead agencies to determine whether the project will have significant, unavoidable impacts on the environment, which alternatives or mitigation measures would minimize significant impacts, and whether the project should be approved. The EIS/EIR must be substantially re-written and re-circulated a second time as a draft EIS/EIR for public review. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)*

BE.5 I am also concerned about the piece meal approach of the proposed project's, to keep local control rather than being under State Regulations. *(Paul Carter, Jr.)*

CX.2 The studies on the long-term effects have not been sufficiently done *(Shelly Harmon)*

HA.4 The questions and comments of this letter are the result of trying to give an analysis on a very poorly prepared document. The inadequacy and length of the EIS/EIR, along with the lack of information requested in a timely manner makes a reasonable response very difficult. It makes one wonder why the urgency for pushing this project forward when all the time in the world should be utilized in making the decision of Fourmile Hill. The Geothermal resource will not deplete during the comment time. We must all, U.S.F.S., B.L.M., B.P.A., Siskiyou county supervisors, Calpine, and all concerned parties, thoroughly evaluate all the information before making this important decision. *(James Shott)*

PH1.18 Unless the foregoing concerns are explicitly addressed in a rigorous, thorough and scientific manner, we believe the Draft EIS/EIR would be incomplete and will not satisfy the many laws which have required its preparation. We suggest that a comprehensive analysis of the foregoing is mandated under the law and request that such an analysis be considered within the final EIS/EIR before any permits are issued. *(Dorris Public Hearing)*

Response—General Adequacy Criticisms

The comments regarding the EIS/EIR's adequacy are noted. The Draft EIS/EIR has been prepared in accordance with the requirements of NEPA and CEQA. The document analyzes the possible adverse impacts that the proposed project may have on the surrounding environment, and recommends mitigation measures to avoid or substantially lessen any potential impacts. An EIS/EIR is an informational document designed to aid decision-makers and inform the public by disclosing the potential environmental effects of a proposed project. The state guidelines for implementing CEQA require an EIR to provide a sufficient degree of analysis to allow decision-makers to make intelligent and informed judgments.

The Draft EIS/EIR discusses the project's potential environmental effects (as well as its cumulative effect and a reasonable range of alternatives that might avoid or substantially lessen the project's significant environmental impacts) in depth in Chapter 4, Environmental Consequences and Mitigation Measures. Chapter 5 outlines a comprehensive Mitigation Monitoring and Reporting Program (MMRP). Additional information clarifying and amplifying the Draft EIS/EIR's discussion of project impacts and mitigation measures is provided in the Final EIS/EIR through these responses to comments. The Final EIS/EIR does not identify any new or more severe significant environmental impacts or mitigation measures necessary to mitigate such effects. As a result, recirculation of the Draft EIS/EIR is not justified.

The information in the EIS/EIR represents the best available scientific data available at the time the document was prepared. The analyses rely on accepted methods of scientific testing and modeling. All reasonably foreseeable impacts that might be caused by the project have been disclosed, and mitigation measures have been designed to address worst-case scenarios.

Comments—Mitigation Measure Adequacy

AG.7 To ensure that project impacts are genuinely addressed, an EIS/EIR must identify specific feasible, effective and enforceable mitigation measures for each significant impact. An EIS/EIR must identify all feasible mitigation measures for each significant environmental impact, if such measures exist. (Cal. Pub. Res. Code § 21100(b)(3); 14 CCR §§ 15126(c); Robertson, 490 U.S. at p. 352.)

The identification of mitigation measures fulfills an EIS/EIR's informational purposes, and also provides a basis for the decisionmaker to determine whether feasible mitigation measures or alternatives have been adopted which substantially lessen the project's impacts. (Pub. Res. Code §§ 21002, 21081; 14 CCR §§ 15002(a)(3), 15021(a), 15091(a)(1); Robertson, 490 U.S. at p. 351.) If an EIR fails to properly analyze mitigation measures or to discuss why no such measures are feasible, the agency cannot make the legally required findings. (Ibid.)

It is not enough for an EIS/EIR to assert that certain mitigation measures might be available and effective; an EIS/EIR must evaluate the feasibility of mitigation. (Kings County Farm Bureau v. Hanford (1990) 221 Cal.App.3d 692, 728 [270 Cal.Rptr. 650].) An agency may not rely on mitigation measures of uncertain feasibility or effectiveness. (Kings County, 221 Cal.App.3d at pp. 727-728.). Nor may it defer consideration of mitigation measures to later studies. (Sundstrom v. County of Mendocino (1988) 202 Cal.App.3d 296, 306-08 [248 Cal.Rptr. 352]).

In Sundstrom, the lead agency conditioned its approval of the project on the post-approval preparation of a hydrological study evaluating the project's potential impacts on downslope properties. This study would allow agency staff to develop specific mitigation measures. The court concluded that since the success of the mitigation was uncertain, the lead agency could not have made a reasonable finding that all potential impacts had been mitigated below a level of significance. (202 Cal.App.3d at pp. 306-308.) The court also found this deferral to violate several of CEQA's fundamental policies:

By deferring environmental assessment to a future date, the conditions run counter to that policy of CEQA which requires environmental review at the earliest feasible stage in the planning process... A study conducted after approval of a project will inevitably have a diminished influence on decision making. Even if the study is subject to administrative approval, it is analogous to the sort of post hoc rationalization of agency actions that has been repeatedly condemned in decisions construing CEQA. [citations]

It is also clear that the conditions improperly delegate the County's legal responsibility to assess environmental impact by directing the applicant himself to conduct the hydrological studies subject to the approval of the Planning Commission staff.

Finally, the use permit circumvents the provisions of CEQA governing the process of environmental review... By merely requiring the administrative approval of the hydrological studies, the use permit provides no similar guarantee of an adequate inquiry into environmental effects. An EIR or negative declaration, moreover, are subject to review by the public and interested agencies. [citations] This requirement of 'public and agency review' has been called 'the strongest assurance of the adequacy of the EIR.' (Ibid.) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.8 An EIS/EIR must also analyze any impacts caused by implementation of proposed mitigation measures. (14 CCR § 15126(c).) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.9 In addition to the requirements of CEQA and NEPA, BLM regulations require geothermal operators to "comply with all Federal and State standards with respect to the control of all forms of air, land, water, and noise pollution." (43 C.F.R. § 3262.6.) The BLM has discretion to establish additional and more stringent standards. (Ibid.)

The Geothermal Resource Operational Orders ("GROs") require geothermal lessees to conduct operations "in a manner that provides maximum protection of the environment; ...[and] take all necessary precautions to protect the public health and safety..." (GRO No. 4, introductory paragraphs.). "Operating plans shall be designed so that operations will result in the least disturbance of land, water, and vegetation." (Id. at § 2.) All operations shall be conducted "in such a manner as to afford reasonable protection of fish, wildlife, and natural habitat." (Id. at § 6.)

Here, the EIS/EIR fails to comply with legal requirements regarding the consideration of mitigation measures by deferring development of mitigation measures for several significant impacts until after project approval. The EIS/EIR's specific deficiencies will be discussed later in these comments.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

Response—Mitigation Measure Adequacy

The Draft EIS/EIR identifies all feasible mitigation measures necessary to avoid or substantially lessen the project's significant environmental impacts. The mitigation measures themselves will not result in any significant environmental impacts. NEPA

and CEQA require the lead agencies to fully monitor and report the status of the mitigation measures identified in the EIS/EIR. The MMRP provides a means of ensuring this enforcement occurs. The MMRP prescribes specific mitigation protocols for each environmental impact, including implementation procedures, the agency responsible for the measures, the actions to be taken, and a monitoring schedule.

Comment AG.7 appears to concern a project other than the Fourmile Hill geothermal project, as this project does not involve a use permit, nor do the mitigation measures identified in the EIS/EIR require that Calpine conduct any hydrologic studies subject to approval by planning commission staff. Mitigation Measure 4.3.7a does require Calpine to repeat the deposition analysis for Medicine Lake that was performed for the Draft EIS/EIR as part of the hydrological monitoring program described in Mitigation Measure 4.3.1a. However, the analysis is not necessary to determine whether there will be an impact, but rather to confirm the conclusions of the EIS/EIR. Moreover, the mitigation measures identify performance criteria that will ensure the project does not result in any significant hydrological impacts, even if the subsequent deposition analyses reveal different levels of emissions than those assumed in the EIS/EIR. Therefore, the EIS/EIR will assess hydrologic impacts adequately, and monitoring will be performed to ensure that the proposed mitigation measures are effective in minimizing any potential impacts to hydrologic resources.

Comments—Lead Agencies' Roles in Ensuring NEPA/CEQA Adequacy

N.1 1. Calpine Corporation submitted a Plan of Utilization to the U.S. Bureau of Land Management and the U.S. Forest Service to develop a 49.9 megawatt (MW) geothermal power plant and wellfield and 24 mile, 230- kilowatt transmission line. This project, known as the Fourmile Hill Geothermal Development Project, would be located in the Glass Mountain Known Geothermal Resource Area on the Klamath and Modoc National Forests, in Siskiyou and Modoc counties, California. The purpose of the Fourmile Hill Geothermal Project is to develop the geothermal resource on Calpine's Federal geothermal leases in order to economically produce and deliver electrical energy to the Bonneville Power Administration.

The proposed would involve production of geothermal fluids (hot water and steam, and associated toxic and non toxic elements) from a claimed underground reservoir. These fluids would be produced from 9 to 11 two-phase production wells located at five proposed production well pad sites. The fluids would be transported via surface pipelines to the proposed dual flash geothermal power plant, where the steam would be directed to two steam turbine-driven generators. Spent brine and condensate would be pumped through surface pipelines to the three proposed injection well pads for injection to the subsurface claimed geothermal reservoir. There would be one injection well located at each injection well pad.

Each of the production and injection well pads would occupy approximately 2.5 acres, for a total well pad area of 20 acres. The power plant site would occupy approximately 3.0 acres. There would be a total of 4.25 miles of surface pipelines (1.5 miles of production lines, and 2.75 miles of injection lines) and about 2.5 miles of new roads associated with the power plant and well pads.

The proposed project would also include development of a transmission line that would extend from the proposed geothermal plant in an easterly direction for approximately 24 miles to a proposed intertie station along the BPA Malin Warner transmission line. The Malin-Warner line is a 230-kV system that parallels Highway 139. The proposed transmission line would be constructed using H-frame wood poles with steel structures used at certain locations. The transmission line would be located primarily on the Modoc National Forest, with a small portion of the line near the power plant site being located on the Klamath National Forest. Right-of-way width would be approximately 125 feet along the constructed length of the transmission line. Construction of access roads for installation and maintenance would be required along portions of the right-of-way.

2. The BLM has decision-making authority on all geothermal activities proposed to be conducted on Federal lands, and therefore serve as a lead Federal agency for the proposed project. However, because the proposed project includes a proposed transmission line corridor that crosses National Forest lands, the U.S. Forest Service will also serve as a lead Federal agency for the proposed project.

We reference Background Information on Proposed and Past Geothermal Activities within the Glass Mountain KGRA; U.S. Bureau of Reclamation, Modoc National Forest, and Klamath National Forest; June 7, 1996.

Duties and Responsibilities by the U.S. Bureau of Land Management and the U.S. Forest Service Under the Federal National Environmental Policy Act

3. The proposed project is highly controversial in the local and regional areas because of the adverse environmental and social impacts which cannot be mitigated or are being unreasonably mitigated in the DEIS/EIR. Pursuant to Section 102(2)(c) and other requirements of the Federal National Environmental Policy Act (NEPA) the U.S. Bureau of Land Management and the U.S. Forest Service have duties and responsibilities as lead Federal agencies to assure the public that the Draft and Final EIS/EIR is in full compliance with NEPA and its requirements.

Duties and Responsibilities by the Siskiyou County Air Pollution Control District Under the California Environmental Quality Act and its Guidelines

4. The proposed project would require permits from the Siskiyou County Air Pollution Control District. The Siskiyou County Air Pollution Control District will serve as the lead agency under the California Environmental Quality Act and its Guidelines. The Siskiyou County Air Pollution Control District has a duty and responsibility as the lead state agency to assure the public that the Draft and Final EIS/EIR are in full compliance with CEQA and its Guidelines. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

T.10 Pursuant to Section 102(2)(c) and other requirements of the federal National environmental Policy Act (NEPA), the U.S. Bureau of Land Management and the US Forest Service have duties and responsibilities as lead federal agencies to ensure that the EIS/EIR is in full compliance with NEPA and its requirements. Full and fair disclosures of relevant information, professional and scientific integrity of work, mitigation or avoidance of adverse effects, and comprehensive scope of analyses are all part of fulfilling NEPA's purpose. Duties and responsibilities of the Siskiyou County Air Pollution Control District to regulate air emissions and protect air quality fall under the California Environmental Quality Act (CEQA) and its implementing guidelines for public disclosure of not only the potential adverse environmental effects, but also of the maximum possible mitigating measures available. The DEIS/EIR falls far short of meeting NEPA and CEQA requirements. *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

AG.6 The process of analyzing a project's impacts must be an interactive one between the public and the lead agencies. The process "must be open to the public, premised upon a full and meaningful disclosure of the scope, purposes, and effect of a consistently described project, with flexibility to respond to unforeseen insights that emerge from the process." (County of Inyo v. City of Los Angeles (1984) 160 Cal.App.3d 1178, 1185 [207 Cal.Rptr. 425].)

CEQA "contemplates serious and not superficial or pro forma consideration of the potential environmental consequences of a project." (Leonoff v. Monterey County Bd. of Supervisors (1990) 222 Cal.App.3d 1337, 1347-48 [272 Cal.Rptr 372].) "Conclusory comments in support of environmental conclusions are generally inappropriate." (Laurel Heights I, 47 Cal.3d at p. 404; see also Seattle Audubon Society v. Moseley (W.D. Wash. 1992) 798 F.Supp. 1473, 1479, quoting Silva v. Lynn (1st Cir. 1973) 482 F.2d 1282, 1285.) "To facilitate CEQA's informational role, the EIR must contain facts and analysis, not just the agency's bare conclusions or opinions." (Laurel Heights I, 47 Cal.3d at p. 404, quoting Concerned Citizens of Costa Mesa v. 32nd Agricultural Ass'n (1986) 42 Cal.3d 929, 935 [231 Cal.Rptr. 748]; see also Robertson, 490 U.S. at p. 349; Adler v. Lewis (9th Cir. 1992) 675 F.2d 1085, 1096.)

The burden of this environmental investigation is placed on the government rather than the public. (Sundstrom v. Mendocino County (1988) 202 Cal.App.3d 296, 311 [248 Cal.Rptr. 352].) An agency is not allowed to "hide behind its own failure to gather relevant data. (Ibid.; see also p. 361 (sparseness of record suggests existence of significant issues); 40 C.F.R. § 1502.22.)

Lead agencies must thoroughly investigate potential project impacts. (Seattle Audubon, 798 F.Supp. at pp. 1479, 1482.) The agency "must use its best efforts to find out and disclose all that it reasonably can." (14 CCR § 15144.) Even if it is not feasible to do sophisticated technical analyses of impacts, the lead agency must perform less exacting analyses and report the results. (Citizens to Preserve the Ojai v. County of Ventura (1985) 176 Cal.App.3d 421, 432 [222 Cal.Rptr. 247].)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

PH1.22 It pretty much brings me up to what I really would like to hear, and that is on what information are the decisions going to be made whether or not to go through with this project, which route it will take and so forth? I asked earlier the water situation, because I know that it's tricky. And I just heard some very well-educated people discuss that very issue. *(Dorris Public Hearing)*

PH3.112 What does it take to do alternatives? *(Yreka Public Hearing)*

PH4.30 Are there any methods to stop the project if the permit requirements are violated? *(Mount Shasta Public Hearing)*

PH4.47 Does the consultation process have any bearing on the agency decision? *(Mount Shasta Public Hearing)*

PH5.23 What effect does that have when it says it is the preferred alternative—just because this says it's the preferred alternative, that doesn't keep, when it gets ready to go, the contractor from building A1, A2, does it? *(Medicine Lake Public Hearing)*

PH5.31 Has the lead agency made a decision on what alternative yet? *(Medicine Lake Public Hearing)*

PH5.101 I have a question as to who ultimately makes the decisions, you know. It's supposedly Forest Service and BLM are the lead agencies, co-lead agencies. Who within the agency ultimately makes the decision at BLM? *(Medicine Lake Public Hearing)*

PH5.109 I'm curious as to the final decision-making. This is a national forest; who can we contact at a national level to give my opinion? *(Medicine Lake Public Hearing)*

PH5.117 Who is making the final decision; does it happen to be you, someone in Annapolis; everybody involved, the Board of Supervisors, the BLM, Forest Service; or is it just up to the BLM to make the final decision? *(Medicine Lake Public Hearing)*

Response—Lead Agencies' Roles in Ensuring NEPA/CEQA Adequacy

The comments regarding the lead agencies' roles in ensuring that the Draft EIS/EIR complies with NEPA and CEQA are noted. The lead agencies' respective roles in preparing the document are described in Section 1.4, and the public scoping process is described in Section 1.6 of the Draft EIS/EIR. .

The public consultation process serves to highlight areas of public concern for the responsible decision-making agencies. The agencies involved will consider these concerns during the review process and when making a final decision.

With respect to the alternative selection process, there has been a preference expressed for Alternative 1. However, the decision-making agencies will review all alternatives during the selection process. If the preferred alternative is selected, the various permitting agencies will ensure that the design specifications are followed in full.

Comments—Compliance with NEPA/CEQA Requirements

T.8 To date, the BLM and USFS have steadfastly ignored NEPA's requirements at 40 CFR 1502.4 to properly define the scope of environmental review at various decision points. Air and water quality impacts, for example, have never been modeled for long-term commercial operations, because all past environmental reviews considered only leasing or only exploration activities. The exploration and testing which have been permitted, and whose results are necessary to an informed estimation of environmental effects, have not been performed. Thus it is improper and illegal to arrive at this decision point and say that the real authorization for industrial geothermal development was made in the past. *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

Y.21 Yet the DEIS/EIR appears to treat the right to commercially develop the geothermal resources as a "done deal" with only the details to be worked out! This smacks of a predetermined decision for which no public involvement or adequate environmental review has ever been done!!

At least three stages were skipped in the NEPA and CEQA process:1) the actually exploratory stage of evaluating what the resource is and whether it is commercially viable and economically feasible in light of current market conditions—it is there on paper but apparently was never completed; 2) the stage of deciding whether commercial geothermal development should be permitted in this particularly landscape, which is a question for the Modoc and Klamath Forest Land and Resource Management Plan (Forest Plan); and 3) public notification in a way that is timely to giving input into the decision-making process regarding commercial geothermal development.

We do not believe that these three processes can be lumped into one DEIS/EIR, because they are sequential and not simultaneous. The DEIS/EIR for proposed project presumes that the earlier processes have been done. An analogy would be to propose a subdivision before a change in zoning has been granted (please see further discussion under Forest Plan processes below). *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

Response—Compliance with NEPA/CEQA Requirements

The EIS/EIR defines the scope of environmental review (at various decision points, in compliance with NEPA, 40 C.F.R. Section 1502.4). Commercial development and utilization of the geothermal resource at the Glass Mountain Known Geothermal

Resource Area (KGRA) was analyzed in the 1984 Supplemental Environmental Assessment (EA) for geothermal leasing in accordance with NEPA. For additional information on that EA, see the response to "Comments—Environmental Documentation for Previous Geothermal Projects" in the Introduction and Purpose and Need Section of this document.

The effects of exploration were analyzed in the 1995 Fourmile Hill Geothermal Exploration Project EA/IS that was distributed to agencies and the public for review and comment, in compliance with NEPA and CEQA. Because the Draft EIS/EIR also analyzes the impacts of well drilling, information from the 1995 EA/IS was summarized in the Draft EIS/EIR as appropriate.

Neither the 1984 EA nor the 1995 EA/IS authorized the Fourmile Hill geothermal project. The 1984 EA acknowledged that project-specific environmental review of geothermal projects would be required. This Draft EIS/EIR has been prepared to provide that review.

It is not "illegal" for the lead agencies to consider the environmental effects of the entire geothermal project prior to performing exploratory work as suggested by comment T.8. There is sufficient information about the project's potential environmental effects to fully evaluate and understand the entire geothermal development. The project impacts are analyzed based on the results of the previous exploration drilling that occurred elsewhere in the Glass Mountain KGRA. The exploration activities that Calpine will conduct are expected to have similar results as the previous exploration. Therefore, the impacts of the proposed Calpine project can be accurately predicted. Any additional information regarding the geothermal resource that is obtained during exploration or well testing would be used to refine the mitigation measures identified in the Draft EIS/EIR, and ensure the project meets the performance standards for mitigation that have been identified in the EIS/EIR. Furthermore, it is not the intent of either NEPA or CEQA to examine the legality of previous decisions made by public agencies, but rather to provide information concerning the potential environmental effects of a proposed project.

The results of long-term air quality and water quality impact analyses are addressed in the Air Quality and Hydrology Sections of the EIS/EIR.

Comment—Compliance with CEQA Guidelines Section 15128

E.4 I would like to add that I was unable to find discussion pursuant to Section 15128 of the CEQA Guidelines, which requires an EIR to contain reasons that various possible significant effects of a project were not determined to be significant and, therefore, not discussed in detail in the EIR. Ideally, this item should be a separate sub-heading under Section 4. The Guidelines also provides that such discussions that are contained in the Environmental Assessment/Initial Study (EA/IS) may be attached to the EIS/EIR as reference. *(Richard D. Barnum, Siskiyou County Planning Department)*

Response—Compliance with CEQA Guidelines Section 15128

Section 15128 of the CEQA guidelines provides that "an EIR shall contain a statement briefly indicating the reasons that various possible significant effects of a project were determined not to be significant and were therefore not discussed in detail in the EIR."

Consistent with this guidance, the Draft EIS/EIR does indicate the reasons that various possible significant effects of the proposed project were determined not to be

significant. These reasons are indicated in the appropriate impact discussions throughout Chapter 4 of the Draft EIS/EIR. The format for this approach is consistent with Section 15120(a) of the CEQA guidelines, which requires that EIRs contain the information outlined in Article 9 of the CEQA guidelines, but allows that the presentation of the information may vary.

EIS/EIR APPROACH

Comment—Purpose of the EIS/EIR

AG.5 CEQA and NEPA confer a "privileged position" upon members of the public based on the belief that they can make important contributions to environmental protection. (Concerned Citizens of Costa Mesa, Inc. v. 32nd Dist. Agric. Ass'n (1986) 42 Cal.3d 929 [321 Cal.Rptr. 748], quoting Selmi, The Judicial Development of the California Environmental Quality Act (1984) 18 U.C. Davis L.Rev. 197, 215-216; accord Robertson v. Methow Valley Citizens Council (1989) 490 U.S. 332, 349 [109 S.Ct. 1835].) The EIS/EIR process is "the principal method by which environmental data are brought to the attention of the agency and the public." (Mira Monte Homeowners Ass'n v. County of Ventura (1985) 165 Cal.App.3d 357, 365 [212 Cal.Rptr. 127].) Hence, the EIS/EIR is primarily an informational document. (Laurel Heights Improvement Ass'n v. Regents of the University of California ("Laurel Heights I") (1988) 47 Cal.3d 376, 392 [253 Cal.Rptr. 426].)

The EIS/EIR process allows the public to review and comment on the impacts and proposed mitigation measures, and provides the agency with a basis for making findings to support its decision on the project. (Sierra Club, 7 Cal.4th at p. 1229; Robertson 490 U.S. at p. 349; Adler v. Lewis (9th Cir. 1992) 675 F.2d 1085, 1096.) "The ultimate decision of whether to approve a project, be that decision right or wrong, is a nullity if based upon an EIR that does not provide the decision-makers, and the public with the information about the project that is required by CEQA." (Santiago County Water Dist. v. County of Orange (1981) 118 Cal.App.3d 818, 829 [173 Cal.Rptr. 602].)

Two key functions of an EIS/EIR are to identify and describe every significant impact of a project and to propose feasible mitigation for each impact, if such mitigation exists. (Cal. Pub. Res. Code §§ 21002.1, 21100(a); Sierra Club v. State Board of Forestry (1994) 7 Cal.4th 1215, 1229 [32 Cal.Rptr.2d 19]; County of Inyo v. City of Los Angeles (1977) 71 Cal.App.3d 185, 192 [139 Cal.Rptr. 396]; Robertson, 490 U.S. at pp. 348-352.) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

Response—Purpose of the EIS/EIR

The comments regarding the purpose of the EIS/EIR are noted.

Comments—Definition of "Effect"

HF.13 Pages S-6ff:Alternatives Comparison:Because I have not had access to the full EIS/EIR, it is not possible for me to evaluate the criteria the ES uses in distinguishing between "effects," "adverse effects," and "significant adverse effects." By what criteria are adverse effects considered "less-than-significant"? *(Daniel T. Spencer)*

HF.18 Pages S-13ff:Summary of Environmental Consequences and Mitigation Measures:This chart presents a dramatic picture of the potential and likely cumulative damage to the Highlands of this project. There are several categories where even after the recommended mitigation efforts the level of significance of adverse effects remains at the significant level, including effects on cultural resources, effects on Medicine Lake Highlands, effects of project noises on traditional sites and uses, effects on landscape views, and effects on Medicine Lake views. There are many other categories where the effects are listed as significance prior to mitigation, yet less than significant after mitigation; by whose criteria and according to whose values and assumptions are these effects deemed less than significant? *(Daniel T. Spencer)*

PH5.92 As far as the graph in the EIR, at the beginning of it, it goes through all the significant levels and everything, for all the options; how do you guys determine significant versus less than significant? *(Medicine Lake Public Hearing)*

Response—Definition of "Effect"

A "significant effect" is defined under CEQA as a "substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic and aesthetic significance" (CEQA Guidelines Section 15382).

The general basis for determining "significant" environmental effects under both NEPA and CEQA is a contextual inquiry. That is, the context of the action and the intensity of the action affect that analysis. The EIS/EIR establishes criteria for determining what would be a significant adverse impact (e.g., impacts to air quality or water quality). Impacts that meet or exceed the significance criteria are "significant" and addressed in greater detail, with proposed mitigation measures developed for each. An "adverse effect" is one that may have some negative impact, but does not meet the identified significance criteria, and thus does not require mitigation.

Comments—One EIS for the Geothermal Projects

A.8 The EPA views the proposed action and the planned Telephone Flat project as similar actions. 40 CFR 1508.25(a)(3) encourages agencies to consider addressing similar actions in the same EIS. Although USFS/BLM have indicated that the two actions should not be considered together because of their location and geologic/hydrologic settings, we believe the DEIS does not provide sufficient information or assurances that water resources and biologic resources would not be affected by long-term cumulative impacts from both projects. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

A.10 We believe that the projects are also similar because they rely on the same transmission line system. The projects would likely produce similar kinds of visual, air, and noise impacts. We believe that, cumulatively, several geothermal operations in the Medicine Lake Highlands could produce significant environmental impacts on traditional cultural uses and recreational uses. These cumulative impacts should be further examined in the FEIS. *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

H.35 While Fourmile Hill and Telephone Flat are separate projects, and will be analyzed separately, they are seemingly interdependent, particularly in regards to the Proposed Alternative, since the proposed alternative would not likely be selected without the Telephone Flat project.
(Bill Dart, American Motorcyclist Association)

Y.52 We believe that in order to adequately evaluate the impact of geothermal development within the Medicine Lake Highlands and surrounding areas, the lead agencies must consolidate and coordinate the environmental review process into one master plan for all potential project permits. The Fourmile Hill draft EIS/EIR piecemeals the cumulative environmental effects of this and other proposed projects. The Proposed Cal Energy Telephone Flat project is already in the EIS scoping stages and at least a third project has been discussed. Only through a comprehensive EIS/EIR can all the cumulative effects be properly evaluated. Part 1,508.7 of the CEQ Regulations implementing NEPA expressly defines cumulative impacts as:

> ...the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency... or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.
> *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AG.14 When the Forest Service analyzed the environmental impacts of geothermal leasing, it analyzed the impacts of all leasing activities within the Glass Mountain KGRA. (Supplemented Environmental Assessment:Geothermal Leasing of National Forest System Lands in the Glass Mountain Known Geothermal Resource Area (Sept. 1984) There is no reason why a similar approach cannot be taken for geothermal production.

The EIS/EIR attempts to explain away this failure to analyze other geothermal development projects on the basis that the Calpine has not "induced" other projects, and that other projects are being independently proposed and processed. (EIS/EIR, p. 4-331.) This does not alter CEQA's mandates against piecemealing of projects. The fact that private entities are proposing separate projects does not alter the fact that these projects are inextricably intertwined. They are geographically related and will use and impact common resources (e.g., geothermal reservoir, forest, visual, air quality, Native American values). The Forest Service and BLM will be making the ultimate decisions about whether these projects should proceed, and these decisions clearly are related Federal actions. (E.g., Minnesota Public Interest Research Group v. Butz (8th Cir. 1976) 541 F.2d 1292, cert. denied, 430 U.S. 922.)
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

FP.22 This document, as stated on page 1-4, "is intended to fulfill both the format and content requirements, as well as the spirit, of the two statutes (NEPA and CEQA)." If this is truly the case, the lead agencies need to do their job and go back to the planning table and address all proposed geothermal development in the KGRA as one whole project, not piecemeal in one project at a time for the next 5-10 years, as appears to be the strategy. At the very least, please address why the proposed transmission line is for 300 MW, and do a more thorough job of addressing the cumulative impacts of the proposed Telephone Flat

project. Please tell s if we should multiply the significant adverse effects of this project by 2 or 6 to come closest to what will ultimately occur in the project(s) area. If these effects and impacts are multiplied by the true number of powerplants that will ultimately be built (2-6?), THEN do they become significant to the lead agencies, or is this still a green project? Please address this question. *(Eric T. Nelson)*

Response—One EIS for the Geothermal Projects

Potential cumulative effects (including effects to water and biologic resources) of the Fourmile Hill geothermal project and the Telephone Flat geothermal project are addressed in detail in Section 4.17, Cumulative Impacts, of the Draft EIS/EIR. The cumulative analysis contained in the Fourmile Hill Draft EIS/EIR reflects an evaluation of the best available information about the Telephone Flat project at the time of the Fourmile Hill Draft EIS/EIR preparation. At that time, the proposal for the Telephone Flat project was still being reviewed by the lead agencies, and no analysis of the Telephone Flat project had yet been conducted.

In May 1998, the Telephone Flat Draft EIS/EIR was released for public review and comment. Information about the Telephone Flat project and its potential environmental effects have therefore been considered in this Final EIS/EIR. The cumulative analysis in the EIS/EIR for the Fourmile Hill project has been updated to include a more detailed analysis of the cumulative effects of the two proposed geothermal projects (see the responses to comments in the Cumulative Effects Section of this document). This updated analysis did not identify any new significant cumulative impacts not previously identified in the Draft EIS/EIR.

The lead agencies considered analyzing the Fourmile Hill and Telephone Flat projects in a single EIS when the proposal for the Telephone Flat geothermal project was accepted in January 1997. At that time, the environmental process was well underway for the Fourmile Hill project (the Fourmile Hill proposal was submitted to the USFS and BLM in December 1995). However, the lead agencies evaluated whether the Fourmile Hill and Telephone Flat projects should be treated as similar actions and analyzed in a single EIS. USFS and BLM staff reviewed 40 CFR 1508.25(a)(3) for guidance on this matter. Based on this review, the USFS and BLM determined that each project (and the associated actions) should be evaluated separately and independently, each in its own EIS. The lead agencies reasoned that decision-makers could best understand the individual effects of each project if separate EIS/EIRs were prepared. Their conclusion was based on the following reasons:

- The two projects do not share common timing or location
- The two projects are being proposed by different private companies
- The two projects require different and independent decisions and approvals

Separate Timing and Locations: The primary reason for not preparing a single EIS for the two projects was that the projects do not share common timing or location. Regarding timing, the Fourmile Hill project was proposed in December 1995, and the proposal for the Telephone Flat project was not accepted by the USFS until January 1997. In fact, the Telephone Flat proposal was not accepted until after the resource surveys for the Fourmile Hill project had been conducted, and the Fourmile Hill Administrative Draft EIS/EIR was nearly completed.

The environmental review of each project has also proceeded on different schedules. The Fourmile Hill Draft EIS/EIR was distributed to the public in June 1997; the Telephone Flat Draft EIS/EIR was not distributed until May 1998. The timing of lead agency review is expected to vary accordingly. The two projects are on different schedules, and it would not be appropriate to force one to be delayed by potentially one year.

The locations of the two projects are also different. The proposed power plant and wellfield sites of the Fourmile Hill and Telephone Flat projects are located approximately six miles from each other. The power plants for each project would be located on different Forests (the Fourmile Hill power plant would be located on the Klamath National Forest, while the Telephone Flat power plant would be located on the Modoc National Forest). In addition, the Fourmile Hill power plant and wellfield would not be located in the Medicine Lake caldera, while the Telephone Flat power plant and wellfield would be located in the caldera.

Finally, the localized hydrologic systems at each location are not similar (see the responses to comments in the Hydrology Section of this document).

Different Project Applicants: The projects are being proposed by two different private companies. Calpine Corporation has proposed the Fourmile Hill project, and CalEnergy has proposed the Telephone Flat project. Each project has been proposed independently of each other, and each proposal proposes construction of a complete transmission line to connect into the regional power grid system (although only one transmission line would be built if both projects are approved).

The USFS could have accepted proposals that would have allowed each project proponent to develop separate transmission lines for their projects. This approach would have further demonstrated that the two projects are separate and independent actions. However, as discussed in the Draft EIS/EIR, the USFS desires to minimize the number of transmission line corridors extending from the Glass Mountain KGRA, in order to minimize the potential environmental effects associated with transmission line development. The Fourmile Hill and Telephone Flat geothermal projects would use the same transmission line in order to accomplish this goal.

Different and Independent Decisions and Approvals: Different decisions and approvals will be required for these unconnected projects. The Fourmile Hill project is not dependent on the Telephone Flat project being approved, and vice versa. Either of the two projects as proposed could proceed regardless of the other project. Each project would also result in different types and levels of intensity of environmental effects that require independent and separate evaluation. Therefore, while the proposed actions could be considered similar (i.e., both involve consideration of geothermal projects on the Forest), these actions would be independent of each other, not related. The actions to be taken by the USFS and BLM regarding the projects would be distinctly separate actions, and different decisions and approvals would be required for each project.

It is acknowledged that the general types of effects from the two projects would be similar since they are both geothermal projects. However, the actual visual, air, and noise impacts would differ due to the different locations of each project. Analyses of these issues for each project in separate EISs allow for a clearer evaluation of the project-

specific environmental effects of each project. The cumulative analyses contained in each EIS adequately evaluate the combined effects of these two projects.

The opinion of the EPA that several geothermal operations at the KGRA (i.e., in the Medicine Lake Highlands) could produce significant effects is noted. The proposed Fourmile Hill and Telephone Flat projects are the only current reasonably foreseeable geothermal development planned for the KGRA. For more information, see the responses to "Comments—Reasonably Foreseeable Geothermal Development" in the Cumulative Effects Section of this document.

DRAFT EIS/EIR PUBLIC INVOLVEMENT

Comments—Public Scoping for the Draft EIS/EIR

M.9 7) Most disturbing is the fact that the above concerns and many other just-as- important related concerns have already been expressed and presented in writing in timely fashion through proper channels in the environmental review process for inclusion in the Draft EIS—and they were not included in the draft EIS. I am referring to three letters:1) letter to Randy Sharp from FR RCD, Grose, and Ellis dated Dec. 4, 1996, 2) letter to Randy Sharp from Peter Stent, Feb. 10,1997, and 3) letter to Randy Sharp from FR RCD, Feb. 18,1997. *(Rick Poore, et al., Fall River Resource Conservation District)*

Y.16 Furthermore, certain communities have had to petition for a public meeting, held only two weeks before the original comment deadline, even though it has long been known (since the 1984 EA at least) that these communities have an interest in the welfare of the Medicine Lake Highlands.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

Y.17 The Forest Service has actually taken measures to prevent sport groups and campers who use the area from receiving information about the proposed development.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

Y.61 In conclusion, through this partial analysis, we hope that we have shown that the outstanding environmental quality of the Medicine Lake area, its Native American cultural importance, and environmental issues of high significance are not being adequately addressed. The DEIS/EIR is flawed in its inception, since it has not addressed. The basic questions of whether commercial geothermal development should be permitted, is inconsistent with applicable Forest Plans, and has not provided for an adequate public notification and participation process in these decisions.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

BP.4 This proposed project will significantly impact Federal public recreational lands, supported by taxpayer-'s dollars. Notice of the public scoping process and the draft EIS/EIR was not properly provided to those who use these lands. First, most of the Medicine Lake homeowners were unaware of the scoping process and most had extreme difficulty in obtaining the draft EIS/EIR. Some still do not have this document or other requested public documents. Secondly, no public notices of the project or public hearings were placed on the Medicine Lake campground bulletin boards this summer. It is estimated that 40,000 people now use these campgrounds annually. These campgrounds stand to be significantly impacted if the project is approved, due to excessive noise, visual impairments, loss of air and water quality and destruction of wildlife habitats. Thirdly, no attempts have been made to notify hunters of the proposed project by posting notices in local sporting goods stores, markets and hotels during hunting season. No hunting advocacy groups were on the mailing list of the draft EIS/EIR. Further no attempt has been made to notify persons who now, by permit, annually harvest mushrooms in and around the proposed project site. The failure to provide adequate public notice has deprived any taxpayers and area users, who have paid for the recreational developments to the Medicine Lake area, of a voice in determining the fate of the project that could have an impact on their recreation. *(S. Peder and Suzanna S. Cuneo)*

BQ.33 The development of the Fourmile Hill Geothermal Project is a large undertaking, involving several agencies, private companies and the public. It is our contention that many members of the public, who would be most directly affected by this project; have not been informed as to the development of this project; have not been given access to information about the project and have not been allowed to make their views on the project heard. Some readily identified members of the public who were not contacted during the public scoping are detailed below, including campers, hunters and mushroom harvesters.

The group that will be most directly affected is the recreational users of Medicine Lake. According to the draft EIS/EIR, more than 40,000 people use the Medicine Lake area annually for recreation. Was there any attempt to inform these people about this project, were there any notices posted at the Medicine Lake campground, was there any attempt to hold public meetings at the campground, no! Public hearings were conduced in only three locations, one of which, Klamath Falls, is the site of a geothermal research unit. However, USFS records show that more than 113 of the campers using Medicine Lake (over

15,000 people) are from Redding, California, but not one public meeting was scheduled for the Redding area. Of the press clippings in the draft EIS/EIR not one is from a newspaper in the Redding area, of the names on the mailing list only eight names of private individuals, in the Redding area, are listed out of the 306 mailings. Why has the public scoping process avoided obtaining input from these users of Medicine Lake? This project will have an impact on the recreation of more than 40,000 people, of which almost 15,000 come from a single geographic area. No attempt was made to inform these people about this project or to obtain any input from them. Without the informed input from such a large number of users of this resource the public scoping for this project has not fulfilled the requirements of CEQA or NEPA.

The area around Medicine Lake is heavily used as a deer hunting area yet no attempt was made to inform the hunting public about this project. Why was a group I that makes heavy use of this area denied information and the ability to have some input on a project that will have such long term effects? There is no hunting advocacy group identified on the mailing list nor was there any indication that hunting groups were contacted about this project.

There is no indication in the draft EIS/EIR that individuals that hold permits for the harvest of mushrooms have been contacted about this project. *(S. Peder and Suzanna S. Cuneo)*

DI.9 Additionally, we would like to comment upon the way in which the public was informed about these projects. No meeting was planned in Mount Shasta until citizens insisted upon it. We did attend that Mount Shasta meeting. There were also long delays in getting the EIS/EIR to individuals who wanted to study the document. Avoidance of public input and delaying tactics only weaken the tenuous ties which now exist between the USFS and the public. These tactics backfire by angering community members in Siskiyou County. Let's communicate with more openness and respect in the future...
(Ana Holub and Richard Lucas)

FO.4 It also concerns me greatly that the community of Mt. Shasta has - been omitted as a public comment site after an earlier hearing there apparently raised significant concerns and objections to the proposal.

As you know, the NEPA/CEQA process is supposed to be an objective process using the EIR/EIS as a way to objectively document the cumulative environmental and economic costs of a project and then coming to an objective decision. It is not intended to be a rubber stamp either for or against. Omitting the location (and thereby many of the people) who raised concerns about the proposal is certainly not the intent of the law. *(Eric T. Nelson)*

FP.10 The majority of the people affected by this proposed project will be the recreational users of the Medicine Lake area, included but not limited to the campers, cabin owners, fishermen, hunters, mushroom hunters, birders, boaters, snowmobilers, etc.... According to the Draft EIS/EIR over 40,000 people use the Medicine Lake area annually for recreation. After reviewing the environmental document, there was little recognition of these user groups in the scoping process.

While visiting the Medicine Lake campgrounds twice this summer, there were no notices posted either at the campgrounds or the boat dock, even to notice users of the public hearing on the project at Medicine Lake on August 30, 1997. There was no attempt to notice any of the game hunters or mushroom hunters, both who must register with state and Federal offices in order to gain permission for use of these resources in the area. This is a whole group of users who's voice on the project should be heard!

Please consider this a second formal request to extend the comment period to August 30, 1997, to allow for the above mentioned users of Medicine Lake the ability to comment. If this will not be done, please comment in the Final EIS/EIR as to attempts to rectify this or justification for the omission.*(Eric T. Nelson)*

HF.8 Page S3:In the listing of groups notified under the Scoping Process, conspicuously absent are the Medicine Lake Homeowners Association (MLHA) and the users of the USFS Campgrounds at Medicine Lake. As a member of the MLHA, I was not notified of the full extent of this proposed project until this Summer, 1997, at which point it was not possible for me to attend the August 30, 1997 meeting with you and the Calpine representative; similarly, your office has not furnished me with a copy of the EIS/EIR which has effectively limited my participation in the public comment period. It is impossible not to conclude that the real intent of this process is to rush through approval of the project by limiting public access to vital information and adequate time to study and respond to the documentation.
(Daniel T. Spencer)

PH1.16 Number seven:Most disturbing is the fact that the above concerns and many other just-as-important related concerns have already been expressed and presented in writing in a timely fashion through proper channels in the environmental review process for inclusion in the Draft EIS, and they were not included in the Draft EIS.

I'm referring to three letters; a letter to Randy Sharp from the Fall River Resource Conservation District and Tom Grose and Maria Ellis, dated December 4th, 1996; letter to Randy Sharp from Peter Stent, February 10th, 1997; and a letter to Randy Sharp from Fall River Resource Conservation District dated February 18th, 1997. *(Dorris Public Hearing)*

even begin to review prior to the September 30th comment deadline. The Lead Agency's delay in making such information available has severely prejudiced our ability to review and comment on this document. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

Y.15 A number of people had trouble obtaining copies of the 800+ page DEIS/EIR in a timely manner. A number of individuals and groups have asked for a 45-day extension to the comment period deadline in order to evaluate requested information and provide detailed comments. A two week extension was granted until September 30, 1997, but some of the asked-for documents have still not been received, and the time allowed is not sufficient to obtain these document nor to adequately review them. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AO.2 There are a lot of people that did not have a copy of the EIR/EIS and most of the ones that now have it had to call and ask for it. *(Mildred J. Aquila)*

DK.1 I am writing to voice my concerns about the proposed Fourmile Hill Geothermal Development near the Medicine Lake area. On August 8, 1997, I stopped at your office and requested a copy of the EIS/EIR report for this project. As of today, I am yet to receive a copy of this report, 6 1/2 weeks after I requested it. This delay makes it extremely difficult to be able to properly review the ramifications of this project. But since the comment period is drawing to a close, I feel I need to respond now, based on the information I have been able to gather. *(Roger G. Hyytinen, Hyytinen Engineering)*

GX.1 I would appreciate a copy of the Draft EIS/EIR and the time to compile reasonable responses. *(David Self)*

HD.22 I appreciate the opportunity to comment on this report. However, for the record. I would like to note that I received the EIR/EIS just over two weeks before the extended deadline for submittal of comments. This is not a sufficient amount of time to be able to review a report that is more than 700 pages in length. *(Amanda Spencer)*

HF.1 I write to you today in follow-up to my letter of July 29, 1997 (still unacknowledged by your office) out of a deep sense of urgency and frustration:urgency, because the public comment period on the future of the Medicine Lake Highlands and the proposed Geothermal Development Project at Fourmile Hill will close on September 30, 1997; frustration because despite my repeated attempts via letter and three phone calls to your office over the past two months, your office never furnished me with a copy of the EIS/EIR report which would be necessary to give a more informed commentary on the proposed geothermal project. I therefore wish to lodge an official complaint and protest about the unsatisfactory process your office has provided for public response to the proposed geothermal project(s) on the Medicine Lake Highlands. If public comment on the project is fairly solicited, we must be given fair and adequate access and time to the project materials in order to make informed comments. *(Daniel T. Spencer)*

PH1.19 I requested one about two weeks ago. Nancy Gardener sent a press release, she told me that the amount of public interest was more than expected and that they were out of copies. I suggested that that might be a good reason to make more copies. She suggested that I borrow one from someone in Fall River. I suggested that if more copies were made or more copies were found, that I would sincerely like one to be sent to me. *(Dorris Public Hearing)*

PH3.38 A lot of people in the Medicine Lake Homeowners Association did not receive those books. There are lots of them that did not receive those books. *(Yreka Public Hearing)*

Response—Draft EIS/EIR Distribution

There has been a focused and concerted effort to make the Draft EIS/EIR available to concerned members of the public. A total of 400 copies of the document were distributed to approximately 350 individuals, agencies, and groups. Every effort was made to send a copy of the Draft EIS/EIR to every individual, agency, and group that requested to be kept notified of the project. Furthermore, the Draft EIS/EIR has been made available for public review at all of the lead and cooperating agency offices, including:

- USFS offices in Alturas, Macdoel, and Tulelake, California
- BLM offices in Alturas, California
- Siskiyou County APCD offices in Yreka, California
- BPA offices in Portland, Oregon

In addition, the Draft EIS/EIR was made available for public review at public libraries in Siskiyou and Modoc Counties, California, and Klamath County, Oregon.

The study is extremely important in the environmental review process because one primary issue is whether the economic need for the project justifies the associated environmental impacts. The information presented by the environmental consultants, the Calpine environmental representative and yourself at the August 30th public hearing and the September 3rd Board project tour indicated there was no demonstrated need for the electricity generated by the project at this time. The draft EIS/EIR does not document a specific need (of course only 3/4 of a single page even discusses the "need" for the project. The other remaining 800+ pages describe the environmental impacts).

At the August 30th public hearing and Sept. 3rd Board tour, the Calpine representative admitted that the cost of producing power from this project would be twice the current market rate. Calpine also stated that the company had no current buyer for the power generated by this project; specifically that they had no commitment from BPA. This is significant because the purpose and need section of the dl-aft EIS/EIR focuses on the "need to economically produce and deliver electrical energy to BPA and others..." (Draft EIS/EIR; 1-3).

In addition, at the Sept. 3rd Board tour, the Calpine representative stated that Calpine had not even determined if a viable geothermal power source exists within the proposed project area because they had not completed test drilling. This fact is also stated in the EIS/EIR (pg. 2-38). Calpine also stated that if after preliminary drilling was completed and the company was unable to find a geothermal power source, the remainder of the project would be abandoned. Given this scenario we are appalled, as taxpayers, that the USFS has spent this amount of time and effort on this "maybe" project.

When asked about the bond that Calpine would be required to post for the project we were informed that the bond amount would be $100,000. Given the size of this project such a small bond would do very little to mitigate the effects of a major environmental disaster. So, one big question remains, who will pay for the clean up if a major accident were to occur—the answer is the taxpayer.

At the August 30th hearing you were unable to provide the amount of the annual lease payments being paid annually by Calpine and Cal Energy for their lease sites in the Medicine Lake area. Yet you had an extensive amount of information about potential royalties that could be generated by this project. At the end of the August 30th hearing you stated that you would provide that information to me, about current lease payments after the meeting. That information has not been provided.

At the hearing and Board tour there was discussion that Siskiyou County and the Federal Government would receive millions of dollars annually from taxes and royalties generated by the project. How are these millions generated? From the taxpayers? Please provide the Economic Feasibility Study within 10 working days of receipt of this letter.

2) Lack of Compliance with FOIA

a) The Medicine Lake Homeowners group made several requests for public documents in July 1997. Many of these documents still have not been provided. They are all necessary to evaluate and provide detailed comments to the draft EIS/EIR.

b) Dan Spencer and Peder Cuneo sent letters in early August requesting copies of the draft EIS/EIR. Neither received the draft EIS/EIR as a result of those letters. Those of us that did receive the document received it on September 5, 1997, as a result of the August 30th hearing. Dan Spencer has still not received it. As this document is in excess of 800 pages, significant additional time must be provided to allow thorough review and comment.

3) Request for Additional Public Documents Pursuant to FOIA

Please consider this a formal request for the following:public documents related to the proposed project:the entire project file including Calpine's permit applications; all project reports submitted by agencies providing input on the project or the environmental review process; (specifically reports by U.S. Fish and Wildlife and California Fish and Game pertaining to impacts on wildlife and threatened species) all public comments; all transcripts from public hearings held during the scoping process; a copy of any draft-proposed permit for the project; a copy of the entire project file for Cal Energy's proposed Telephone Flat project, including all of the above described items; a copy of all prior environmental documents considered in developing the draft EIS/EIR for this project a copy of all relevant Klamath and Modoc Natl. Forest plans for the area including any correspondence with the Park Service regarding the impact for the Lava Beds Natl. Monument and development of the Scenic Corridor (see draft EIS/EIR page 1-5 for specific reference) a copy of the regulations covering administrative appeals.

Please provide all of the documents within 10 days, pursuant to FOIA requirements. If there is a cost with providing these documents please notify us by telephone (520-621-1330 [office]) or by letter. This request will be followed up by telephone calls a week after this letter has been posted.

(S. Peder and Suzanna S. Cuneo)

BQ.1 The purpose of this letter is to provide specific comments to the draft EIR/EIS. We developed the issues raised in this letter without the additional information that we requested in our letter of September 15, 1997. In addition we wrote this letter with very limited time to review the 800 page draft EIR/EIS. If the review process is to be at all meaningful more time must be given to allow concerned parties to read,

review and; analyze all of the information that contributed to the draft EIR/EIS. In our letter of September 1997 we had requested an extension of the comment period to December 30, 1997. After a short review of the draft EIS/EIR we are requesting an extension to August 30, 1998. We have detailed the reasons for this extension in section 111 (Lack of Adequate Public Scoping)below. We are asking for a specific written response if the comment period for the draft EIS/EIR is not extended to August 30, 1998. As stated above, we are writing this letter without full access to all of the information that went into the preparation of the draft EIS/EIR, therefore we reserve the right to add additional information to our response as we receive further information. *(S. Peder and Suzanna S. Cuneo)*

BQ.34 Many homeowners in the Medicine Lake area did not know of the project until the August 30, 1997 homeowners meeting. Since then there have been many requests for more information from members of this group. The president of the homeowners mailed a request for information in July 1997, that information was not received until September 1997. If the public is not given the necessary information and not given an opportunity to assess and respond to that information then this process is not truly providing accurate public response. *(S. Peder and Suzanna S. Cuneo)*

CX.3 The public has not been given enough time to be made aware of the facts in this case. *(Shelly Harmon)*

GX.2 An extension of the comment period would thus be greatly appreciated. The Medicine Lake and Shasta and vicinity are of great importance within a rather broad region as well as locally and thus the process should elicit and give reasonable time for comment from afar. *(David Self)*

HA.2 At the Medicine Lake public hearing, Mr. Sharp, requests were made to extend the comment period to October 30, 1997. Your reply to the request was "I see no problem with that". Still the comment period was just extended to September the 30th, and not the later date. Please consider this to be a second formal request to extend the comment period to October 30th. Please respond in a written response if this extension is not given. I reserve the right to comment and question issues of this project. *(James Shott)*

HF.2 When it became clear that I would not receive a copy of the EIS/EIR before the expiration date of the public comment period, I was able to get a friend to fax to me a copy of the 19-page Executive Summary (ES). I will therefore address my concerns to the conclusions and points raised in the ES. I ask, however, that you extend the comment period for the 800 page EIS/EIR to at least December 30, 1997, and that you send to me in a timely manner a copy of the EIS/EIR so that I can review the full report. To not extend the comment period and provide full access to the project materials and reports is to make a mockery of citizen commentary and input on the project. *(Daniel T. Spencer)*

HF.22 In summary, Mr. Sharp, I am asking that a fair and accessible assessment process be put in place to allow concerned citizens both the time and access to full documentation needed to provide informed commentary on this project. *(Daniel T. Spencer)*

PH3.117 I am just curious why there weren't any meetings in Mt. Shasta, that area? *(Yreka Public Hearing)*

PH4.2 Request was made for an extension of public comment period. *(Mount Shasta Public Hearing)*

PH5.37 Incidentally, I'd like to ask the lead agency for a request to extend the comment period till October 30th, 1997, if that's—in light of the facts of these meetings, because ultimately the last meeting was supposed to be August 7th. *(Medicine Lake Public Hearing)*

PH5.93 I strongly support Jim and other people's recommendation that the comment period be extended to the end of October. I haven't had a chance to look at it. *(Medicine Lake Public Hearing)*

PH5.113 I'd like to put it on record, with the vote of the home owners' membership, that we extend the comment period to this as a whole, the members, to October 31st, and then an economic based statement be forwarded to the Homeowners Association for study. *(Medicine Lake Public Hearing)*

PH5.115 The comment period for talk, October 30th. We also would like an economic impact report forwarded to the Homeowner's Association. *(Medicine Lake Public Hearing)*

Response—Draft EIS/EIR Review Period

The Draft EIS/EIR was available for public review and comment for two weeks longer than the 60 days required. The Draft EIS/EIR was distributed on July 11, 1997, and the public review period for the Draft EIS/EIR formally began on July 18, 1997. The original closure date for the Draft EIS/EIR review period was September 16, 1997, which provided for a formal 60-day public review period. As a result of public requests, the lead agencies extended the closure of the Draft EIS/EIR review period until September 30, 1997. A formal review period for the Draft EIS/EIR of 74 days was therefore provided. A letter notifying the public of the extension of the review period was distributed on September 10, 1997 to all Draft EIS/EIR recipients, and extension notices were published in the Federal Register and regional newspapers.

Neither NEPA nor CEQA require an economic feasibility study.

The information requested from the public agencies has been provided to the parties concerned. The Freedom of Information Act (FOIA) request in comment BP.2 was responded to in a timely manner, and the commentor was provided with all information about the project and the environmental process in compliance with FOIA. For further discussion of this matter, refer to the response to "Comments—Siskiyou County APCD Role" in the Introduction and Purpose and Need Section of this document.

PLAN TO ACT AGAINST PROJECT APPROVAL

Comments—Plan to Act Against Project Approval

X.12 Until all of these potentially damaging effects are removed from the realm of possibility, the MMAS Board of Directors will take whatever action necessary to see that the Fourmile Hill Geothermal Project EIS/EIR is rejected. *(Michael Hauptman, Mount Shasta Area Audubon Society Board of Directors)*

BQ.2 Please be advised that if the final EIS/EIR has a finding that allows for the development of this project we plan to appeal that decision. *(S. Peder and Suzanna S. Cuneo)*

HA.3 Please be advised if the lead agencies approve this proposed project an appeal is for sure. *(James Shott)*

Response—Plan to Act Against Project Approval

The statements made in the comments regarding the potential for appeal are noted. If the proposed action (or one of the other "action" alternatives) is approved by the decision-making agencies, interested parties may appeal the decisions of the Federal lead agencies under NEPA and the CEQA lead agency.

5: RESPONSES TO PROJECT PREFERENCE COMMENTS

5: RESPONSES TO PROJECT PREFERENCE COMMENTS

5.1 Introduction

This chapter provides responses to project preference comments raised during the public comment period for the Draft EIS/EIR. Although these comments do not necessarily comment on the Draft EIS/EIR, responses are provided. Each comment in this chapter (as well as other chapters) of this document was considered without regard to the author's location, occupation, or lifestyle. Each comment will be considered by decision-makers in determining whether to approve the project.

The comments and responses in this chapter are grouped under the following headings:

- Alternative Preference
- Project Opposition
- Project Support

Under each of these headings, comments and their responses are grouped under specific sub-headings.

5.2 Project Preference

ALTERNATIVE PREFERENCE

Comments—Preference for Alternative 5

BR.3 It's been a few years since I've been to Medicine Lake and the surrounding area, but I'd hate to see this area spoiled by intrusive power plants. I use electrical power myself so I won't object to some sort of development, but the power lines should be posted away from the Lake as in alternative 5. *(Bill DeJager)*

BR.5 I therefore urge the Forest service and BLM to adopt Alternative 5. *(Bill DeJager)*

HC.1 My main comment on this project is the same as it has been from the beginning: STAY OUT OF THE MEDICINE LAKE CALDERA AND RECREATION AREA!!

Table S-4: Comparison of Key Issues for Alternatives, clearly shows that Alternative 5 is less impacting in eleven (11) out of the twenty-six factors considered, and more impacting on only one. It could also be argued that Alt. 5 is also the environmentally-preferred alternative, since the only significant difference between this and Alt. 6 is the temporary impact of transmission line construction in the vicinity of Tionesta. The nearest residence at Tionesta is 1500′ from the proposed line, and impacts are expected to

last for less than a week, hardly a significant impact when compared to those that would occur should the line be routed through the caldera and recreation area.

Other factors in favor of Alt. 5 are:

-No released roadless areas are affected, not that you have to worry about these anymore anyway (where did the term 'roadless release area' come from?).

-There are no special status species on segment A3.

-There are no sensitive plant communities on segment A3.

-There would be no conflict with summer recreational access to Medicine Lake.

-Recreationists on Medicine Lake wouldn't have their view cluttered up by a power line stretching across the horizon.

-The transmission line would be 0.2 miles shorter, therefore somewhat less expensive to build.

In short, it should be obvious what the preferred alternative for this project should be, and it probably didn't need a five pound ($10/copy to mail) EIS to demonstrate this. *(Lawrence K. Smith)*

Response—Preference for Alternative 5

The preferences expressed in the comments for Alternative 5 are noted.

Comments—Preference for Alternative 6

Q.12 If the No Action Alternative is not chosen, then Alternative 6 should be chosen. The transmission lines for the proposed project should follow existing roads and other utility rights-of-way entirely. The last thing the Medicine Lake Highlands area needs is more roads and rights-of-way fragmenting forests and other types of wildlife habitat. *(Lori J. Cooper, Klamath Forest Alliance)*

DB.3 If the project is approved, then the alternative selected should be Alt. 6, for the reasons stated in Sec. 2-4. The project would still be very destructive of natural values, but probably anything that can be done to mitigate the destruction should be done. *(Stan Haye)*

Response—Preference for Alternative 6

The preferences expressed in the comments for Alternative 6 are noted. Alternative 6 was identified in Section 2.4 of the Draft EIS/EIR as the environmentally preferable alternative from among the alternatives that would involve project implementation. Alternative 6 has also been identified in this Final EIS/EIR as the lead agencies' preferred alternative.

Comments—Preference for Alternative 5 or 6

AI.3 The preferred alternatives recommend a reasonable development plant, but we believe there are opportunities to further minimize impacts. The defined alternatives 5 and 6 for the transmission route appear the best. They avoid the MT Hoffman RRA, the MLSA south of Glass Mountain and avoid Medicine Lake. This will take advantage of existing roads and will stay away from areas managed as late successional reserves. *(Rachel Shimshak and Peter West, Renewable Northwest Project)*

DF.3 For those who have summer homes at Medicine Lake I urge that the visual impact to them be mitigated by routing the power line over the alternate route behind the mountain where it cannot be seen by them. *(Robert L. Hickerson)*

DK.3 Alternates 5 and 6 show the power lines being kept on the north side of the summit, outside of the Medicine Lake basin, following a shorter route than any of the first four alternates. Either of these two alternates look much better than the first four. I cannot understand how it could be a better alternate to expend more money on a longer route, and ruin the pristine nature of the basin by allowing the power lines to run down the summit and through the basin. *(Roger G. Hyytinen, Hyytinen Engineering)*

EO.3 There is but one alternative route for each project that shows the application of logic. CalEnergy's proposed Telephone Flat Power Plant and Wellfield, which should be an independent entity preceding from the power plant to D2, B2, to the COPT transmission line.

Calpine's Fourmile Hill Project, also as an independent entity, has suggested a route A3 from the Proposed Power Plant and Wellfield, east on A5 and B1, to the COPT transmission line.

As independent entities, each project would be protected from major damage from wind, lightening or wildfire that caused serious damage to the other project. *(Natalie Macy)*

Response—Preference for Alternative 5 or 6

The preferences expressed in the comments for either Alternative 5 or 6 are noted. As discussed in the response to "Comments—Preference for Alternative 6," Alternative 6 was identified in the Draft EIS/EIR as the environmentally preferable alternative from among the alternatives that would involve project implementation. Alternative 6 has also been identified in this Final EIS/EIR as the lead agencies' preferred alternative.

Comments—Preference for Alternative 7

K.14 Lastly, it is important to consider that roadless areas and ancient forests are rare in the Modoc. We believe such wild, irreplaceable places are far too important to be subjected to geothermal development--or any other kind of destructive development. We believe that every effort should be made to preserve these wildlands for future generations. For this reason. we strongly support Alternative 7 as described in the EIS/EIR. We encourage the Forest Service and Bureau of Land Management to select Alternative 7 as the preferred alternative in the final version of the EIS/EIR.
(Ryan Henson, California Wilderness Coalition)

O.2 We urge you to follow Alternative 7, the no-action alternative, so that Medicine Lake can be preserved.
(Katherine Kowatch, Friends of the River)

O.22 Given the issues previously mentioned, we urge adoption of Alternative 7--the No-Action alternative. Alternative 7 will:

* preserve the water quality of Medicine Lake
* preserve the wild and roadless character of the Mount Hoffman Roadless Area
* protect and ensure sensitive and protected aquatic and terrestrial plant and wildlife species
* preserve the habitat of sensitive and protected plant and wildlife species
* maintain the visual quality objectives of Modoc National Forest
* preserve the religious and cultural practices of the Pit River, Modoc and Klamath tribes

(Katherine Kowatch, Friends of the River)

Q.1 The area in which the proposed Fourmile Hill Geothermal Project is located, the Medicine Lake Highlands, is a critical biological link between the Modoc Plateau and the Cascade Mountains, contains two roadless areas, rare old growth groves, Northern Spotted Owls, California Spotted Owls, Fishers, Pine Martens, Northern Goshawks, and many other wildlife species. The area also has religious and cultural significance for Native Americans. Because of the uniqueness and crucial biological role of the area, the Klamath Forest Alliance supports the No Action Alternative.
(Lori J. Cooper, Klamath Forest Alliance)

Q.9 Because of the effects of the proposed project to Native American religious and cultural uses of the Medicine Lake Highlands, the No Action Alternative should be chosen.
(Lori J. Cooper, Klamath Forest Alliance)

Q.11 Because of both the short-term and long-term impacts of the proposed project, and the fact that the area will be irreparably harmed in exchange for 45 years' worth of electricity, the No Action Alternative should be chosen. *(Lori J. Cooper, Klamath Forest Alliance)*

U.27 Please help us save Medicine Lake. The only acceptable alternative to this project is Alternative 7, the no action alternative. *(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)*

Y.62 As a government agency which has been given responsibility for our public lands and their natural and cultural resources, we urge you to adopt the no action alternative and leave Medicine Lake Highlands in its beautiful pure inspiring condition. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

AB.8 The "No Action" alternative is the only right decision regarding this development that would devastate Native American sacred lands.
(Michelle Berditschevsky, Native Coalition for Cultural Restoration of Mount Shasta)

AE.7 The "No Action" alternative is the only right decision regarding this development that would devastate Native American sacred lands. *(Arnold Wilkes, Pit River Tribe)*

BE.6 So, after reading the Fourmile Hill Draft EIS/EIR Report. I urge all the Government Agencies to adopt alternative No. 7, because there is to many un-answered question's regarding these projects.
(Paul Carter, Jr.)

BN.5 In conclusion, I recommend that the "No Action" Alternative is the only choice regarding this project.
(S. Peder Cuneo)

BO.5 While I agree that public lands should be put to multiple uses where appropriate and that we need to pursue clean sources of power wherever environmentally and economically feasible, this proposed

project in the pristine Medicine Lake area given the documented adverse impacts and lack of economic need, simply MAKES NO SENSE! In short, the No Action Alternative is the only reasonable recommendation at this time. *(Suzanna S. Cuneo)*

BP.10 In conclusion, we refer you to the Draft EIS/EIR, S-10, which describes the environmentally preferable alternative as the "No Action Alternative." As there has been no need demonstrated for the development of this project, this alternative is the only appropriate alternative to approve. This letter will be supplemented with specific written comments to the Draft EIS/EIR. We look forward to hearing from you promptly regarding the information requests made herein.*(S. Peder and Suzanna S. Cuneo, et al.)*

CN.5 The "No Action" alternative is the only right decision regarding this development that would devastate Native American sacred lands. *(Gloria Gomes)*

CV.4 Because of the short-term and long-term impacts to sensitive species such as Northern Spotted Owls, California Spotted Owls, Fishers, Pine Martens, Northern Goshawks and Bats, and the old growth forests necessary for their survival, I recommend that the no action alternative be choosen. *(Kyle Haines)*

DB.1 First, I would like to observe that this project is not on mining claims, so there is no legal mandate to approve the project, as there would be under the 1872 Mining Law. I believe that the natural, ecological, recreational, and scenic values far outweigh the possible value of the relatively small amount of electrical energy which would be produced here. The entire character of the area would be changed from its relatively pristine character to heavy industrial use. I have seen the geothermal plant near mammoth lakes, and it is not pretty. Therefore, I am strongly in favor of the No Project alternative. I believe that it is in the best interest of the land, and the landowners, us, to select this alternative. *(Stan Haye)*

DQ.5 The 'No Action' alternative is the only right decision regarding this development that would devastate Native American sacred lands. *(Jessica E. Jim)*

DT.3 In light of these acknowledged harms, I prefer the "No Action" alternative proposed in the Draft EIS/EIR. *(Carolyn D. Jones)*

FK.10 I urge the Forest Service to choose the NO ACTION ALTERNATIVE because once this pristine area is lost and damaged, it will never be able to recover, EVEN WITH TAX PAYER MONEY. *(Charles F. Moss)*

FO.1 I have just received notice regarding the proposal for the geothermal power plant proposed for the Four Mile Hill Area near Medicine Lake. I strongly support the No Action Alternative in the EIR, based on the adverse and significant adverse effects listed in the EIR regarding visual resources, air quality, noise, water quality, vegetation and wildlife resources. *(Eric T. Nelson and Martha Spencer)*

FP.1 We have recently reviewed the EIS/EIR for the geothermal power plant proposed for the Four Mile Hill Area near Medicine Lake. We strongly support the No Action Alternative, based on the adverse and significant adverse effects documented either in the EIS/EIR or this letter regarding socioeconomic, cumulative impacts, endangered and threatened species, wildlife habitat, water quality and quantity, visual resources, and air quality and noise. *(Eric T. Nelson and Martha Spencer)*

FP.26 While we agree that public lands should be put to multiple uses where appropriate and that we need to pursue clean sources of power wherever environmentally and economically feasible, this proposed project in the pristine Medicine Lake area given the documented adverse impacts and lack of economic benefit, simply MAKES NO SENSE! In short, the No Action Alternative is the only reasonable recommendation at this time. *(Eric T. Nelson and Martha Spencer)*

GC.6 In conclusion, I recommend that the "No Action" alternative is the only choice regarding this project. *(Carole Plank)*

GK.3 We therefore urge the Forest Service to recommend the "No Project Alternative" and comply with all applicable guidelines. *(Mary and Wallace Preston)*

GP.1 Having read the EIS, I believe the only correct option for the Fourmile Hill Geothermal Development Project is the No Action option. It should not be built as currently proposed. *(Fred L. Rinne)*

GY.2 In the last fifty years we as a progressive people have created many of our own environmental problems. There is an opportunity here NOT to create another one. We are hopeful that the decision makers choose not to go with this project and opt for alternative #7-NO ACTION. We like to believe that there will be unspoiled areas for our grandchildren's grandchildren. *(Micheal L. and Janet K. Server)*

HF.24 Given the evidence I have been able to examine so far, I believe that Alternative 7, the "no development" option, is the only wise and prudent course. *(Daniel T. Spencer)*

HI.2 I support the NO ACTION alternative in the EIR/EIS based on the adverse environmental effects regarding visual resources, air quality, water quality, noise, vegetation. recreation and wildlife resources as listed in the Environmental Analysis. *(Martha Spencer)*

HI.9 In short, the No Action Alternative is the only reasonable recommendation at this time. *(Martha Spencer)*

HR.3 We have so few pristine treasures left in California that each one must be protected for future generations. Please adopt only the "No Project" alternative and protect not only our forest ecosystems

but the fragile wildlife of the area. Stop this project—the damage done will far outweigh any economic benefits which will result. *(Annabel J. Teberg)*

HT.21 In conclusion, Option 7, the No Action alternative is what I favor. Do not allow big money developers to ruin this beautiful area. *(Louise Thompson)*

HV.3 I advocate Option 7 - The No Action Alternative. *(Louise Thompson)*

IA.3 I urge you to adopt the "No Action" Alternative 7. *(Susan Turney)*

IB.1 Please excuse the handwritten comments on the Calpine Fourmile Hill Draft EIS/EIR. I only recently learned of this project and received the Draft EIS /EIR, and now must write these comments hurriedly while traveling.

This project must never be implemented as proposed. The only acceptable decision will be to choose the no-action alternative. *(Wayne Verrill)*

IB.2 I'm not sure at this point that you have correctly identified all significant impacts associated with the proposed alternative, but the many you have identified would far outweigh any conceivable benefits of this project (which appear to me to be limited to filling the bank accounts of Calpine executives). *(Wayne Verrill)*

IQ.4 Because the effects of the proposed project cannot be adequately mitigated, the Forest Service must choose the "No Action Alternative" to preserve the unique environment of the Medicine Lake Highlands. *(Phil Woodward)*

IQ.20 I urge the Forest Service to choose the No Action Alternative based upon the dubious economic viability of the proposed project, lack of necessary information to evaluate the effects on the hydrology of the area, and the incompatibility of such an industry with the natural peace and solitude, clean air and pristine forest, and unique geologic features of the Medicine Lake Highlands. This unspoiled area of California should be preserved for all to enjoy without the intrusion of a loud and visible industry where it doesn't belong. *(Phil Woodward)*

PH5.22 In conclusion, Option 7, no action alternative, is what I favor. Do not allow big money developments to ruin this beautiful area. Thank you. All these facts are in that book, every one of them. *(Medicine Lake Public Hearing)*

PH5.94 I'd like to go on the record as supporting Alternative 7 at this point, given I haven't had a chance to go all the way through it. *(Medicine Lake Public Hearing)*

PH5.103 I don't know whether or not they'll get a chance to review the comments or what, but I really—I am in favor of the no-action alternative. *(Medicine Lake Public Hearing)*

Response—Preference for Alternative 7

The preferences expressed for Alternative 7 have been noted. Alternative 7, the "No Action" alternative, remains a viable option for the lead agencies to select if it is concluded that the proposed project's potential impacts are too great.

PROJECT OPPOSITION

Comments—Opposition to Project

H.37 If the Telephone Flat project must be added in to make Fourmile Hill more viable, we are opposed to both projects. I expect there will be considerable opposition to the Telephone Flat project from virtually everyone who enjoys Medicine Lake for what it is today, a beautiful pristine remote location without constant noise, light pollution, visual blight, and industrial conflicts with established recreation activities. *(Bill Dart, American Motorcyclist Association)*

J.1 The California Native Plant Society is opposed to this proposal for a number of reasons. We do not believe that the benefits to our society as a whole and to the subset of the local community is sufficient to merit the issuance of a permit which would irrevocably degrade an exquisite and unique element of our California heritage. *(Vivian Parker, California Native Plant Society)*

L.1 Desert Survivors opposes the large geothermal development slated for the Medicine Lake Highlands by the power companies, "CalEnergy" and "CalPine". *(Steve Tabor, Desert Survivors)*

P.1 The Kalapooya Sacred Circle Alliance is vehemently opposed to any further drilling or development activity at Glass Mountain due to the tremendous environmental impacts that such activity will have on the environmentally significant area. *(Carol Logan, Kalapooya Sacred Circle Alliance)*

Q.8 Native American sacred sites are under assault by logging, mining, and other types of development (such as the proposed project) all across the United States. This is tragic and must be stopped. A geothermal development would not be allowed to be built next to a church or temple, and it should not be allowed in an area as sacred as the Medicine Lake Highlands. *(Lori J. Cooper, Klamath Forest Alliance)*

R.1 The Klamath Tribes have reviewed the Environmental Impact Study Four Mile Hill Geothermal project and have decided that this project cannot be supported by the Klamath Tribes. There are far to many issues we feel cannot be mitigated. *(Dino Herrera, The Klamath Tribes)*

W.1 Our group is writing to express our deep concern and our opposition to the proposed geothermal development in the Medicine Lake Highlands.*(Carole Plank, Medicine Lake Citizens for Quality Environment)*

X.1 While the Mount Shasta Area Audubon Society (MSAAS) recognizes the importance of electrical power generation, that in many cases geothermal power plants are a more environmentally "clean" method of producing electricity than, say burning coal or gas, and that many hundreds of man-hours have gone into the development of the said project's Draft EIS/EIR of July 1997, we oppose the said project as presented in the same because of several issues we see as unacceptable, potentially causing unrecoverable losses to the Medicine Lake Highlands and to the surrounding area that encompasses the proposed project site: *(Michael Hauptman, Mount Shasta Area Audubon Society Board of Directors)*

AB.1 The Native Coalition for Cultural Restoration of Mount Shasta is submitting these comments in strong opposition to geothermal development in the Medicine Lake Highlands and in support of the Native American Tribes whose sacred lands are being threatened by geothermal developments. *(Michelle Berditschevsky, Native Coalition for Cultural Restoration of Mount Shasta)*

AC.1 I adamantly oppose any construction of a geothermal power plant in the Medicine Lake highlands region. *(Tim McKay, North Coast Environmental Center)*

AD.1 The following comments are written on behalf of the Pit River Tribe regarding the Fourmile Hill Geothermal Project in the Medicine Lake Highlands. The Pit River Tribe has already expressed many concerns about and opposition to this project, and this previous input is incorporated into these comments by reference. *(Floyd J. Buckskin, Pit River Tribe)*

AE.1 I am writing in strong opposition to geothermal development in the Medicine Lake Highlands and in support of the Native American Tribes whose sacred lands are being threatened by geothermal developments. I support the Pit River, Modoc, Klamath and Shasta Tribes in their opposition to these developments which would have devastating impacts on the sacred character of the whole Medicine Lake Highlands; on many individual sites and cultural resources; on the water quality of Medicine Lake and the many springs, creeks, and rivers that have their sources in the Highlands; on the animals, their habitats and migration routes; on the trees and plants; on the visual and air quality; and on the peace and natural beauty of the area. *(Arnold Wilkes, Pit River Tribe)*

AH.1 On behalf of the Santa Cruz Rainforest Action Group, I would like to express our extreme opposition to the CalEnergy and Calpine geothermal projects proposed for the Medicine Lake Highlands. This is yet another corporate "boondoggle' at the expense of the American taxpayers and our precious PUBLIC LANDS. Our public lands must not be for sale to the highest bidder. *(Ray Newkirk, Santa Cruz Rainforest Action Group)*

AL.1 I am strongly opposed to the Medicine Lake Geothermal Project. *(Barbara Allen)*

AN.1 I am against any of your Geothermal projects in or near the Medicine Lake Highlands. *(John Aquila)*

AO.1 After attending four (4) of your scoping meetings, I am more than ever against any geothermal development in the Medicine Lake Highlands. There are just too many "I don't knows" and "It's in the book" *(Mildred J. Aquila)*

AU.1 [I oppose] Because it will devastate the wilderness. *(Jack Bernotte)*

AW.2 Not in favor of #1 Plan. *(Marian and Jack Blakeney)*

BD.1 I am writing to oppose any geothermal projects at Medicine Lake Highlands. *(Alan Carlton)*

BG.2 My vote is "no way"! *(Colleen Cena)*

BK.1 I am writing to express my strong opposition to the CalEnergy and CalPine geothermal power project in the Medicine Lake Highlands. *(John Copoulos)*

BN.1 The purpose of this letter is to express my extreme opposition to the proposed geothermal development project in the Medicine Lake basin. *(S. Peder Cuneo)*

BO.1 The purpose of this letter is to express my extreme opposition to the geothermal development project proposed near the Medicine Lake recreational area. *(Suzanna S. Cuneo)*

BR.1 This letter is in response to the Draft EIS/EIR. I want to express my strong opposition to:

(1) Locating industrial facilities, including power lines, close to Medicine Lake; *(Bill DeJager)*

BU.1 I oppose the permit request by the CalEnergy and CalPine power companies to construct a geothermal plant in the Medicine Lake Highlands. *(Bob DeNike)*

BX.2 I greatly appreciate your time. I've visited the Medicine Lake Highlands for 40 years, staring with camping trips with my father. I was awestruck, even at an early age, at the vast grandeur and majestic ancient beauty of eastern Siskiyou County. We visited the highlands and Lava Beds National Monument, and the stark volcanic landscape was always exciting and dramatic. I also enjoyed the

fauna and flora, and since completing my schooling, I understand the complexities of pristine ecosystems. I have an Associate in Natural Resources Management, a Bachelor's in Biology and a Master's in Environmental Biology; and I'm very much against any geothermal development by CalEnergy and Calpine. *(Dean H. duVernet)*

CG.2 I have camped at Medicine Lake the past two summers; it is a beautiful place to camp, sit and watch the eagles. I oppose the Fourmile Hill Geothermal Project. *(Jim Evans)*

CH.1 I would like to submit my objection to the Geothermal Project proposed for the Medicine Lake Highlands. I am very much against using this area for any type of power plants. *(Elizabeth V. Farioletti)*

CH.5 These power plants would destroy all that is good and beautiful about this area. Again I submit my strong and personal objection to such an idea. In fact I really wonder why the Forest Service would sell out to private industry the way it seems it has. I find this disgusting and destructive to the American way of life. I wish you would reconsider not only this project but your part in this action. *(Elizabeth V. Farioletti)*

CK.1 I am strongly opposed to the Geothermal project as presented and proposed by Calpine. *(Betty Foist)*

CK.3 My objections to this project. *(Betty Foist)*

CN.1 I am writing in strong opposition to geothermal development in the Medicine Lake Highlands and in support of the Native American Tribes whose sacred lands are being threatened by geothermal developments. I support the Pit River, Modoc, Klamath and Shasta Tribes in their opposition to these developments which would have devastating impacts on the sacred character of the whole. Medicine Lake Highlands; on many individual sites and cultural resources; on the water quality of Medicine Lake and the many springs, creeks and rivers that have their sources in the Highlands; on the animals, their habitats and migration routes; on the trees and plants; on the visual and air quality; and on the peace and natural beauty of the area. *(Gloria Gomes)*

CQ.1 I absolutely do not want Medicine Lake area to be developed for geothermal energy!!! Is there nothing to be left sacred and natural? *(Martha Grainger)*

CS.1 This letter is in opposition to the Fourmile Hill and Telephone Flat Geothermal Projects. *(G.S. Green)*

CW.1 I am opposed to the geothermal projects that have been proposed for the Medicine Lake area in Northern California. *(Barbara Hannelore)*

CX.1 I'm writing to protest the Medicine Lake proposed Calpine Geothermal power plant. *(Shelly Harmon)*

DC.1 I strongly oppose the proposal by the CalEnergy and Calpine agencies who are going to build power plants in the Medicine Lake Highlands. *(Anita E. Henning)*

DH.1 I am writing to express my opposition to the Fourmile Hill/Telephone Flat geothermal energy project. *(Katherine Holmes)*

DI.1 We are writing to express our opposition to the proposed geothermal plants in the Medicine Lake area *(Ana Holub and Richard Lucas)*

DM.1 The purpose of this letter is to strongly oppose the proposed Fourmile Hill Geothermal; Project located at the Medicine Lake Highlands. *(Jerald Jackson)*

DQ.1 I am writing in strong opposition to geothermal development in the Medicine Lake Highlands and in support of the Native American Tribes whose sacred lands are being threatened by geothermal developments. I support the Pit River, Modoc, Klamath and Shasta Tribes in their opposition to these developments which would have devastating impacts on the sacred character of the whole Medicine Lake Highlands; on many individual sites and cultural resources; on the water quality of Medicine Lake and the many springs, creeks and rivers that have their sources in the Highlands; on the animals, their habitats and migration routes; on the trees and plants; on the visual and air quality; and on the peace and natural beauty of the area. *(Jessica E. Jim)*

DS.1 I write to oppose the proposed CalEnergy and Calpine geothermal projects in the Medicine Lake Highlands. *(Verna Johnston)*

DT.1 This letter is to inform you of my opposition to the proposed development of a geothermal power plant on the Four Mile Hill site near Medicine Lake in Siskyou County, California. Having read the draft Environmental Impact Statement for this project, and having spent 30 summers vacationing at Medicine Lake, I have many concerns about this effort to develop these unique and sensitive National Forest lands. *(Carolyn D. Jones)*

DV.1 I am writing to let you and your staff know that I do not want a geothermal plant in the highlands of Medicine Lake. *(Marilee Jordan)*

DW.1 I have just learned of plans to develop a geothermal energy project in the Medicine Lake Highlands, and I am writing to voice my opposition to this project. *(Mike Keesee)*

DX.1 Please know that my family and I, who have long acquaintance with the area that will be affected by the above project, are unalterably opposed to its going forth. *(Nancy B. Kenyon)*

DY.1 I am writing to express my total opposition to all geothermal development in the Medicine Lake Area. *(Daniel Kiely)*

EB.1 As a frequent visitor to the Mt. Shasta region, I am opposed to the Fourmile Hill Geothermal Project. *(Harry Kraft)*

EC.1 I would like to comment once again on the proposed Medicine Lake Geothermal Project, I would like to state my opposition to this Project and state in detail the rational for my opinion (which I firmly believe is well founded). I would also like to state the several areas of study that I feel may be overlooked in the EIS but..... why? *(Thomas F. Krauel)*

EE.1 I have recently learned of the plan for geothermal development in the Medicine Lake region. I oppose this type of land use in this area. This project would result in unnecessary damage to public trust lands while providing limited economic benefits to the government. *(Mark Langner)*

EJ.1 I want to express my strong opposition to the geothermal projects being considered in the Medicine Lake Highlands. A more unsuitable place couldn't be imagined. *(Laraine Lewis)*

EL.1 Please register my strongest opposition to planned geothermal development in Medicine Lake Highlands. Please consider your alternatives. *(Mitch Lorens)*

EM.1 We wish to go on record as being opposed to the proposed Fourmile Hill Geothermal Project. We are opposed to all geothermal exploration and exploitation in the Medicine Lake Caldera. *(Pete and Laurel Lorenzen)*

EN.1 I strongly oppose both the CalEnergy and Calpine geothermal projects. *(Laura Louttit)*

ER.1 I oppose the CalEnergy and CalPine geothermal projects proposed for the Medicine Lake Highlands. *(Stephanie Grace Mandel)*

ES.1 This project's effect is enormous to our wonderful Medicine Lake area. It infringes on all that the sacred area stands for. It most certainly will put the entire area out of balance. It has far-reaching effects of destructive possibilities.

It most certainly isn't a project in that area for the highest good of all concerned. There is a reason why it is called Medicine Lake—healing area for all who come—human and animal alike. It is life supporting. *(Lea Marie)*

ES.2 I am opposed to the Geothermal Project in that area. *(Lea Marie)*

EV.1 I am against the proposed development of the Fourmile Hill Geothermal Project because I don't feel it would significantly lower any one's power bills or create a larger power supply that is more efficient. *(Shari Mazzini)*

EX.1 I oppose this because I don't want to breath in anymore pollution than I am already. I want to live a long life and see nice lakes so I oppose. *(Maria McClowd)*

EZ.4 Of course we are opposed. *(Joan McDermos)*

FA.1 I oppose the CalEnergy and Calpine geothermal projects. *(Bob McLaughlin)*

FB.4 I am strongly opposed to the entire proposed project. (Alternative?) *(Robert Medley)*

FC.1 To all Parties who advocate the Fourmile Hill Geothermal Development.

As a resident of South Siskiyou County for the past 17 years, I would like to state my disapproval of the proposed Fourmile Hill Geothermal Project. *(John W. Mikec)*

FG.1 I am totally opposed to ANY Geothermal Projects on the Klamath and Modoc National Forest Lands! The entire project is a rip-off!!! *(David Porter Misso)*

FH.1 I am writing to state my opposition to the Fourmile Hill and Telephone Flat geothermal projects. These are to be situated in a pristine and rare area. We must preserve this beautiful area for future generations, and for benefit of the ecosystem, rather than disrupt it for the profit of a few corporations. *(Joy Mockbee)*

FI.1 I was reading through our local paper here in Mt. Shasta. I came across an article in the opinion section.

I want to vote no on the development of the Medicine Lake area. *(Vicky Moro)*

FJ.1 I am writing to you to oppose the CalEnergy and Calpine geothermal projects slated to be constructed in the Medicine Lake Highlands. *(Carolyn J. Mosher)*

FN.1 We are totally against the development in Medicine Lake Highlands with regard to geothermal development. *(Barbara Myers)*

FO.6 Unfortunately, I will not be able to attend the public hearings scheduled for August 5-7, but wish to go on record as adamantly opposing any geothermal development in the Medicine Lake Basin on behalf of myself and my family. *(Eric T. Nelson and Martha Spencer)*

FR.1 I am writing this letter in opposition to proposed Geothermal plants in Medicine Lake. *(Julie Norman)*

FX.1 I strongly oppose geothermal development in the Medicine Lake area. Our need for electricity does not balance the permanent destruction of pristine wilderness land that is irreplaceable. *(Jacquie Parker)*

FX.3 Please add my name to those who oppose this project. *(Jacquie Parker)*

FY.1 We are very opposed to the proposed Fourmile Geothermal project. Because of LSR status we object to wildlife habitat destruction. This area has long been a native american heritage area. No to this project. *(S. Perlman)*

FZ.1 Being concerned about this proposal to construct a geothermal power plant in these Medicine Lake Highlands area, I am very much opposed to this project. *(Katherine Petterson)*

GC.1 The purpose of this letter is to express my extreme opposition to the proposed Geothermal development project in the Medicine Lake highlands. *(Carole Plank)*

GE.1 I am opposed to the "proposed" Geothermal project in the Medicine Lake area. *(Sami Jo Pohlman)*

GI.1 I oppose of it because it will destroy the beautiful land up there, and wildlife. *(Myrna L. Potter)*

GJ.1 I am very much against the proposed geothermal development in the Medicine Lake Highlands. *(Melody Pratt)*

GK.1 The Atwamsini Band members are opposed to the proposed Fourmile Hill Geothermal Development Project, as the proposed development would adversely impact significant Tribal/Cultural Resources important to the Atwamsini Band members and the Pitt River Tribe. *(Mary and Wallace Preston)*

GL.1 We are writing to express our opposition to requests by CalEnergy and CalPine to construct a geothermal power plant in the Medicine Lake Highlands. *(Deirdre and Randy Rand)*

GM.2 We are against these geothermal projects for all the usual bald-arsed reasons that I'll spare you the listing of. *(Ken Reed)*

GN.1 After reading the articles in the newspapers about the proposed geothermal development around Medicine Lake, I am very much against it. Im sure the people living around it are against it also. *(Verna Reed)*

GO.1 In response to the environmental impact statement on the proposed Fourmile Hill and Telephone Flat geothermal projects, I oppose and urge abandonment of these projects because of their cumulative adverse impacts on old-growth forests and sacred Indian sites. *(June Ringer)*

GR.1 I adamantly oppose any construction of a geothermal power plant in the Medicine Lake highlands region. *(Marylee Patricia Rohde)*

GS.1 I oppose the geothermal plants proposed by CalEnergy and Calpine. *(Anna Rongen)*

GU.1 I am writing to express my strong opposition to both the CalEnergy and CalPine geothermal projects. *(Robin L. Schaeffer)*

GW.3 So I would like to register my strong objections to the development of the geothermal projects in the Medicine Lake area. *(Fai Schwarzenberg)*

GZ.1 We are opposed to the Fourmile Hill geothermal project for the following reasons:

1) The Medicine Lake area is a remote recreational area. The people that go there want the quiet and peacefulness that is unique.

2) The geothermal project will be intrusive with noise and surface pollution.

3) Because of these negative aspects, those of us that have property there will lose in property values. *(Harry and Bettie Shott)*

HE.3 1. There is no demonstrated local energy need for this project; hence the ecological and economic costs far outweigh the short-term proposed benefits. I am adamantly opposed to developing and damaging the natural ecological balance of one area -- in this case, Medicine Lake -- to satisfy corporate energy interests and greeds far from this area. *(Daniel T. Spencer)*

HE.7 I am particularly opposed to any development inside the Medicine Lake Caldera. *(Daniel T. Spencer)*

HE.8 I am astonished that Proposed Route 1 for the transmission line is routed within the caldera and between the Medicine Lake Docite Flow and the Campgrounds on the northside of Medicine Lake. How can such an obtrusive and ludicrous idea have even reach the planning stage??? If this is an example of the proposed project's sensitivity to environmental and recreational interests at Medicine Lake, it is cause for even greater concern. NO ECONOMIC DEVELOPMENT INSIDE THE MEDICINE LAKE CALDERA!! *(Daniel T. Spencer)*

HF.4 After reading through the Executive Summary and the other project descriptions made available through mailings of the Medicine Lake Homeowners association, I oppose this project strongly on both philosophical and pragmatic grounds. *(Daniel T. Spencer)*

HI.1 The purpose of this letter is to express my extreme opposition to the geothermal development project proposed near the Medicine Lake recreation area. *(Martha Spencer)*

HJ.1 I oppose and urge the Forest Service and BLM to rescind the proposed Fourmile Hill and Telephone Flat Geothermal Projects. *(Richard Spotts)*

HK.1 Upon review of the Environmental Impact Statement for Fourmile Hill Geothermal Development Project we have decided that we oppose construction of this and subsequent facilities based on the fact that the economic and environmental costs far outweigh the benefits of proceeding with construction. *(Marshall Staunton)*

HL.1 This letter is to protest the Fourmile Hill Geothermal development. I believe that it is at best unnecessary and evidently an abuse of public resources. *(Barbara Stauss)*

HP.1 Please accept my following comments concerning the Powerlines and Geothermal Powerplants, Medicine Lake Highlands.

I oppose powerline and geothermal powerplants in the Medicine Lake area. As such development will destroy soil, water, air, wildlife, fish, plant, recreation, scenic-visual, and roadless-wilderness resources. *(John R. Swanson)*

HQ.1 We have no use for the proposed geothermal development in the Medicine Lake Highlands. This is a very important recreation and natural area and is enjoyed by many people and should remain so. *(Donald Teague)*

HS.1 I am writing to express my strong opposition to the proposed geothermal projects envisioned by CalEnergy and CalPine for the Medicine Lake Highlands area of the Modoc National Forest. *(Larry Thompson)*

HW.1 I'm opposed to both the CalEnergy and Calpine geothermal projects. *(Joyce T. Todd)*

HX.1 My husband and I are opposed to the Four Mile Hill and the Telephone Flat projects. *(Elizabeth R. Tozier)*

HY.1 Pursuant to receiving the DEIS/EIR dated July 1997, after a brief and preliminary review on selected segments of this "convoluted" document, not only that I request for an extension of the review period to the end of this year, but I personally decided to go against the project because I found the following, and not limited to, discrepancies and deficiencies in addressing the various impacts resulted from the Fourmile Hill Geothermal Project: *(Alice Tseng)*

HY.10 In summary, after a brief and preliminary review on chapters 1 & 3 of this "convoluted" document, not only that I request for an extension of the review period to the end of this year, so I can pour over in greater details the technical portions of this project, but I personally am against the project because the discrepancies and deficiencies found, just in chapters 1 & 3, in addressing the various impacts resulted from the Fourmile Hill Geothermal Project. *(Alice Tseng)*

HZ.1 We strongly oppose the Fourmile Hill Geothermal Project. *(Richard Turner)*

IC.1 I really oppose of this geothermal plant because I seen the impact already with the sumps, and wells, up there. Now I can imagine what more from hearing from one of your sources that this geothermal is going to be real huge. *(Sharon Villarruel)*

IJ.1 I am ADAMANTLY opposed to this "project." *(Mary Jo Wheeler)*

IP.1 I oppose the geothermal project. *(Joyce Wilson)*

IR.1 I am writing to express opposition to the proposed geothermal project at Medicine Lake. I am a resident of Siskiyou County where I have been in Education Administration for many years. *(Carol Wright)*

PH4.4 Project should not happen. *(Mount Shasta Public Hearing)*

PH5.118 I think it would be helpful for the public record if we could get an idea of the number of people here that oppose this project, so that we could get that number so—compared to other public meetings. I don't know. Seventy-five people here, whatever. Seventy-five? And of that seventy-five, I don't know how many people, but I would like a show of hands. I think most of us are opposed to the project, and would go on record proposing the last alternative, which is no project. *(Medicine Lake Public Hearing)*

Response—Opposition to Project

The opposition to the proposed project has been noted. Particular citizen grievances concerning the potential environmental impacts of the proposed project have been addressed in depth throughout the response to comments on the EIS/EIR. The decision-making agencies will have this information to consider in their final determination of whether to approve the proposed project.

Comments—Deny Action and Do Not Implement Project

J.15 To conclude, the Shasta Chapter of the California Native Plant Society asks that you address all of these issues adequately, and we hope that you will decide in favor of the people and the plants, as well as the wildlife and other unique biological and geological elements of this special area, and make a decision to abandon this project. *(Vivian Parker, California Native Plant Society)*

R.6 The Klamath Tribes stand strong on the protection of its Sacred and Cultural sites and request that the Modoc National Forest assist the Tribes in the protection of this cultural area. The Klamath Tribes are well aware of the responsibility that the forest service has in managing and protecting cultural resources, we ask the Modoc National Forest to go one step further and start to manage for the living culture of the Klamath Tribes.

The assistance we are requesting is to not allow the development of the Geothermal project in the Medicine Lake area. *(Dino Herrera, The Klamath Tribes)*

V.39 Most importantly, until this EIR is corrected to reflect those valid public and other agency comments which are received, and the EIR is made to fully comply with NEPA and CEQA requirements, it is essential that your agencies not approve this Fourmile Hill Geothermal Plant project. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

AH.3 The time for unlimited exploitation of our public lands must come to a screeching halt. Our planet can not withstand the continual destruction of our ancient forests and sensitive ecosystems for mere short term economic gain. We must stop all mineral extraction, logging, and other destructive practices on our National Forests immediately: 100 years of devastation by industry with the aid of the Forest Service and other PUBLIC agencies is enough!

Please do the right thing, and protect these natural heritage resources for future generations—deny these projects in their entirety and work diligently toward permanent protection of this area through a National Monument designation. Thank you for your consideration. *(Ray Newkirk, Santa Cruz Rainforest Action Group)*

AM.1 I am writing to urge you not to proceed with the CalEnergy and Calpine geothermal projects in the Medicine Lake Highlands. This magnificent country needs protection from any commercial development both for its biodiversity, old growth forest, and endangered species habitat, as well as its importance to several Native American tribes. Please do what you can to stop these proposed projects. *(Clifford E. Anderson)*

AP.1 Please DO NOT allow the Fourmile High Geothermal Project to be build with or without mitigations. The Medicine Lake area is a very valuable piece of real estate just as it sits, in its national state. It's appreciated and enjoyed by thousands of nature enthusiasts, hunters, and those seeking quiet, pristine, natural places for spiritual retreat and meditation. *(Ashalyn)*

AP.4 I'm all for creating alternative sources of power, but NOT at the expense of the environment. Please stop this project now. *(Ashalyn)*

AV.1 I am writing to ask that you deny the request from CalEnergy and CalPine to build the geothermal Project referenced above. *(Dave and Laurie Bish)*

AV.6 Please stop this unneeded project now. *(Dave and Laurie Bish)*

AY.1 Please withdraw your requests to do the CalEnergy and Calpine projects in the Medicine Lake Highlands of Modoc National Forest. *(Theresa Brady)*

BB.1 Please deny permission for CalEnergy and CalPine (and anyone else for that matter) to build a geothermal power plant in the Medicine Lake Highlands. This project would ruin the area's ecosystems - and this is an area that deserves protection! *(Tom Camara)*

BH.14 I will make my suggestion clearly heard DO NOT APPROVE THIS PROJECT. Cancel this project for the next 45 years! Lets see if a need exist in 45 years, then per your report it will only take 3 years to implement to resource. *(Richard S. Cimino)*

BK.4 Please stop all development. *(John Copoulos)*

BM.2 Geothermal energy is not long-term; and the damage done to the rare and beautiful plants, animals and the natural habitat they need would be illogical. Please disallow any marring of the biotic and geological landscape. *(Rhodelio Cruz)*

BS.1 My wife and I certainly hope you do not allow geothermal plants near the Medicine Lake area. We do not want you to even mention it's name. It is the quietest, prettiest place in California.

Please leave this pristine gem the way nature intended. It, (and the area around it) should be left alone. It would even be dirty shame to allow better roads into the whole area. *(Paul and Charlotte Dember)*

BV.4 PLEASE DO NOT DO THIS to the Medicine Lake area. Tell everyone the truth about your organization. So far everyone has been lied to! *(Carlos DeRossett)*

BW.1 We are writing to express our concerns with geothermal projects within the Medicine Lakes Highlands area. This is a beautiful part of California containing significant remnants of old growth forest, outstanding habitat for wildlife and excellent recreational opportunities.

We believe that the proposed power plants, new roads, geothermal wells, and power lines that this project involves are not appropriate in this area. Please do not let this geothermal project go forward. *(Joel D. Despain, et al.)*

BX.3 Please do not allow geothermal power plants, well sites, electrical; towers or any new roads in the highlands, which are a very special wilderness (and there is not much left compared to what there was), and I believe it should be a protected biosphere. *(Dean H. duVernet)*

BY.3 Please do not allow development. Here in California we receive $80 billion per annum based on visitation to our national and state parks and forests. Our forests have been abused enough -0- 95% of ancient forests on public land have been cut. Was that fair or logical? Please do not mar the Highlands. *(Dean H. duVernet)*

CB.3 I would not put in power plants in such a beautiful area. As it is now, PG&E and other companies that sunk wells are now shutting down many of them because of a lack of generating power. They overdid a good thing. Please reconsider your options for the Fourmile Hill Geothermal Project. *(Richard Dye)*

CE.1 I am writing to you to urge you to refuse permission by the Forest Service to the geothermal power companies CalEnergy and CalPine to construct a geothermal power plant in the Medicine Lake Highlands. *(Paul Emery)*

CE.4 Please oppose this destruction of another of our natural treasures. *(Paul Emery)*

CJ.1 Please abandon plans to construct a geothermal power plant in the Medicine Lake Highlands. Do you really want your short term business deal or do you want to do our home, this beautiful planet, a great favor and leave my favorite wild spot wild? *(Krista Bennion Feeney)*

CR.1 Please deny the CalEnergy and Calpine geothermal projects proposed for the Medicine Lake Highlands. These projects will destroy the beauty and integrity of this wonderful ecosystem. This area deserves permanent protection as a National Heritage site, not devastation for profit for energy that leaves the state! *(Steve and Paddy Graves)*

CR.3 I urge you to deny these projects, not only is it within your power to do so, it is in the interest of justice, and protection of these critical resources that you MUST DO SO! I hope that you will have the courage to reverse the horrendous trend that your agency has established over many years (timber salvage rider, timber theft, etc. etc. etc. etc.....) and make the right decision. NO GEOTHERMAL PROJECTS!!! Thank you. *(Steve and Paddy Graves)*

DD.1 Please do not drill at Medicine Lake Highlands! *(Pam Henson)*

DP.4 Please use your authority to save the Medicine Lake Highlands from unneeded development. *(DelMar Janson)*

DU.6 As a long time user of Medicine Lake and member of a cabin owning family, I urge you to not let these power plants be built in the Medicine Lake Highlands. *(Charles B. Jones)*

DW.6 And the USFS should look beyond the short-term (and I suspect faulty) economics of this project and kill it before it starts. *(Mike Keesee)*

DY.6 I have lived around Mt. Shasta for much of the last fifteen years, and will be returning to the area to settle permanently and build a home. The future of this area is important for me personally. I hope to see it remain as undeveloped as possible; while acknowledging the need for jobs and income, I cannot support projects that take resource benefits away from local communities. Thank you. *(Daniel Kiely)*

EG.1 Please deny the geothermal projects proposed for the Medicine Lake area. These proposals are an outrage and are certainly not in the best interest of the taxpayers or the environment.

Please act to persevere and protect our public lands - not conspire to destroy them. Please deny these projects. Also I support an end to logging on our public lands - "not one more ancient tree must fall on our National Forests!" *(David Leavitt)*

EN.3 Please do what you can to oppose these projects. Protect California's last stands of wilderness. Thank you for your attention to this matter. *(Laura Louttit)*

FH.2 The BLM and the Forest Service are entrusted to manage and care for public lands, not to enhance their own budgets by making decisions that are detrimental to the public. I urge you to help stop the destructive Fourmile Hill and Telephone Flat geothermal projects. *(Joy Mockbee)*

FM.1 Please do not allow a Geothermal plant to be built at Medicine Lake, Siskiyou County, California. Medicine Lake is a precious resource. It is more beautiful than Lake Tahoe, CA. *(Ana Mulvaney)*

FM.6 Please help stop this now. *(Ana Mulvaney)*

FQ.2 Please oppose CalEnergy and Calpine and preserve the Medicine Lake Highlands in the Modoc National Forest and the sacredness of Native tribal homelands. *(Joy Louise Newcom)*

FS.1 I would like to comment on the CalEnergy and CalPine proposals to build a geothermal power plant in the Medicine Lake Highlands. This plant, which will involve the installation of quite a few well sites, 20 miles of electrical towers and many new roads, may be acceptable in a grasslands or desert area. But the Medicine Lake Highlands has remarkable old-growth forests, endangered species (including the spotted owl), two roadless areas and other outstanding natural and cultural attributes.

For all these reasons, I urge you to oppose both of these projects. Thank you. *(Frank Norris)*

FU.5 Please, please: whatever you do, cancel these big plans for creating thermal power that will destroy the natural environment of this very special place. *(Olga E. Orr)*

FZ.5 Please oppose the CalEnergy and Calpine geothermal project. Instead encourage national monument status to protect its wild character. It's a wonderful place. *(Katherine Petterson)*

GD.1 I am writing to urge you to oppose the CalEnergy and Calpine Geothermal Projects. *(Dolores Plumb)*

GT.1 Please oppose both the Fourmile Hill and Telephone Flat geothermal project. *(John Savavele)*

HU.4 This area belongs to the people, not to the big money interests. Let's stop the development before it's lost to us forever. Please use your influence to stop this development. *(Louise Thompson)*

HW.3 Please do not permit the terrible damage those projects would inflict: visual blight, habitat loss, infringement on religious practices of Native Americans. Thanks for making the right decision. *(Joyce T. Todd)*

HX.3 I know that the USFS and the BLM will do what you can to help prevent this unnecessary development of one of the most magnificent & natural places on earth. *(Elizabeth R. Tozier)*

IK.1 The Fourmile Hill and Telephone Flat geothermal projects should not be pursued. The cost effectiveness is questionable, and the environmental and ecological costs are exorbitant. *(Howard J. Whitaker)*

IR.3 Please STOP this project. *(Carol Wright)*

IS.3 No more extraction! Let's help heal the sacred Earth. *(Carter Wynn)*

IU.2 I've been recreating there since 1968. It is an irreplaceable place. Please rethink - and preferably cancel this project. *(Michael Zanger)*

Response—Deny Action and Do Not Implement Project

The requests to deny action and to not implement the project are noted. The Draft EIS/EIR addresses many of the concerns raised in these comments. Section 4.5, Cultural Resources and Section 4.6, Traditional Cultural Values, analyze the potential impacts of the project on cultural and tribal resources, and propose several mitigation measures to minimize potential effects. Sections 4.7, Vegetation and 4.8, Wildlife, address the potential environmental impacts that the proposed project might have on the native ecology. Again, these sections contain several mitigation measures that are designed to reduce potential effects.

Comments—Protect Medicine Lake Highlands

W.6 We feel that if Medicine Lake Highlands could speak, she would beg you to protect her environment and wildlife. We ask your help in protecting the beauty of this pristine and unique area. *(Carole Plank, Medicine Lake Citizens for Quality Environment)*

AC.5 I urge you to....

PROTECT MEDICINE LAKE!

DO NOT DESTROY IT! *(Tim McKay, North Coast Environmental Center)*

AD.64 In conclusion, these comments only partly reflect issues regarding the Fourmile Hill project and the other geothermal projects proposed for the Medicine Lake Highlands. It is our deep prayer that you will hear the concerns of the Native People in the role given to us by the Creator to be the caretakers of this land. *(Floyd J. Buckskin, Pit River Tribe)*

AW.5 I Marian Brownele Blakeney have spent many, many years since early 1920's, loving and enjoying this unique and beautiful country. PLEASE don't destroy it! *(Marian and Jack Blakeney)*

BF.1 I am writing regarding the proposed geothermal plant at Medicine Lake. I do favor development of geothermal electricity -- though not at the cost of the sacred Medicine Lake site.

Please visit for yourself. Experience its pristine beauty and magical serenity. I believe you will come to believe that such a rare site must be preserved at all costs. *(JoAnne Cedar)*

BJ.1 1. The Medicine Lake Highlands are one of the few truly wilderness areas left in California. Every effort should be made to preserve the area. The proposed development will forever destroy this pristine environment. *(Martin Copenhaferr)*

BU.2 This pristine area contains archaeological sites, spotted owl nesting habitat, two roadless areas and old-growth forests. These resources deserve maximum protection. *(Bob DeNike)*

BU.4 I am weary of watching our last remaining islands of wilderness in North America whittled away by profit-hungry corporations. Please protect the Medicine Lake Highlands from development.*(Bob DeNike)*

BX.7 Please protect our natural heritage! *(Dean H. duVernet)*

BY.2 I greatly appreciate your time and effort to help me. I've heard the Medicine Lake Highlands are in danger of manipulation by Calpine and CalEnergy.

I've been visiting for 40 years and this biotic and geologic landscape is precious and sacred to me and it is one of the most novel bioregions in the world, and deserves full protection. I've written Randall Sharp but I wanted you to know how I feel (and many others, too). *(Dean H. duVernet)*

BZ.6 Please don't destroy land and ancient grounds in Modoc. *(Dean H. duVernet)*

CP.1 Where do we stop? Or do we just keep on pushing and pushing the line between wilderness and "human resource area" until there is no wilderness left at all?

If I imagine a world without wilderness I am devastated and close to lost.

Please leave SOME areas untouched by the bulldozer and plow. *(Cathy Gould)*

CW.3 Many areas deserve to be left undisturbed. Please allow this to be one of them. *(Barbara Hannelore)*

CW.6 The Medicine Lake area, as a sacred area to many people and a vital source of water, seems an important site to preserve in its wild and natural state. *(Barbara Hannelore)*

DG.3 I realize the USFS and BLM wants to make money, but I believe your basic responsibility is to preserve the land belonging to the people in the way that the people want it to be preserved.

The majority of the people want the Medicine Lake Highlands to be left the way it is. *(Shirley Hill)*

DH.5 This is a unique and pristine region of California. Let's preserve it for wildlife and future generations! *(Katherine Holmes)*

DO.1 I'm 11 years old. I remember when grandpa and grandma took us all to Medicine Lake. I was only 6 years old then but it was real pretty. The water was cold and clear. Please save something beautiful for me and my kids. *(Tony L. S. Jackson)*

DS.2 The Highlands are too unique as a natural area to be invaded this way. They should be left intact, both for ecological value and Native Americans. *(Verna Johnston)*

DV.6 Instead of sacrificing our NATIONAL HERITAGE for the sake of a few dollars for a few people, let us keep this area safe from destruction so our children's children can enjoy it as the spectacular ecosystem that it now is. *(Marilee Jordan)*

EA.1 This project will irreversibly damage a sacred, wilderness area. This land has been protected and cherished buy local natives as well as Indian Brothers and Sisters.

The lake has great traditional meaning to the Intermountain Culture and provides a healthy environment for wildlife, plant life and nature to exist in harmony. Don't rape Medicine Lake. *(Diane Kinyon)*

EB.3 The USFS and BLM should be protecting our natural areas not giving them to developers. I would rather learn to be less dependent on electricity than to see this beautiful natural area defaced. *(Harry Kraft)*

ED.1 It's not a good idea on the seenery and the environment and seigeing Medicine Lake is unspoiled for now but the power plant will ruin the environment and everything around it like wildlife and people will not go to enjoy the looks of a 90' feet power plant, don't need such a destructive thing at all on, US forestland and Bureu of Land Management you specialized people suppose to protect the land that us tax payers pay to protect land such as national forest and monuments and states, lands and Deserts and trees lakes canyons rock formations and plants and animals please help save the area and the lake itself and the land around it. *(Daniel S. Kuhn)*

EF.3 Please help us preserve this wonderful area and let these folks do their research somewhere else. *(Bill Larsen)*

EJ.5 DO NOT DESTROY THIS SACRED AND BEAUTIFUL LAND!! *(Laraine Lewis)*

EM.4 STOP - think of the future - deny these proposed trashings of one of the most beautiful areas in the Western U.S. *(Pete and Laurel Lorenzen)*

ER.4 I beg you to prevent its destruction/degradation by the proposed projects. *(Stephanie Grace Mandel)*

FF.4 Stand up for the beautiful area that belongs to the people NOT BIG BUSINESS.

Do not allow the power plants to go in and ruin our wilderness. *(Victoria K. Miller)*

FV.1 Please keep our beautiful natural lake and all surroundings unspoiled from all man (developments). Some areas are and should be as is for the people and these person's children to have these areas natural and only available for sightseers and campers.

Please leave it be. There are hundred of acres in other areas that are available without so much beautiful history. *(Anna Lee Padula)*

FW.3 Save Medicine Lake and the surrounding countryside for the present and future enjoyment of everyone. *(Doug and Phyllis Parker)*

GA.2 Leave Medicine Lake the way it is. Please!!! *(Antoinette C. Phillips)*

GG.2 Please help preserve this old-growth reserve from destruction and protect its natural beauty for future generations. *(D. R. Popplewell)*

GR.5 I urge you to...

PROTECT MEDICINE LAKE!

DO NOT DESTROY IT! *(Marylee Patricia Rohde)*

GS.3 Please protect all of the highlands and include my comments as official input.

P.S. Will it be left pure and pristine? *(Anna Rongen)*

HH.4 Please allow this land to stay untouched and undeveloped! There are other solutions to energy than to tear up this sacred land. It is sacred. *(Lucinda Spencer)*

HQ.3 Please do not allow this costly, anti-environment project to be built and destroy all this very beautiful and important recreation area. Too much of this type of destruction is already taking place. We do not want any more. *(Donald Teague)*

HS.4 I urge you to work to protect our valuable natural resources and biodiversity in the Medicine Lake Highlands by opposing this project. With our incredibly expanding population problem in California, we need to protect as much land as possible from development. These lands are part of the natural heritage of all Americans and should not compromised.

I swam once in Medicine lake. It is a day I will never forget as a wonderful venture to be remembered the rest of my life.

I hope that you will adopt a firm position in favor of the many birds and animals that call this area their home. *(Larry Thompson)*

II.2 Please don't ruin the peace and quiet we now have at the Lake. We go up there for a chance to rest and relax. *(Vivian Wells)*

IJ.4 Please stop this before it is too late.

Manage the Land - not desecrate it. *(Mary Jo Wheeler)*

IL.1 I am writing to urge you to protect the Medicine Lake Highlands. *(Claudia Whitnah)*

Response—Protect Medicine Lake Highlands

The comments requesting that Medicine Lake and the Medicine Lake Highlands be protected are noted.

Comments—Opposition to Alternatives that Would Use Segment A1

A.5 Our objections to the selected transmission line routes described under alternatives 1 through 4 reflect possible significant impacts to wetlands, water quality and visual resources.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.13 EPA states particular objection to the transmission line routes described under alternatives 1 through 4 because they include segment A1, which would traverse a sensitive environmental area.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.15 According to the DEIS (pg. 2-59), all of the transmission line alternatives are considered to be technically feasible and reasonable from a cost perspective. EPA recommends that USFS and BLM select a transmission line route which avoids the A1 segment.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

H.13 Without the Telephone Flat Project, there is absolutely no need for power lines within the Medicine Lake Caldera, and all alternatives with segments A1, A2, and B2 should be rejected.
(Bill Dart, American Motorcyclist Association)

H.36 If the transmission lines are kept out of the Medicine Lake Caldera, and the issue of snowmobile route and safety conflicts on 44NO 1 and 44N54 is resolved, the project would be acceptable, even though

there would still be adverse noise, light pollution, and visual impacts.
(Bill Dart, American Motorcyclist Association)

AR.4 (4) A transmission line between Medicine Lake and the Glass Flow is NOT ACCEPTABLE AT ALL! It just proves that Calpine is only interested in profits and is taking the cheapest way out. How many of the required mitigations will they follow in such a remote area when they think no one is watching?
(Marcia Barrow)

EI.1 I am not against geothermal power and am aware of the limited areas in which ample supplies are harvestable.

I am against the proposed powerline running along the northside of Medicine Lake.

From attending a geothermal meeting in Klamath Falls, I understand Calpine proposed to run the powerline away from the Lake and follow the 7 mile road.

Please do not allow the powerline to run near Medicine Lake Basin. *(Nik M. Lettlinich)*

EO.1 Proposed action alternatives Al, A2 and D1 are visually and environmentally unacceptable because of their negative impacts in the Medicine Lake Highlands. The already diminished wildlife and the stressed shrubs and flowering plants that produce feed needed for all species, will be further threatened. *(Natalie Macy)*

EO.4 The routes numbered Al, and A2 should be eliminated from consideration as possible powerline passages FOREVER. *(Natalie Macy)*

PH2.3 I'm definitely opposed to running the power line down around A1 and A2. A3 was my personal choice, would be the much better choice. It would leave the hot spots still left to natural terrain, even if it's swinging your power lines at 1400 feet tower to tower or whatever you want to swing them, though you'll be crossing an area that is—well, I consider more sacred than any Indians probably would, the hot spots and that lava bed. But we look directly across from our property. *(Klamath Falls Public Hearing)*

PH2.6 And I'm too rattled to make any more comments, but I—like I say, I'm definitely opposed to running that A1 power line. And I read in your—that as I read it, the forest service is actually proposing more to run A1 around close to the lake. And I want to know why, if the forest service is proposing that route, is it so the forest service can get electricity in there to the campgrounds or—and develop the area?
(Klamath Falls Public Hearing)

PH2.7 One of the portions of it stated that the forest service preferred the A1 route. And I think you could appreciate, being in the forest service, that you wouldn't want to sit there and look across the lake at a set of power lines. Even if they paint them brown, which I don't think they can do.
(Klamath Falls Public Hearing)

PH2.10 I would like to point out, I'm all for the powerhouse, but don't run the line down by the lake.
(Klamath Falls Public Hearing)

PH4.3 Routing the transmission line along segment A1 adjacent to Medicine Lake is unacceptable.
(Mount Shasta Public Hearing)

PH5.47 My wife and I and my family would strongly object to the A1 line coming close to the lake. And then basically we have no objection to the geothermal within the basin, as long as it's within two miles or more of the lake. And keep all the major activity away from the lake, because there is a tremendous resource there, and I certainly am not against utilizing it. *(Medicine Lake Public Hearing)*

Response—Opposition to Alternatives that Would Use Segment A1

Opposition to the use of Segment A1 for the proposed project is noted. Alternatives 1 (proposed action), 2, 3, and 4 would all use Segment A1 as part of the transmission line route. Segment A1 is a 4.72 mile-long section that would follow a route near Medicine Lake. Alternative transmission line routes were developed to avoid or reduce the impacts that would occur if segment A1 was constructed. These alternatives are described in Section 2.3 of the Draft EIS/EIR. Two alternatives, Alternatives 5 and 6, propose the use of Segment A3 instead of A1, which would pass several miles to the north of the A1 route. Alternative 6 is designated the agencies' preferred alternative.

Comment—Opposition to Alternatives that Would Use Segment A2

CV.5 If the no action alternative is not chosen, then there should be no construction done inside segment A2. The transmission lines should be built along existing roads and other utility rights-of-way entirely. No tree over 18" should be cut when possible, and roads should not be built over cave or crack systems. *(Kyle Hames)*

Response—Opposition to Alternatives that Would Use Segment A2

Opposition to the use of Segment A2 is noted. Alternatives 3, 4, 5, and 6 proposed the use of either the B2 or B1 routes instead of A2. Alternative 6 is designated the agencies' preferred alternative. See responses to comments in the Vegetation Section regarding tree removal. See responses to comments in the Geology and Soils Section for a discussion of caves.

PROJECT SUPPORT

Comments—Support for the Project

I.1 CalEnergy Company Inc. supports the preferred alternative presented at the public hearings for the Fourmile Hill Geothermal Project provided that the selection of the northern transmission line route does not preclude CalEnergy from developing a transmission line to deliver power from the Telephone Flat Project. The location of the main transmission line corridor must be accessible to CalEnergy's Telephone Flat Project. The preferred alternative routes the transmission line corridor north of Mount Hoffman. Selection of this alternative, while avoiding conflicts with the recreational uses at Medicine Lake, will have a significant effect on the Telephone Flat Project's transmission line alternatives. It is CalEnergy's concern that the selection of the preferred alternative does not preclude CalEergy from gaining access to the transmission line corridor. The U.S. Forest Service has held from the beginning that there will be only one transmission line corridor from the highlands area. Calpine's proposed route in the Plan of Operations passed near the Telephone Flat project. The preferred alternative route is approximately 6 miles north of the project which will essentially limit the alternative routes available for the Telephone Flat project. The Record of Decision should recognize that the northern corridor is expected to service the entire KGRA. *(Dale R. Schuster, CalEnergy International Ltd.)*

AI.9 We can not get to a sustainable environment and economy without renewable resources. With the limitations noted above, we support the preferred alternatives outline in the Draft EIS for the Four Mile Hill Geothermal Project. *(Rachel Shimshak and Peter West, Renewable Northwest Project)*

DE.1 I believe that the Geothermal project should be allowed to proceed. *(Don Herger)*

DF.1 I attended and made comments at the most recent meeting in Yreka on the proposed Geothermal Project at Medicine Lake. Having researched the impact of energy use on society as an avocation since about 1948 my position is unique. I am in favor of the project. The enclosed research paper by me will give some insight into why. *(Robert L. Hickerson)*

DF.2 Siskiyou county gets its electricity mostly from coal powered plants operated by PacifiCorp. Eminent geologist and geophysicist M. King Hubbert was at the forefront of energy forecasting for nearly a half century. He accurately predicted the peaks of world oil and gas production. World oil production will peak in 2005 and it is downhill from there. However in 1956 Hubbert predicted that world coal production would peak around 2156. Based on the historical data, Dr. Richard Duncan of the Institute on Energy and Man has shown that the coal production peak will occur around 2007. Hubbert's coal error stems from a vast overestimate, by a factor of ten or more, of the amount of coal that can ever be practically mined from the earth. Instead of using his method of analysis, he took the Energy Industry's estimate. What this means is that Siskiyou County will be competing for the declining amount of electrical energy that will be available in the future. To deal with this certain and predictable electrical energy crunch I have a proposal.

Siskiyou County should encourage the development of this geothermal project. The first 49.5 Megawatt plant could supply all of the electrical needs of Siskiyou County for the indefinite future. Siskiyou County should use every means possible, political, economic and legal to insure that in the future it has first crack at the geothermal electrical energy which will be generated. There is the challenge for Siskiyou County, its Air Pollution Control District, the Planning Department, the Board of Supervisors and anybody else who has a vital interest in the Future of Siskiyou County.

Environmentally, geothermal power is more benign than Nuclear or Fossil Fuel power. The concern about loss of tourism will become irrelevant because in the future the increase in the price of gasoline will exclude all but the most wealthy as tourists. *(Robert L. Hickerson)*

EK.1 A great project for an economically depressed County! Relative clean, environmentally safe & needed for future energy requirements. Please proceed! *(Kathleen Linden)*

EW.1 The Fourmile Hill Geothermal Project should be approved with the stipulations identified in the draft Environmental Impact Statement. The stipulations more than off set any significant impacts the project may have on the environment, cultural resources and recreational opportunities of the surrounding Federal forest lands. *(David W. McClain)*

FT.1 In regard to the proposed Geothermal power plants near Medicine Lake, I would like to go on record as in favor of this project. *(Claude Olson)*

FT.2 I am presently and have been the owner of a home at Medicine Lake. I am also a member of the Medicine Lake Homeowners Association.

There are some self-proclaimed "leaders" of the Homeowners Association, that are adamantly opposed to this project, and are fighting it with every bit of propaganda that they can, including some false statements.

I feel that they are very short-sighted, as they are all dependent on electricity along with millions of other people. I believe that in a few years hence the demand for electricity will be greater than the supply, and this new resource of energy will be needed to help fill the void.

I have attended a couple of local informational meetings, as well as the seminars at OIT in Klamath Falls, plus the field trip to Medicine Lake. With all of the data presented and the questions answered I cannot see any objectionable impact to the environment at Medicine Lake. *(Claude Olson)*

FT.3 Now is the time to approve this power plant project, and take advantage of this wonderful natural resource which will be financially beneficial to the F.S. and the economy of the region.

It is my hope that this project gets on line before other sources of electricity get shut down.*(Claude Olson)*

HM.1 The "Medicine Lake Citizen's for Quality Environment" has asked me to comment on the Forest Service proposed action in the Medicine Lake area.

I am in agreement with the U.S. Forest Service to allow geothermal development in the Medicine Lake area. This project, up to six or more units, will have very little if any effect on wildlife and minimal effect on visual quality. *(Howard I. Stearns)*

HM.2 I feel that the "Medicine Lake Citizens for Quality Environment" are a bunch of people who have cabins in the area and don't want "their land" to be disturbed and they are being a bunch of NIMBY's. The nation needs more power all the time to supply the country and NIMBY's with the electric power they demand. *(Howard I. Stearns)*

HM.3 Please proceed with your project. *(Howard I. Stearns)*

HN.1 Please, please let the geothermal project proceed. Geothermal power is a natural resource often overlooked. The proposed project is in a remote area. The benefits far outweigh the objections of the few residents of the area. I have observed 3 other geothermal projects and can take no exception to them. *(Don Sterner)*

HN.2 God gave man dominion over all the animals and resources of this earth and it is up to man to use these resources wisely. How else could you wisely use geothermal power? *(Don Sterner)*

HN.3 Again, please don't buckle to the few greed individuals but proceed as quickly as possible for the completion of this project for cheap, clean power. *(Don Sterner)*

PH5.48 I am a hundred percent for the geothermal well coming to Siskiyou County. I want to bring us back to a point on sulfur emissions. We have an air pollution officer here, he can verify anybody's concerns of emissions of sulfur into the atmosphere or acid rain. I've been working with sulfur for over twelve years from the geyser, Unocal, sulfur extracting from crude oil, with the refiners. We make good excellent sulfur plant food. We've been putting it on alfalfa in Macdoel, Shasta Valley, Scott Valley, probably twelve years now. It's an excellent plant food. We should be so lucky we have this hot water in our county to develop with the power. *(Medicine Lake Public Hearing)*

Response—Support for the Project

The support for the project is noted.

Comments—Project Benefits

AI.2 The Fourmile Geothermal Plant will help retire older, dirty coal and natural gas plants, or eliminate the need to build newer ones. As proposed, the Fourmile Geothermal Plant could displace annual emissions of at least 300,000 tons of CO_2, 2,200 tons of SO_x, 1,200 tons of NO_x and 1,300 tons of methane[1].

[1] Based on emissions and fuel data from the US Energy Information Agency and US Environmental Protection Agency.

The current system of generating electricity has enormous environmental impacts. Fossil fuels produce about half of the electricity generated in the Western Grid. Large hydro accounts for another 30% to 35% of generation. The Fourmile Hill Project provides an opportunity to avoid some of these destructive resources.

According to the EPA, air emissions from burning fossil fuels (coal, petroleum, and natural gas) to generate electricity account for 71% of all sulfur oxides; 35% of all carbon dioxide, 32% of all nitrogen oxides, 18% of all methane, and almost 9% of all regulated particulate matter (PM-10). The Exxon Valdez accident alone resulted in the death of 500,000 birds.

Fossil fuels are major sources of acid rain, pollution-caused illnesses, habitat destruction, and smog. The fuel cycle, form extraction to combustion of fossil fuels, results in the vast majority of human-made release of greenhouse gases. Large hydro has been a significant cause of the drastic decline in anadramous and resident fisheries along the West Coast.

The pace of fossil fuels development has picked up. The western grid has been in a rush to add gas-fired power plants and increase its addiction to fossil fuels. About 1,400 megawatts (MW) of gas-fired power plants were built in the Northwest over the last four years. These plants can spew more than 5,000,000 tons of CO_2 per year-- the pollution equivalent of nearly 1,000,000 cars every year. Another 5 gas-fired power plants have recently come on line in California.

Stocks of salmon and stealhead are being listed on the endangered and threatened species lists. Energy conservation programs have been cut in the Northwest by as much as 70% by major utilities. The current reality is that the electricity system is on a path to be more and more reliant on highly destructive hydro and fossil fuel resources.

Nuclear power plants in California and Washington are aging and as many as four are likely to be closed within five years. Without established sources of clean, alternative energy, these plants will be replaced with more fossil fueled power plants. It is critical that we take steps now to avoid being backed into a continually unsustainable corner.

As mentioned above, the Fourmile Geothermal Plant has net emissions significantly less than traditional electricity sources. The amount of CO_2 emissions the plant will help avoid and offset each year is sizable--as much as the annual emissions of at least 60,000 cars.

(Rachel Shimshak and Peter West, Renewable Northwest Project)

AI.7 As you examine this development, we ask you to consider the broader benefits of renewables and the greater damage they help to avoid. Renewable resources neither harm fish nor create the air, water and land pollution associated with fossil fuels or hydro. The growing need to control green house gas emissions will create a greater need for very low emission resources such as the Four Mile Hill Geothermal Project. *(Rachel Shimshak and Peter West, Renewable Northwest Project)*

EW.2 This project when developed will help to off set the need to build more fossil fuel power generation facilities in the region. Geothermal power plants when compared to other energy sources on a pounds of pollution per megawatt of output basis produce 1/1000th of the emissions of a gas fired power plant and 1/10,000th of the emissions of a coal-fired power plant (Goddard and Goddard, GRC 1987).

(David W. McClain)

EW.3 Also this project will feed into the Bonneville Power Administration Malin substation. The delivery of this power to Malin substation will help to free up valuable Columbia River water by negating the need to deliver an additional 49 MW of power to California from the Columbia River hydroelectric system. This water can be used for salmon by-pass of the turbines and help with the recovery of the endangered Snake River salmon. *(David W. McClain)*

Response—Project Benefits

The comments addressing the potential benefits of the project are noted. Although the 49 MW of power from this project could help free up the Columbia River water, the power would potentially displace less than 1 percent of BPA's hydroelectric resources. This percentage is unlikely to result in any significant changes in operations of the hydroelectric system.

6: RESPONSES TO GENERAL COMMENTS

6: RESPONSES TO GENERAL COMMENTS

6.1 Introduction

This chapter provides responses to general comments raised during the public comment period for the Draft EIS/EIR. Although these comments do not necessarily comment on the Draft EIS/EIR, responses are provided. Each comment in this chapter (as well as other chapters) of this document was considered without regard to the author's location, occupation, or lifestyle. Each comment will be considered by decision-makers in determining whether to approve the project.

The comments and responses in this chapter are grouped under the following headings:

- Public Requests
- General Concern About Project Effects
- Incorporation of Other Comments by Reference
- Statements and Opinions
- Other General Comments

Under each of these headings, comments and their responses are grouped under more specific sub-headings.

6.2 General Comments

PUBLIC REQUESTS

Comments—Request for National Monument Status

CS.5 The Medicine Lake Highland is one of the finest forest and recreation resources of its type in the nation, in addition to being a unique shield volcano. There is no economic reason powerful enough to permanently change its character and alter the values it currently has with such abundance. There also is the question of the disruption of sacred Indian lands—something that no government should allow.

The highest and best use for this land would be to include it in a greatly expanded Lava Beds National Monument which would encompass the entire highland. *(G.S. Green)*

ER.2 This area is important as an ecological link between the Cascade Range and the Modoc Plateau and should be preserved for its natural character. It should be a national monument. *(Stephanie Grace Mandel)*

FA.2 These projects are way out-of-scale for the affected area. Industrializing the Medicine Lake Highlands is exactly the wrong management direction to take. You should be trying to preserve this area's wild and remote character. You should recommend the Medicine Lake Highlands as a National Monument because of its many unique features. Turning the area into an industrial zone is tragic. My family visited

Medicine Lake two years ago and we were looking forward to returning. If these projects go forward, we will go elsewhere. *(Bob McLaughlin)*

FZ.2 Here in Lake County, California we have a similar geothermal project and resulting change in environmental biodiversity. I am horrified to think of similar devastation to the Medicine Lake area as a result of geothermal power exploitation. I am a frequent visitor to Medicine Lake and along with many other visitors love its biodiversity values which includes freedom from the frantic pace of recreation activities. This precious isolated area deserves national monument status instead of the blight of powerplants, well sites, pipelines for steam, electrical towers, many new roads for access, destruction of ancient forest for roads and powerlines -- and so forth. These factors I am familiar with here in Lake County. *(Katherine Petterson)*

GU.3 In addition to the religious reason to oppose these projects, rare old growth exists in this area that is fast disappearing from the planet. This great national treasure is given us by the Creator. It must not be desecrated before it can receive the national monument status it deserves. *(Robin L. Schaeffer)*

HP.4 With the establishment of the Medicine Lake National Monument of 61,000 acres, and the designation of the Medicine Lake National Monument Wilderness of 52,000 acres. *(John R. Swanson)*

IB.4 Aside from Native American values, the Medicine Lake Highlands have many other values; geologic, pedologic, wildlife, and recreation most importantly. As a magnificent example of an active basaltic, shield volcano and a living laboratory of recent soil formation, as well as other reasons, the area as a whole is deserving of consideration for National Monument status. *(Wayne Verrill)*

Response—Request for National Monument Status

The comments requesting National Monument status are noted. This determination is separate from the decision to permit the development of the proposed Fourmile Hill geothermal project. Therefore, this decision and analysis are not within the scope of the EIS/EIR for the proposed project.

Comments—Request for Information and Documents

N.39 29. The Fall River Wild Trout Foundation formally request the following documents:

(a) A timely copy of the final EIS/EIR for the proposed project;

(b) A timely copy of the FONSI document for the proposed project;

(c) A timely copy of the Decision document for the proposed project;

(d) Timely copies of all public notices and project notices for the proposed project;

(e) Timely copies of all letters and memos to the to the U.S. Fish and Wildlife Service and the California Department of Fish and Game pertaining to the proposed project;

(f) A timely copy of any and all draft and final environmental documents pertaining to proposed project, the Telephone Flat Geothermal Project, and any proposed project affecting the Medicine Highlakes Area, including the proposed transmission corridor;

(g) A timely copy of any information and data pertaining to the proposed project.
(Robert J. Baiocci, Fall River Wild Trout Foundation)

P.3 Previously, I wrote and requested a copy of the Project's Cultural File. As a practitioner of the traditional way of life, and an indigenous person of the Northwest, I requested detailed information regarding the cultural impacts of the proposed project, including the record of consultations that have been conducted with the indigenous and tribal communities. I also requested copies of any Memoranda of Agreement or Understanding (MOAs or MOUs) that had been established with the tribal or indigenous communities regarding the conduct of federal actions in and around a sacred site, pursuant to Executive Order #13007. In response to my request, I received a letter denying me this information. I am concerned that my rights to obtain information in a non-discriminatory manner, that would allow me to more successfully evaluate the impacts that this proposed project would have on sacred sites, have been violated.

Due to the fact that I was not provided with a copy of the cultural file or the MOUs, I am not able to provide you with *specific* information relative to impacts that this project will have on sacred sites.
(Carol Logan, Kalapooya Sacred Circle Alliance)

Y.14 The general attitude of the USFS/BLM personnel in charge of this project has been one of contempt for the inconvenience that the public is causing them in wanting more information and meetings about the project. Freedom of Information Act (FOIA) requests have been delayed time and again and often only partially (and begrudgingly) filled. This has particularly been the experience of the Medicine Lake Citizens for Quality Environment, whose information we have shared.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

BQ.35 In order to insure that members of the public, who will be impacted by this project, have an opportunity to involve themselves in the public scoping process we are asking for the following:

Allow public response to the Draft EIS/EIR until August 30, 1998

Publish information about this project in more regional newspapers

Have public hearings in the Redding area Post information about the project in the Medicine Lake campground until the end of hunting season this year and post information next summer

Insure timely responses to request for information as requested under FOIA, to all interested parties that have requested information.

Delay the start of construction, if this project is approved, until spring of 1999 to allow all involved parties an opportunity to become involved in the public input process.

(S. Peder and Suzanna S. Cuneo, et al.)

BY.4 P.S. May I have a map showing protected wilderness? *(Dean H. duVernet)*

CA.2 Also, I would greatly appreciate the addresses for these individuals.....Scott W. Lieurance of the BLM & Barbara Holder of Klamath Nat'l Forest. *(Dean H. duVernet)*

EY.1 I would like to obtain a copy of the DEIS of the Fourmile Hill Geothermal Development project near Medicine Lake and the Telephone Flat Project. *(R.C. McClymonds)*

HA.1 The purpose of this letter is to provide specific comments and to raise pertinent questions to the Draft EIS/EIR. Many of the issues of this letter are raised without the necessary information that has been requested by various parties, but has not been received. Without the necessary information, a reasonable analysis of the proposed project is not possible. *(James Shott)*

PH3.36 This is the Proposed Draft Environmental Impact Statement. If the Medicine Lake homeowners wanted to purchase one, what would be the cost? There is a lot of good information that is not in the packets that we are getting. *(Yreka Public Hearing)*

PH3.37 The Medicine Lake Homeowners Association would like at least one copy. *(Yreka Public Hearing)*

PH4.32 Why has the Medicine Lake Homeowner's Association Freedom of Information Act request not be filled? *(Mount Shasta Public Hearing)*

PH4.33 Who represented the California Department of Fish and Game in this process? *(Mount Shasta Public Hearing)*

Response—Request for Information and Documents

The requested documents have been provided to the parties concerned, where possible. Information has been provided and disseminated as required under applicable Federal and state statutes. Furthermore, the Draft EIS/EIR has been made available in accordance with the requirements of NEPA and CEQA.

Cultural resource files are confidential and are not disseminated to the public (beyond that information in the EIS/EIR). The confidentiality is designed to protect cultural resource sites. Involved tribes have specifically requested that the Ethnographic Report and site-specific traditional cultural site information remain confidential. More than 350 copies of the Draft EIS/EIR were distributed to agencies, organizations, and the public at no charge. As discussed in response to "Comments—Draft EIS/EIR Review Period" in the NEPA/CEQA Issues Section, the comment period was extended to September 30, 1998.

Terri Weist, of the Montague Office, represented the California Department of Fish and Game (CDFG) during the informational process.

Comments—Keep Informed

A.7 We appreciate the opportunity to review this DEIS and request that we meet to discuss our objections and concerns, as provided in the comment letter, prior to release of the FEIS. We kindly request that two copies of the FEIS be sent to this office when it is officially filed with our Washington, D.C., office. To schedule a meeting, or if you should have questions, please contact David Farrel, Chief, Federal Activities Office, or Karl Kanbergs at (415) 744-1483.

(Deanna M. Wieman, U.S. Environmental Protection Agency)

B.16 We request that this office be added to the mailing list found in Appendix A of the Draft EIS/EIR so that we will receive future documents as soon as they are made available. Please contact Nadine R. Kanim of my staff if you have questions regarding these comments. *(Ronald A. Iverson, U.S. Fish and Wildlife Service)*

H.38 Please keep us informed as the process proceeds, and keep us on your mailing list for the final EIS/EIR. Additionally, please make sure we are on the mailing list for the Telephone Flat project. *(Bill Dart, American Motorcyclist Association)*

K.15 Thank you for considering our comments. Please mail us a copy of the final version of the EIS/EIR when it is completed. *(Ryan Henson, California Wilderness Coalition)*

L.6 Please put me on the mailing list for all future actions concerning this geothermal project, the two roadless areas mentioned above, and the Medicine Lake Highlands area generally. *(Steve Tabor, Desert Survivors)*

O.23 We would appreciate receiving any further documents on this project and notice of any decisions made. *(Katherine Kowatch, Friends of the River)*

T.22 We appreciate your receiving and considering these and other public comments. We would welcome additional opportunities to learn more about and comment on the proposed Fourmile Hill Geothermal Development Project. Please add my name and address to your public involvement list for all future mailings and notices concerning this project. *(Linda L. Blum, Medicine Lake Citizens for Quality Environment)*

V.38 If you have any questions about any of the issues raised in this comment letter, please contact us at our address above. Please be sure to add our group's name to your mailing list so that we may receive any additional public notices, revisions to the draft EIR, and a copy of your agency's Response to Comments. *(Carol Plank, Medicine Lake Citizens for Quality Environment)*

AG.188 Thank you for the opportunity to submit comments on this Project. We look forward to reviewing your responses to these comments (including the detailed expert comments in Exhibits A through C). *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AS.5 Thank you for your time and considerations; please add my name to your mailing list concerning energy development in the Medicine Lake Highlands. I look forward to receiving the above requested map. *(Brian B. Beard)*

BN.6 I am requesting a copy of the EIR/EIS and that I be added to your mailing list and be informed as to the progress of this project. Thank you for your attention in this matter. *(S. Peder Cuneo)*

BX.1 *Note: Please update me on any news concerning these projects. *(Dean H. duVernet)*

CU.1 Please keep me informed by mail per phone conversation reguarding:

"Bonneville Corps" guilt or lack of it in the line fire vs. equal guilt or lack by the Lumber Corps.

"There's no linar board feet under power-lines so we don't have to (cut clear) there, it's not cost affective." *(Deborah Lynn Gregory - Fisher)*

CU.2 Please send any and all information reguarding & related to the implementaded Recycle Management involved. Per your request I will also contact Cal-Pine Corp. *(Deborah Lynn Gregory - Fisher)*

CV.6 Thank you for reviewing my comments on the proposed Fourmile Hill Geothermal Project Draft EIS/EIR. Please keep me advised of any future actions concerning this project. *(Kyle Haines)*

DB.8 Please let me know regarding the decision on this project. Thank you for considering these comments. *(Stan Haye)*

DW.7 Please keep me appraised of any project developments, including public notices, EIRs, etc. *(Mike Keesee)*

DX.4 Please do not put this project into effect. I would appreciate a response from you. *(Nancy B. Kenyon)*

EM.5 Please keep us on your mailing list. *(Pete and Laurel Lorenzen)*

FO.7 Please add me to the mailing list for this project & any other geothermal proposals or exploration work to be done in Modoc or Siskiyou Nat'l Forests. *(Eric T. Nelson and Martha Spencer)*

GD.4 Please keep me informed on this issue. *(Dolores Plumb)*

GU.4 Thank you for considering my views. Please let me know what you decide to do on this. I'll look forward to hearing from you. *(Robin L. Schaeffer)*

HE.6 Please include me on any future mailings and reports that have to do with the Medicine Lake Geothermal Development Projects. *(Daniel T. Spencer)*

HI.10 Please put me on your mailing list for all future public decisions regarding this project. *(Martha Spencer)*

IB.8 I wish to be kept informed of all future developments related to the Calpine Fourmile Hill project and any other proposed geothermal development in the Medicine Lake Highlands. Specifically, I wish to be added to the mailing list to receive the CalEnergy Telephone Flat Draft EIR/EIS, when that document becomes available. *(Wayne Verrill)*

Response—Keep Informed

The Final EIS/EIR was made available to the public, and distributed to those individuals on the mailing list who have requested the document. All parties who requested information will be kept informed to the fullest extent possible.

Comments—Consideration of Public Comments

M.1 The Fall River Resource Conservation District (FR RCD) in cooperation with Dr. Thomas Grose and Maria Ellis would like to comment on the draft EIS/EIR that was recently issued for the Fourmile Hill Geothermal Proposal.

Dr. Grose informed the FR RCD that the document was available. Unfortunately, no copy has been sent to the FR RCD. Additional copies are apparently unavailable. The FR RCD had understood that our specific request to Randy Sharp to be included on all future mailings for any geothermal issues would include receipt of this important document. Furthermore, the FR RCD provided written comments of concern in a letter dated Dec. 4, 1996. Not only were these concerns ignored in the EIS/EIR document, but the effort to present these concerns did not even warrant inclusion on the mailing list. (Reference EIS Document Table of Concerns Raised During Public Scoping Period) Fortunately, a copy was located and a review was possible.

As the USFS project coordinator for this proposal, it is your responsibility to see that all legitimate concerns of the public are addressed in the environmental review documentation. The failure of this document to address (or even acknowledge) these concerns is unacceptable.

(Rick Poore, et al., Fall River Resource Conservation District)

N.38 We are requesting the U.S. Forest Service and the U.S. Bureau of Land Management respond in writing to our specific comments in this submittal. *(Robert J. Baiocci, Fall River Wild Trout Foundation)*

BH.1 Sir, please enter into the official record my comments and suggestions regarding Fourmile Hill Geothermal Development Project. *(Richard S. Cimino)*

BM.3 I would like this letter to go into the public record. Thank you. *(Rhodelio Cruz)*

BO.6 Please provide a response to the concerns raised in this letter and advise as to the results of the public hearing process. My family intends to follow this project closely, communicate with our legislators and the Sierra Club and consider appropriate legal action if the project is approved and permits issued.

(Suzanna S. Cuneo)

BZ.1 NOTE: Thank you for reading this and I hope for a response concerning the Medicine Lake Highlands - I hope they will be protected. *(Dean H. duVernet)*

CA.1 I have visited your beautiful area for forty years!

I sent a letter protesting the fourmile Hill project and I enclosed articles showing flaws of geothermal energy. I also stated Modoc Nat'l Forest, with its volcanic landscape, ancient forest and turquoise lakes, is one of the most special and dramatic ecosystems on the planet- and tourism will bring in more money and be more sustainable than geothermal activity.

Did you receive my letter and articles? *(Dean H. duVernet)*

EV.5 Please consider these comments in making decisions regarding the Fourmile Hill Geothermal Project.

(Shari Mazzini)

FG.2 I request that this letter of opposition be included in the permanent record. *(David Porter Misso)*

FP.2 Issues regarding the proposed project and the Draft EIS/EIR are listed below. A written response in the Final EIS/EIR to these comments is requested. A more detailed explanation on the need for this project and bond requirements along with additional public scoping is also requested.

(Eric T. Nelson and Martha Spencer)

GF.4 It is my hope that you will take this into consideration so that my grandchildren can enjoy this lake.

(Sarah Poaler)

PH1.8 Dear Mr. Sharp, the Fall River Resource Conservation District, Fall River RCD, in cooperation with Dr. Thomas Grose and Maria Ellis would like to comment on the Draft EIS/EIR that was recently issued for the Fourmile Hill Geothermal proposal.

Dr. Grose informed the Fall River RCD, that the document was available. Unfortunately, no copy has been sent to the Fall River RCD, and additional copies are apparently unavailable. The Fall River RCD has understood that our specific request to Randy Sharp to be included on all future mailings for any geothermal issues would include receipt of this important document.

Furthermore, the Fall River RCD provided written comments of concern in a letter dated December 4th, 1996. Not only were these concerns ignored in the EIS/EIR document, but the effort to present these concerns did not even warrant inclusion on the mailing list. Reference EIS document Table of Concerns

raised during the public scoping period. Fortunately, a copy of the EIR/EIS was located and a review was possible.

As the U.S. Forest Service project coordinator for this proposal, it's your responsibility to see that all legitimate concerns of the public are addressed in the environmental review documentation. The failure of this document to address or even acknowledge these concerns is unacceptable. *(Dorris Public Hearing)*

PH1.23 In the early stages of the EIS, we noticed that significant comments made during the public scoping period were—our comments were completely absent from the listing; do you know of any reason why those were not considered? *(Dorris Public Hearing)*

PH1.30 I looked at it just in a very cursory manner, but I didn't see the public comment that I expected to. I saw where in the Butte Valley Star there was indication of a meeting is going to be held, but I didn't see anything that after the meetings were held what the public comments were. I am very interested to know what they are and if this was available, I would like a copy. *(Dorris Public Hearing)*

PH3.35 We are sending in public comments and stuff. Will any of that be published? Will we see the result of how many people voted "no" against it? Will there be information given back to us as to what our comments have accomplished or anything? *(Yreka Public Hearing)*

PH3.109 So you are telling me that Calpine has dumped a few million dollars—I don't know how many—into drilling these test wells and they are going to listen to us? *(Yreka Public Hearing)*

PH3.110 I assume you have several million dollars sunk into sinking these test wells and into Environmental Impact Studies, and you are telling me that Calpine is going to listen to us, that Calpine is going to be willing to lose those millions of dollars that they already have invested? *(Yreka Public Hearing)*

PH5.102 When we write a letter to you regarding our comments on the document, would it be worth our while to write to these people? *(Medicine Lake Public Hearing)*

Response—Consideration of Public Comments

All public comments concerning the proposed project have been incorporated into this document. Responses have been prepared for every comment received from the public, and concerned Federal, state, and local agencies.

In response to comments M.1, PH1.8, and PH1.23, the specific hydrologic concerns expressed by the Fall River Resource Conservation District (FR RCD) were addressed in Sections 3.3 and 4.3, Hydrology, and Sections 3.4 and 4.4, Geothermal Resources, of the Draft EIS/EIR. Elaboration of the analyses of these issues is provided in the Hydrology and Geothermal Resources Sections in this document. A copy of the Draft EIS/EIR was provided to FR RDC at the August 5, 1997 public hearing for the Draft EIS/EIR held in Dorris, California. For more information on the public distribution of this document, see the response to "Comments—Draft EIS/EIR Distribution" in the NEPA/CEQA Issues Section of this document.

GENERAL CONCERN ABOUT PROJECT EFFECTS

Many commentors stated broad concerns covering many environmental parameters. These general statements are included here. Additional responses can be found in responses to comments for each environmental parameter (e.g., vegetation, wildlife, air quality, hydrology, etc.).

Comments—General Concern About Project Effects

A.3 With regard to impacts from the powerplant/wellfield, our objections are based on insufficient information or mitigation measures in the DEIS that would assure less than significant impacts to the shallow groundwater system, springs, lakes, water supplies and wildlife.
(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.14 Selection of the segment A1 alignment could create significant visual and biologic/ecologic impacts, and could have a significant effect on potential tribal use of sacred/traditional sites. Furthermore, the A1 segment may cross a seasonal wetland. Under Executive Order 11990 (Protection of Wetlands, 1977), "Each agency shall avoid undertaking or assisting in wetland construction projects, unless the head of the agency determines that there is no practicable alternative to such construction...."
(Deanna M. Wieman, U.S. Environmental Protection Agency)

A.16 Alternatives 5 and 6 avoid the heart of the Medicine Lake recreational area and would avoid the intensity of environmental and cultural impacts that alternatives 1- 4 pose. EPA has concerns that wetlands could be affected (particularly for segments C1 or C2), and is also concerned about possible impacts to roadless areas, sacred/traditional sites, impacts on biologic resources, visual/socioeconomic impacts to the community of Tionesta (along segment C1), and visual impacts to views from the Lava Beds National Monument (segments A3 and B1). *(Deanna M. Wieman, U.S. Environmental Protection Agency)*

K.1 With habitat for northern spotted owl, goshawk, peregrine falcon, and pine marten, the Mount Hoffman Roadless Area, several important old growth groves, and one of the only year-round water sources in the region, the Medicine Lake Highlands is a critical source of connectivity between the Modoc plateau, Cascades, and Klamath-Siskiyou regions. As you know, the Highlands are also tremendously important to the Pit. Klamath, Shasta, and Modoc peoples. As a result, the protection and restoration of this unique landscape is a high priority for our organization.

We have many grave concerns about the proposed Fourmile Hill Geothermal Development Project, as well as all of the other planned development projects in the Medicine Lake Highlands. We fear that the cumulative impact of these projects will be to leave the Highlands with all the habitat value and aesthetic appeal of an industrial park. *(Ryan Henson, California Wilderness Coalition)*

O.1 Friends of the River has reviewed the Fourmile Hill Geothermal Project Environmental Impact Statement and we wish to comment on the proposed project. We are concerned about water quality in Medicine Lake in the absence of a cumulative watershed analysis; the preservation of the Mt. Hoffman roadless area; the violation of visual quality objectives as a result of a geothermal facility; the viability of protected wildlife and plant species found in the proposed project area and the absence of management plans for these species; and the disruption that a geothermal plant would cause to Native American ceremonial and cultural practices. *(Katherine Kowatch, Friends of the River)*

U.1 We feel that the Draft EIS/EIR and Calpine have failed to properly address important issues from the conception of the proposed Fourmile Hill geothermal project.

The EIS/EIR contains incomplete and misguided information concerning the scoping process and public input, exploration, water and air quality, recreation, road conditions, old growth forest, cumulative effects and more. *(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)*

Y.2 The high level of environmental quality and pristineness of the Medicine Lake Highlands area, its exceptionally pure waters, its great cultural significance to several Native American Tribes, and the intense controversy that proposed geothermal developments are generating, are factors prompting us to have deep concerns about this proposed project.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

Y.4 The proposed development would bring levels of visual, noise, water and air pollution incompatible with age-old and current uses of the area. We feel it is vital to uphold the intent of NEPA and CEQA for better decisions that do not destroy the natural world, and to make a statement that a project should not qualify as "green" when it has such devastating environmental impacts on a pristine natural and cultural area as this Fourmile Hill project and the other projects for which it would open the door.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AB.5 They have not sufficiently tested the potential hazards to water, air, and life according to law.
(Michelle Berditschevsky, Native Coalition for Cultural Restoration of Mount Shasta)

AG.189 The DEIR contains numerous errors, omissions, and deviations from standard practices and procedures. It has substantially underestimated toxic criteria pollutant emissions, followed improper air quality modeling protocols, omitted numerous toxic substances that would be released from the Project, overlooked significant hydrologic assumptions and procedures, proposed inadequate mitigation, overlooked significant impacts, and failed to discuss and evaluate noise impacts of the transmission line, hazardous waste minimization and recycling, and vibration impacts. As a result, the DEIR has substantially understated the impacts that the Project would have on the local environment.

The Projects would have numerous significant impacts that were not identified in the DEIR. These include violation of ambient PM10 standards during construction; significant odor impacts in a wide area around the facility including Lava Beds National Monument during construction, normal operation, and upset conditions; significant air quality impacts from burning of cleared vegetation; significant acute health impacts; significant air quality impacts from the deposition of metals in Medicine and other nearby lakes; significant impacts on the aquatic biota in Medicine and other nearby lakes from acid rain; significant reduction in the water level of lakes and in the discharge of springs, significant impacts to vegetation from the deposition of boron and fluorine; and significant worker and public safety impacts from accidental chlorine release, among others.

As discussed in my comments, the DEIR must be revised to correct these errors and omissions and to use standard procedures. The significant impacts must be discussed, mitigation evaluated and proposed, and the DEIR recirculated for public review.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AH.2 This area contains ancient forests and an ecosystem which warrants the highest level of protection. These projects would destroy ancient forests, degrade the ecosystem, and destroy the visual, recreational, and spiritual values of this beautiful area. *(Ray Newkirk, Santa Cruz Rainforest Action Group)*

AJ.1 "...because of the moderate forest cover of ponderosa pine and junipers, the presence of the proposed line would not substantially alter the intactness of the landscape character as perceived from Tionesta..." (Pg 4-169)

"Project construction would also not be expected to affect property values in Tionesta. ..... In addition, there are five existing transmission line corridors with multiple lines in the vicinity of Tionesta. Placement of I - an additional transmission line within the area is not expected to negatively affect property values." (Pg 4-301)

"At Tionesta, a portion of segment C1 of the transmission line would be visible. .... The proposed transmission line would not be expected to be visually prominent in the landscape around fionesta and would not significantly affect views from Tionesta. (Pg 4-302)

We consider these statements to be ill-founded and incorrect. *(Larry Hearne, et al., Tionesta Residents)*

AK.3 CalEnergy and CalPine want to construct a geothermal power plant in the Medicine Lake Highlands. 18 acre power plant acres of well sites over 20 miles of 120 foot electrical towers not to mention all the new roads which would be needed. Imagine suggesting this for the Vatican. My intention is not to be profane but sometimes I wonder when we will wake up. Are our grandchildren going to have to watch documentary videos to see what it was like??? We have a responsibility to act responsible here and now and 1 am hopeful that you will make the choice which reflects the highest well being for us all. *(Wise Earth Council)*

AN.4 The devastation from new roads, power lines, and pip lines is enough to make a person sick at the thought. All for the almighty dollar for big business to tear up more of the land. "Public Land"? *(John Aquila)*

AP.3 The developers are underplaying its effects on the environment. A project of this size and kind would eliminate many of the present reasons for visiting Medicine Lake, not to mention what it would do to the national animal habitat. *(Ashalyn)*

AR.5 (5) The EIR Section 4.21 states there will be irreversible environmental changes of non-renewable resources. Also the danger of trucking hazardous materials, well blowouts (1 in 1984 on a test well) and emissions from accidents and improper handling.

(6) The EIR Section 4.19 states there will be unavoidable effects ranging from removal of habitat, plant emissions and impacts on cultural values. Read your EIR before you tell us "no problem".*(Marcia Barrow)*

AR.7 Siskiyou County may be the most sparsely settled county in California, but we are passionate about our wilderness areas and the rights of our people. This land belongs to <u>us</u> and you no longer have the right to sell it and our heritage.

The BLM and Forest Service have lost sight of what their true function should be; which is the protection of our forests, streams, and wildlife, and not the marketing of it.

We, the citizens of Siskiyou County will do everything legal at our disposal to block any and all further development in the Medicine Lake Highlands. *(Marcia Barrow)*

AS.4 During the planning process please take action to insure that the natural and pristine qualities of this region are not degraded. I am opposed to energy development that would negatively impact the old growth forests and associated wildlife populations. *(Brian B. Beard)*

BC.1 The Fourmile Hill Geothermal project will destroy the Medicine Lake area. It is a spiritual place where wild life, recreation and the invironment will be distroyed. It also will affect:

A. Noise

B. Poluting the air

C. Property value

D. Forest

E. Eagles, deer other wild life

F. possibly affect Medicine Lake water level. *(Louie J. Capoyilla)*

BH.5 Pages S-8 and S-9 which show Alternatives indicate that every natural resource in the regional will be adversely effected. The most blatant arrogant show power is the total 100% acknowledgment that Medicine Lake water quality and quantity, along with a remarkable old growth forest will be ADVERSELY EFFECTED GREATER THAT PROPOSED ACTION IN TOTAL. *(Richard S. Cimino)*

BH.10 I feel very strongly that is project will have a life long lasting effect on Medicine Lake its water quality it water quantity, the air quality of the region, the wildlife habitat will be impacted beyond any computer models you have Gerry rigged. This is a very poor decision of the management team of the Modoc

National Forest, it is very short sighted and smacks of special interest projects pedaling on public land. *(Richard S. Cimino)*

BI.1 We are very concerned/against about the environmental effects of the geothermal project. For example,

1. On wildlife (Deer, Bear, Fish, Squirrels, etc.)
2. Chemical Pollution (Sulfur, etc.)
3. Lines (power through forested area)
4. Effects on homeowners (cabins) etc.
5. Possible side effects on volcanic disturbances. *(Steven and Nancy Cook)*

BQ.37 In summary, Mr. Sharp, we are asking that there be an assessment of the areas that we have questioned in the Draft EIS/EIR. We believe there is no economic justification for this project and we have serious questions about parts of the Draft EIS/EIR. We believe that important parts of the public have not had an adequate opportunity to be informed and to respond about this project and we are concerned about the cumulative effects of similar projects in this area. We only need to examine the Draft EIS/EIR to see what the long-term environmental consequences of this project will be. Mr. Sharp, our families have grown up in the West and we have seen the loss of many truly unique natural treasures because of the drive for economic development. How does this project reflect a sprit of collaborative stewardship, by depriving more than 40,000 people a unique recreational resource and increasing the energy cost for 45,000 homes? Medicine Lake is truly a unique place, one of the last, best places in Northern California. The public does not need this power plant, Calpine and BPA do not need their profits, as much as we all need what Medicine Lake has to offer, as it is today. If this plant is built, the negative environmental effects will be with us for the next 45 years, there is no need to rush judgment on this project. *(S. Peder and Suzanna S. Cuneo, et al.)*

CE.2 Destruction of one of our nation's greatest natural treasures does not justify the limited benefits and environmental and cultural costs of visual blight, habitat loss, and infringement on the religious practices of Native Americans. *(Paul Emery)*

CF.1 The noise and "pollution" this project will create will spoil this beautiful area. *(Cindy Engstrom)*

CL.2 All emissions of chemicals undesirable. Wildlife migrations interrupted and destroyed. And what happens to the fish in the lake? Visual, air, ground, water pollution too horrendous. *(Catherine Gardner)*

CT.4 The year-round water source would be compromised for a power plant and the needs of well sites, power towers and powerlines will drastically change an area that deserves national monument status to protect the wild character and habitat.

The last visit I made to Medicine Lake was a stunning experience that I hope to repeat without being assaulted by geothermal development. *(Sylvia M. Gregory)*

DC.3 The negative impact on the environment, the flora and fauna, the geology, the Native American ceremonial sites and recreation, will change the face of the Medicine Lake Highlands forever. *(Anita E. Henning)*

DG.1 I hope you will reconsider allowing any company to establish a geothermal complex in the Medicine Lake Highlands area.

This area is very valuable as it is and very fragile. Once it is comprised it would never be returned to its former value. *(Shirley Hill)*

DT.2 First: The Draft EIS/EIR acknowledges that the Medicine Lake region will suffer extensive adverse effects as a result of the Four Mile Hill Geothermal project. The project will harm air and water quality, diminish animal habitat, create noise pollution, and impact Native American cultural sites. *(Carolyn D. Jones)*

DW.3 Second and more importantly, the proposed project will result in irreparable harm to the Medicine Lakes area. A project of this size and its attendant power lines will severely impact the area's biotic, wildlife and recreational resources. Furthermore the project has the potential of marring Native American ceremonial sits located in the area. *(Mike Keesee)*

EE.2 The addition of power lines and generation plants will result in the degradation of recreational, scenic and wildlife values. the project is not the best use of our public lands. *(Mark Langner)*

EO.2 That the projects could be found to be of "no significant impact" to the areas concerned indicates complete ignorance of the fragility of the Medicine Lake area. *(Natalie Macy)*

EU.1 Please, no more power plants in California, especially not in the Medicine Lake Highlands of our Modoc National Forest. *(Frances Martin)*

FF.2 The plant would be noisy, dirty and an eyesore; not to mention that overhead transmission lines are a determent to any scenery. *(Victoria K. Miller)*

FJ.2 Although I am sure that these energy companies claim that their impact on the land will be minimal, any intrusion of this nature will be devastating for both the wildlife and the sheer scenic beauty of this yet unspoiled land. *(Carolyn J. Mosher)*

FO.2 I was born and raised in Northern California and have been vacationing at Medicine Lake for the past twenty years. This is an area of high recreational value, and has been promoted (and developed) as such by both the Forest Service and local communities. This area is also unique because of its volcanic geology, cultural resource values, and abundant wildlife. As I'm sure the EIR indicates, the proposed project area around Medicine Lake is habitat for nesting Bald Eagles, Osprey, and Cooper's hawks (probably Spotted Owls and Goshawks also), as well as mountain lion, black bear, marten, mule deer and a host of other species. In short, an area of significant biodiversity that has sustained itself despite increasing recreational use and consistent timber harvest. Unlike the latter two uses however, which are short-term and seasonal in nature, the proposed development is neither short-term nor seasonal. This proposal is NOT compatible with the existing values of the area. I grew up near the geysers project in Lake County, California and have seen first hand how the significant adverse effects of a geothermal development can wreak havoc with part of an ecosystem. *(Eric T. Nelson and Martha Spencer)*

FU.2 I am sure you are aware of the fact that when the bright lights go on and all the generators rumble on all day and night, it will not only drive away outdoor-loving people (and ruin the value of our property). They will also drive away the songbirds and other wildlife in the area. *(Olga E. Orr)*

FX.2 I have no new arguments to add to those you've heard before:

Wildlife migration

noise and visual pollution

air pollution

destruction of wilderness. *(Jacquie Parker)*

GF.1 I am writing this in regard to the Fourmile Hill Geothermal Project. I am concerned about the environmental impact of the proposed project. First of all, I do not see much benefit of the plant(s). *(Sarah Poaler)*

GL.3 Regardless of who the power is sold to, we find it completely unacceptable to destroy the ancient forests involved, the wildlife habitat, the roadless areas which help maintain the habitat, and the Indian religious sites. We would like to see Medicine Lake Highlands become a national monument. In the meantime, its wild nature needs to be protected. *(Deirdre and Randy Rand)*

GN.2 know the wildlife and the beauty around this would be changed, as well as are miles away. *(Verna Reed)*

GQ.2 As has been pointed out, the negative impact on the environment would be severe. The Medicine Lake Highlands, the native flora and fauna, the geology, Native American ceremonial sites, and recreation will all be severely impacted or destroyed. My wife and I have both been to Medicine Lake. *(Walter Rivers)*

GW.2 Not only would this pristine lake be affected, and the area in its vicinity destroyed, but the flora and fauna, the geology, the Native American ceremonial sites, and the recreational use of the area would be severely impacted. *(Fai Schwarzenberg)*

HD.1 This letter presents comments on the subject EIR/EIS. I am a Registered Geologist and Professional Engineer in the state of California and am deeply concerned with the lack of information available to adequately review the proposed geothermal project. Based on a review of the subject report, there appears to be insufficient data to evaluate the potential environmental impacts due to the proposed project or determine the need for the project in accordance with the intent of the Geothermal Steam Act of 1970 and the Energy Policy Act of 1990. In additional, my family has owned a residence near Medicine Lake for more than 30 years and I am also concerned with the evaluations contained in the report regarding the visual effects, and the effects to wildlife and vegetation due to the project. *(Amanda Spencer)*

HF.15 Given this kind of evaluation in this case, how are we to assess the evaluations of the report on other areas where the effects are listed as adverse, such as the effects on the Medicine Lake water quality, effects to historic or archaeological resources, effects on traditional cultural values and uses, effects on vegetation, effects on views from Medicine Lake and Lava Beds, air quality from power plant emissions, and effects of the noise I from construction and operation? The effects of any one of these factors would be of I significant concern, their cumulative effects would be devastating to the Medicine Lake Highlands. *(Daniel T. Spencer)*

HI.4 In reviewing articles written about the proposed project it is clear that all of the proposed actions, other than the no alternative action, will cause major adverse effects to the environment water quality and wildlife of the region. *(Martha Spencer)*

HJ.2 As a former California resident, I am familiar with the remote and beautiful Medicine Lake Highlands volcanic area south of the Lava Beds National Monument. This area's pristine character, old-growth forests, wildlife, and sacred religious sites should not be sacrificed for this costly and speculative source of energy. The proposed projects would create substantial cumulative adverse impacts, and fragment the landscape with miles of transmission lines, pipelines, and roads. *(Richard Spotts)*

HO.2 I am writing about Medicine Lake area. My two sisters, Louise Thompson and Olga Orr have a cabin there for 30+ years. I have taken my children, grandchildren and now great grandchildren for a vacation from the city for the past 30+ years. What will I tell them when we cannot go there because of the rape of the land, Medicine Lake, the forests and the many animals & birds—large, small. *(Victoria Sturgis)*

HP.5 To full preserve the Native American cultural areas in this region and to save the area from air and water pollution as will to save all roadless areas. *(John R. Swanson)*

HR.2 I have read the proposal for the development of geothermal power which will include wells, well pads, roads and interconnected geothermal fluid pipelines in the Fourmile Hill area which is only three (!) miles northwest of Medicine Lake. I have reviewed the proposed route and am frankly astonished that such a proposal so close to the lake was even considered! I am very aware of the damage to the forest that any such proposal would accomplish, but to carry out such a plan so close to the lake, a valuable recreation area, will result in deforestation, noise, and air pollution is unthinkable. *(Annabel J. Teberg)*

HS.2 California does not need further loss of animal and bird habitat in these oldgrowth forests. We do not need more roads and clear-cutting in our national forests, more blight from power lines, and invasion of areas sacred to Native Americans (and other Americans too). This project would be especially unnecessary since the power generated would apparently be sold to Oregon. *(Larry Thompson)*

HT.1 I read the EIS/EIR report and here are some of my observations.

We should consider the entire Medicine Lake area and not just the well pads and transmission lines. It is a unit as a whole - surface and sub-surface, air, water, and atmosphere. *(Louise Thompson)*

HU.3 The noise, air and water pollution of this pristine area - the closest to wilderness that most people will ever see - is unacceptable. *(Louise Thompson)*

HW.2 My husband and I have camped in the area and love it dearly: there is no other place like it. The Medicine Lake Highlands deserve National Monument status. Its old-growth forests, birds, and animals and plants must be protected. *(Joyce T. Todd)*

IC.3 I happen to know that there is going to be devastation to the wildlife and plants (from this geothermal plant) and I am trying my best to see if we can find another solution with this problem with the plant. *(Sharon Villarruel)*

ID.1 I feel that the geothermal project devastates the natural surroundings and endangers the wildlife that encompasses the area. After the project is finished, the ugly pipes are left behind along with the poisonous pools of noxious goo. Do we really need all of this? is it seriously needed? We need to start looking at the effects long term on the land, not for the project. If we don't have people, what good is the project going to do? *(Raquel Walters)*

IE.2 Medicine Lake has a historical Native American heritage dating back thousands of years. The numerous adverse environmental impacts of this geothermal development will not be so easily or quickly remedied. The cost effectiveness of these projects is questionable. The environmental and ecological costs are not. These developments will be extremely costly to the Medicine Lake Highlands, and to the people and wildlife living in and using the area. *(Alysa Waring)*

IF.1 I'm very concerned about the impacts that the proposed geothermal project will have on the Medicine Lake area.

I am a resident of Siskiyou County and I enjoy visiting the lake and surrounding wilderness. I appreciate the pristine quality of the area for camping and hiking and fishing. The untouched beauty and serenity of this priceless area make it worthy of special attention. I'm worried that the disruption and destruction the geothermal project will bring to Medicine Lake Highlands will far outweigh the power it might produce.

It's just not worth the risk to the environment. *(A. Jonathan Webb)*

IG.1 I would like to express my concern about the proposed geothermal project. I don't believe that any benefits we would see from this project could possibly offset the damage the construction and operating of it would bring to the Medicine Lake Highlands.

I don't want to see this wonderful are be cluttered and dirtied with powerlines and machinery. Why take the risk of hurting this beautiful and unique wilderness? It's simply unconscionable to let it happen! *(Debbie Webb)*

IH.2 The smell and the noise will be horrible. The whole environment will change. The animals, insects and old trees will go. Isn't this what we've been protecting all these years, but now it's okay? *(Jerry and Vicky Weber)*

IL.2 The area deserves national monument status to protect its wild character. Until that happens, in the meantime, Medicine Lake Highlands should be protected from geothermal drilling and degradation. Thank you for your consideration. *(Claudia Whitnah)*

IM.3 These prposed projects are so controversial that the BPA should consider the negative publicity that would follow pruchase of the expensive power pruced at this location. *(Brenda Willey)*

IM.5 This is not an "enviornmentally-friendly" way to produce power located where it degrades recretaional use in a recreationally-based economoy, reduces land values; affects Native American cultural sites; reduces wildlife habitat for many species including goshawks, nartens and fishers in a Late Successional Reserve, and disrupts a critical biological link between the Modoc Plateau and the Cascade Mountain. *(Brenda Willey)*

IR.2 The location of the proposed Fourmile Hill Geothermal Project makes it dangerously unsuitable for the following reasons:

-The destruction of the Late Successional Reserve and important wildlife habitat for martens, fishers and goshawks.

-The Native American religious/cultural significance and their ceremonial sites.

-Degradation of the prized recreational area used by a large number of Siskiyou and surrounding county residents.

-The affects to the Mount Hoffman Roadless area. *(Carol Wright)*

IS.1 I am writing to you this morning with grave concern after learning about prospective plans to build two giant geothermal projects in the Modoc National Forest. *(Carter Wynn)*

IU.1 These proposed geothermal projects for the Medicine Lake Highlands are very ill conceived. The largest shield volcano in North America, and maybe worldwide? Native American sacred places, old-growth forests, and rare species? And the potential power to be sold to Oregon? *(Michael Zanger)*

PH4.56 What will the effects of chemical use, emission, storage, and disposal be on humans and wildlife? *(Mount Shasta Public Hearing)*

Response—General Concern About Project Effects

The general concerns about the proposed project's potential effects are noted. The EIS/EIR and the responses to comments address the potentially adverse environmental impacts that could be caused by the proposed project. Within the document, there is an analysis of these potential impacts, as well as mitigation measures proposed to reduce or eliminate impacts. The project alternatives were developed to reduce or eliminate impacts.

For in-depth analyses of potential adverse environmental impacts, and corresponding mitigation measures for the proposed project, please see the following sections of the EIS/EIR:

- Section 4.2 for Geology and Soils
- Section 4.3 for Hydrology
- Section 4.4 for Geothermal Resources
- Section 4.5 for Cultural Resources
- Section 4.6 for Traditional Cultural Values
- Section 4.7 for Vegetation
- Section 4.8 for Wildlife
- Section 4.9 for Visual Quality
- Section 4.13 for Air Quality
- Section 4.14 for Noise
- Section 4.15 for Human Health and Safety
- Section 4.16 for Socioeconomics
- Section 4.17 for Cumulative Effects

Additional clarification of impacts is provided in the responses to comments. The comments are grouped by topic to provide a comprehensive response to related issues.

INCORPORATION OF OTHER COMMENTS BY REFERENCE

Several commentors referenced the comments made by other individuals and requested that other comments be incorporated by reference. These requests are noted and presented here. Responses to the referenced comments can be found by consulting the Comment Index (Chapter 7 of this volume) to identify the author's comment letter designation, and noting the page numbers where the comments and responses can be found.

Comments—Incorporation of Other Comments By Reference

K.2 Unfortunately, we do not have time to focus on the innumerable flaws and biases in the EIS/EIR's analysis of water quality, Native American spiritual concerns, air quality, visual quality, etc. On the other hand, we trust our Native American and conservation friends will address these topics. As a result, we would like to incorporate by reference all of the comments on this project provided by the following organizations:

- Klamath Forest Alliance
- Sierra Club
- Wilderness Society
- Friends of the River
- Fall River Resource Conservation District
- Fall River Wild Trout Foundation
- Save Mount Shasta Association
- Pit River Nation (including all associated bands)
- Shasta Nation (including all associated bands)
- Klamath Nation (including all associated bands)
- Modoc Nation (including all associated bands)
- Seventh Generation Fund
- Medicine Lake Citizens for Quality Environment *(Ryan Henson, California Wilderness Coalition)*

T.1 I have been asked to review and submit comments on the Draft EIS/EIR for the Fourmile Hill Geothermal Development Project on behalf of the Medicine Lake Citizens for Quality Environment, a citizens' group formed in response to Calpine Corporation's proposal to develop Fourmile Hill. It is comprised primarily of the owners and users of recreational cabins and facilities of the Medicine Lake area.

Members of the Medicine Lake Citizens group have consulted with members of other affected interest groups about the proposed development project. These other groups and individuals have far more knowledge and expertise about specific topics than we, and for that reason we would like to adopt their comments as our own. For purposes of legal standing, then, we would ask you to consider their concerns to be ours as well. In particular, we would incorporate as our own the issues and concerns expressed by Medicine Lake property owners, native Americans, Fall River Wild Trout Foundation, California Wilderness Coalition, and Klamath Forest Alliance. Individuals whose letters of comment represent our concerns include, but are not limited to: Janie Painter, Jerry Turek, Carol Plank, Michelle Berditschevsky, Phil Woodward, Louise Thompson, and Suzanna and Peder Cuneo.

(Linda L. Blum, Medicine Lake Citizens for Quality Environment)

Y.1 We are writing in response to your request for public comments on the Draft Environmental Impact Statement/Report (DEIS/EIR) on the proposed Fourmile Hill Geothermal Development proposed for the Medicine Lake Highlands.

Since 1988, our non-profit public interest organization has been dedicated to the preservation of environmental and cultural values in the Northern California area. We have put this commitment to work in the Save Mount Shasta Project, the H.O.M.E. (Honor Our Mountain Environment) Stewardship Project, the Toxics Action Committee and others, have worked in close cooperation with the Native Coalition for Cultural Restoration of Mount Shasta, as well as conducted numerous educational and cultural events in the area. Our constituency numbers over 4,000 thousand people and is committed to preserving the beauty of the natural and cultural environment of this bioregion.

These comments incorporate by reference the comments of other groups with which we are cooperating. These include the Pit River Tribe, Quartz Valley Indian Reservation, the Modoc/Klamath Tribes, the Shasta Nation, the Native Coalition for Cultural Restoration of Mount Shasta, Medicine Lake Citizens for Quality Environment, the California Wilderness Coalition, the Klamath Forest Alliance, Medicine Lake

Homeowners Association, Fall River Wild Trout Foundation, and the Fall River Conservation District.
(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

AB.9 For the purpose of legal standing, we ask you to incorporate by reference the comments and concerns of the signatories to the attached letter dated September 21,1997. Incorporation by reference refers to comments made by individuals as well as organizations on the attached letter, as well as Philip Woodward, Louise Thompson, Suzanna and Peder Cuneo, other members of the Medicine Lake Citizens for Quality Environment, and the Fall River Resource Conservation District.
(Michelle Berditschevsky, Native Coalition for Cultural Restoration of Mount Shasta)

AG.4 These comments are supported by the expert analyses of Dr. Phyllis Fox of Russell Resources, Inc., Dr. Karen Weissman, Victoria Harris, and Wendy Poinsot of Thomas Reid Associates, and David Marcus. Dr. Fox holds a Ph.D. in Civil/Environmental Engineering and has extensive experience in analyzing environmental impacts associated with energy development projects, including impacts on air quality, hydrology, and public health and safety. Dr. Weissman has a Ph.D. in Biology and has prepared and reviewed numerous environmental impact studies and reports. Ms. Harris has been an environmental consultant since 1981, and has particular expertise in the fields of impact assessment and habitat conservation planning for rare and endangered species. Ms. Poinsot has been an environmental consultant since 1987, and has worked extensively with geotechnical reports, noise assessments, and cultural resource investigations. Mr. Marcus has an M.A. in Energy and Resources, and has a broad background in analyzing energy-related issues. The analyses of these experts can be found in Exhibits A through C, and are incorporated into these comments by reference. Their analyses should be responded to separately. *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AT.1 Many people have stated their objections to this project on the basis of the negative impacts upon the wildlife, including threatened animals, and recreational amenities. We concur with these concerns, therefore, we will not repeat these environmental issues. *(Kenneth and Leona Beatty)*

BT.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(W.S. Denham)*

IV.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(Shawn Adams)*

IW.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(D. Ano)*

IX.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(Dick Carnell)*

IY.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(Laurie E. Denham)*

IZ.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(Tobin E. Frank)*

JA.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(Ross Loffmoy)*

JB.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(Dawn E. Parkhurst)*

JC.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(Matt Parkhurst)*

JD.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(Robert J. Piper)*

JE.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(Mark Sowert)*

JF.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(Stacey Sowert)*

JG.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(Ken Wallace)*

JH.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(LeRoy Walland)*

JI.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(A. Clayton Whitmarsh)*

JJ.1 I would like to express my support for the position taken by Bill Dart in regard to the geothermal development project in your district. *(Bob Wolf)*

Response—Incorporation of Other Comments By Reference

The comments incorporated by reference, and support for the comments of others are noted. Responses to the referenced comments can be found by consulting the comment index (at the end of this volume) to identify the author's comment letter designation, and noting the page numbers where the comments and responses can be found. The comment letter from Bill Dart of the American Motorcyclist Association is designated as Letter H.

STATEMENTS AND OPINIONS

Comments—Statements and Opinions

H.1 In response to the Fourmile Hill Geothermal Development Draft Environmental Impact Statement/Environmental Impact Report, I am submitting my comments on behalf of District Thirty Six of the American Motorcyclists Association (AMA), the California/Nevada Snowmobile Association (CNSA), the Blue Ribbon Coalition, and my family. The proposed project will have significant unmitigated negative impacts under all action alternatives, with the proposed alternative having by far the most negative impacts as identified within the Draft EIS/EIR document.

(Bill Dart, American Motorcyclist Association)

H.4 AMA District 36 is a non-profit association of several thousand northern California and Nevada families that participate in motorized recreation on public lands in the region, including the Medicine Lake Highlands. I am the Legislative Officer for AMA District 36. The California-Nevada Snowmobile Association (CNSA) also consists of several thousand families that participate in snowmobiling in the region, and particularly the Medicine Lake Highlands. I am a past member of the Board of Directors CNSA, and I have been authorized by CNSA President Ron Rawlings to comment on behalf of CNSA regarding this project. The Blue Ribbon Coalition is a national coalition of over 500,000 motorized recreationists and organizations, of which I am also a member of the Board of Directors. I grew up in Tulelake, where my parents and my wife's parent's still reside. I have visited Medicine Lake regularly since the mid 1950's during the summer and fall, and since the mid 1960's during the winter on snowmobiles. My wife's parents own a cabin on a Forest Service lease at Little Medicine Lake, which we use regularly both winter and summer.

Medicine Lake has always been extremely important to regional residents, and increasing so to the growing number of visitors from more distant origins, as the only nearby high elevation clear water lake in California. It is a major recreation resource for sight-seeing, fishing, water-skiing, camping, hiking, hunting, snowmobiling, cross country skiing, off-highway vehicle recreation, and just getting away from the heat during the summer months. The Medicine Lake Caldera retains a very natural appearance overall, which is also a significant part of its intrinsic value. The absence of significant night time light sources for scores of miles is also valued, since stargazing is outstanding in the area.

My comments are focused on visual, noise, recreation conflicts, light pollution, transportation, and cumulative impacts of Fourmile Hill and the Telephone Flat projects.

(Bill Dart, American Motorcyclist Association)

J.3 We further recommend that this area be managed by the BLM and the US Forest Service for its natural, recreational, historical and cultural, as well as spiritual values, which benefit the greater public and represents the highest and best use of the area. Development of this area for geothermal power is a gross abuse of the public's trust, which would benefit a corporate industrial entity while ignoring the public's desire to maintain this area in its present natural condition. *(Vivian Parker, California Native Plant Society)*

Q.2 While geothermal energy may be "greener" than many other forms of energy, it is not worth the long term degradation of important wildlife habitat and sacred Native American sites for short term energy production and profits for the corporation developing this energy. If as much money and effort were put into energy conservation or developing more efficient uses of energy as has been (and will be if it proceeds as proposed) put into this project, we would be a long way towards living more sustainably.

(Lori J. Cooper, Klamath Forest Alliance)

R.5 The development and destruction of cultural areas has been a common practice by the Euro-Americans for the last 200 plus years. Today there are very few cultural areas that have not had some kind of alteration done to them. It is very important that federal land managers understand that these type of projects can cause irreplaceable harm to sacred areas. This has been a longtime problem for the Tribes, educating other cultures to not only be sensitive but also to protect and preserve places like the Medicine Lake area as a whole. *(Dino Herrera, The Klamath Tribes)*

T.3 The proposed project is highly controversial because of the adverse environmental and social impacts which cannot be mitigated or are being unreasonably and inadequately mitigated. Native Americans

from several different tribes and councils, cabin owners at Medicine Lake, snowmobilers, hunters, and fishermen—long-time, regular users of the Medicine Lake area—will be significantly and adversely affected by the proposed project. Their traditional uses of the area will be impacted by air and noise pollution; acid rain or acid fog damage to plants, water, and fish and wildlife; fragmentation and loss of forest ecosystems throughout the extent of the Fourmile Hill Geothermal Development Project Page 2 transmission line corridor; light pollution at night; and visual and aesthetic quality degradation due to both t-he power plant and the transmission line.

(Linda L. Blum, Medicine Lake Citizens for Quality Environment)

U.26 The Medicine Lake area is a very special place. It is a pristine remote region that needs to be saved. There are no telephones or power lines, no stores or gas stations. It is a beautiful recreation destination. It is a true visitors paradise, enjoyed by campers, hikers, fishermen, hunters and all recreationalists. There is not another place left in California, like Medicine Lake.

Industrial and commercial developments have ruined so many beautiful areas of our state. This last summer, President Clinton and dignitaries visited Lake Tahoe. There they witnessed first hand commercial devastation of Lake Tahoe and the effects on the surrounding environment. Why are the US Forest Service and BLM promoting industrial devastation for Medicine Lake? Medicine Lake is the Crater Lake of California, can they afford to promote the devastation of such an unique area? When will it stop?

The people need Medicine Lake for relaxation and recreation. The people do not need over priced electrical power development that will create irreversible environmental damage to California's last pristine getaway. *(Janie and Rob Painter, Medicine Lake Citizens for Quality Environment)*

W.4 Medicine Lake has a historic Native American heritage dating back thousands of years. The numerous adverse environmental impacts of this geothermal development will not be easily or quickly remedied. The cost effectiveness of these projects is questionable. The environmental and ecological costs are-not. These developments will be very costly to the Medicine Lake Highlands, and to the people and wildlife living in and using the area. *(Carole Plank, Medicine Lake Citizens for Quality Environment)*

W.5 The location of these projects are on "our land". The Forest Service and the Bureau of Land Management are paid by "us" to protect our lands. Will the USFS and the BLM allow our properly to be desecrated for the "almighty dollar"? *(Carole Plank, Medicine Lake Citizens for Quality Environment)*

Y.3 The Medicine Lake Highlands is an area of superlative beauty and solitude. The area has previously been proposed as part of the Lava Beds National Monument, and contains three roadless areas. In addition, as the easternmost habitat of the northern spotted owl, it contains a late successional reserves under Option 9 of the Northwest Forest Plan, and harbors a number of other species that are endangered, threatened or of concern, including the pine marten, goshawk, bald eagle, osprey, pileated woodpecker and peregrine falcon. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

Y.8 We have reason to believe that there is considerable bias and favoritism on the part of the USFS/BLM in promoting this project, and we have grave concerns that the final decision made will not be an objective one, genuinely weighing the environmental and cultural impacts against the purpose and need of the proposed development. *(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)*

Y.13 The National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) review process for the Fourmile Hill project appears to be on a fast track, presumably to meet Calpine's agreements with the Bonneville Power Administration (BPA), and in order to obtain subsidies from the California Energy Commission and qualify for tax credits; but most importantly to escape a complete environmental review of the cumulative impacts including the Telephone Flat Project for which another NEPA and CEQA review is underway, and other potential projects in the Medicine Lake Highlands. There would be "unavoidable significant effects" on Native American traditional cultural values and long-term visual effects, not to mention severe impacts on water and air quality, forests and wildlife.

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

Y.55 The project appears not to be able to stand on its own but will rely on a $2 million annual subsidy from the California Energy Commission (CEC) pending the approval of the DEIS/EIR. If the CEC funds this as benign "green" energy, it would be a terrible misuse of taxpayer monies. We believe that CalPine may also be benefiting from tax credits for this project, but do not yet have sufficient information on this.

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

Y.59 We believe that the public is being misled by the USFS/BLM in that the proposed development is being passed off as a "green energy" project with low impacts to the environment. This is *absolutely* not true for a forested culturally sensitive pristine area such as the Medicine Lake Highlands.

(Michelle Berditschevsky, Mount Shasta Bioregional Ecology Center)

Z.1 I am writing you this letter not as an advocate or an opponent, but as a neutral President of the Mt. Shasta Snomobile Club. Unfortunately I have not been able to attend any of your local public hearings regarding the Fourmile Hill Geothermal Development Project, but several members of our club have attended meetings, one of them you might have heard of is Chuck Best from Weed, CA. I believe our

club is split on their views of this project. I'd like to address some of the concerns of our members in this letter.

Some members do not want this project to happen. They have many concerns and do not want to give up any of their snowmobiling areas.

Some members think this project is good for our community and it will create much needed jobs and revenue. They support this project. *(Eileen K. Maier, Shasta Sno-Mobilers Inc.)*

AG.1 We represent the Plumbers and Pipefitters. U.A. Local 228, the Plumbers and Steamfitters, U.A. Local 342 (the "Unions"), and John D. Coots, and James Gholson. These unions represent thousands of construction workers, many of whom live near, visit, or recreate in the Medicine Lake area. Messrs. Coots and Gholson are union members who regularly visit and recreate in the Medicine Lake area.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)

AG.2 The Unions and their members are interested in sustainable economic development. Continued environmental degradation may jeopardize future jobs by making it more difficult and more expensive for business and industry to expand in California, and by making it less desirable to live here. Continued degradation can, and has, caused construction moratoriums and other growth restrictions which, in turn, reduce future employment opportunities.

Additionally, construction workers themselves live in and use the areas that suffer the impacts of environmentally detrimental projects. Union members breathe the same polluted air that others breathe, and suffer the same health and safety impacts. Unions have an interest in enforcing environmental laws to protect these workers.

Construction workers are concerned about projects that cause serious environmental harm without providing countervailing economic benefits such as decent wages and benefits. Both the National Environmental Policy Act ("NEPA") and the California Environmental Quality Act ("CEQA") provide a balancing process whereby economic benefits are weighed against significant impacts on the environment. (40 C.F.R. ß 1508.14; Cal. Pub. Res. Code ß 21081(a)(3); 14 Cal. Code Regulations ("CCR") ß 15131; Citizens for Sensible Development of Bishop Area v. County of Inyo (1985) 172 Cal.App.3d 151, 171 [217 Cal.Rptr. 893].) *(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342 et al.)*

AG.265 At your request we have reviewed the Draft EIS/EIR for the Fourmile Hill Geothermal Development Project. We find that the document is fundamentally flawed in that it does not establish: (1) a description (qualitative and quantitative) of how the project generates impacts, (2) a proper frame of reference for assessing the impacts, or (3) a quantitative analysis of receptors and receptor sensitivity to impacts. The organization of the document is backwards: sensitive receptors are defined irrespective of their relationship to project components and then the document attempts to relate the project to the receptors. Consequently, the document spends most of its time discussing impacts that are less-than-significant, leaving the reader unclear about what are the truly significant impacts of the project that should require mitigation, or whether alternatives would substantially avoid or reduce impacts.
(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AG.267 Before providing comments on the inadequacies of the EIS/EIR, it is helpful to consider how a proper impact assessment should be conducted. The project itself should first be carefully delineated, *as an impact generator,* which also includes the definition for each project component and environmental factor, and the zone in which there could be significant impacts. Then the project should discuss which potentially sensitive receptors are actually located within the zone where significant impacts could be felt. The combination of a certain level of impact within a certain zone *and* the presence of receptors within the zone together constitute a significant impact requiring mitigation.

The project has three primary components — power plant, well field, and transmission line — each of these produces a distinct set of potential impacts on environmental resources. The location for the power plant and well field are relatively fixed by the location of the geothermal resource while the transmission line can occupy any one of several alternate routes. Thus, for the well field and power plant, mitigation (onsite or compensatory) may be the primary means of reducing impact, while for the transmission line, impact may be avoidable by selection of an alternate route. This point needs to be made clear from the start of the analysis.

To assess impact, then, each component of the project should be described in detail as to how it produces impact. The following matrix may be helpful. It is meant to be illustrative only, not comprehensive. It addresses some impacts of construction of the power plant. After understanding how the project produces impact, one can then define a zone or zones where the impact may be felt (e.g. onsite, immediately adjacent, within 500 feet away, one-quarter mile away, one-half mile away, 1 mile, 1-5 miles, beyond 5 miles etc.). For example, some impacts may be significant only in the closest zone or zones, others may be significant as far away as a mile. Some impacts may be perceptible at greater distances, but only significant at near distances. This is what is meant by the frame of reference.

In addition, the significance of impact is guided by the nature of the receptors, their sensitivity to impact, and features which may reduce potential impacts. For example, hikers in the nearby forest may see the power plant or hear noise from well field operation. But to determine whether this is a significant effects

requires (1) a *quantification* of receptor numbers (e.g. the number of hikers -- 10 hikers a month is not significant, but 500 would be), (2) *distance from the impact generator* -- whether they are close enough to the site to even notice the noise, and (3) *impact reduction features* -- whether intervening vegetation or topographic features would block their view of the plant site or steam plumes. The discussion of impacts in the EIS/EIR, in many instances, is pure conjecture and does not give any information with regard to significance because it does not provide an analysis according to the above criteria which serve to discriminate between significant and non-significant effects.

MATRIX OF IMPACT GENERATORS, ZONES AND RECEPTORS

POWERPLANT IMPACT GENERATORS	EXAMPLES OF DISCIPLINES AFFECTED/ MEASUREMENT TO BE REPORTED IN EIR	EXAMPLES OF ZONE OF POTENTIALLY SIGNIFICANT IMPACT	EXAMPLES OF SENSITIVE RECEPTORS WITHIN ZONE
Construction	Geology and soils (grading, erosion and slope stability)	Construction site	
	Hydrology (sedimentation)	Watershed downstream of site	Aquatic life (fish, invertebrates) potentially affected by changes in water quality
	Noise (noise levels emitted by all equipment)	Areas within 1 mile of construction sites	Recreationists; Traditional cultural resource users; Residences (if any);
	Air Quality (dust, vehicular emissions)	Zone downwind of work site	Residences (if any); workers
	Vegetation (area of disturbance or vegetation removal)	Work site; access roads; equipment storage areas	Special status plant species; plant communities
	Wildlife (vegetation removal, noise, activity)	Work site; access roads; zone of noise impacts	Mule deer herd; other species using site
	Cultural Resources	Site and construction disturbance area	Significant pre-historic resources
	Traditional cultural resource values	Traditional use sites close enough to experience noise or visual impact	Significant traditional use sites identified by Native Americans

(Lizanne Reynolds, et al., on behalf of Plumbers and Steamfitters U.A. Local 342, et al.)

AI.1 We welcome this opportunity to comment on the Draft Environmental Impact Statement for the Fourmile Hill Geothermal Development Project. The Renewable Northwest Project (RNP) is an organization consisting of environmental groups, consumer organizations, renewable energy developers and energy efficiency companies. Northwest Environmental Advocates (NWEA) is an environmental advocacy organization working on clean air and clean water issues.

RNP and NWEA work to move the electricity generating system to a more sustainable path, including the implementation of environmentally responsible renewable technologies. Recently, RNP and NWEA also led the development of a new law in Oregon creating the first mandatory standards in the US to control the emissions of the most prevalent global warming gas, carbon dioxide.

Renewable resources need to be examined within the context of the resources they can displace or help avoid. Proceeding with a properly sited project will benefit the region's environment and help to shift the region away from fossil fuels and toward environmentally benign and sustainable power resources. We support the development of Fourmile Hill Geothermal Project, as outline in the preferred alternatives in Draft EIS, for the following reasons and with the following qualifications.

(Rachel Shimshak and Peter West, Renewable Northwest Project)

AK.1 We have the technology to use alternate forms of energy which do not require devastating our sacred lands. When you consider this project I respectfully request that you consider your grandchildrens' grandchildren. It is true that what we do now is the legacy that we leave for our future. We become the ancestors who did the thus and so's. *(Wise Earth Council)*

AL.4 I am not willing to sacrifice our natural treasure, Medicine Lake Highlands, so that a few can make a few dollars.

How about trying a little conservation of our resources before destroying another priceless area. Let's begin to control progress and growth before we are driven to commit irreversible mistakes.*(Barbara Allen)*

AO.6 I am still in a state of shock and disbelief that the USFS, BLM and our County Supervisors, the "Caretakers of the Public Lands" would have ever given the slightest consideration to any of these projects. *(Mildred J. Aquila)*

AQ.3 The earth is a living, breathing entity who has been very patient with human disrespect and destruction of her body. Her patience is running short. How much more will she take before shaking us off like water off a dog?! I'm not joking—this is real. *(Barbara Barr)*

AW.1 These are comments of both my son and me – M. Blakeney-JB Blakeney. Having attended meetings this summer held at the Shilo Inn both of us feel very definitely that this project is in no way constructive. There are so few pristine areas left for us to enjoy. For example, our National Parks are all being noticed as polluted, overrun and and are costing millions of dollars to remedy and repair. *(Marian and Jack Blakeney)*

AW.4 Why destroy the Caldera??!! *(Marian and Jack Blakeney)*

AX.1 I recently read of the proposed GEOTHERMAL project at Medicine Lake and thought this won't come to pass. It would be like going into a national cathedral and deciding to drill because it would be profitable. We would never allow that to happen and yet when it comes to our Natural Resource Treasury we seem to be quite asleep. Please ensure the safety and well being of this land you are entrusted with. 100 million dollars to construct the 4 megawatt CalEnergy Telephone Flat Project is simply not cost effective. *(Susan Bradfield)*

AX.4 Please do sell this in order to generate funds for the BLM and FS. Go to the public and let them know you need greater funding and watch the taxpayers speak out in behalf of protecting the land. It is our heritage to our grandchildren. Of course we are willing to protect it. We just need to be informed. *(Susan Bradfield)*

AZ.1 My personal opinion regarding the geothermal development in the Medicine Lake area is another disaster to our environment. Why keep destroying our federal and state parks, along with beautiful pristine areas throughout our country for the damned almighty dollar. *(Ann Brightwell)*

AZ.3 I have spent many wonderful days in the Medicine Lake area and I can not imagine allowing its destruction. I hope it can be stopped. The people in the good old USA have got to get involved in keeping this kind of development from happening. Too bad the property owners in the Medicine Lake area didn't take action when it was known that a geothermal project was in the making eight years ago. I wish them well at this late date, but I'll be happy to join them in stopping the Fourmile Hill Project and any others to follow. This land belongs to all of us. Let's keep it that way. God help us. *(Ann Brightwell)*

BA.1 Day in and day out we the people suffer thru more and land closer's and boundry changes, as an avid snowmobler I can forsee the emmate closer of these areas to the winter recreationalist and hunters.

I see no problem with this type of project if it didn't cause such circumstances as it will. The proven plan of giving back some of the wilderness areas that you've stolen from us in the past would be the only way you'll get any support from me or the community at large. *(Kevin Brooks)*

BD.2 This area should be completely protected as wilderness, not commercially developed. It contains many species that need to be protected, ancient forests, and biodiversity values. Any electricity generated will only be of short-term value but the loss of the wilderness character of these lands will last forever. We don't need any more development in such areas. *(Alan Carlton)*

BE.1 I am writing you regarding the proposed Fourmile Hill Geothermal Project planned for the Medicine Lake area. I have attended five of your hearings, and there seem's to be more question's than answer's given to the general public. *(Paul Carter, Jr.)*

BE.2 I failed to see very much support for the project. The only support I have seen is from the commercial interest's and bureaucrat's with dollar sign's in their eye's. *(Paul Carter, Jr.)*

BE.3 The people proposing this project do not really know what the effect will be on the environment, or the Medicine Lake area. *(Paul Carter, Jr.)*

BH.2 I have a full copy of the Draft EIS/EIR. and I reviewed it. I have followed this project from its beginning and been in early communication with the consulting firm in Burlingame, California. The consulting firm was very unprofessional, not responding to my earlier requests for information. I even send register mail in hope of creating a dialog. Having said this, does not make me feel better about this development. *(Richard S. Cimino)*

BH.3 It seems very clear to me that the Forest Service, Bonneville Power Admin. and BLM will have their way, with the PUBLIC's LAND AND THE HELL WITH THE BEAUTY AND SOLITUDE OF THE MEDICINE LAKE REGION ITS WATER QUALITY and FISHERY RESOURCE. *(Richard S. Cimino)*

BH.8 Come you fellows are a lot more intelligent than your acting. This Calpine project is an environmental bust, its slap in the face of all Californians. Why in the hell are we sending millions in the state on air and water quality and the Forest Service, BLM and a Washington State Power company Bonneville Power come up with a plan to "do their own thing" all because of some obscure Geothermal ACT of 1970? *(Richard S. Cimino)*

BH.9 I won't even get into wildlife, Indian religious, etc. because it really does not matter, Calpine, CalEnergy and the federal agency have their mind made up and you believe that this project is a go. I feel very strongly that this project is not in the best interest of The State of Californian, environmentally or economically. *(Richard S. Cimino)*

BH.12 I close with my final argument as stated on page S-5 PLEASE READ THIS ! I QUOTE "THE PLANNED PERIOD OF COMMERCIAL OPERATION IS 45 YEARS"

All this destruction for a 45 year project ?????????????? *(Richard S. Cimino)*

BH.13 I QUOTE again from the recent movie, Jerry MACURE "SHOW ME THE MONEY." *(Richard S. Cimino)*

BL.1 I was born in Susanville, California. I lived in Mt. Shasta for 1-1/2 years, 30 years ago. I just moved back because I love the area. I love it because of the mountains and the unspoiled natural beauty.

If we continue to allow "big money" and government agencies to encroach on our wilderness areas, how long before the whole continent looks like Los Angeles, CA??!! If that is the kind of environment you want, then more down there!! Don't allow our area to become spoiled.

Some people think if something gets broke it can always be fixed or replaced! I urge you to REMEMBER THE BUFFALO!!! *(Charlene Cousins)*

BM.1 I do not believe that it is proper to allow construction in the Medicine Lake Highlands—the Calpine, CalEnergy projects are ill-conceived. *(Rhodelio Cruz)*

BO.2 I have been coming to Medicine Lake for thirty-five years, since I was nine years of age. I have also lived in Siskiyou, Shasta and Humboldt Counties and am very familiar with the diverse and pristine forests and lakes of the region. Finally, I am an attorney, licensed in both California and Arizona. While living in Humboldt County, I practiced land-use planning law for the County and reviewed numerous EIR's.

In reviewing articles written about the proposed project, it is clear that all of the proposed actions, other than the no alternative action, will cause major adverse effects to the environment, water quality and wildlife of the region. *(Suzanna S. Cuneo)*

BQ.3 This letter is the result of a very quick analysis of a very long document and may have errors in fact or analysis but the intent of this letter is to preserve our right to appeal any administrative decision. The urgency required to develop any reasonable response to such a long and detailed document must be questioned. Why is there such a need to rush the analysis of this project when any decision could have such 'long-term and profound consequences. Who will benefit from a hurried analysis of this data? Who will lose? We believe the losers will be the consumers who will pay the cost of more expensive power and those who now enjoy the recreation and beauty of Medicine Lake. The only ones who stand to benefit are the owners of Calpine (and BPA?). The geothermal resource of the Medicine Lake area is not in danger of being lost, this is not a salvage timber sale and we must all: USFS, BLM, BPA, Siskiyou County, Calpine and private citizens, make an informed decision based on all of the information. *(S. Peder and Suzanna S. Cuneo, et al.)*

BZ.2 I very much appreciate your time and effort to read this letter and the enclosed articles, which related to the Medicine Lake Highlands. I've visited the Highlands many times over the last 40 years (since I was born, and father went camping every year), and it rates as one of the most special places on this planet (and I've been to a lot of places). *(Dean H. duVernet)*

BZ.5 A geothermal plant involving acres of structures, well sites, towers and power lines, and miles of new roads (the last thing we need in any national forest are new roads -- in fact old roads should be discontinued and replanted -- this will take decades anyway), and manipulation of landscape as well as destruction of precious ancient forests (our natural heritage) is neither morally nor economically viable. And the E goes to Oregon!!?

The value of the Highlands is leaving it as is -- to me the Medicine Lake Highlands are equitable to Yosemite, and would Yosemite or Yellowstone be the same with power plants, or shopping malls or condominiums or dams? Very few tourists visit Hetch-Hetchy anymore compared to Yosemite Valley, and it would have been more logical to have that land available for tourist visitation. *(Dean H. duVernet)*

CC.1 Its very good that we received a letter from the Forest Service inviting participation. I sure do not know the remaining 300 or so who wrote letters and probably never will because I'm not a person who belongs to groups pro or con on environmental issues. The reason is that on both sides of a case there is too much aggressive hollering about the facts. One word that covers a lot is the old "gobbledegook" coined by a Senator about 50 years ago. *(Bob Eastman)*

CD.1 I have studied the use of geothermal power. New Zealand's vented hot water became a disaster. Northern California's existing wells are having terrific problems.

The CRATER LAKE attempt was a foolish suggestion.

At the most in Modoc Co. one might get Hot Water "Space" heating as is done in places in Klamath Falls, Oregon.

Do not waste taxpayers money on this project nor permit so called "PRIVATE" money to be used. Cancel the motion now. *(Walter Eastman)*

CI.1 I have lived in Siskiyou County since I was three years old. The main thing I like about this area is the natural beauty which surrounds us, although as I have grown older, I have noticed that some areas are not as beautiful as they once were five or ten years ago. I really do not understand why the Forest Service is giving private industry both the land around Medicine Lake, and the tax money to develop geothermal power plants there. Then the private industry would sell the energy and make a profit. It does not make any sense. *(Marius A. Farioletti)*

CI.4 Is Medicine Lake to become another Copper Hill, Tennessee? Why is not the United States Forest Service protecting our wilderness areas instead of making plans to destroy them? Why are you going along with this, yourself? I do not want these geothermal plants built near Medicine Lake. I want this area protected and preserved as it is for generations to come, so that my children and my grandchildren will know its beauty. *(Marius A. Farioletti)*

CK.2 The project appears to be too overwhelming and destructive to the pristine Medicine Lake and Medicine Lake Highlands- I cannot believe the Environmental Impact Study will be approved. *(Betty Foist)*

CL.4 Leave the Native Americans in peace and don't plan on developing this project for above reasons and many more concerns I'm sure will be brought up by this local citizenry. Your project will impact too much land and too many people. *(Catherine Gardner)*

CR.2 We must stop destroying our public lands out of corporate greed. Our frustration and mistrust of the Forest Service is continually exasperated, when your agency continues to support these types of environmental disasters. You are entrusted with the Public Trust, it is your job to make decisions based upon what is best for the public good, not merely for economic gain. Please do your job, and stop selling off the last of our ancient forests and wilderness areas! *(Steve and Paddy Graves)*

CU.3 Lumber Corps must be stopped from quoting it isn't worth clearing by stating why bother there's no linar board feet?" This isn't forest management or forest growth but most of all it's definitely not responsible Stand out in the middle of no where right next to a powerline cutting trees and say "We done clear there cause it's not cost affective?!" Double-Da! *(Deborah Lynn Gregory - Fisher)*

CY.3 Don't take this away from the campers, the cabin owners, the wildlife and most importantly the children of tomorrow who will want to take their families to Medicine Lake one day. It's time we all stood together to fight this project. I do not believe in it nor will I ever support this project. I want to keep Medicine Lake the way I've always remembered it; quiet, beautiful, and most of all a wonderful family vacation area. *(Dave Harris)*

CZ.1 My family owns a cabin at Medicine Lake and I can't believe that they are trying to allow this type of project to be developed in such a beautiful place as "Medicine Lake". My children and myself look forward every year to flying out to California to spend our summer at Medicine Lake with our family. We look forward to the peacefulness, the beauty, and the many things that Medicine Lake has to offer to our family. By putting in this type of project it will destroy everything that the lake has to offer and won't be an enjoyable place to go when something like this takes over the area. The beauty of this lake and its surroundings is why we chose to have a cabin at Medicine Lake. Please do not take this away from my family. It's something we look forward to every year. *(Noell Harris)*

DA.1 It occurs to me that the BLM and the USFS are in place to manage our public lands in the best interest of those lands and the public who owns them and uses them. With ever dropping timber income it makes sense to look elsewhere for funding to finance the programs to manage and steward our lands. Part of the stewardship obligation is to protect the environmental systems of our delicate lands and the decision to go forward with this and other geothermal projects in the Medicine Lake area would be a bad one. I don't know what the financial benefits would be for any of these projects but the environmental costs are too great. My family and I have been enjoying Medicine Lake for its unique beauty for many years and will be outraged if any project as detrimental as this is allowed to go forward. *(Ronald Hart)*

DC.5 The location of this project is on public lands. These agencies are supposed to management and protect these areas for the public's good. Instead BLM and USFS will desecrate this area to enhance their own coffers in complete and utter disregard of the public trust. *(Anita E. Henning)*

DD.3 Human beings in many cases do not care about the environment or other species and yet they should at least care about themselves and destroy no more natural habitat, especially water lands. Thank you for your attention to these matters and this letter. *(Pam Henson)*

DL.1 I am speaking for all my relations the water, the waterlife, the trees, the land, the winged ones, the four legged, our winged ones, the rocks glass mountain, our air, with out all of these "where would we be"? And on behalf of all of us as Brothers and Sisters and Keeper of the Land. Let's be real! Let's ask ourselves, "Do you want to rape Mother Earth and continue to ruin this beautiful mother of ours, for something that will probably (Destroy all of Us!) in the long run.

Some people don't believe in spirits but believe me they do exist and one way or another they will fight back. *(Charlene Jackson)*

DP.3 The proposed geothermal project would devastate this region. Well sites of up to 18 acres, twenty miles of electric transmission lines, clear cutting of forests, new roads with cuts and fills, would destroy the natural quality of the forest. For the foregoing reasons the geothermal projects proposed by CalEnergy and CalPine should be disapproved. *(DelMar Janson)*

DR.2 Forest Service & BLM land should be left undestured. *(Gerald Johnson)*

DT.7 Overall, I see no justification for authorizing a risky project that sacrifices the quality of a spectacular portion of land belonging to the American people in order to benefit a handful of energy corporations and their investors. I was unable to attend the recent meetings that were held to solicit comments from the public, and I ask that you accept this letter as my statement of position on the Fourmile Hill proposal. *(Carolyn D. Jones)*

DV.5 The small amount of electricity generated from this ill-conceived plant will NEVER make up for the IRREPARABLE DAMAGE DONE. *(Marilee Jordan)*

DW.5 CalEnergy should stick to what it does best—developing natural gas fueled co-generation plants. *(Mike Keesee)*

DY.5 The benefits of this project for the whole community are not substantial; and the impact of this project would be substantial for many people. Economic gain for a few is not the purpose of public lands. *(Daniel Kiely)*

EM.3 B.L.M. and U.S.D.A. (Forest Service) are supposed to be stewarts of our public lands. You are paid with TAX Dollars. We the people are tax payers also owners of Public Lands. I have been to 3 meetings on proposed geothermal projects. I have heard only 2 people from the audience speak in favor of this exploytation - I would say the vast majority of "we the people" are against this folly. *(Pete and Laurel Lorenzen)*

EO.6 With the studies of the two projects nearly completed and approved, it is time to plan for the future. One way to approach a solution would be to lock up the area until Medicine Lake Highlands' little dab of energy is really needed. When that time comes, with proper plans and procedures in place, development should progress without devastation of the area.

Think about it! Perhaps CE General Corp. can be stopped before their proposed plans of development in their Glass Mountain Unit go further. *(Natalie Macy)*

EP.1 As a former resident of Lake County CA. having lived in a community near the lake and Napa county geothermal fields, I feel qualified to comment on the Fourmile Geothermal project. *(Maurice J. Maggiora, et al.)*

EQ.1 I found the Environmental Impact Report to be a vary scholarly document but it does not address the reality of Geothermal field conditions that I personally have experienced. I make that statement based on over thirty years as an process engineer and equipment supplier to the major geothermal power producers through out the world. The last seven years of my career prior to my retirement four years ago, I was extensively involved with Flour Corporation, Unical Geothermal Division with process equipment design, installation, start up and operation of design, The Calipatria California 350 MW geothermal power plant and the upgrade of the 50 MW plant as well as the new production wells adjacent to the Salton Sea. I provided equipment and service to all the other plants in the area, Red Hill Geothermal and Magma Power Company in Calipatria Calif. And San Diego Gas and Electric in El Centro. I urge you to investigate for yourself the problems the Calipatria geothermal problems which resulted to some of the environmental disasters the operators have covered up. *(Ronald A. Maire)*

EQ.4 It's bad enough to put such a plant near the Salten Sea which is bounded by desert and agricultural land with little or no aesthetic appeal but it is quite another matter to locate such a proven high risk geothermal series of plants proposed in one of our nations natural unspoiled treasures as the Medicine Lake Highlands in the Modoc and Klamath National Forests and the pristine Medicine Lake which is such a tourist attraction as well. *(Ronald A. Maire)*

ER.3 There is too little wild, ancient forest like that of the Medicine Lake Highlands left in California. *(Stephanie Grace Mandel)*

ET.1 I am really disgusted with the article in the herald and news from Klamath Falls, OR. I can not believe that some big business has the guts to just take over the medicine lake area without even considering the consequence to the environment. I am also just blown away by the fact that they do not intend to do any environment impact studies and they have not even drilled to see if there is any geothermal resources available. Obviously they think that they can just build it and hope to sell because as of yet they do not even have a buyer. If they think that they can just sneak one power plant in at a time and no one will notice they are sadly mistaken. *(Dawn Markee)*

ET.2 I have been to Medicine Lake to snowmobile. I enjoy the untouched beauty that man kind has left alone. There are not many lakes that I know of that are untouched. Unlike, Lake of the Woods which has a store and a gas station, Medicine Lake has only its beauty. It is the only place that I know of were you can see the wildlife that you do not get a chance to see everyday. *(Dawn Markee)*

ET.3 The USFS/BLM had better stop and think of what they are doing before it is to late. It is the total disregard from these agencies that just makes me sick. I hope that more of the people that will be affected speak out to protect the Medicine Lake area. I also hope that the USFS/BLM realize that it is public land and we have a right to say what will be done or not. *(Dawn Markee)*

EU.2 Our national forests are our national treasures, to be held in sacred trust for-our children and theirs, yours and mine. We do not have the right to destroy them for any reason, and most certainly not for profit!

We must preserve what natural beauty we have; God knows it's disappearing already at an alarming rate! And the last thing mankind anywhere needs is another power plant! *(Frances Martin)*

EV.2 What I do think the purpose of the plant will be is to make a lot of money for a small group of people much to the detriment of the Medicine Lake area. *(Shari Mazzini)*

EV.4 The Medicine Lake country is gorgeous and enjoyed by many. As a lifetime resident of Burney, I have had the good fortune to visit many times and experience the beauty of it. *(Shari Mazzini)*

EW.4 The development of this project will be in compliance with the Presidents Forest Plan and the Geothermal Steam Act. *(David W. McClain)*

FB.1 Medicine Lake is a very special and pristine recreational area that has miraculously maintained its balance with nature up to 1997. The survival of this natural resource has occurred primarily for two reasons: (1) It's remote location and long distance to any sizable populated area. (2) It's total lack of commercial development. There is no electricity, no telephones, not even a grocery store. This raw undeveloped state has been key to its preservation. *(Robert Medley)*

FB.2 The proposed Geothermal Project is big-time industry. It will change the Medicine Lake area forever. It will tilt the balance of nature. You cannot pour hundreds of millions of dollars into an area for industrial development without affecting a significant change. *(Robert Medley)*

FB.5 I have been going to Medicine Lake for 15 years and am now a cabin owner. It has a "spirit of soul" feel that is so incredibly rare in today's world. *(Robert Medley)*

FC.3 Having enjoyed many days hunting and fishing in the area, I learned that Medicine Lake and the surrounding area is a Crown Jewel. With so few of these precious recreation areas left it is incumbent upon us to preserve them for the next generation. Once beautiful areas are compromised they are difficult to bring back. Medicine Lake is one of a few natural high mountain lakes in California that the general public has access to. All parties should consider the Generations that follow us when making their decision. *(John W. Mikec)*

FF.1 I believe that the Medicine Lake area geothermal plants are a bad idea. This is pristine wilderness area of which we are quickly running out. *(Victoria K. Miller)*

FF.3 I do not believe that the people want this plant(s). Only the businesses, politicians who will gain from them and the people in Oregon who will get the power want these plants. *(Victoria K. Miller)*

FF.5 P.S. It is NOT your land it is the peoples!! *(Victoria K. Miller)*

FI.2 I was born and raised in Mt. Shasta. I moved from this area for 5 years to the Sacramento area. I moved back up here to raise my family.

Once it is developed the beauty of the Medicine Lake area would be gone forever. Northern California is a very special area let's keep it that way. *(Vicky Moro)*

FJ.4 We should be stewards of this land and all its creatures not the destroyers. Constructing an 18-acre power plant in this pristine setting would be yet another assault on lands that have been brutally altered, permanently sacred.

In our quest for "inexpensive" sources of energy we are stripping our planet of all its natural beauty. *(Carolyn J. Mosher)*

FJ.6 People throughout this country need to repeatedly stop and ask themselves where this reckless, escalating consumption of energy (at any cost to our land and all its creatures) leads us. Certainly not to a greater satisfaction with life—only a faster more polluted, more harried existence amidst more pavement, more cars more toxins in and on the earth, and a landscape that is increasingly less natural.

We should ask ourselves which is more important in the greater scheme of things to protect our remaining wild, wonderful and sacred lands as places to be quietly, gently enjoyed now and for future generations or for a very few people to get a "break" on their utility bills for a few years at best. *(Carolyn J. Mosher)*

FN.2 This is a treasured and pristine area. Do not allow this desecration. Protect the precious wildlife. The land the people use are distraught by the filthy greed, greed, greed! SHAME! SHAME! SHAME! *(Barbara Myers)*

FO.3 I have been a Wildlife Biologist with the US Fish and Wildlife Service for the past 15 years and worked as a seasonal biological technician for both the USFS (Big Valley Ranger District, Modoc County) and the

BLM. I am familiar with the concept of multiple use and am aware of the difficulties involved in managing public lands, as I do so on a daily basis.

Although I have not yet had a chance to review the full EIR/EIS, (I will do so as soon as possible and send a more detailed response then), my comments today are based primarily on two newspaper articles from Mt. Shasta written by David Manley.

If these articles are accurate, it appears that the BLM/USFS (and associated responsible officials) are not concerned about the potential real adverse effects of the proposed projects as identified in the EIR/EIS. It appears to be a case of public officials sacrificing a significant amount of PUBLIC resources to appease local politicians (Siskiyou County Board of Supervisors) and a couple of PRIVATE geothermal development companies seeking to enrich themselves and their stockholders at the expense of the public, a true tragedy of the commons in the making. *(Eric T. Nelson and Martha Spencer)*

FQ.1 Please Please don't sell out to CalEnergy and Calpine. The destruction of the old-growth reserve would be blasphemous and desecrate the Creation. Let Oregon generate its own power. We need awesome nature more than those greedy companies need money. We do not want an 18-acre powerplant, acres of well sites, 20 miles of 120 ft. electrical towers and more roads!!! Isn't California good for anything besides exploitation by Euro-Americans? *(Joy Louise Newcom)*

FR.2 I was born and raised here in Mt. Shasta. My family went camping every Summer in the Medicine Lake region. Mt. Shasta is my home and I plan on coming back here when I get done with college. I do not want to take my children to an area that was once beautiful and clean and is now ruined due to your plants. The people in Siskiyou County will not benefit from this plant nor will the environment. *(Julie Norman)*

FU.1 I am absolutely appalled at what is being planned by the U.S. Government in the Medicine Lake area.

We discovered Medicine Lake more than fifty years ago. We would throw our sleeping bags on the sand and spend several nights and days there. We were, then as now, overwhelmed by the pristine beauty of this area. This was before there were any cabins, etc. at the Lake. The quiet serenity of the Lake and the surrounding area made this an ideal place for summer camping. And in winter we would trek in by skis and snowmobile, across the frozen Lake, to enjoy the hush of the snowy forest.

Now I am in my nineties and still enjoy the Lake. Over the years, we have shared experiences there with our children and grandchildren and their friends. *(Olga E. Orr)*

FU.3 It seems to me that your right hand does not know what the left hand is doing. As long as I can remember, the government has been advocating: Save the environment!. Now you are planning to go full blast in destroying it. *(Olga E. Orr)*

FW.1 Medicine Lake has been a favorite destination for us over many years. We enjoy the lake, the fishing, the mountains, the pine forests and winter sports. *(Doug and Phyllis Parker)*

GA.1 I am a registered voter. I moved to Mt. Shasta area because of the unspoiled, beautiful wilderness. I agree with Carole Plank, and the concerned citizens that these plants should not be allowed here.

This country is being torn apart because no one can stand to leave this earth in its original shape. Where will we have to move next?? To Alaska? *(Antoinette C. Phillips)*

GF.3 Medicine Lake is beautiful and unspoiled. I hope that it will not lie squandered for a few dollars (which will benefit who?). *(Sarah Poaler)*

GH.1 I feel that if you would like this project to go on you need to begin construction on the Nina, Pinta, and Santa Maria as you cross the Atlantic back to Europe to dirty up your own air. You have already filled our land with feces and other human waste beneath the ground level so leave the air we breath natural and clean. I feel this is another attempt for you and your race to try and receive a tan as our red people but please do it in Europe so only your skins will burn and brown. We are already shaded and do not wish to change our appearances as your race is always trying to do. *(Jack Potter, Jr.)*

GJ.2 Although I do not have the pleasure of being a property owner in Medicine Lake, I still have appreciated the recreation the area provides.

It is my feeling that the geothermal project will spoil the environment and wildlife. I cannot possibly see putting in something of this proportion and it not in some way having a negative effect on the environment and wildlife. I would like to believe that the Forest Service and the Bureau of Land Management would NOT put money before protecting this unspoiled area. *(Melody Pratt)*

GM.1 First of all, thank you for the copy of the Fourmile EIR (quite a production!), and for extending the comment period...

I bicycled through the Modoc National Forest this summer ... good cycling and little traffic.

I feel strongly that any geothermal development in this area would be another crime of the sort I would hope we've recognized by now as short-sighted and environmentally unconscionable. *(Ken Reed)*

GM.3 I am also disappointed in the BLM support of these projects, an agency that has recently appeared to be far more pro-environmental than the Forest Service, which granted, isn't saying much... You get the picture. *(Ken Reed)*

GN.3 As it is stated the Forest Service and Bureau of Land Management are paid by us to protect our lands form this sort of thing. Why could this happen? *(Verna Reed)*

GO.2 These projects would substantially change the character of these pristine federal lands south of Lava Beds National Monument. Many miles of new roads, pipelines, and high-voltage transmission lines would scar the landscape. *(June Ringer)*

GP.8 The justifications of the Fourmile Hill Project are flimsy. It appears to be another case of corporate welfare the public is justifiably tired of providing. The power from this project could easily be provided by energy conservation, something we seem to have abandoned of late. The promise of jobs reminds me of the Timber Salvage Rider passed by Congress and enthusiastically enforced by the Forest Service. Where is the economic salvation to our rural areas that the Salvage Rider logging produced? The. royalties actually returned to the county will amount to $30-$50,000 over 20 years! Pathetic!

The Fourmile Hill Geothermal Project smacks of yet another corporate boondoggle at the public's expense, and it will not make our region and our Nation a whit more independent in our energy situation.

I respectfully submit the proceeding comments for the public record. *(Fred L. Rinne)*

GQ.1 Both the Fourmile Hill and Telephone Flat geothermal very-costly proposals run against the public interest in this unique and pristine region. *(Walter Rivers)*

GS.2 The Medicine Lake Highland should be protected as a park, and the sensitive environment is worth more aesthetically and economically if left intact.

Please, no manipulation of the magnificent highlands is worth it, and geothermal runs out eventually; but the land is scarred for generations to come.

This land belongs to the people, not just one or two businesses. Fair and equitable multiple-use would mean at least 50% of the Modoc would be wilderness officially. This is not so much when one considers over 95% of our ancient and majestic forests have been logged on public land. Was this fair?? *(Anna Rongen)*

GV.1 No! No! No!

It will ruin one more wilderness area for the people in the Mt.'s - No! *(R. J. Schwartz)*

GW.1 I am outraged to hear of the proposed geothermal development in the vicinity of Medicine Lake. My husband and I have lived in Siskiyou County for 45 years, and have spent many happy times in the area, visiting not only Medicine Lake but the whole volcanic area there.

I feel this development would be a great mistake, a 100 million dollar construction which would not be cost effective in the first place, would not benefit the citizens of California, but most of all would be environmentally destructive. *(Fai Schwarzenberg)*

GW.4 The USFS should be representing the people who own this area, and not the financial interests bent on destroying it. *(Fai Schwarzenberg)*

GY.1 We are writing this letter to express our deep concern over the proposed 4 Mile Hill geothermal project and the accompanying power lines. It does not seem reasonable to put such a massive project with all it entails in such a fragile environment. The bordering Medicine Lake Caldera and Lava Beds National Park are themselves very unique and worthwhile. They should not have to be subjected to this project. *(Micheal L. and Janet K. Server)*

HB.1 My family owns property at Medicine Lake and have used this lake since the early 60's. We are opposed to the geothermal project projected on Medicine Lake. We feel this is a poor project for this area. *(David Smith)*

HE.1 I write to you from Medicine Lake (hence the informal stationery) where three generations of my family have had a cabin since 1963. I write to you to express the very great concern we all feel about the proposed geothermal development projects for the Medicine Lake area.

In addition to nearly 35 summers spent at our family cabin, I have a B. A. in Geology (focus on vulcanology) and a Ph.D. in Environmental Ethics. I spent the summer of 1980 as a field geologist with the U.S. Geological Survey, mapping the Medicine Lake caldera with Julie Donnelly-Nolar. I know the Medicine Lake area very well, having walked most of its area on foot and doing a detailed geologic study of the area.

My current focus in environmental ethics is on developing sustainable long-term relationships between humanity, other members of the ecosystems where humans live and recreate, and the biologic and geologic processes that shape the earth. In general I am supportive of geothermal energy, 1) when there

is a demonstrated regional need, and 2) when it can be developed with no short or long-term damage to local ecosystems and human environments. *(Daniel T. Spencer)*

HE.5 To conclude, it has taken many years of careful planning and debate to achieve the current balance of low-impact human recreational use, environmental protection, and low-impact resource use. The Geothermal Development Project would be a major factor in upsetting this balance and greatly damaging it for the foreseeable future. *(Daniel T. Spencer)*

HF.3 With respect to my qualifications to comment on the report:
(1) My family has had a cabin at Medicine Lake since 1963, and I have spent nearly every summer and parts of some winters since then at the Medicine Lake Highlands. I know the Highlands intimately, and am very familiar with each area that would be affected by the proposed project.

(2) I am a trained field geologist with experience in mapping volcanics. During the summer of 1980 I worked for the United States Geological Survey as a field geologist mapping the Medicine Lake Highlands with project manager Julie Donnelly-Nolan of the USGS Menlo Park office. I have personally walked most of the area inside the Medicine Lake Caldera, and have done extensive field work on the northern and eastern sides of the Highlands, through which the proposed transmission lines would pass. I have maintained regular contact with Ms. Donnelly- Nolan about the progress of the geological mapping of the Highlands, and most recently spoke with her in August, 1997. I am very familiar with the geology of the Medicine Lake Highlands, both in terms of its geothermal potential and its many distinctive surface geological, biological, and ecological features.

(3) I hold a Ph.D. in Ethics with a focus on Environmental Ethics. My main area of research and teaching is in the area of building sustainable ecological and social relationships between human society and the rest of the natural world, while respecting the integrity of nonhuman nature. Given the deleterious effects of human use and exploitation of natural resources throughout the U.S. West to this date, such sustainability requires a fundamental rethinking of our relationship to and use of nonhuman nature if we are going to make the much needed social transformation of society towards ecological and social sustainability. *(Daniel T. Spencer)*

HF.5 At the philosophical level, development of this project would only continue the exploitative, utilitarian relationship of humans toward nature that has led us into the current environmental crisis. The ES itself alludes to this when it states on page S-I 'The Glass Mountain KGRA represents one of the only remaining undeveloped Known Geothermal Resource Areas in North America with a demonstrated resource." The logic informing the entire ES is "if we can exploit this resource, we should exploit it." Rather than continuing this logic of hunting down and exploiting every last natural resource for human consumption, however, what is needed is a fundamental rethinking of human energy use and consumption. Developing the geothermal project at Medicine Lake only feeds an addictive energy consumption pattern that can never be satisfied, rather than addressing the roots of the addiction itself. *(Daniel T. Spencer)*

HF.11 Transmission Line: I continue to be flabbergasted that the primary proposed routing for the transmission line is the A1-A2-BI-CI routing that runs the transmission line into the caldera and between the north shore of Medicine Lake and the Medicine Lake Dacite flow--right by the campgrounds, Little Medicine Lake, the road, and the hiking and biking re(recreational trails. I find this proposed route astonishing for its total disregard for the recreational development of Medicine Lake-development that has for over 30 years sought to balance recreational and ecological needs in the caldera. As the EIS/EIR apparently states on P. 3-124' "Medicine Lake is located at the visual and topographic center of the Caldera. There are no telephone or electricity service lines sewing the basin. Combined, these characteristics create a strong sense of place and remoteness to the lake." It is precisely that "strong sense of place and remoteness to the lake" that is threatened and would be destroyed by developing this project, and in particular Alternative 1 of the proposed Transmission Line. *(Daniel T. Spencer)*

HF.25 With a wise and far-sighted national and regional energy policy there would be no perceived need whatsoever for this ill-designed energy project; even under the best of circumstances the sacrifice of the Medicine Lake Highlands for a temporary increase in electricity cannot be justified. If the plant is built we will deprive both our children and nonhuman kin the opportunity to enjoy and thrive in this unique environment. *(Daniel T. Spencer)*

HG.2 Having spent the past 34 summers in the Medicine Lake Highlands and particularly at Medicine Lake I can testify to the beauty, the pristine air quality and the wonderfully quiet evenings and nights there. It is so quiet that you can hear conversations from one side of the lake to the other. If this project is approved these qualities which make this area so special will be ruined. *(Lorin C. Spencer)*

HH.1 I have been coming to Medicine Lake for 35 years. This area is one of the few pristine areas left in California. Between the amazing geologic history and the incredible history of the Modoc Indian's inhabitation really creates this are to stand out. *(Lucinda Spencer)*

HH.3 Medicine Lake is my family's "spiritual" gathering place. It is where 3 generations of Spencers have been gathering, sharing, loving and appreciating for over 35 years. *(Lucinda Spencer)*

HI.3 I have been coming to Medicine Lake every summer for thirty-five years, since I was four years old. During this time I learned to value the pristine environment that this area offered: no electricity, dirt roads and no television I can't express in words the thrill it is to see an eagle sweep down from a tree and catch a fish or a mountain lion saunter across a road or a pine martin play in your "front yard"! All these things I have witnessed and enjoyed at Medicine Lake.

I have worked for the Forest Service in the Medicine Lake area [at the Big Valley Ranger District Modoc National Forest] for four seasons, and am very familiar with the fragile ecosystems of the area. I received a Masters of Science in Natural Resource Planning and spent the last 10 years reviewing environmental documents for Siskiyou, Trinity, Humboldt and Glenn Counties [California]. *(Martha Spencer)*

HI.8 While I agree that public lands should be put to multiple uses where appropriate and that we need to pursue clean sources of power wherever environmentally and economically feasible. this proposed project in the pristine Medicine Lake area given the documented adverse impacts and lack of economic benefit simply MAKES NO SENSE! *(Martha Spencer)*

HK.3 Throughout the scope of time in which humans have been attracted to Medicine Lake the place has spoken to their hearts and souls. It deserves protection as the treasure that it is in a relatively undeveloped state. There is a major effort to connect Medicine Lake to a Scenic Byway which some have supported. The construction of one power plant and then the subsequent construction of future power plants clashes with our Nation's investment into the area for camping, fishing, hunting, boating, hiking, auto touring, snowmobiling and X-country skiing. *(Marshall Staunton)*

HK.5 Small rural Western counties are hurting in the wake of a lockup of Natural Resources. However, our environment is important and use should design and develop natural resources wisely. We should allow rural counties the opportunity to sustainably use natural resources without severely damaging the ecosystem we are connected to. This project as proposed does not satisfy that standard. *(Marshall Staunton)*

HL.3 In addition to the lack of actual need for this development, there seems to be a substantial give-away of public resources in the plan. Roads through sensitive wildlife habitat and an astonishing amount of water usage would seem to me to negate any value this may have, even if it were necessary.

I would caution your agency to become increasingly careful of its stewardship of public lands and resources. Your friends are becoming fewer. Thank you for your attention to this matter. *(Barbara Stauss)*

HO.1 It seems a shame. Money is such a powerful tool in destroying a wonderful camp area. I know it is just a job for you. From here you go to the next one. No looking back at the havoc you have caused. *(Victoria Sturgis)*

HO.4 Why the hurry? Why not tell what it will really be like when you finish. Is that what happened at Salton Sea? and is causing its demise? *(Victoria Sturgis)*

HP.2 May I suggest that this area be managed as a Wildlife Fish Plant Habitat Sanctuary amend with no development activities. To save all old-growth, and including a national old-growth preservation system. *(John R. Swanson)*

HQ.2 The proposed development is on government land, OUR LAND. The Forest Service and the Bureau of Land Management are paid by us, the taxpayer, to protect OUR land. They must not stab us in the back and allow this beautiful property to be destroyed for greed. The proposed development will benefit very few, the rest of us will never realize any benefit from it. But many benefit from the camping, fishing, hiking, boating and snowmobilers that the area now provides. *(Donald Teague)*

HR.1 It is with deep concern that I write to you regarding the proposed geothermal power plant project located in the Modoc National Forest.

Our family has had a tiny, primitive cabin at Medicine Lake for the past thirty five years. During this time we have all come to dearly love and greatly appreciate the unspoiled and natural beauty of the area, and have felt so privileged to be part of the surroundings. Having lived in Southern California east of Los Angeles, we have witnessed the desecration of our beautiful land over the past 45 years. We have felt so fortunate to be a part of, if only for a few short weeks during the summer, the unchanged and protected natural area of the Medicine Lake Highlands.

We have welcomed each year the nesting pair of bald eagles, the osprey, blue heron, double crested cormorant and many warblers that migrate through the Medicine Lake area during the summer months. Our children have witnessed the beauty of the mule deer, black bear and mountain lion. From this childhood influence, all of our six children have learned to appreciate the beauty and fragility of nature and how it must be protected from those who would destroy it. Two of our children have geology degrees and work toward understanding and preserving our environment. All six cherish their world and understand the value of protecting their environment. *(Annabel J. Teberg)*

HU.5 I attended 3 public comment meetings with FS/BLM personnel and was constantly told in answer to my questions to "read the EIS". I analyzed the EIS/EIR report and enclose my comments on it. *(Louise Thompson)*

HU.6 This whole development is unconscienable and immoral to destroy a recreation environment for the sake of the big money interests. Please help us. *(Louise Thompson)*

HV.1 I have been to 3 of your meetings and asked questions which you did not answer but repeatedly said — "Read the EIS".

I have read it and hereby submit comments on 3 or 4 sections of it. If I commented on all of it, it would run to 4 or 5 pages of closely typed material. *(Louise Thompson)*

HX.2 For several years now, we have been making payments on an old fixer-upper and property in rural Modoc County. We intend to retire there when we can afford to. Therefore, we are appalled when we read that our pristine wilderness areas are threatened by such objectionable development as geothermal wells, pipelines and substations.

Medicine Lake and its surroundings are one of our favorite places to visit, to take children and friends, and to photograph. It seems criminal to consider detracting from such beautiful, unspoiled areas, which otherwise could go on giving pleasure to millions of visitors on down the ages. As a matter of fact, the last time we were at Lava Beds National Monument, we heard and saw many foreigners who were tourists there. Surely Medicine Lake is a national treasure, which we must not spoil, simply to get further tax revenue and a measly 19 jobs!

When we chose Modoc County as our retirement spot, we wanted to get away from the voracious development that we see in central coast California, and all the plagues of over-population. We assumed (perhaps foolishly) that the evils of population density and a high tech society would not pursue us there. But every few months we read of another threatened encroachment on that precious haven of north-eastern California. *(Elizabeth R. Tozier)*

HZ.3 The thought of putting such a plant in this beautiful area is absurd. If there were a shortage of power, it would be one thing, but to ruin the beauty of this area for the sake of big business is unconscionable. *(Richard Turner)*

IB.5 The fragmentation of the area into 3 National Forests and numerous management units has prevented full recognition of the values of the area as a whole, as is evident in your Draft EIR/EIS. At the very least, the Medicine Lake Highlands must not be turned into an industrial zone, for the profit of a few. *(Wayne Verrill)*

IH.1 We feel it's unfair for big business and government to take land and destroy it when we the people have had to protect it all these years. No logging is allowed. No 4 wheeling, but when the Forestry Department and BLM need money, they roll over for big business. *(Jerry and Vicky Weber)*

IH.3 You people are messing with Mother Nature, and with all your knowledge and degrees, you've heard the saying "Don't mess with Mother Nature!" *(Jerry and Vicky Weber)*

IJ.2 The Medicine Lake & surrounding area is one of the few precious places pristine oases (OASES) left in our world To use it for this geothermal project would be a sacrilege!

This land belongs to We the People & we are speaking! And so is the Land! *(Mary Jo Wheeler)*

IK.2 The USFS should be managing those lands for the public good and conservation of the area's resources, not for the profits of the developers. *(Howard J. Whitaker)*

IM.2 When I became aware of the extensive disruption to the environment of even one of these industrial plants, I was surprized that the BLM/Forest Service would seriously consider locating even one in a unique recreational area. It is a conflict with existing uses. Even the best planned, minimum impact project would be out of place in the Medicine Lake Highlands. *(Brenda Willey)*

IM.4 The Medicine Lake Homeowners Association, the Native American Coalition, and increasingly informed public in Siskiyou County reject the projects as beneficial in the long run to their well-being and quality of life. This public includes realtors, sportsmen, snowmobilers, doctors, businessmen, relying on the recreational potential of our area, as well as those actuely aware of the need to protect a unique geological, sensitive natural enviornment. *(Brenda Willey)*

IM.7 If only the first project was completed becasue of unforeseen problems, limited geothermal resources or public outcry would the cost and disadvantages of the transmission lines outweigh its advantages? My answer is yes. *(Brenda Willey)*

IM.9 This Fourmile Hill project whether by itself or as part of a two to six project plan is the beginning of a bad tradeoff that the adjacent area will suffer from as well as the whole county and its people. It is precipitating a flight that if not resolved now will continue to drain precious energy on all sides that could be used to discover a more beneficial, less controversial use for our National Forest. *(Brenda Willey)*

IN.2 I cherish the winter and summer recreation in and around Medicine Lake and do not want to lose its prestine, quiet beauty to the hussle and activity of an everyday work area. A sad waste of an exceptional area. *(Ray Williamson)*

IO.2 Winter and summer recreation in and around Medicine Lake would be ruined forever! *(Sharon Williamson)*

IP.2 The land is our Mother Earth. We need to take care of it not destroy it in its natural state. *(Joyce Wilson)*

IQ.1 The EIS/EIR for the Fourmile Hill Geothermal Development Project contains serious deficiencies and misleading information in environmental issues including hydrology, visual effects, and noise, and contains no supporting evidence that the project is even economically viable in light of the deregulation of the power industry in the immediate future. As a result, the EIS/EIR is decidedly bias in its approach to evaluating the project. *(Phil Woodward)*

IS.2 I guess the first thought I wish to highlight about this is, and I don't mean this for sarcasm's sake alone, but when is enough enough? When is enough development of precious resources enough? When will we have enough electricity? When will we stand up and say "No" more!

Los Angeles isn't that far away, & yet it is sucking up water and electricity from far away, from pristine lands that don't support the high consumption life-style the big cities propagate.

We must have areas left untouched by human greed for more and more. The problem is not a statistical off-shoot of, say "more people, more need", but rather one that can be traced back to the individual like you and me who answers the question: is this in the truly best interest of all Life, our children, and the people that live where the development is to take place?

When we answer these personal questions with all the sincerity of our heart and conscious, then we are acting out of responsibility. Just some thoughts your way. *(Carter Wynn)*

IT.2 Second, it is time that the forest service stop playing pawns to the large energy brokers who are determined to destroy every inch of wild land on the planet for unnecessary greed. A series of solar panels on the roof of every house in the country makes far more sense than the further irreversible destruction of sacred lands. *(Grant Yousie)*

IT.3 Finally, as you know the Medicine Lake area derived its name from the fact that it exists as medicine for the soul. There is no soul or spirit in a geothermal project and watching a television powered by a geothermal power plant in an air conditioned house powered by the same apparatus is no replacement for the medicine at Medicine Lake and the surrounding area. *(Grant Yousie)*

PH2.9 You remarked about the Indians, I'm not too proud of the Americans and what they have done to the Indians. And I see this area where you're going, and you maybe just pick up a branch and you see an arrowhead. Many, many arrowheads we have picked up around Medicine Lake. Maybe not picking them up, just kicking them over. I'm not too proud of us. Somebody wins and somebody loses, I'll grant you that. I hate to see too much going on along around Medicine Lake, having been there so long. We see what's happened to Yosemite, we've seen what has happened to Yellowstone Park. We've got to draw back somewhere. I don't know where that is to be. An eagle nest; did you ever crawl up into one? There's one at Medicine Lake, and I crawled up into it. It's almost as big as some of the apartments that we have. It's a huge thing. Do I want that destroyed by tourists? *(Klamath Falls Public Hearing)*

PH3.7 First to you, can you give me a representative percentage of how many power plants in the west right now are not running to full capacity? *(Yreka Public Hearing)*

PH3.14 Some of these things were glossed over pretty rapidly and I couldn't absorb it all. Also, I hear a lot of reference to EIR and EIS. I have seen it. It is about eight inches thick. It takes a good six weeks to go through it if you are an attorney and a scientist, which I am not. *(Yreka Public Hearing)*

PH3.34 If it were having such significant impacts on potential and current recreational uses, perhaps you could say the environmental issues were less of an impact. But in this particular area, I don't think there is any way to mitigate slow-growing trees being clearcut, cultural cites being devastated for their traditional use. There is no mitigation. It goes on and on and on. The environmental and cultural and human impacts in that area are significant, and I don't think there is a mitigation that can—I don't see how it is a good trade-off. And it is certainly—well, I don't think people in this county who are going to be significantly impacted by it are going to be getting a good trade-off. I think we are going to be coming out very short. *(Yreka Public Hearing)*

PH3.41 When you are going to cut that big corridor, you are going to build those roads in, you can't just snake a little road in. You have got to clear everything. And it totally ruins the area. *(Yreka Public Hearing)*

PH3.61 I have been studying for last 27 or nine years the life expectancy of industrial civilization. And I am not the only one that has done that. But industrial civilization looks like a little blip, goes up here and then goes back down. The reason it goes down is that industrial civilization is completely dependent upon the energy per person. And the planet is now on the downhill side of the fossil fuel. Essentially, the fossil fuels will be gone by the year 2040. So I would urge Siskiyou County Planning and everybody else to ensure themselves that they have got at least 45 megawatts of power that they can restrict to Siskiyou County because these people here are going to need that electricity in the future. And I have two research papers, if anybody is interested, that essentially speaks to what I have just said. *(Yreka Public Hearing)*

PH3.65 Once they get the first plant in, then they will be able to go ahead and develop the rest of the area? *(Yreka Public Hearing)*

PH3.66 So we ought to stop it right now. It is totally unacceptable, even one. *(Yreka Public Hearing)*

PH3.76 This is a mess we are going to have when all of this is done. When you let these people in there, it is over. Going to get all of them, more transmission lines, the whole damn thing. *(Yreka Public Hearing)*

PH3.77 This is something here—this is something important here. This is not politics. This is the last good area around here. You are letting these guys come in here and do this stuff. You are ruining that area. *(Yreka Public Hearing)*

PH3.79 Number one, comparing Geysers, this is not a reaction that volunteered to come out of the bowels of the earth. We are drilling down. You are comparing Geysers with something that come up naturally. We are bringing this up manmade. Number two, talking about not clearcutting. Only six foot. When they get ten, what do you do, drop them over the next 40 years? You are robbing Peter to pay Paul. I don't buy that. You have to continue to drop all of these trees as soon as they get big. Don't tell me you are leaving trees. As soon as they get big enough and they pose a threat to the line, you are going to go in there and drop them. *(Yreka Public Hearing)*

PH3.88 I think you guys definitely need to look at the total picture of this thing, not just putting in one plant. They are not going to come up here to do one plant. They are going to go for the whole thing. Don't worry about approving one. If you let one in, you are going to do the rest of it. You haven't—you don't have nothing like that to stop it. So it is going. That—you need to look at the whole overall picture, not just one little project. These guys aren't going to drill one well and get it going and go home and say, "Good." they are going to pop everyone of those leases, once they do it. These two other companies, they are going to get on the wagon. It is going to happen and we are going to have a big, old mess up there. I don't think you ought to look at these individual. You have go to look at the whole, overall. *(Yreka Public Hearing)*

PH3.93 What I have heard all night long, time and time again is, "I don't know. I am not sure about that. Refer to the book." You know that the vast majority of people are not going to send away for an eight-inch-thick book and sit down and read it and understand what is happening. And now, I think it is pretty obvious from the audience that there are a lot of people in Siskiyou County that don't want to be in Calpine's pocket for their experimental research, whatever you want to call it, and destroy our wilderness for us. All I hear is there is going to be minimal impact, negative impact. I don't buy that, I am sorry. I just don't buy it. *(Yreka Public Hearing)*

PH3.98 Make the comment, take all these books you are getting like this, it says "Medicine Lake." All these pipelines around, get the book and see what you have visually. About six books this thick and wonder what happened to this pristine area. *(Yreka Public Hearing)*

PH3.104 I am just getting at that some—some of your figures and whatnot in this thing, they are so far from reality I'm just hoping that all of the whole book isn't so far from reality as this. You know, you have got professionals that do this, but they seem like somebody has dropped the ball here in a few spots. *(Yreka Public Hearing)*

PH3.107 I want to say I am a little disappointed in this meeting. I didn't have access to that big, thick book. And yet you people have been doing this three nights in a row. Surely, the same questions have come up, yet we have been told over and over, "Look at the book. Go read and the book." I don't know. I mean, how are we to take you as experts or you as authorities when you seem to not know very much about this whole process? *(Yreka Public Hearing)*

PH3.108 You are evading a lot of questions. Kind of beating around the bush with these people. I guess we are just country hicks. *(Yreka Public Hearing)*

PH3.113 I am getting so upset with developers coming in and they see wilderness and all they see are dollar signs. And I guess I was naive when I moved up here. I understood that the Forest Service and BLM are supposed to manage our land, our heritage, and yet the Forest Service is constantly selling our heritage. They sell our timber. They sell our land to develop. They allow cattle to graze on Forest Service lands. To me, that is not management. To me, that is not taking care of our environment, which I think is the primary purpose of the Forest Service. *(Yreka Public Hearing)*

PH3.114 That land is public land. It belongs to us. It doesn't belong to you, the resource manager, or the Forest Service or Cal Energy, anybody else. That's our land. And so we should have a say how we want our land to be developed. And we are saying we don't want that outfit up there. *(Yreka Public Hearing)*

PH3.115 Has anybody from this company been to Iceland and see what they do with geothermal energy up there? The whole country is run with geothermal energy. Everybody in the land gets free hot water and heat in their house. And they got no problems with the environment, because they use what's there. Look at other people and what they do with it. It is a simple solution. This clearcutting thing—what about that 40-inch gas line came from Canada? Going all the way from San Diego on a 125-foot swath. Up there by Burney Falls, when you drive through the highways you can see it. They didn't have any problem getting that through, did they? That's natural gas, but very much needed right now. *(Yreka Public Hearing)*

PH4.6 Project would permanently devastate the environment. *(Mount Shasta Public Hearing)*

PH5.1 I attended your whatever you call it, information session in Yreka on August 7th, and asked numerous questions. In fact, the whole audience asked them, and we were met with the response continually: "Read the EIS, we don't have the information right here at our fingertips." So I spent the last three weeks reading the EIS and I have comments and questions. *(Medicine Lake Public Hearing)*

PH5.2 We should consider the entire Medicine Lake area, not just the well pads and transmission lines. It is a unit as a whole, surface and subsurface, air, water and atmosphere. *(Medicine Lake Public Hearing)*

PH5.24 They take into account economics. The only reason that I can see that they would go that route would be to pick up the other power plants right along their line and save them building additional lines. *(Medicine Lake Public Hearing)*

PH5.35 And on page 3.99 and 3.100, it keeps stating that timber harvesting has already adversely affected the habitat in this area. Well, this caldera has never been harvested. *(Medicine Lake Public Hearing)*

PH5.44 How come we can't find anybody that's been around these other plants that like it; that have anything good to say about them? *(Medicine Lake Public Hearing)*

PH5.49 You say you don't want it in your backyards, but it's in my backyard, too. I pay county taxes in this county, too; I come here—that we do—or your question, do I have a cabin out here? I respect this whole area environmentally as much as you, sir. Once again, welcome to Siskiyou County, good luck. You might have the air pollution officer explain the environmental quality that you have to perform. I'm working with him now to produce sulfur. I know my bill for equipment, for scrubbers and inspections is over $600,000. I'm a little person, I work hard, I know what you have to go through. Thank you. *(Medicine Lake Public Hearing)*

PH5.57 I think we need to keep in mind we're looking at public lands and appropriate use of public lands. And the appropriate use for this set of public lands is recreation. That's what the last twenty years has been spent doing is developing it for recreation. A very important part of that recreation is the wilderness aspect. And everything I've heard has indicated this project will significantly impact that aspect. All the way across the board. And it can't be mitigated. *(Medicine Lake Public Hearing)*

PH5.65 I think I look to the Forest Service to recognize the absolute beauty of this area; the desecration of so many other areas in California and Oregon. I think we need to look at the future generations. I think we're being penny-wise and pound foolish. We're looking at a value that is absolutely unbelievable, and I'm not sure that many people who have not been acquainted with this area are even aware of it. I think we're looking to balance it with a monetary—a business that has really no meaning, if you think in terms of future generations, and what we have. I think to do anything that might impact on this area, which is so invaluable in its state right now, is not moral. And I think the Forest Service needs to think in terms that they protect the public. This belongs to the public. And it must benefit the public, and it must belong for generations. *(Medicine Lake Public Hearing)*

PH5.68 I doubt if these customers want to see a beautiful, pristine place like Medicine Lake destroyed environmentally, visually and culturally so these people can have green energy. Let them come to Medicine Lake and see how it is now. I don't think they'd want this construction here and all this devastation, personally. That's my opinion. *(Medicine Lake Public Hearing)*

PH5.69 I'm absolutely amazed that it's gotten this far; that somebody doesn't say no, that this beautiful place—this isn't going to happen. I'm not against progress. Yes, we need power, that's fine. But why here? All of us here, not one of us will be here a hundred years from now. I think we need to think about that. I think we need to think about the kids that will grow up. My eight year olds in second grade will not be here a hundred years from now, but their kids will be. I think people want to know about that. I don't think there's a lot of people that have seen this or maybe—I don't know, I don't want Calpine people to starve, no, but I'm sure they've got their finger in—fingers in other places. *(Medicine Lake Public Hearing)*

PH5.82 This BP&L, it's not going to change their power rate. Going to do the average consumer absolutely no good; that's just a smoke screen you're putting up. *(Medicine Lake Public Hearing)*

PH5.89 I guess my concern is I work for a environmental consulting firm. And we're generally hired, after you guys come in, to clean up the mess. And that's what I'm concerned is going to happen here. *(Medicine Lake Public Hearing)*

PH5.98 I want to know, because I think the company that's trying to put in a geothermal—and the company that does the environmental impacts where they are paying their wage, we could have a whole bias of the whole project. *(Medicine Lake Public Hearing)*

PH5.104 I think that this area is so valuable that way, that it is for the future, and it really scares me to have a development like this in the area because I think it changes the whole ambience, I guess, if you want to save the area. And I think when you're looking at public lands, that affects our entire nation, not just the power users or who are going to get to use the power physically; the entire nation. I think it's important for us to be protecting it for future generations. I feel fortunate that I've been able to experience this my whole life, coming up to the area that offers so much. And it bothers me to think that we can change that so drastically with this development. And California again does not have a lot of areas like this available.

And I grew up in southern California, I saw the change down there. I just think for our future this is worth protecting. *(Medicine Lake Public Hearing)*

PH5.105 As a Tulelake farmer I use sulfur also, but based on the project proposed, I wouldn't want to buy that at this point. I think that the costs of developing this area far outweigh the benefits. I go to the Tulelake Rotary Meeting where I may not have the cost material for the power, the wholesale cost of the plants, but I think what was shown there, it was something like six cents per kilowatt hour. And I may be wrong and the wholesale market supposedly was two to two and a half. And I have a brother-in-law that's in Sierra Pacific, and he was dealing with Canada and natural gas pipelines, and those have negative environmental consequences. Again, the cost is low and cheap, and it's forecasted to remain that way. So I would sure like to see, if we're discussing royalties, we're discussing all the issues, I'd like to see a discussion of the economics, because I don't think—as I businessman, I don't think they're there. And I'd like to see that brought out to the light of day. *(Medicine Lake Public Hearing)*

PH5.106 We talked and talked about money and impact, but we are really not talking about the future and about this particularly pristine area. And I sort of leave it to the Forest Service people. I think this is their responsibility to manage appropriately, and I do not think that these public lands will be managed appropriately if something like this comes in. We're penny-wise and pound foolish. I can see forty years from now cleaning up the darn mess, but you will never go back to the pristine area where you were. I think that we do not need this energy here, we do not need this development here. And to do harm to an area that you can never get again is stupid. It is just plain stupid. And I doubt the morals of this. And it's not for me, I've had mine; it's for our future generations and for two hundred years from now, it's for two thousand years from now. Don't do something for today that has an effect that will last forever. And I feel it's your responsibility, I put the onus on the Forest Service's shoulders to make this appropriate decision to manage these lands for the benefit of the public for ages. *(Medicine Lake Public Hearing)*

PH5.107 Get lost in there. I've been coming up here about twenty-five years; this is a very, very special place. Finally built a cabin about two years ago; it has a spirit of the soul. This place that which very few places in my lifetime I've found. And I think it is a miracle, in the year 1997, this place has survived. Absolutely a miracle. You try to think why it survived. I think two reasons: One, we're kind of isolated from any major population area; and number two is, there's been no commercial development. And we don't even have a grocery store. But even that's part of it. That's kind of kept us isolated, and it's kept everything the way it was. I had a real fear that you could bring in this amount of industrial commercial activity and not tilt the balance of this place. *(Medicine Lake Public Hearing)*

PH5.108 I have not been coming up near as long as some of you. However, I would like to invite the Calpines people, before they build anything, the big-wigs, the man who's going to sign the paychecks, come up here and spend a week. I would like to invite the Forest Service and BLM people to spend—come up here and spend a week and tell me then that nothing will change. *(Medicine Lake Public Hearing)*

PH5.114 Just forget all the home owners, doing a census at the campgrounds, and there have been people from all over the world have come up here. And they said they wouldn't come back if this goes in. It's a special spot not just for the home owners; this is for everyone; the human race. *(Medicine Lake Public Hearing)*

PH5.116 I want to make one more statement about the BPA buying this power. I attended the August 7th meeting, and there was a representative of that group there. She said that they do not need this power, they have no obligation to buy the power, until this EIS is approved, and that it would just be a notch in their belt. Are we willing to trade this wonderful area to put a notch in Bonneville Power's belt? I think not. *(Medicine Lake Public Hearing)*

Response—Statements and Opinion

The statements and opinions concerning the proposed project are noted. The proposed project has been subject to the review and documentation required by NEPA and CEQA. There has been no preferential or special-status procedure used for the Fourmile Hill geothermal project. The EIS/EIR addresses in detail the environmental effects of the proposed project in accordance with the requirements of NEPA and CEQA. Responses to specific comments on the Draft EIS/EIR can be found in Chapter 3, Responses to Comments on the Draft EIS/EIR, and Chapter 4, Responses to NEPA/CEQA Issues Comments, in this volume of the Final EIS/EIR.

OTHER GENERAL COMMENTS

Comment—Input of Siskiyou County Planning Commission

E.5 In closing, this response is tempered by additional input and recommendations made by the Siskiyou County Planning Commission to the Board of Supervisors, at the time of certification of the Final EIS/EIR. I anticipate that the Planning Department will be notified of the availability of the Final EIS/EIR in order to schedule the appropriate meeting and presentation to the Siskiyou County Planning Commission.

Thank you for the opportunity to comment. If you have any questions, please contact me immediately.
(Richard D. Barnum, Siskiyou County Planning Department)

Response—Input of Siskiyou County Planning Commission

The input of the Siskiyou County Planning Commission is noted. The planning commission will receive a copy of the Final EIS/EIR.

Comments—Changes to Executive Summary

F.7 Tables S-4 and S-5. We expect that these Tables will be revised to reflect the comments and suggestions received about the DRAFT. *(John R. Hannum, North Coast Regional Water Quality Control Board)*

EQ.13 I could go on, but I have listed some of the significant items. I still have problems with so many items in the Executive Summary that are at odds with the main body of the Environmental Impact Statement and Impact Report. What purpose does the report serve when the Executive Summary ignores the substance of the report. The average citizen is so intimidated with the size and complexity of the report they read, very probably, only the summary. I allege it is dishonest to identify the "Executive Summary" as a summary. It is not summary but an Executive Position! *(Ronald A. Maire)*

Response—Changes to Executive Summary

The Executive Summary of the Draft EIS/EIR provides a brief description of the proposed project, and gives an overview of the scope of each section of the document. The Executive Summary gives a brief overview of the process leading up to agency approval or denial of the proposed project. The subsequent portions of the Draft EIS/EIR address the potential environmental impacts as required by NEPA and CEQA. The Executive Summary portion of the document does not, nor does it feign to, account for all the information contained in the remaining sections of the document.

The Draft EIS/EIR was designed to present information to the public in the most clear and concise manner possible. The length of the document reflects the effort taken to address all potential adverse effects on the environment to the fullest extent possible. While sections of the Draft EIS/EIR contain technical information, such information is necessary to present an accurate and honest assessment of the proposed project's potential effects and possible mitigation measures for these effects.

Comments that have been received regarding the Executive Summary and the Draft EIS/EIR are addressed in this volume (Volume III: Final EIS/EIR Responses to Comments on the Draft EIS/EIR) and in the revised EIS/EIR (Volume I: Final EIS/EIR). Any inaccuracies or changes that were needed on the Draft EIS/EIR have been incorporated into the Final EIS/EIR. The Final EIS/EIR Executive Summary is consistent with the findings of the EIS/EIR.

Comments—Project Name

AO.5 Why is this one called the "Four Mile Hill" project when it is not down at Four Mile Hill?
(Mildred J. Aquila)

BE.4 I feel the government agencies have mislead the general public by calling the project Fourmile Hill. It is not located at Fourmile Hill. It is much nearer Grouse Hill. Therefore, it is much closer to Medicine Lake than the public thought, or more people would have opposed the project at the conception.
(Paul Carter, Jr.)

Response—Project Name

The name for the project was selected because Fourmile Hill is considered to be a representative geographic locator for the project. Fourmile Hill is one of the tallest surface features in the project vicinity. In addition, figures in the Draft EIS/EIR clearly illustrate the location of the proposed power plant, wellfield, and alternative transmission lines. The location of these project facilities was also clearly identified in public notices distributed during the public scoping meetings and public hearings on the Draft EIS/EIR.

Comment—Open-Access Policy for Transmission Line

I.2 In addition to route selection, CalEnergy requests that the Record of Decision stipulate that the transmission line corridor have an open access policy which will allow both CalEnergy and Calpine to utilize the same corridor and possibly the same power transmission line.
(Dale R. Schuster, CalEnergy International Ltd.)

Response—Open-Access Policy for Transmission Line

The comment concerning an open transmission line corridor is noted. The agencies involved in the EIS/EIR process are not in a position to dictate who gets access to the transmission line. Transmission line access is governed by rules set by the Federal Energy Regulatory Commission.

Comments—Power Export

AL.3 To develop more power, they say. For whom? *(Barbara Allen)*

AV.5 The worst impact of the project is that the resulting power will be sold out of state while the negative ramifications will remain with California. *(Dave and Laurie Bish)*

AX.2 California will pay the environmental destruction costs and Oregon will receive the energy that will be produced??? What is wrong with this picture? *(Susan Bradfield)*

BX.6 ....and any power gained by the highlands would go to Oregon. Why destroy the highlands so as to export energy? *(Dean H. duVernet)*

CW.4 The energy generated by these geothermal projects would not even benefit our state! *(Barbara Hannelore)*

DC.4 The power generated will not benefit the citizens of California, who will be paying the price with the environmental destruction of the pristine and unique area. The power will be sold to Oregon. It was obvious that the intent is to take the national resources put in trust for the people and sell it for a price to the highest bidder. *(Anita E. Henning)*

DH.4 Combine all this with the fact that the energy will be sold to Oregon makes this a very bad deal for Californians. *(Katherine Holmes)*

DX.3 It is my understanding that the power generated from the project will not even be used in California.
(Nancy B. Kenyon)

EJ.4 Most glaring, is the fact this energy wont even stay in California—it's Deeded for Oregon. *(Laraine Lewis)*

EN.2 The power generated from these projects will be sold in Oregon, leaving California with the environmental and cultural costs of visual blight, habitat loss, and infringement on religious practices of Native Americans. This hardly seems fair and just. *(Laura Louttit)*

FD.4 Finally, the need for the power locally could be an over-riding consideration. However, when the power generated will be sent elsewhere (coupled with the knowledge that other plants will follow to service other areas), it provides NO benefit locally. Generating power here and then shipping it elsewhere is the same as letting our water be diverted to southern California. Does this make sense? I doubt if this is what the local citizens want to happen. *(H. K. "Bud" Miller)*

FR.3 If the people in Oregon need power, put the plants up there not here. *(Julie Norman)*

FZ.4 High tension power lines as of now run through the Tulelake Basin bringing power south from Oregon - Washington - Columbia River sources. It seems highly ironic to reverse electrical flow south to north leaving California to Oregon. It is certainly more feasible for Oregon to tap into these power lines originating in their territory rather than destroy our unique Medicine Lake and surrounding environs including infringement of historical religious use for the Klamath, Modoc, Shasta tribes; habitation for both northern and California spotted owls, goshawk, peregrine falcon, etc. and year around water source of Medicine Lake. *(Katherine Petterson)*

GD.3 The power would not go to California anyway. *(Dolores Plumb)*

GL.2 It is unconscionable to allow this kind of environmental degradation and destruction to lands in California so that power will be generated for sale to Oregon. *(Deirdre and Randy Rand)*

HI.6 I have always been very supportive of the development of alternative energy sources. I co-taught an Environmental Science at Columbia Basin College (Washington state) for the past 18 months with an emphasis on alternative energy. Geothermal energy was discussed at great length. However, I believe that this energy supply should benefit the users of the area without great environmental destruction. The proposed development does not meet these qualifications. The nearest large urban area is over 350 miles south of the project site. This energy supply will not be developed for the citizens of Siskiyou, Modoc and Shasta Counties! *(Martha Spencer)*

HS.3 This project would be especially unnecessary since the power generated would apparently be sold to Oregon. *(Larry Thompson)*

HY.4 The estimated 24-mile of the proposed transmission line, which extends "in an easterly direction from the proposed power plant site through the Modoc NF to a proposed substation along the BPA Malin-Warner transmission line (which parallels Hwy. 139 near Perez, CA," as stated on p1-3, actual crosses the CA-OR border, is there any sharing of energy and economic benefits between CA and Oregon from this project? It was not stated in Chapter one overview, this I found very deficient in the economic framework of this project. *(Alice Tseng)*

IA.2 Furthermore, the power and profits generated will be funneled out of Siskiyou and Modoc Counties. *(Susan Turney)*

IE.3 Let's put aside the smell, noise, the disruption to wildlife intrusion into Native American spiritual areas. There is still no buyer for the electricity. It could go to Oregon, Montana or New Mexico IT WON'T even benefit the energy need in California. *(Alysa Waring)*

IH.4 If Oregon needs the power so bad build it in their backyard! We don't want it here! *(Jerry and Vicky Weber)*

PH1.4 I asked this before and I can do it again, I guess. In what way will this benefit us, the local people; will we get any of that power? *(Dorris Public Hearing)*

PH3.9 If the electricity is sold to Bonneville, does that mean the electricity goes to Oregon? *(Yreka Public Hearing)*

PH3.59 Can or does the BPA wield any power into Yreka? *(Yreka Public Hearing)*

PH3.60 Is it possible to reroute power from this project back into Siskiyou County? *(Yreka Public Hearing)*

PH4.40 Who would be the primary receiver of energy?

PH4.41 What percent [of energy] would serve the local counties and Medicine Lake area? *(Mount Shasta Public Hearing)*

PH5.81 You're going to sell just forty-nine megawatts of the power to Bonneville Power. When Bonneville Power runs that over their lines, how are they going to determine when they sell this out to the general company, that that's green power or not? They're not going to make—for a little ol' diddley thing like that you're not going to make an adjustment of power rates. *(Medicine Lake Public Hearing)*

Response—Power Export

The concern regarding export of power to Oregon is noted. The Bonneville Power Administration (BPA) is a Federal agency responsible for purchasing, developing and marketing electrical power to utility and industrial customers throughout the western United States, including California. The Surprise Valley Electric Cooperative, for example, is a BPA customer. Pacific Power and Light, which serves parts of northern California, also buys power from BPA. In 1996, California accounted for most of the roughly 14 percent of BPA's revenue that came from power sales outside the Northwest.

The proposed Fourmile Hill Geothermal Development Project would supply power to the BPA Malin-Warner transmission line. This connection would deliver the electricity from the Fourmile site directly into the regional power grid. Energy from this grid would be distributed throughout the Pacific Northwest. It is not possible to predict the ultimate destination of electricity generated by the project.

BPA is considering purchasing only 30 MW of the project's output. The remaining output could be in the California market or elsewhere.

Comment—Proposed Amendment for Utility Corridor Impact Assessment

AJ.12 A recently proposed amendment to the standard implies that impacts of utility corridors on associated communities and private lands are to be fully considered. (See page 1 of Modoc Record dated July 24, 1997.) While this amendment has not yet been adopted, it should be kept in mind. If it is to be followed, it would seem that there must be some substantial information interchange and discussion between the community and the agencies. As stated previously in this letter, such interchange has not occurred in the present case. *(Larry Hearne, et al., Tionesta Residents)*

Response—Proposed Amendment for Utility Corridor Impact Assessment

The proposed amendment to the standard concerning utility corridors has been noted. On pages 2-39 through 2-52 of the Draft EIS/EIR, the design and structure of the utility corridors for transmission lines for the proposed project are described in detail. All information concerning the utility corridors that would be created by the proposed project has been included in the Draft EIS/EIR. The impacts of utility corridors on associated communities and private lands have also been addressed in the Draft EIS/EIR. The Tionesta community was notified of the four public scoping meetings and the five public meetings that were held to receive comments on the Draft EIS/EIR.

Comments—Project Subsidy

AT.3 As taxpayers, we object to paying for any more subsidized projects. The profit potential, without government subsidy, is very, very low. To subsidize this project in order for 'the county of Siskiyou to derive some "income" is an illusion—we still pay for it, and so do each of you. *(Kenneth and Leona Beatty)*

PH5.72 That's the tax payer that's subsidizing the government, which is us. *(Medicine Lake Public Hearing)*

PH5.73 I would like a question answered in my mind, is this entire program subsidized by the federal government? *(Medicine Lake Public Hearing)*

PH5.75 Then we're talking about green power, and we realize that that is subsidized. So if I'm a irrigator in the Tulelake area and have fifty electric pumps, I can get a subsidy to use green power? *(Medicine Lake Public Hearing)*

PH5.76 This is what I am getting at, is it primarily the individual household, or is it primarily the industrial that—this green power advantage subsidy? *(Medicine Lake Public Hearing)*

PH5.78 Down in the Bay Area, San Francisco Bay Area, they built thousands and thousands of windmills. And those were all subsidized, people got tax credits to construct those. And they built thousands of these things. And they did not use them because they could not sell them because it was so much more expensive, their existence, that they could not sell the power. And they're just sitting idle twenty years later, and yet the developer—I don't know who developed them, but the developer got tax credits to where they were constructing these things almost free because of the benefits. And that just increases the cost to the county, the people. We have to pay for it because of the tax credits. And I think that's kind of—the basis of the question is, how much are you, Calpine, being subsidized? How much is going to come—out of the hundred fifty million dollars is going to come out of your pocket and not out of ours as property owners? Have they changed the laws to where you're not getting these tax credits to build these boondoggles like they did in the Bay Area? *(Medicine Lake Public Hearing)*

Response—Project Subsidy

The opinion expressed in the comment that subsidies will be required for the project is noted. There are no plans for subsidies for the project at this time.

Comment—Noise Effects of the Telephone Flat Project

H.33 The Telephone Flat Project is likely to receive tremendous opposition due to the much higher noise levels that would impact the receptors in the Medicine Lake Caldera. *(Bill Dart, American Motorcyclist Association)*

Response—Noise Effects of the Telephone Flat Project

The comment concerning the Telephone Flat project has been noted.

7: COMMENT INDEX

7: COMMENT INDEX

This document provides responses to comments on the Draft EIS/EIR received from the public and various state and Federal agencies for the proposed Fourmile Hill Geothermal Development Project. The purpose of this document is to provide further information on the proposed project, and to clarify issues that may have been unclear to readers. In addition, the responses highlight the changes that have been made to the EIS/EIR.

7.1 Comments and Responses Organization

COMMENTS

A total of 270 comment letters were received on the Draft EIS/EIR. Most of the letters contained several comments on a variety of topics. Additional comments were made at the five public hearings that were held after the Draft EIS/EIR was published. Each comment letter or source has been assigned an alphabetical designation for easy reference (see Section 2.1 of this document). After the 24th letter (Letter "Z"), the code continues as "AA, AB, AC, ..." and so on. Letters were ordered alphabetically in three broad categories, in the following order:

1. Comment letters from regulatory agencies
2. Comment letters from other organizations
3. Comment letters from individuals

Each comment in each letter was assigned a number code. Thus, each comment has a unique alphanumeric code, representing the comment letter (the letter code) and the individual comment within each letter (the number code). For example, the third comment in the second letter would have the code "B.3."

Many of the comments received addressed the same topic (e.g., potential for effects on Fall River Mills water quality and quantity). The lead agencies determined that the most effective way to respond to the comment letters was to group individual comments by topic area, rather than to respond separately to each comment letter. This format is intended to provide readers with a more comprehensive and concise discussion of each topic area.

Comment letters were converted to electronic form by scanning or typing. The content of each letter was fully preserved. Individual comments in each letter were then separated and categorized by broad environmental parameter (e.g., hydrology, vegetation, etc.). The comments were then grouped by these parameters. In many cases,

comments addresses several topics at once (i.e., in the same sentence). In these cases, comments were assigned to the primary environmental topic addressed. In cases where there was no primary comment (e.g., a list of topics), the comment was assigned the topic that appeared first in the sentence. Within each environmental topic, the comments were further organized into subtopics addressing specific areas of each environmental parameter (e.g., "Effects of Well Venting on Vegetation").

ORGANIZATION OF COMMENTS

The environmental parameters are presented in the same order in which they appear in the EIS/EIR. Subtopics are then organized within each environmental parameter. For each subtopic, there are two sections: comments (organized alphabetically and numerically), and their responses. The Comment Index provides a listing of comment letters with corresponding alphabetical designations, as well as numeric designations for each individual comment.

RESPONSES

The responses address all individual comments. The text of the responses was written to provide a thorough discussion of the issues raised by the comments, rather than segmented answers to isolated issues. Where appropriate, responses reference specific comments by alphanumeric designation (e.g., "In response to comment A.9,...") in order to address specific issues.

7.2 How to Find Your Comments

The index is organized alphanumerically. For each comment, its comment number and the name of the commentor is identified, the section of Volume III in which the comment is located is provided, and the page number on which the comment is located is identified.

1. Turn to the Comment Index in this chapter (the Comment Index also appears in Volume IV, which contains the original comment letters). The pages of the index are tan for easy identification.
2. Find your name or the name of your organization (alphabetized). Please note that letters IV through JJ were received after the comment period had ended, and are therefore not alphabetical with the rest of the letters.
3. Identify your letter's letter designation (e.g., Q, AL, BA, JJ, etc.).
4. Find your comment letter in Volume IV (the table of contents in Volume IV identifies the page on which the letters begin), which contains all original comments letters with individual comments identified by the letter designation and number.
5. Using the Comment Index, identify the page number on which your comments appear.
6. Turn to the pages in this volume where your comments are located. The responses will follow the comments.

An alternative method of using this document is to turn to a topic of interest, review the comments received on the topic and read the responses.

7.3 Comment Index

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Deanna M. Weiman, U.S. Environmental Protection Agency		
A.1	Alternatives, Including the Proposed Action	67
A.2	Alternatives, Including the Proposed Action	40
A.3	General Comments (Chapter 6)	6
A.4	Cumulative Effects	659
A.5	Project Preference (Chapter 5)	15
A.6	Traditional Cultural Values	261
A.7	General Comments (Chapter 6)	3
A.8	NEPA/CEQA Issues (Chapter 4)	11
A.9	Hydrology	119
A.10	NEPA/CEQA Issues (Chapter 4)	11
A.11	Alternatives, Including the Proposed Action	67
A.12	Alternatives, Including the Proposed Action	68
A.13	Project Preference (Chapter 5)	15
A.14	General Comments (Chapter 6)	6
A.15	Project Preference (Chapter 5)	15
A.16	General Comments (Chapter 6)	7
A.17	Vegetation	314
A.18	Socioeconomics	645
A.19	Hydrology	126
A.20	Hydrology	119
A.21	Hydrology	133
A.22	Hydrology	133
A.23	Hydrology	130
A.24	Hydrology	91
A.25	Hydrology	98
A.26	Hydrology	91
A.27	Hydrology	179
A.28	Cumulative Effects	680
A.29	Hydrology	157
A.30	Hydrology	102
A.31	Hydrology	126
A.32	Hydrology	130
A.33	Hydrology	204
A.34	Alternatives, Including the Proposed Action	48
A.35	Hydrology	98
A.36	Hydrology	91
A.37	Hydrology	91
A.38	Geology and Soils	74
A.39	Geothermal Resources	214
A.40	Cumulative Effects	677
A.41	Alternatives, Including the Proposed Action	66
A.42	Cumulative Effects	686
A.43	Introduction and Purpose and Need	25
A.44	Cumulative Effects	680
A.45	Cumulative Effects	697
A.46	Air Quality	531

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
A.47	Air Quality	542
A.48	Air Quality	503
A.49	Air Quality	542
A.50	Human Health and Safety	623
A.51	Human Health and Safety	640
A.52	Hydrology	134
A.53	Alternatives, Including the Proposed Action	68
A.54	Human Health and Safety	616
A.55	Human Health and Safety	612
A.56	Vegetation	314
A.57	Introduction and Purpose and Need	10
A.58	Human Health and Safety	618
A.59	Hydrology	98
A.60	Alternatives, Including the Proposed Action	63
A.61	Noise	595
A.62	Wildlife	343
A.63	Socioeconomics	650
A.64	Traditional Cultural Values	268
Ronald A. Iverson, U.S. Fish and Wildlife Service		
B.1	Wildlife	325
B.2	Wildlife	378
B.3	Hydrology	141
B.4	Cumulative Effects	692
B.5	Other Statutory Sections	706
B.6	Wildlife	363
B.7	Plans and Policies	426
B.8	Wildlife	338
B.9	Wildlife	330
B.10	Wildlife	329
B.11	Wildlife	347
B.12	Vegetation	312
B.13	Alternatives, Including the Proposed Action	63
B.14	Wildlife	326
B.15	Wildlife	384
B.16	General Comments (Chapter 6)	4
B.17	Wildlife	342
B.18	Wildlife	342
B.19	Wildlife	342
B.20	Wildlife	343
B.21	Hydrology	194
B.22	Wildlife	380
Julie Donnelly-Nolan, U.S. Geological Survey		
C.1	Geology and Soils	75
C.2	Geology and Soils	75
C.3	Geology and Soils	75
Richard L. Elliot, California Department of Fish and Game		
D.1	Vegetation	302
D.2	Vegetation	311
D.3	Hydrology	141

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
D.4	Hydrology	204
D.5	Hydrology	194
D.6	Wildlife	345
D.7	Cumulative Effects	659
Richard D. Barnum, Siskiyou County Planning Department		
E.1	NEPA/CEQA Issues (Chapter 4)	1
E.2	Air Quality	486
E.3	NEPA/CEQA Issues (Chapter 4)	1
E.4	NEPA/CEQA Issues (Chapter 4)	9
E.5	General Comments (Chapter 6)	33
John R. Hannum, North Coast Regional Water Quality Control Board		
F.1	Introduction and Purpose and Need	23
F.2	Hydrology	168
F.3	Human Health and Safety	621
F.4	Hydrology	138
F.5	Geothermal Resources	216
F.6	Introduction and Purpose and Need	23
F.7	General Comments (Chapter 6)	33
F.8	Introduction and Purpose and Need	23
F.9	Geothermal Resources	212
F.10	Alternatives, Including the Proposed Action	44
F.11	Hydrology	102
F.12	Alternatives, Including the Proposed Action	48
F.13	Alternatives, Including the Proposed Action	50
F.14	Geothermal Resources	207
F.15	Hydrology	165
F.16	Hydrology	92
F.17	Hydrology	86
F.18	Geothermal Resources	214
F.19	Hydrology	169
F.20	Hydrology	102
F.21	Alternatives, Including the Proposed Action	50
F.22	Hydrology	191
F.23	Hydrology	165
F.24	NEPA/CEQA Issues (Chapter 4)	2
F.25	Geothermal Resources	214
F.26	Geothermal Resources	214
Cherilyn E. Widell, State Office of Historic Preservation		
G.1	Cultural Resources	228
American Motorcyclist Association		
H.1	General Comments (Chapter 6)	15
H.2	NEPA/CEQA Issues (Chapter 4)	2
H.3	Cumulative Effects	677
H.4	General Comments (Chapter 6)	15
H.5	Visual Quality	411
H.6	Visual Quality	399
H.7	Visual Quality	400
H.8	Visual Quality	400
H.9	Visual Quality	403

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
H.10	Visual Quality	403
H.11	Visual Quality	413
H.12	Visual Quality	410
H.13	Project Preference (Chapter 5)	15
H.14	Land Use and Recreation	457
H.15	Alternatives, Including the Proposed Action	68
H.16	Land Use and Recreation	462
H.17	Land Use and Recreation	462
H.18	Land Use and Recreation	462
H.19	Land Use and Recreation	460
H.20	Land Use and Recreation	461
H.21	Cumulative Effects	697
H.22	Transportation	475
H.23	Land Use and Recreation	462
H.24	Land Use and Recreation	462
H.25	Visual Quality	392
H.26	Cumulative Effects	696
H.27	Visual Quality	392
H.28	Noise	563
H.29	Noise	600
H.30	Noise	610
H.31	Noise	593
H.32	Cumulative Effects	698
H.33	General Comments (Chapter 6)	37
H.34	Noise	579
H.35	NEPA/CEQA Issues (Chapter 4)	11
H.36	Project Preference (Chapter 5)	15
H.37	Project Preference (Chapter 5)	5
H.38	General Comments (Chapter 6)	4
Dale R. Schuster, CalEnergy International Ltd.		
I.1	Project Preference (Chapter 5)	17
I.2	General Comments (Chapter 6)	34
Vivian Parker, California Native Plant Society		
J.1	Project Preference (Chapter 5)	5
J.2	Vegetation	278
J.3	General Comments (Chapter 6)	15
J.4	Vegetation	318
J.5	Vegetation	306
J.6	Vegetation	278
J.7	Vegetation	284
J.8	Cumulative Effects	687
J.9	Vegetation	302
J.10	Vegetation	307
J.11	Vegetation	309
J.12	Vegetation	307
J.13	Vegetation	297
J.14	Visual Quality	391
J.15	Project Preference (Chapter 5)	11

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Ryan Henson, California Wilderness Coalition		
K.1	General Comments (Chapter 6)	7
K.2	General Comments (Chapter 6)	13
K.3	Plans and Policies	436
K.4	Plans and Policies	436
K.5	Land Use and Recreation	454
K.6	Plans and Policies	437
K.7	Plans and Policies	437
K.8	Plans and Policies	437
K.9	Plans and Policies	431
K.10	Plans and Policies	427
K.11	Plans and Policies	434
K.12	Vegetation	303
K.13	Plans and Policies	430
K.14	Project Preference (Chapter 5)	3
K.15	General Comments (Chapter 6)	4
Steve Tabor, Desert Survivors		
L.1	Project Preference (Chapter 5)	5
L.2	Wildlife	334
L.3	Vegetation	301
L.4	Traditional Cultural Values	252
L.5	Hydrology	126
L.6	General Comments (Chapter 6)	4
Rick Poore, et al., Fall River Resource Conservation District		
M.1	General Comments (Chapter 6)	5
M.2	Hydrology	141
M.3	Hydrology	141
M.4	Hydrology	141
M.5	Hydrology	119
M.6	Hydrology	119
M.7	Geothermal Resources	212
M.8	Hydrology	141
M.9	NEPA/CEQA Issues (Chapter 4)	14
M.10	Hydrology	93
M.11	NEPA/CEQA Issues (Chapter 4)	2
Robert J. Baiocchi, Fall River Wild Trout Foundation		
N.1	NEPA/CEQA Issues (Chapter 4)	6
N.2	Introduction and Purpose and Need	11
N.3	Introduction and Purpose and Need	12
N.4	Hydrology	86
N.5	Wildlife	339
N.6	Cumulative Effects	681
N.7	Hydrology	141
N.8	Cumulative Effects	681
N.9	Wildlife	378
N.10	Hydrology	142
N.11	Traditional Cultural Values	250
N.12	Cumulative Effects	686
N.13	Wildlife	380

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
N.14	Hydrology	194
N.15	Hydrology	91
N.16	Noise	565
N.17	Visual Quality	408
N.18	Visual Quality	396
N.19	Air Quality	486
N.20	Human Health and Safety	627
N.21	Vegetation	297
N.22	Vegetation	310
N.23	Vegetation	297
N.24	Hydrology	157
N.25	Wildlife	334, 384
N.26	Cumulative Effects	693
N.27	Cumulative Effects	693
N.28	Land Use and Recreation	464
N.29	Wildlife	347
N.30	Wildlife	326
N.31	Cumulative Effects	693
N.32	Wildlife	326
N.33	Wildlife	326
N.34	Introduction and Purpose and Need	31
N.35	Alternatives, Including the Proposed Action	68
N.36	Alternatives, Including the Proposed Action	63
N.37	NEPA/CEQA Issues (Chapter 4)	2
N.38	General Comments (Chapter 6)	5
N.39	General Comments (Chapter 6)	2
Katherine Kowatch, Friends of the River		
O.1	General Comments (Chapter 6)	7
O.2	Project Preference (Chapter 5)	3
O.3	Plans and Policies	425
O.4	Hydrology	142
O.5	Hydrology	119
O.6	Geology and Soils	80
O.7	Geology and Soils	83
O.8	Plans and Policies	437
O.9	Visual Quality	410
O.10	Wildlife	378
O.11	Wildlife	335
O.12	Wildlife	369
O.13	Wildlife	361
O.14	Wildlife	355
O.15	Vegetation	301
O.16	Vegetation	296
O.17	Vegetation	307
O.18	Vegetation	308
O.19	Geology and Soils	83
O.20	Vegetation	311
O.21	Traditional Cultural Values	254
O.22	Project Preference (Chapter 5)	3

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
O.23	General Comments (Chapter 6)	4
Carol Logan, Kalapooya Sacred Circle Alliance		
P.1	Project Preference (Chapter 5)	5
P.2	Traditional Cultural Values	250
P.3	General Comments (Chapter 6)	2
P.4	Traditional Cultural Values	253
P.5	Traditional Cultural Values	260
P.6	Traditional Cultural Values	251
P.7	Traditional Cultural Values	253
Klamath Forest Alliance		
Q.1	Project Preference (Chapter 5)	3
Q.2	General Comments (Chapter 6)	15
Q.3	Wildlife	369
Q.4	Vegetation	321
Q.5	Wildlife	343
Q.6	Plans and Policies	438
Q.7	Traditional Cultural Values	263
Q.8	Project Preference (Chapter 5)	5
Q.9	Project Preference (Chapter 5)	3
Q.10	Land Use and Recreation	450
Q.11	Project Preference (Chapter 5)	3
Q.12	Project Preference (Chapter 5)	2
The Klamath Tribes		
R.1	Project Preference (Chapter 5)	6
R.2	Cultural Resources	228
R.3	Traditional Cultural Values	263
R.4	Traditional Cultural Values	268
R.5	General Comments (Chapter 6)	15
R.6	Project Preference (Chapter 5)	11
Lawrence Livermore National Laboratory		
S.1	Hydrology	142
S.2	Cumulative Effects	681
S.3	Hydrology	205
Medicine Lake Citizens for Quality Environment		
T.1	General Comments (Chapter 6)	13
T.2	NEPA/CEQA Issues (Chapter 4)	18
T.3	General Comments (Chapter 6)	15
T.4	Introduction and Purpose and Need	28
T.5	Cumulative Effects	659
T.6	Alternatives, Including the Proposed Action	40
T.7	Cumulative Effects	659
T.8	NEPA/CEQA Issues (Chapter 4)	8
T.9	Alternatives, Including the Proposed Action	44
T.10	NEPA/CEQA Issues (Chapter 4)	2, 7
T.11	Alternatives, Including the Proposed Action	44
T.12	Wildlife	325
T.13	Vegetation	321
T.14	Cumulative Effects	659
T.15	Plans and Policies	415

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
T.16	Plans and Policies	436
T.17	Plans and Policies	418
T.18	NEPA/CEQA Issues (Chapter 4)	2
T.19	Air Quality	489
T.20	Wildlife	353
T.21	NEPA/CEQA Issues (Chapter 4)	2
T.22	General Comments (Chapter 6)	4
Medicine Lake Citizens for Quality Environment		
U.1	General Comments (Chapter 6)	7
U.2	Introduction and Purpose and Need	28
U.3	Alternatives, Including the Proposed Action	45
U.4	Hydrology	87
U.5	Hydrology	169
U.6	Hydrology	165
U.7	Hydrology	138
U.8	Hydrology	161
U.9	Hydrology	194
U.10	Hydrology	134
U.11	Wildlife	380
U.12	Hydrology	195
U.13	Land Use and Recreation	450
U.14	Land Use and Recreation	467
U.15	Land Use and Recreation	457
U.16	Land Use and Recreation	460
U.17	Air Quality	519
U.18	Air Quality	539
U.19	Air Quality	546
U.20	Air Quality	487
U.21	Air Quality	488
U.22	Human Health and Safety	621
U.23	Vegetation	310
U.24	Geology and Soils	83
U.25	Cumulative Effects	659
U.26	General Comments (Chapter 6)	16
U.27	Project Preference (Chapter 5)	3
Medicine Lake Citizens for Quality Environment		
V.1	NEPA/CEQA Issues (Chapter 4)	2
V.2	Noise	561
V.3	Noise	567
V.4	Noise	602
V.5	Noise	581
V.6	Noise	573
V.7	Noise	569
V.8	Noise	596
V.9	Noise	582
V.10	Noise	567
V.11	Noise	597
V.12	Noise	586
V.13	Noise	576

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
V.14	Cumulative Effects	673
V.15	Cumulative Effects	698
V.16	Cumulative Effects	699
V.17	Noise	574
V.18	Cumulative Effects	699
V.19	Noise	570
V.20	Cumulative Effects	70
V.21	Cumulative Effects	701
V.22	Introduction and Purpose and Need	16
V.23	Introduction and Purpose and Need	21
V.24	Air Quality	549
V.25	Cumulative Effects	660
V.26	Introduction and Purpose and Need	17
V.27	Air Quality	549
V.28	Air Quality	550
V.29	Air Quality	482
V.30	Air Quality	477
V.31	Air Quality	478
V.32	Noise	587
V.33	Air Quality	478
V.34	Air Quality	438
V.35	Air Quality	438
V.36	Air Quality	540
V.37	NEPA/CEQA Issues (Chapter 4)	16
V.38	General Comments (Chapter 6)	4
V.39	Project Preference (Chapter 5)	11
Medicine Lake Citizens for Quality Environment		
W.1	Project Preference (Chapter 5)	6
W.2	Cumulative Effects	660
W.3	Land Use and Recreation	451
W.4	General Comments (Chapter 6)	16
W.5	General Comments (Chapter 6)	16
W.6	Project Preference (Chapter 5)	13
Mount Shasta Area Audobon Society Board of Directors		
X.1	Project Preference (Chapter 5)	6
X.2	Wildlife	335
X.3	Vegetation	310
X.4	Vegetation	314
X.5	Vegetation	301
X.6	Vegetation	311
X.7	Wildlife	355
X.8	Wildlife	363
X.9	Wildlife	370
X.10	Wildlife	345
X.11	Geology and Soils	83
X.12	NEPA/CEQA Issues (Chapter 4)	21
Mount Shasta Bioregional Ecology Center		
Y.1	General Comments (Chapter 6)	13
Y.2	General Comments (Chapter 6)	7

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Y.3	General Comments (Chapter 6)	16
Y.4	General Comments (Chapter 6)	7
Y.5	Traditional Cultural Values	263
Y.6	Land Use and Recreation	467
Y.7	Land Use and Recreation	468
Y.8	General Comments (Chapter 6)	16
Y.9	Introduction and Purpose and Need	3
Y.10	Introduction and Purpose and Need	31
Y.11	Cumulative Effects	660
Y.12	Introduction and Purpose and Need	6
Y.13	General Comments (Chapter 6)	16
Y.14	General Comments (Chapter 6)	2
Y.15	NEPA/CEQA Issues (Chapter 4)	17
Y.16	NEPA/CEQA Issues (Chapter 4)	14
Y.17	NEPA/CEQA Issues (Chapter 4)	14
Y.18	Introduction and Purpose and Need	28
Y.19	Introduction and Purpose and Need	26
Y.20	Introduction and Purpose and Need	31
Y.21	NEPA/CEQA Issues (Chapter 4)	8
Y.22	NEPA/CEQA Issues (Chapter 4)	3
Y.23	Traditional Cultural Values	259
Y.24	Wildlife	329
Y.25	Hydrology	87
Y.26	Hydrology	87
Y.27	Hydrology	143
Y.28	Alternatives, Including the Proposed Action	45
Y.29	Geothermal Resources	214
Y.30	Wildlife	380
Y.31	Hydrology	169
Y.32	Air Quality	486
Y.33	Air Quality	546
Y.34	Visual Quality	396
Y.35	Visual Quality	411
Y.36	Visual Quality	392
Y.37	Visual Quality	408
Y.38	Noise	563
Y.39	Wildlife	344
Y.40	Plans and Policies	415
Y.41	Traditional Cultural Values	254
Y.42	Plans and Policies	415
Y.43	Plans and Policies	418
Y.44	Plans and Policies	419
Y.45	Plans and Policies	419
Y.46	Plans and Policies	416
Y.47	Plans and Policies	431
Y.48	Vegetation	310
Y.49	Plans and Policies	436
Y.50	Alternatives, Including the Proposed Action	40
Y.51	Alternatives, Including the Proposed Action	51

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Y.52	NEPA/CEQA Issues (Chapter 4)	11
Y.53	Human Health and Safety	624
Y.54	Introduction and Purpose and Need	31
Y.55	General Comments (Chapter 6)	16
Y.56	Geology and Soils	76
Y.57	NEPA/CEQA Issues (Chapter 4)	3
Y.58	Alternatives, Including the Proposed Action	72
Y.59	General Comments (Chapter 6)	16
Y.60	Alternatives, Including the Proposed Action	72
Y.61	NEPA/CEQA Issues (Chapter 4)	14
Y.62	Project Preference (Chapter 5)	3
Mount Shasta Sno-mobilers Inc.		
Z.1	General Comments (Chapter 6)	16
Z.2	Land Use and Recreation	459
Z.3	Land Use and Recreation	461
Z.4	Land Use and Recreation	457
Z.5	Land Use and Recreation	460
Mount Shasta Tomorrow		
AA.1	Noise	603
AA.2	Cumulative Effects	677
Native Coalition for Cultural Restoration of Mount Shasta		
AB.1	Project Preference (Chapter 5)	6
AB.2	Traditional Cultural Values	251
AB.3	Alternatives, Including the Proposed Action	51
AB.4	Geology and Soils	78
AB.5	General Comments (Chapter 6)	7
AB.6	Introduction and Purpose and Need	6
AB.7	Traditional Cultural Values	254
AB.8	Project Preference (Chapter 5)	3
AB.9	General Comments (Chapter 6)	14
North Coast Environmental Center		
AC.1	Project Preference (Chapter 5)	6
AC.2	Traditional Cultural Values	252
AC.3	Plans and Policies	432
AC.4	Traditional Cultural Values	251
AC.5	Project Preference (Chapter 5)	13
Pit River Tribe		
AD.1	Project Preference (Chapter 5)	6
AD.2	Traditional Cultural Values	261
AD.3	Traditional Cultural Values	252
AD.4	NEPA/CEQA Issues (Chapter 4)	18
AD.5	Cultural Resources	229
AD.6	Traditional Cultural Values	261
AD.7	Traditional Cultural Values	261
AD.8	Cultural Resources	238
AD.9	Cultural Resources	232
AD.10	Traditional Cultural Values	272
AD.11	Cultural Resources	229
AD.12	Cultural Resources	233

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
AD.13	Cultural Resources	229
AD.14	Cultural Resources	232
AD.15	Traditional Cultural Values	260
AD.16	Traditional Cultural Values	254
AD.17	Traditional Cultural Values	254
AD.18	Traditional Cultural Values	254
AD.19	Traditional Cultural Values	254
AD.20	Introduction and Purpose and Need	13
AD.21	Cultural Resources	229
AD.22	Alternatives, Including the Proposed Action	45
AD.23	Hydrology	87
AD.24	Traditional Cultural Values	266
AD.25	Hydrology	195
AD.26	Cumulative Effects	660
AD.27	Cultural Resources	248
AD.28	Cumulative Effects	660
AD.29	Cumulative Effects	677
AD.30	Introduction and Purpose and Need	29
AD.31	Traditional Cultural Values	270
AD.32	Cultural Resources	229
AD.33	Visual Quality	392
AD.34	Traditional Cultural Values	269
AD.35	Visual Quality	392
AD.36	Traditional Cultural Values	269
AD.37	Cumulative Effects	696
AD.38	Traditional Cultural Values	269
AD.39	Visual Quality	396
AD.40	Visual Quality	388
AD.41	Traditional Cultural Values	269
AD.42	Cultural Resources	233
AD.43	Traditional Cultural Values	275
AD.44	Cultural Resources	233
AD.45	Cultural Resources	233
AD.46	Cultural Resources	236
AD.47	Cultural Resources	238
AD.48	Cultural Resources	241
AD.49	Cultural Resources	238
AD.50	Cultural Resources	242
AD.51	Visual Quality	405
AD.52	Cultural Resources	242
AD.53	Cultural Resources	238
AD.54	Cultural Resources	242
AD.55	Cultural Resources	236
AD.56	Cultural Resources	233
AD.57	Traditional Cultural Values	276
AD.58	Traditional Cultural Values	276
AD.59	Traditional Cultural Values	276
AD.60	Traditional Cultural Values	276
AD.61	Plans and Policies	438

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
AD.62	Vegetation	308
AD.63	Traditional Cultural Values	276
AD.64	Project Preference (Chapter 5)	13
AD.65	NEPA/CEQA Issues (Chapter 4)	18
Pit River Tribe		
AE.1	Project Preference (Chapter 5)	6
AE.2	Alternatives, Including the Proposed Action	51
AE.3	Geology and Soils	78
AE.4	NEPA/CEQA Issues (Chapter 4)	3
AE.5	Introduction and Purpose and Need	6
AE.6	Traditional Cultural Values	255
AE.7	Project Preference (Chapter 5)	3
Pacific Gas & Electric		
AF.1	Hydrology	143
Plumbers & Steamfitters		
AG.1	General Comments (Chapter 6)	17
AG.2	General Comments (Chapter 6)	17
AG.3	NEPA/CEQA Issues (Chapter 4)	3
AG.4	General Comments (Chapter 6)	14
AG.5	NEPA/CEQA Issues (Chapter 4)	10
AG.6	NEPA/CEQA Issues (Chapter 4)	7
AG.7	NEPA/CEQA Issues (Chapter 4)	5
AG.8	NEPA/CEQA Issues (Chapter 4)	5
AG.9	NEPA/CEQA Issues (Chapter 4)	5
AG.10	Alternatives, Including the Proposed Action	40
AG.11	Alternatives, Including the Proposed Action	41
AG.12	Cumulative Effects	660
AG.13	Alternatives, Including the Proposed Action	51
AG.14	NEPA/CEQA Issues (Chapter 4)	11
AG.15	Cumulative Effects	660
AG.16	Geology and Soils	81
AG.17	Geology and Soils	79
AG.18	Geology and Soils	85
AG.19	Hydrology	87
AG.20	Hydrology	180
AG.21	Hydrology	183
AG.22	Hydrology	184
AG.23	Hydrology	187
AG.24	Hydrology	109
AG.25	Hydrology	158
AG.26	Hydrology	119
AG.27	Hydrology	138
AG.28	Hydrology	191
AG.29	Hydrology	94
AG.30	Hydrology	97
AG.31	Introduction and Purpose and Need	24
AG.32	Geothermal Resources	220
AG.33	Other Statutory Sections	707
AG.34	Cultural Resources	243

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
AG.35	Cultural Resources	237, 243
AG.36	Cultural Resources	238
AG.37	Plans and Policies	419
AG.38	Cultural Resources	245
AG.39	Cultural Resources	241
AG.40	Cultural Resources	246
AG.41	Cultural Resources	247
AG.42	Traditional Cultural Values	266
AG.43	Traditional Cultural Values	272
AG.44	Traditional Cultural Values	273
AG.45	Traditional Cultural Values	270
AG.46	Vegetation	278
AG.47	Vegetation	304
AG.48	Vegetation	308
AG.49	Vegetation	282
AG.50	Vegetation	311
AG.51	Vegetation	297
AG.52	Plans and Policies	419
AG.53	Plans and Policies	424
AG.54	Vegetation	315
AG.55	Vegetation	312
AG.56	Vegetation	315
AG.57	Plans and Policies	430
AG.58	Vegetation	323
AG.59	Vegetation	315
AG.60	Vegetation	284
AG.61	Vegetation	320
AG.62	Vegetation	312
AG.63	Vegetation	296
AG.64	Vegetation	313
AG.65	Vegetation	315
AG.66	Vegetation	284
AG.67	Vegetation	281
AG.68	Wildlife	325
AG.69	Wildlife	331
AG.70	Wildlife	375
AG.71	Vegetation	311
AG.72	Wildlife	331
AG.73	Wildlife	345
AG.74	Plans and Policies	419
AG.75	Plans and Policies	424
AG.76	Wildlife	339
AG.77	Wildlife	325
AG.78	Wildlife	356
AG.79	Wildlife	361
AG.80	Wildlife	363
AG.81	Wildlife	369
AG.82	Wildlife	358
AG.83	Wildlife	359

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
AG.84	Wildlife	331
AG.85	Wildlife	332
AG.86	Wildlife	332
AG.87	Wildlife	332
AG.88	Wildlife	332
AG.89	Wildlife	384
AG.90	Wildlife	374
AG.91	Wildlife	374
AG.92	Vegetation	321
AG.93	Wildlife	347
AG.94	Plans and Policies	419
AG.95	Wildlife	384
AG.96	Wildlife	326
AG.97	Visual Quality	389
AG.98	Visual Quality	396
AG.99	Visual Quality	392
AG.100	Visual Quality	412
AG.101	Land Use and Recreation	443
AG.102	Land Use and Recreation	446
AG.103	Land Use and Recreation	443
AG.104	Transportation	473
AG.105	Transportation	474
AG.106	Human Health and Safety	621
AG.107	Air Quality	490
AG.108	Air Quality	483
AG.109	Air Quality	503
AG.110	Air Quality	497
AG.111	Air Quality	515
AG.112	Air Quality	516
AG.113	Air Quality	520
AG.114	Air Quality	527
AG.115	Air Quality	524
AG.116	Air Quality	524
AG.117	Air Quality	524
AG.118	Air Quality	524
AG.119	Air Quality	490
AG.120	Air Quality	517
AG.121	Air Quality	482
AG.122	Air Quality	536
AG.123	Air Quality	536
AG.124	Air Quality	544
AG.125	Air Quality	545
AG.126	Air Quality	545
AG.127	Air Quality	550
AG.128	Air Quality	552
AG.129	Air Quality	554
AG.130	Air Quality	551
AG.131	Air Quality	547
AG.132	Air Quality	501

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
AG.133	Other Statutory Sections	707
AG.134	Other Statutory Sections	710
AG.135	Noise	561
AG.136	Noise	561
AG.137	Noise	588
AG.138	NEPA/CEQA Issues (Chapter 4)	3
AG.139	Human Health and Safety	616
AG.140	Human Health and Safety	612
AG.141	Human Health and Safety	622
AG.142	Human Health and Safety	618
AG.143	Human Health and Safety	640
AG.144	Human Health and Safety	623
AG.145	Human Health and Safety	626
AG.146	Human Health and Safety	631
AG.147	Human Health and Safety	636
AG.148	Human Health and Safety	631
AG.149	Human Health and Safety	638
AG.150	Human Health and Safety	630
AG.151	Socioeconomics	642
AG.152	Socioeconomics	643
AG.153	Socioeconomics	644
AG.154	Socioeconomics	653
AG.155	Socioeconomics	654
AG.156	Socioeconomics	654
AG.157	Socioeconomics	654
AG.158	Human Health and Safety	640
AG.159	Human Health and Safety	618
AG.160	Socioeconomics	651
AG.161	Socioeconomics	647
AG.162	Land Use and Recreation	466
AG.163	Socioeconomics	644
AG.164	Alternatives, Including the Proposed Action	62
AG.165	Alternatives, Including the Proposed Action	62
AG.166	Alternatives, Including the Proposed Action	62
AG.167	Alternatives, Including the Proposed Action	51
AG.168	Cumulative Effects	660
AG.169	Cumulative Effects	660
AG.170	Cumulative Effects	681
AG.171	Cumulative Effects	681
AG.172	Cumulative Effects	685
AG.173	Cumulative Effects	685
AG.174	Cumulative Effects	687
AG.175	Cumulative Effects	688
AG.176	Cumulative Effects	688
AG.177	Cumulative Effects	693
AG.178	Cumulative Effects	693
AG.179	Cumulative Effects	701
AG.180	Cumulative Effects	704
AG.181	Cumulative Effects	677

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
AG.182	Alternatives, Including the Proposed Action	68
AG.183	Alternatives, Including the Proposed Action	68
AG.184	Alternatives, Including the Proposed Action	51
AG.185	Alternatives, Including the Proposed Action	60
AG.186	Alternatives, Including the Proposed Action	51
AG.187	NEPA/CEQA Issues (Chapter 4)	3
AG.188	General Comments (Chapter 6)	4
AG.189	General Comments (Chapter 6)	7
AG.190	Air Quality	493
AG.191	Air Quality	483
AG.192	Air Quality	484
AG.193	Air Quality	490
AG.194	Air Quality	504
AG.195	Air Quality	506
AG.196	Air Quality	506
AG.197	Air Quality	508
AG.198	Air Quality	510
AG.199	Air Quality	510
AG.200	Air Quality	512
AG.201	Air Quality	516
AG.202	Air Quality	516
AG.203	Air Quality	514
AG.204	Air Quality	516
AG.205	Air Quality	516
AG.206	Air Quality	520
AG.207	Air Quality	528
AG.208	Air Quality	525
AG.209	Air Quality	525
AG.210	Air Quality	526
AG.211	Air Quality	526
AG.212	Air Quality	498
AG.213	Air Quality	518
AG.214	Air Quality	485
AG.215	Air Quality	494
AG.216	Air Quality	499
AG.217	Air Quality	502
AG.218	Air Quality	537
AG.219	Air Quality	533
AG.220	Air Quality	537
AG.221	Air Quality	550
AG.222	Air Quality	551
AG.223	Air Quality	554
AG.224	Air Quality	553
AG.225	Air Quality	556
AG.226	Air Quality	557
AG.227	Air Quality	558
AG.228	Air Quality	548
AG.229	Hydrology	169
AG.230	Hydrology	181

Note: Comments can be found in Chapter 3, unless otherwise indicated.

Comment #	Volume III Section	Volume III Page
AG.231	Hydrology	183
AG.232	Hydrology	184
AG.233	Hydrology	187
AG.234	Wildlife	380
AG.235	Hydrology	188
AG.236	Vegetation	281
AG.237	Hydrology	109
AG.238	Hydrology	113
AG.239	Hydrology	117
AG.240	Hydrology	113
AG.241	Hydrology	115
AG.242	Hydrology	118
AG.243	Hydrology	158
AG.244	Hydrology	161
AG.245	Hydrology	162
AG.246	Hydrology	162
AG.247	Hydrology	126
AG.248	Hydrology	138
AG.249	Vegetation	284
AG.250	Vegetation	281
AG.251	Vegetation	292
AG.252	Vegetation	294
AG.253	Vegetation	295
AG.254	Vegetation	295
AG.255	Human Health and Safety	616
AG.256	Human Health and Safety	619
AG.257	Human Health and Safety	640
AG.258	Human Health and Safety	619
AG.259	Human Health and Safety	640
AG.260	Human Health and Safety	631
AG.261	Human Health and Safety	636
AG.262	Noise	606
AG.263	Noise	608
AG.264	Wildlife	344
AG.265	General Comments (Chapter 6)	17
AG.266	NEPA/CEQA Issues (Chapter 4)	3
AG.267	General Comments (Chapter 6)	17
AG.268	Cumulative Effects	660
AG.269	Cultural Resources	237
AG.270	Cultural Resources	239
AG.271	Cultural Resources	246
AG.272	Traditional Cultural Values	264
AG.273	Vegetation	304
AG.274	Vegetation	308
AG.275	Vegetation	321
AG.276	Vegetation	282
AG.277	Vegetation	315
AG.278	Vegetation	320
AG.279	Vegetation	313

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
AG.280	Vegetation	297
AG.281	Vegetation	323
AG.282	Wildlife	363
AG.283	Wildlife	347
AG.284	Wildlife	344
AG.285	Wildlife	359
AG.286	Wildlife	359
AG.287	Wildlife	332
AG.288	Wildlife	375
AG.289	Plans and Policies	427
AG.290	Wildlife	345
AG.291	Vegetation	322
AG.292	Wildlife	374
AG.293	Wildlife	344
AG.294	Wildlife	327
AG.295	Wildlife	353
AG.296	Wildlife	339
AG.297	Visual Quality	389
AG.298	Visual Quality	408
AG.299	Visual Quality	411
AG.300	Visual Quality	408
AG.301	Visual Quality	393
AG.302	Visual Quality	393
AG.303	Visual Quality	393
AG.304	Visual Quality	412
AG.305	Visual Quality	413
AG.306	Visual Quality	412
AG.307	Land Use and Recreation	446
AG.308	Noise	562
AG.309	Noise	577
AG.310	Noise	582
AG.311	Noise	572
AG.312	Noise	572
AG.313	Noise	574
AG.314	Noise	582
AG.315	Land Use and Recreation	446
AG.316	Noise	566
AG.317	Noise	604
AG.318	Noise	588
AG.319	Noise	590
AG.320	Traditional Cultural Values	266
AG.321	Traditional Cultural Values	266
AG.322	Traditional Cultural Values	266
AG.323	Traditional Cultural Values	266
AG.324	Traditional Cultural Values	267
AG.325	Traditional Cultural Values	267
AG.326	Noise	604
AG.327	Traditional Cultural Values	267
AG.328	Traditional Cultural Values	267

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
AG.329	Traditional Cultural Values	273
AG.330	Traditional Cultural Values	273
AG.331	Noise	597
AG.332	Noise	610
AG.333	Noise	582
AG.334	Noise	582
AG.335	Noise	583
AG.336	Noise	583
AG.337	Noise	574
AG.338	Noise	567
AG.339	Noise	574
AG.340	Noise	570
AG.341	Noise	564
AG.342	Noise	580
AG.343	Noise	580
AG.344	Noise	600
AG.345	Noise	596
AG.346	Noise	597
AG.347	Noise	592
AG.348	Noise	604
AG.349	Noise	604
AG.350	Noise	601
AG.351	Noise	601
AG.352	Noise	601
AG.353	Noise	601
AG.354	Noise	610
AG.355	Noise	598
AG.356	Noise	596
AG.357	Noise	598
AG.358	Noise	593
AG.359	Noise	591
AG.360	Noise	564
AG.361	Noise	606
AG.362	Noise	604
AG.363	Noise	599
AG.364	Noise	610
AG.365	Noise	593
AG.366	Noise	596
AG.367	Noise	602
AG.368	Noise	596
AG.369	Noise	593
AG.370	Noise	593
AG.371	Noise	604
AG.372	Noise	602
AG.373	Noise	607
AG.374	Noise	607
AG.375	Noise	586
AG.376	Noise	588
AG.377	Noise	588

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
AG.378	Noise	586
AG.379	Noise	588
AG.380	Noise	589
AG.381	Noise	589
AG.382	Noise	598
AG.383	Noise	565
AG.384	Noise	579
AG.385	Noise	591
AG.386	Noise	568
AG.387	Noise	592
AG.388	Noise	602
AG.389	Noise	608
AG.390	Noise	608
AG.391	Noise	608
AG.392	Noise	608
AG.393	Noise	609
AG.394	Noise	609
AG.395	Human Health and Safety	629
AG.396	Human Health and Safety	638
AG.397	NEPA/CEQA Issues (Chapter 4)	3
AG.398	Alternatives, Including the Proposed Action	52
AG.399	Alternatives, Including the Proposed Action	41
AG.400	Alternatives, Including the Proposed Action	52
AG.401	Alternatives, Including the Proposed Action	52
AG.402	Alternatives, Including the Proposed Action	52
AG.403	Alternatives, Including the Proposed Action	52
AG.404	Alternatives, Including the Proposed Action	53
AG.405	Alternatives, Including the Proposed Action	53
AG.406	Alternatives, Including the Proposed Action	62
AG.407	Alternatives, Including the Proposed Action	60
AG.408	Alternatives, Including the Proposed Action	53
AG.409	Alternatives, Including the Proposed Action	53
AG.410	Alternatives, Including the Proposed Action	54
Santa Cruz Rainforest Action Group		
AH.1	Project Preference (Chapter 5)	6
AH.2	General Comments (Chapter 6)	8
AH.3	Project Preference (Chapter 5)	11
Renewable Northwest Project		
AI.1	General Comments (Chapter 6)	18
AI.2	Project Preference (Chapter 5)	18
AI.3	Project Preference (Chapter 5)	2
AI.4	Alternatives, Including the Proposed Action	70
AI.5	Cumulative Effects	662
AI.6	Mitigation Monitoring and Reporting Program	712
AI.7	Project Preference (Chapter 5)	19
AI.8	Introduction and Purpose and Need	6
AI.9	Project Preference (Chapter 5)	17

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Tionesta Residents		
AJ.1	General Comments (Chapter 6)	8
AJ.2	Alternatives, Including the Proposed Action	39
AJ.3	Vegetation	280
AJ.4	Visual Quality	388
AJ.5	Visual Quality	388
AJ.6	Visual Quality	405
AJ.7	Socioeconomics	645
AJ.8	Visual Quality	405
AJ.9	Visual Quality	391
AJ.10	Visual Quality	405
AJ.11	Plans and Policies	416
AJ.12	General Comments (Chapter 6)	36
AJ.13	Visual Quality	406
AJ.14	Visual Quality	410
AJ.15	Visual Quality	406
AJ.16	Visual Quality	406
AJ.17	Alternatives, Including the Proposed Action	70
AJ.18	Alternatives, Including the Proposed Action	71
AJ.19	Alternatives, Including the Proposed Action	60
Wise Earth Council		
AK.1	General Comments (Chapter 6)	18
AK.2	Traditional Cultural Values	264
AK.3	General Comments (Chapter 6)	8
Allen, Barbara		
AL.1	Project Preference (Chapter 5)	6
AL.2	Introduction and Purpose and Need	6
AL.3	General Comments (Chapter 6)	34
AL.4	General Comments (Chapter 6)	18
Anderson, Clifford E.		
AM.1	Project Preference (Chapter 5)	11
Aquila, John		
AN.1	Project Preference (Chapter 5)	6
AN.2	Socioeconomics	647
AN.3	Land Use and Recreation	468
AN.4	General Comments (Chapter 6)	8
Aquila, Mildred J		
AO.1	Project Preference (Chapter 5)	6
AO.2	NEPA/CEQA Issues (Chapter 4)	17
AO.3	Cumulative Effects	697
AO.4	Wildlife	343
AO.5	General Comments (Chapter 6)	34
AO.6	General Comments (Chapter 6)	19
Ashalyn		
AP.1	Project Preference (Chapter 5)	11
AP.2	Traditional Cultural Values	252
AP.3	General Comments (Chapter 6)	8
AP.4	Project Preference (Chapter 5)	11

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Barr, Barbara J.		
AQ.1	Introduction and Purpose and Need	6
AQ.2	Alternatives, Including the Proposed Action	72
AQ.3	General Comments (Chapter 6)	19
Barrow, Marcia		
AR.1	Wildlife	335
AR.2	Cumulative Effects	662
AR.3	Alternatives, Including the Proposed Action	45
AR.4	Project Preference (Chapter 5)	16
AR.5	General Comments (Chapter 6)	8
AR.6	Traditional Cultural Values	251
AR.7	General Comments (Chapter 6)	8
Beard, Brian B.		
AS.1	Plans and Policies	435
AS.2	Wildlife	335
AS.3	Plans and Policies	432
AS.4	General Comments (Chapter 6)	8
AS.5	General Comments (Chapter 6)	4
Beatty, Kenneth and Leona		
AT.1	General Comments (Chapter 6)	14
AT.2	Land Use and Recreation	451
AT.3	General Comments (Chapter 6)	36
Bernotte, Jackie		
AU.1	Project Preference (Chapter 5)	6
Bish, Dave and Laurie		
AV.1	Project Preference (Chapter 5)	11
AV.2	Plans and Policies	432
AV.3	Traditional Cultural Values	252
AV.4	Land Use and Recreation	449
AV.5	General Comments (Chapter 6)	34
AV.6	Project Preference (Chapter 5)	11
Blakeney, Marian and Jack		
AW.1	General Comments (Chapter 6)	19
AW.2	Project Preference (Chapter 5)	6
AW.3	Geothermal Resources	226
AW.4	General Comments (Chapter 6)	19
AW.5	Project Preference (Chapter 5)	13
Bradfield, Susan		
AX.1	General Comments (Chapter 6)	19
AX.2	General Comments (Chapter 6)	34
AX.3	Introduction and Purpose and Need	32
AX.4	General Comments (Chapter 6)	19
Brady, Theresa		
AY.1	Project Preference (Chapter 5)	11
AY.2	Plans and Policies	432
AY.3	Traditional Cultural Values	251
AY.4	Hydrology	87
Brightwell, Anne L.		
AZ.1	General Comments (Chapter 6)	19

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
AZ.2	Introduction and Purpose and Need	6
AZ.3	General Comments (Chapter 6)	19
Brooks, Kevin		
BA.1	General Comments (Chapter 6)	19
Camara, Tom		
BB.1	Project Preference (Chapter 5)	11
Capoyilla, Louie J.		
BC.1	General Comments (Chapter 6)	8
Carlton, Alan		
BD.1	Project Preference (Chapter 5)	6
BD.2	General Comments (Chapter 6)	19
Carter, Paul and Dorothy		
BE.1	General Comments (Chapter 6)	19
BE.2	General Comments (Chapter 6)	19
BE.3	General Comments (Chapter 6)	19
BE.4	General Comments (Chapter 6)	34
BE.5	NEPA/CEQA Issues (Chapter 4)	4
BE.6	Project Preference (Chapter 5)	3
BE.7	Cumulative Effects	698
BE.8	Land Use and Recreation	446
Cedar, JoAnne		
BF.1	Project Preference (Chapter 5)	13
BF.2	Traditional Cultural Values	252
Cena, Colleen		
BG.1	Land Use and Recreation	449
BG.2	Project Preference (Chapter 5)	6
Cimino, Richard S.		
BH.1	General Comments (Chapter 6)	5
BH.2	General Comments (Chapter 6)	19
BH.3	General Comments (Chapter 6)	19
BH.4	Introduction and Purpose and Need	3
BH.5	General Comments (Chapter 6)	8
BH.6	Air Quality	519
BH.7	Visual Quality	407
BH.8	General Comments (Chapter 6)	19
BH.9	General Comments (Chapter 6)	20
BH.10	General Comments (Chapter 6)	8
BH.11	Introduction and Purpose and Need	6
BH.12	General Comments (Chapter 6)	20
BH.13	General Comments (Chapter 6)	20
BH.14	Project Preference (Chapter 5)	11
Cook, Steven and Nancy		
BI.1	General Comments (Chapter 6)	9
Copenhafer, Martin		
BJ.1	Project Preference (Chapter 5)	14
BJ.2	Introduction and Purpose and Need	32
BJ.3	Introduction and Purpose and Need	6

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Copoulos, John		
BK.1	Project Preference (Chapter 5)	6
BK.2	Plans and Policies	432
BK.3	Plans and Policies	415
BK.4	Project Preference (Chapter 5)	11
Cousins, Charlene		
BL.1	General Comments (Chapter 6)	20
Cruz, Rhodelio		
BM.1	General Comments (Chapter 6)	20
BM.2	Project Preference (Chapter 5)	11
BM.3	General Comments (Chapter 6)	5
Cuneo, S. Peder		
BN.1	Project Preference (Chapter 5)	6
BN.2	Introduction and Purpose and Need	6
BN.3	Land Use and Recreation	451
BN.4	Introduction and Purpose and Need	32
BN.5	Project Preference (Chapter 5)	3
BN.6	General Comments (Chapter 6)	4
Cuneo, Suzanna S.		
BO.1	Project Preference (Chapter 5)	6
BO.2	General Comments (Chapter 6)	20
BO.3	Introduction and Purpose and Need	6
BO.4	Land Use and Recreation	451
BO.5	Project Preference (Chapter 5)	3
BO.6	General Comments (Chapter 6)	5
Cuneo, S. Peder and Suzanna S.		
BP.1	NEPA/CEQA Issues (Chapter 4)	18
BP.2	NEPA/CEQA Issues (Chapter 4)	18
BP.3	Introduction and Purpose and Need	32
BP.4	NEPA/CEQA Issues (Chapter 4)	14
BP.5	Cumulative Effects	662
BP.6	Cumulative Effects	677
BP.7	Land Use and Recreation	451
BP.8	Land Use and Recreation	451
BP.9	Land Use and Recreation	448
BP.10	Project Preference (Chapter 5)	4
Cuneo, S. Peder and Suzanna S., et al.		
BQ.1	NEPA/CEQA Issues (Chapter 4)	19
BQ.2	NEPA/CEQA Issues (Chapter 4)	21
BQ.3	General Comments (Chapter 6)	20
BQ.4	Introduction and Purpose and Need	32
BQ.5	Alternatives, Including the Proposed Action	63
BQ.6	Socioeconomics	647
BQ.7	Alternatives, Including the Proposed Action	44
BQ.8	Alternatives, Including the Proposed Action	48
BQ.9	Hydrology	169
BQ.10	Traditional Cultural Values	264
BQ.11	Noise	610
BQ.12	Traditional Cultural Values	273

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
BQ.13	Traditional Cultural Values	271
BQ.14	Hydrology	169
BQ.15	Wildlife	348
BQ.16	Visual Quality	401
BQ.17	Visual Quality	396
BQ.18	Visual Quality	401
BQ.19	Visual Quality	401
BQ.20	Land Use and Recreation	451
BQ.21	Land Use and Recreation	451
BQ.22	Socioeconomics	652
BQ.23	Air Quality	532
BQ.24	Air Quality	546
BQ.25	Air Quality	532
BQ.26	Air Quality	546
BQ.27	Air Quality	551
BQ.28	Air Quality	546
BQ.29	Air Quality	539
BQ.30	Air Quality	546
BQ.31	Noise	609
BQ.32	Noise	597
BQ.33	NEPA/CEQA Issues (Chapter 4)	14
BQ.34	NEPA/CEQA Issues (Chapter 4)	20
BQ.35	General Comments (Chapter 6)	3
BQ.36	Cumulative Effects	677
BQ.37	General Comments (Chapter 6)	9
De Jager, Bill		
BR.1	Project Preference (Chapter 5)	6
BR.2	Plans and Policies	438
BR.3	Project Preference (Chapter 5)	1
BR.4	Plans and Policies	436
BR.5	Project Preference (Chapter 5)	1
Dember, Paul and Charlotte		
BS.1	Project Preference (Chapter 5)	11
Denham, W.S.		
BT.1	General Comments (Chapter 6)	14
BT.2	Land Use and Recreation	457
DeNike, Bob		
BU.1	Project Preference (Chapter 5)	6
BU.2	Project Preference (Chapter 5)	14
BU.3	Plans and Policies	433
BU.4	Project Preference (Chapter 5)	14
DeRossett, Carlos		
BV.1	Air Quality	529
BV.2	Noise	595
BV.3	Air Quality	530
BV.4	Project Preference (Chapter 5)	11
Despain, Joel D., et al.		
BW.1	Project Preference (Chapter 5)	14

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Du Vernet, Dean H.		
BX.1	General Comments (Chapter 6)	4
BX.2	Project Preference (Chapter 5)	6
BX.3	Project Preference (Chapter 5)	12
BX.4	Socioeconomics	650
BX.5	Geothermal Resources	221
BX.6	General Comments (Chapter 6)	34
BX.7	Project Preference (Chapter 5)	14
Du Vernet, Dean H.		
BY.1	Geothermal Resources	221
BY.2	Project Preference (Chapter 5)	14
BY.3	Project Preference (Chapter 5)	12
BY.4	General Comments (Chapter 6)	3
Du Vernet, Dean H.		
BZ.1	General Comments (Chapter 6)	5
BZ.2	General Comments (Chapter 6)	20
BZ.3	Plans and Policies	433
BZ.4	Socioeconomics	650
BZ.5	General Comments (Chapter 6)	20
BZ.6	Project Preference (Chapter 5)	14
Du Vernet, Dean H.		
CA.1	General Comments (Chapter 6)	5
CA.2	General Comments (Chapter 6)	3
Dye, Richard E.		
CB.1	Air Quality	530
CB.2	Air Quality	508
CB.3	Project Preference (Chapter 5)	12
Eastman, Bob		
CC.1	General Comments (Chapter 6)	20
CC.2	Geothermal Resources	221
CC.3	Geothermal Resources	221
CC.4	Geothermal Resources	221
Eastman, Walter R.		
CD.1	General Comments (Chapter 6)	20
Emery, Paul		
CE.1	Project Preference (Chapter 5)	12
CE.2	General Comments (Chapter 6)	9
CE.3	Plans and Policies	433
CE.4	Project Preference (Chapter 5)	12
Engstrom, Cindy		
CF.1	General Comments (Chapter 6)	9
Evans, Jim		
CG.1	Human Health and Safety	622
CG.2	Project Preference (Chapter 5)	7
Farioletti, Elizabeth V.		
CH.1	Project Preference (Chapter 5)	7
CH.2	Land Use and Recreation	464
CH.3	Air Quality	519
CH.4	Land Use and Recreation	448

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
CH.5	Project Preference (Chapter 5)	7
Farioletti, Marius A.		
CI.1	General Comments (Chapter 6)	21
CI.2	Land Use and Recreation	464
CI.3	Air Quality	542
CI.4	General Comments (Chapter 6)	21
Feeney, Krista B.		
CJ.1	Project Preference (Chapter 5)	12
Faist, Betty		
CK.1	Project Preference (Chapter 5)	7
CK.2	General Comments (Chapter 6)	21
CK.3	Project Preference (Chapter 5)	7
Gardener, Catherine M.		
CL.1	Alternatives, Including the Proposed Action	72
CL.2	General Comments (Chapter 6)	9
CL.3	Traditional Cultural Values	264
CL.4	General Comments (Chapter 6)	21
Ghiorso, John		
CM.1	Hydrology	143
CM.2	Hydrology	143
Gomes, Gloria		
CN.1	Project Preference (Chapter 5)	7
CN.2	Alternatives, Including the Proposed Action	54
CN.3	Introduction and Purpose and Need	6
CN.4	Traditional Cultural Values	255
CN.5	Project Preference (Chapter 5)	4
Gonzaleze, Linda		
CO.1	Traditional Cultural Values	251
Gould, Cathy		
CP.1	Project Preference (Chapter 5)	14
Grainger, Martha		
CQ.1	Project Preference (Chapter 5)	7
Graves, Steve and Paddy		
CR.1	Project Preference (Chapter 5)	12
CR.2	General Comments (Chapter 6)	21
CR.3	Project Preference (Chapter 5)	12
Green, G.S.		
CS.1	Project Preference (Chapter 5)	7
CS.2	Land Use and Recreation	449
CS.3	Geology and Soils	78
CS.4	Geothermal Resources	221
CS.5	General Comments (Chapter 6)	1
Gregory, Sylvia M.		
CT.1	Traditional Cultural Values	252
CT.2	Wildlife	363
CT.3	Plans and Policies	433
CT.4	General Comments (Chapter 6)	9
Gregory-Fisher, Deborah Lynn		
CU.1	General Comments (Chapter 6)	4

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
CU.2	General Comments (Chapter 6)	4
CU.3	General Comments (Chapter 6)	21
Haines, Kyle		
CV.1	Geology and Soils	76
CV.2	Plans and Policies	435
CV.3	Plans and Policies	424
CV.4	Project Preference (Chapter 5)	4
CV.5	Project Preference (Chapter 5)	17
CV.6	General Comments (Chapter 6)	4
Hannelore, Barbara		
CW.1	Project Preference (Chapter 5)	7
CW.2	Wildlife	335
CW.3	Project Preference (Chapter 5)	14
CW.4	General Comments (Chapter 6)	34
CW.5	Plans and Policies	436
CW.6	Project Preference (Chapter 5)	14
Harmon, Shelly A.		
CX.1	Project Preference (Chapter 5)	7
CX.2	NEPA/CEQA Issues (Chapter 4)	4
CX.3	NEPA/CEQA Issues (Chapter 4)	20
Harris, David A.		
CY.1	Visual Quality	401
CY.2	Alternatives, Including the Proposed Action	71
CY.3	General Comments (Chapter 6)	21
Harris, Noell M.		
CZ.1	General Comments (Chapter 6)	21
Hart, Ronald W.		
DA.1	General Comments (Chapter 6)	21
Haye, Stan		
DB.1	Project Preference (Chapter 5)	4
DB.2	Introduction and Purpose and Need	30
DB.3	Project Preference (Chapter 5)	2
DB.4	Alternatives, Including the Proposed Action	54
DB.5	Alternatives, Including the Proposed Action	64
DB.6	Mitigation Monitoring and Reporting Program	712
DB.7	Wildlife	346
DB.8	General Comments (Chapter 6)	4
Hennig, Anita E.		
DC.1	Project Preference (Chapter 5)	7
DC.2	Geology and Soils	76
DC.3	General Comments (Chapter 6)	9
DC.4	General Comments (Chapter 6)	34
DC.5	General Comments (Chapter 6)	21
Henson, Pam		
DD.1	Project Preference (Chapter 5)	12
DD.2	Hydrology	165
DD.3	General Comments (Chapter 6)	21
Herger, Don		
DE.1	Project Preference (Chapter 5)	17

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Hickerson, Robert L.		
DF.1	Project Preference (Chapter 5)	17
DF.2	Project Preference (Chapter 5)	17
DF.3	Project Preference (Chapter 5)	2
Hill, Shirley		
DG.1	General Comments (Chapter 6)	9
DG.2	Alternatives, Including the Proposed Action	71
DG.3	Project Preference (Chapter 5)	14
Holmes, Katherine		
DH.1	Project Preference (Chapter 5)	7
DH.2	Vegetation	310
DH.3	Introduction and Purpose and Need	33
DH.4	General Comments (Chapter 6)	34
DH.5	Project Preference (Chapter 5)	14
Holub, Ana and Richard Lucas		
DI.1	Project Preference (Chapter 5)	7
DI.2	Cumulative Effects	662
DI.3	Alternatives, Including the Proposed Action	54
DI.4	Introduction and Purpose and Need	23
DI.5	Wildlife	344
DI.6	Human Health and Safety	622
DI.7	Alternatives, Including the Proposed Action	72
DI.8	Traditional Cultural Values	253
DI.9	NEPA/CEQA Issues (Chapter 4)	15
Hutchinson, Calvin		
DJ.1	Traditional Cultural Values	251
Hyytinen, Roger G.		
DK.1	NEPA/CEQA Issues (Chapter 4)	17
DK.2	Visual Quality	401
DK.3	Project Preference (Chapter 5)	2
DK.4	Alternatives, Including the Proposed Action	71
DK.5	Transportation	474
DK.6	Vegetation	281
Jackson, Charline		
DL.1	General Comments (Chapter 6)	21
DL.2	Traditional Cultural Values	253
Jackson, Jerald		
DM.1	Project Preference (Chapter 5)	7
DM.2	Traditional Cultural Values	252
DM.3	Traditional Cultural Values	261
Jackson, Marjorie		
DN.1	Traditional Cultural Values	264
Jackson, Tony L.S.		
DO.1	Project Preference (Chapter 5)	14
DO.2	Traditional Cultural Values	253
Janson, DelMar		
DP.1	Plans and Policies	433
DP.2	Traditional Cultural Values	251
DP.3	General Comments (Chapter 6)	22

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
DP.4	Project Preference (Chapter 5)	12
Jim, Jessica E.		
DQ.1	Project Preference (Chapter 5)	7
DQ.2	Alternatives, Including the Proposed Action	54
DQ.3	Introduction and Purpose and Need	6
DQ.4	Traditional Cultural Values	255
DQ.5	Project Preference (Chapter 5)	4
Johnson, Gerald		
DR.1	Hydrology	170
DR.2	General Comments (Chapter 6)	22
Johnston, Vernia		
DS.1	Project Preference (Chapter 5)	7
DS.2	Project Preference (Chapter 5)	14
Jones, Carolyn D.		
DT.1	Project Preference (Chapter 5)	7
DT.2	General Comments (Chapter 6)	9
DT.3	Project Preference (Chapter 5)	4
DT.4	Cumulative Effects	662
DT.5	Air Quality	544
DT.6	Introduction and Purpose and Need	33
DT.7	General Comments (Chapter 6)	22
Jones, Charles B.		
DU.1	Air Quality	519
DU.2	Visual Quality	397
DU.3	Visual Quality	392
DU.4	Vegetation	301
DU.5	Visual Quality	393
DU.6	Project Preference (Chapter 5)	12
Jordan, Marilee		
DV.1	Project Preference (Chapter 5)	7
DV.2	Plans and Policies	433
DV.3	Plans and Policies	433
DV.4	Traditional Cultural Values	253
DV.5	General Comments (Chapter 6)	22
DV.6	Project Preference (Chapter 5)	14
DV.7	Alternatives, Including the Proposed Action	72
Keesee, Mike		
DW.1	Project Preference (Chapter 5)	7
DW.2	Introduction and Purpose and Need	6
DW.3	General Comments (Chapter 6)	9
DW.4	Introduction and Purpose and Need	6
DW.5	General Comments (Chapter 6)	22
DW.6	Project Preference (Chapter 5)	12
DW.7	General Comments (Chapter 6)	4
Kenyon, Nancy B.		
DX.1	Project Preference (Chapter 5)	2
DX.2	Traditional Cultural Values	251
DX.3	General Comments (Chapter 6)	34
DX.4	General Comments (Chapter 6)	4

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Kiely, Daniel		
DY.1	Project Preference (Chapter 5)	8
DY.2	Introduction and Purpose and Need	7
DY.3	Land Use and Recreation	452
DY.4	Vegetation	301
DY.5	General Comments (Chapter 6)	22
DY.6	Project Preference (Chapter 5)	12
Kinyon, Bill and Bette		
DZ.1	Noise	563
DZ.2	Hydrology	170
DZ.3	Wildlife	335
DZ.4	Traditional Cultural Values	253
Kinyon, Diane		
EA.1	Project Preference (Chapter 5)	14
Kraft, Harry		
EB.1	Project Preference (Chapter 5)	8
EB.2	Cumulative Effects	662
EB.3	Project Preference (Chapter 5)	14
Krauel, Thomas F.		
EC.1	Project Preference (Chapter 5)	8
Kuhn, Daniel S.		
ED.1	Project Preference (Chapter 5)	14
Langner, Mark		
EE.1	Project Preference (Chapter 5)	8
EE.2	General Comments (Chapter 6)	9
Larsen, Bill		
EF.1	Socioeconomics	650
EF.2	Alternatives, Including the Proposed Action	71
EF.3	Project Preference (Chapter 5)	14
Leavitt, David		
EG.1	Project Preference (Chapter 5)	12
Ledor, Kobi and Casey Kim		
EH.1	Cumulative Effects	673
Lettinich, Nik M.		
EI.1	Project Preference (Chapter 5)	16
Lewis, Laraine		
EJ.1	Project Preference (Chapter 5)	8
EJ.2	Geology and Soils	78
EJ.3	Introduction and Purpose and Need	7
EJ.4	General Comments (Chapter 6)	34
EJ.5	Project Preference (Chapter 5)	14
Linden, Kathleen		
EK.1	Project Preference (Chapter 5)	18
Lorenz, Mitch		
EL.1	Project Preference (Chapter 5)	8
Lorenzen, Pete and Laurel		
EM.1	Project Preference (Chapter 5)	8
EM.2	Introduction and Purpose and Need	7
EM.3	General Comments (Chapter 6)	22

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
EM.4	Project Preference (Chapter 5)	14
EM.5	General Comments (Chapter 6)	4
Louttit, Laura		
EN.1	Project Preference (Chapter 5)	8
EN.2	General Comments (Chapter 6)	34
EN.3	Project Preference (Chapter 5)	12
Macy, Natalie		
EO.1	Project Preference (Chapter 5)	16
EO.2	General Comments (Chapter 6)	9
EO.3	Project Preference (Chapter 5)	2
EO.4	Project Preference (Chapter 5)	16
EO.5	Geothermal Resources	221
EO.6	General Comments (Chapter 6)	22
Maggiora, Maurice J., et al.		
EP.1	General Comments (Chapter 6)	22
EP.2	Mitigation Monitoring and Reporting Program	713
Maire, Ron		
EQ.1	General Comments (Chapter 6)	22
EQ.2	Introduction and Purpose and Need	33
EQ.3	Introduction and Purpose and Need	33
EQ.4	General Comments (Chapter 6)	22
EQ.5	Wildlife	335
EQ.6	Traditional Cultural Values	264
EQ.7	Introduction and Purpose and Need	33
EQ.8	Geology and Soils	81
EQ.9	Geothermal Resources	214
EQ.10	Alternatives, Including the Proposed Action	64
EQ.11	Alternatives, Including the Proposed Action	43
EQ.12	Alternatives, Including the Proposed Action	64
EQ.13	General Comments (Chapter 6)	33
EQ.14	Alternatives, Including the Proposed Action	72
EQ.15	Introduction and Purpose and Need	33
Mandel, Stephanie Grace		
ER.1	Project Preference (Chapter 5)	8
ER.2	General Comments (Chapter 6)	1
ER.3	General Comments (Chapter 6)	22
ER.4	Project Preference (Chapter 5)	14
ER.5	Alternatives, Including the Proposed Action	71
Marie, Lea		
ES.1	Project Preference (Chapter 5)	8
ES.2	Project Preference (Chapter 5)	8
Markee, Dawn		
ET.1	General Comments (Chapter 6)	22
ET.2	General Comments (Chapter 6)	22
ET.3	General Comments (Chapter 6)	23
Martin, Frances V.		
EU.1	General Comments (Chapter 6)	9
EU.2	General Comments (Chapter 6)	23

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Mazzini, Shari		
EV.1	Project Preference (Chapter 5)	8
EV.2	General Comments (Chapter 6)	23
EV.3	Alternatives, Including the Proposed Action	64
EV.4	General Comments (Chapter 6)	23
EV.5	General Comments (Chapter 6)	5
McClain, David W.		
EW.1	Project Preference (Chapter 5)	18
EW.2	Project Preference (Chapter 5)	19
EW.3	Project Preference (Chapter 5)	19
EW.4	General Comments (Chapter 6)	23
EW.5	Socioeconomics	657
McClowd, Maria		
EX.1	Project Preference (Chapter 5)	8
McClymonds, R.C.		
EY.1	General Comments (Chapter 6)	3
McDermos, Joan		
EZ.1	Hydrology	117
EZ.2	Traditional Cultural Values	252
EZ.3	Land Use and Recreation	450
EZ.4	Project Preference (Chapter 5)	8
McLaughlin, Bob		
FA.1	Project Preference (Chapter 5)	8
FA.2	General Comments (Chapter 6)	1
Medley, Robert		
FB.1	General Comments (Chapter 6)	23
FB.2	General Comments (Chapter 6)	23
FB.3	Introduction and Purpose and Need	30
FB.4	Project Preference (Chapter 5)	8
FB.5	General Comments (Chapter 6)	23
Mikec, John W.		
FC.1	Project Preference (Chapter 5)	8
FC.2	Introduction and Purpose and Need	7
FC.3	General Comments (Chapter 6)	23
Miller, H.K. "Bud"		
FD.1	Air Quality	530
FD.2	Geology and Soils	76
FD.3	Socioeconomics	651
FD.4	General Comments (Chapter 6)	34
Miller, Ray		
FE.1	Wildlife	339
Miller, Victoria K.		
FF.1	General Comments (Chapter 6)	23
FF.2	General Comments (Chapter 6)	9
FF.3	General Comments (Chapter 6)	23
FF.4	Project Preference (Chapter 5)	14
FF.5	General Comments (Chapter 6)	23
Misso, David Porter		
FG.1	Project Preference (Chapter 5)	8

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
FG.2	General Comments (Chapter 6)	5
Mockbee, Joy		
FH.1	Project Preference (Chapter 5)	8
FH.2	Project Preference (Chapter 5)	12
Moro, Vicki		
FI.1	Project Preference (Chapter 5)	8
FI.2	General Comments (Chapter 6)	23
Moiher, Carolyn J.		
FJ.1	Project Preference (Chapter 5)	8
FJ.2	General Comments (Chapter 6)	10
FJ.3	Traditional Cultural Values	252
FJ.4	General Comments (Chapter 6)	23
FJ.5	Other Statutory Sections	707
FJ.6	General Comments (Chapter 6)	23
Moss, Charles F.		
FK.1	Alternatives, Including the Proposed Action	54
FK.2	Hydrology	97
FK.3	Hydrology	163
FK.4	Air Quality	486
FK.5	Cumulative Effects	682
FK.6	Hydrology	138
FK.7	Noise	602
FK.8	Hydrology	134
FK.9	Alternatives, Including the Proposed Action	64
FK.10	Project Preference (Chapter 5)	4
Moss, Doris H.		
FL.1	Socioeconomics	648
Mulvaney, Ana		
FM.1	Project Preference (Chapter 5)	12
FM.2	Hydrology	130
FM.3	Wildlife	335
FM.4	Human Health and Safety	622
FM.5	Air Quality	530
FM.6	Project Preference (Chapter 5)	12
Myers, Bart and Pamela		
FN.1	Project Preference (Chapter 5)	8
FN.2	General Comments (Chapter 6)	23
Nelson, Eric T.		
FO.1	Project Preference (Chapter 5)	4
FO.2	General Comments (Chapter 6)	10
FO.3	General Comments (Chapter 6)	23
FO.4	NEPA/CEQA Issues (Chapter 4)	15
FO.5	Other Statutory Sections	708
FO.6	Project Preference (Chapter 5)	8
FO.7	General Comments (Chapter 6)	4
Nelson, Eric T. and Martha Spencer		
FP.1	Project Preference (Chapter 5)	4
FP.2	General Comments (Chapter 6)	5
FP.3	Introduction and Purpose and Need	3

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
FP.4	Introduction and Purpose and Need	33
FP.5	Alternatives, Including the Proposed Action	45
FP.6	Introduction and Purpose and Need	30
FP.7	Introduction and Purpose and Need	7
FP.8	Alternatives, Including the Proposed Action	64
FP.9	Alternatives, Including the Proposed Action	64
FP.10	NEPA/CEQA Issues (Chapter 4)	15
FP.11	Hydrology	195
FP.12	Hydrology	114
FP.13	Wildlife	335
FP.14	Visual Quality	401
FP.15	Visual Quality	401
FP.16	Noise	609
FP.17	Socioeconomics	648
FP.18	Socioeconomics	652
FP.19	Air Quality	519
FP.20	Introduction and Purpose and Need	21
FP.21	Cumulative Effects	678
FP.22	NEPA/CEQA Issues (Chapter 4)	11
FP.23	Alternatives, Including the Proposed Action	41
FP.24	Cumulative Effects	662
FP.25	Land Use and Recreation	452
FP.26	Project Preference (Chapter 5)	4
Newcom, Joy Louise		
FQ.1	General Comments (Chapter 6)	24
FQ.2	Project Preference (Chapter 5)	12
Norman, Julie		
FR.1	Project Preference (Chapter 5)	8
FR.2	General Comments (Chapter 6)	24
FR.3	General Comments (Chapter 6)	35
Norris, Frank		
FS.1	Project Preference (Chapter 5)	13
Olson, Claude		
FT.1	Project Preference (Chapter 5)	18
FT.2	Project Preference (Chapter 5)	18
FT.3	Project Preference (Chapter 5)	18
Orr, Olga E.		
FU.1	General Comments (Chapter 6)	24
FU.2	General Comments (Chapter 6)	10
FU.3	General Comments (Chapter 6)	24
FU.4	Introduction and Purpose and Need	7
FU.5	Project Preference (Chapter 5)	13
Padula, Anna Lee		
FV.1	Project Preference (Chapter 5)	15
Parker, Doug and Phyllis		
FW.1	General Comments (Chapter 6)	24
FW.2	Hydrology	127
FW.3	Project Preference (Chapter 5)	15

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Parker, Jacquie		
FX.1	Project Preference (Chapter 5)	9
FX.2	General Comments (Chapter 6)	10
FX.3	Project Preference (Chapter 5)	9
Perlman, S.		
FY.1	Project Preference (Chapter 5)	9
Petterson, Katherine		
FZ.1	Project Preference (Chapter 5)	9
FZ.2	General Comments (Chapter 6)	2
FZ.3	Hydrology	117
FZ.4	General Comments (Chapter 6)	35
FZ.5	Project Preference (Chapter 5)	13
Phillips, Antoinette C.		
GA.1	General Comments (Chapter 6)	24
GA.2	Project Preference (Chapter 5)	15
Pierson, Elizabeth D.		
GB.1	Wildlife	370
GB.2	Wildlife	370
GB.3	Wildlife	370
GB.4	Wildlife	370
GB.5	Wildlife	371
GB.6	Wildlife	371
GB.7	Wildlife	371
GB.8	Hydrology	155
GB.9	Wildlife	371
Plank, Carole		
GC.1	Project Preference (Chapter 5)	9
GC.2	Socioeconomics	648
GC.3	Land Use and Recreation	452
GC.4	Socioeconomics	648
GC.5	Introduction and Purpose and Need	7
GC.6	Project Preference (Chapter 5)	4
GC.7	Socioeconomics	648
Plumb, Dolores		
GD.1	Project Preference (Chapter 5)	13
GD.2	Plans and Policies	433
GD.3	General Comments (Chapter 6)	35
GD.4	General Comments (Chapter 6)	4
Pohlman, Sami Jo		
GE.1	Project Preference (Chapter 5)	9
GE.2	Traditional Cultural Values	251
Poaler, Sarah		
GF.1	General Comments (Chapter 6)	10
GF.2	Alternatives, Including the Proposed Action	41
GF.3	General Comments (Chapter 6)	24
GF.4	General Comments (Chapter 6)	5
Popplewell, D.R.		
GG.1	Wildlife	336
GG.2	Project Preference (Chapter 5)	15

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Potter, Jack Jr.		
GH.1	General Comments (Chapter 6)	24
Potter, Myrna L.		
GI.1	Project Preference (Chapter 5)	9
Pratt, Melody		
GJ.1	Project Preference (Chapter 5)	9
GJ.2	General Comments (Chapter 6)	24
Preston, Wallace and Mary		
GK.1	Project Preference (Chapter 5)	9
GK.2	Traditional Cultural Values	250
GK.3	Project Preference (Chapter 5)	4
Rand, Deirdre and Randy		
GL.1	Project Preference (Chapter 5)	9
GL.2	General Comments (Chapter 6)	35
GL.3	General Comments (Chapter 6)	10
GL.4	Plans and Policies	415
Reed, Ken		
GM.1	General Comments (Chapter 6)	24
GM.2	Project Preference (Chapter 5)	9
GM.3	General Comments (Chapter 6)	25
Reed, Verna		
GN.1	Project Preference (Chapter 5)	9
GN.2	General Comments (Chapter 6)	10
GN.3	General Comments (Chapter 6)	25
Ringer, June		
GO.1	Project Preference (Chapter 5)	9
GO.2	General Comments (Chapter 6)	25
GO.3	Wildlife	336
Rinne, Fred L.		
GP.1	Project Preference (Chapter 5)	4
GP.2	Visual Quality	399
GP.3	Plans and Policies	438
GP.4	Traditional Cultural Values	264
GP.5	Wildlife	336
GP.6	Air Quality	519
GP.7	Hydrology	114
GP.8	General Comments (Chapter 6)	25
Rivers, Walter		
GQ.1	General Comments (Chapter 6)	25
GQ.2	General Comments (Chapter 6)	10
Rohde, Marylee Patricia		
GR.1	Project Preference (Chapter 5)	9
GR.2	Traditional Cultural Values	252
GR.3	Plans and Policies	433
GR.4	Traditional Cultural Values	251
GR.5	Project Preference (Chapter 5)	15
Rongen, Anna		
GS.1	Project Preference (Chapter 5)	9

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
GS.2	General Comments (Chapter 6)	25
GS.3	Project Preference (Chapter 5)	15
Savavele, John		
GT.1	Project Preference (Chapter 5)	13
Schaeffer, Robin L.		
GU.1	Project Preference (Chapter 5)	9
GU.2	Traditional Cultural Values	251
GU.3	General Comments (Chapter 6)	2
GU.4	General Comments (Chapter 6)	4
Schwartz, R.J.		
GV.1	General Comments (Chapter 6)	25
Schwarzenberg, Fai		
GW.1	General Comments (Chapter 6)	25
GW.2	General Comments (Chapter 6)	10
GW.3	Project Preference (Chapter 5)	9
GW.4	General Comments (Chapter 6)	25
Self, David		
GX.1	NEPA/CEQA Issues (Chapter 4)	17
GX.2	NEPA/CEQA Issues (Chapter 4)	20
Server, Michael L. and Janet K.		
GY.1	General Comments (Chapter 6)	25
GY.2	Project Preference (Chapter 5)	4
Shott, Harry and Bettie		
GZ.1	Project Preference (Chapter 5)	9
GZ.2	Noise	602
Shott, James		
HA.1	General Comments (Chapter 6)	3
HA.2	NEPA/CEQA Issues (Chapter 4)	20
HA.3	NEPA/CEQA Issues (Chapter 4)	20
HA.4	NEPA/CEQA Issues (Chapter 4)	4
HA.5	Other Statutory Sections	708
HA.6	Cumulative Effects	662
HA.7	Introduction and Purpose and Need	21
HA.8	Hydrology	170
HA.9	Introduction and Purpose and Need	33
Smith, David		
HB.1	General Comments (Chapter 6)	25
Smith, Lawrence K.		
HC.1	Project Preference (Chapter 5)	1
Spencer, Amanda		
HD.1	General Comments (Chapter 6)	10
HD.2	Alternatives, Including the Proposed Action	45
HD.3	Hydrology	102
HD.4	Geothermal Resources	208
HD.5	Geothermal Resources	208
HD.6	Geothermal Resources	208
HD.7	Geothermal Resources	208
HD.8	Hydrology	195
HD.9	Alternatives, Including the Proposed Action	42

HD.10 Hydrology 94
HD.11 Air Quality 539
HD.12 Air Quality 519
HD.13 Hydrology 170
HD.14 Wildlife 380
HD.15 Hydrology 195
HD.16 Visual Quality 390
HD.17 Visual Quality 409
HD.18 Visual Quality 399
HD.19 Alternatives, Including the Proposed Action 42
HD.20 Hydrology 94
HD.21 Hydrology 192
HD.22 NEPA/CEQA Issues (Chapter 4) 17

Spencer, Daniel T.

HE.1 General Comments (Chapter 6) 25
HE.2 Introduction and Purpose and Need 7
HE.3 Project Preference (Chapter 5) 9
HE.4 Other Statutory Sections 708
HE.5 General Comments (Chapter 6) 26
HE.6 General Comments (Chapter 6) 4
HE.7 Project Preference (Chapter 5) 9
HE.8 Project Preference (Chapter 5) 9

Spencer, Daniel T.

HF.1 NEPA/CEQA Issues (Chapter 4) 17
HF.2 NEPA/CEQA Issues (Chapter 4) 20
HF.3 General Comments (Chapter 6) 26
HF.4 Project Preference (Chapter 5) 9
HF.5 General Comments (Chapter 6) 26
HF.6 Introduction and Purpose and Need 33
HF.7 Introduction and Purpose and Need 22
HF.8 NEPA/CEQA Issues (Chapter 4) 15
HF.9 Traditional Cultural Values 250
HF.10 Hydrology 163
HF.11 General Comments (Chapter 6) 26
HF.12 Alternatives, Including the Proposed Action 64
HF.13 NEPA/CEQA Issues (Chapter 4) 10
HF.14 Wildlife 348
HF.15 General Comments (Chapter 6) 10
HF.16 Introduction and Purpose and Need 7
HF.17 Cumulative Effects 662
HF.18 NEPA/CEQA Issues (Chapter 4) 10
HF.19 Wildlife 384
HF.20 Visual Quality 402
HF.21 Land Use and Recreation 443
HF.22 NEPA/CEQA Issues (Chapter 4) 20
HF.23 Introduction and Purpose and Need 34
HF.24 Project Preference (Chapter 5) 4
HF.25 General Comments (Chapter 6) 26

Spencer, Lorin C.

HG.1 Land Use and Recreation 444
HG.2 General Comments (Chapter 6) 26

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Spencer, Lucinda		
HH.1	General Comments (Chapter 6)	26
HH.2	Other Statutory Sections	708
HH.3	General Comments (Chapter 6)	26
HH.4	Project Preference (Chapter 5)	15
Spencer, Martha		
HI.1	Project Preference (Chapter 5)	9
HI.2	Project Preference (Chapter 5)	4
HI.3	General Comments (Chapter 6)	27
HI.4	General Comments (Chapter 6)	10
HI.5	Introduction and Purpose and Need	7
HI.6	General Comments (Chapter 6)	35
HI.7	Land Use and Recreation	452
HI.8	General Comments (Chapter 6)	27
HI.9	Project Preference (Chapter 5)	4
HI.10	General Comments (Chapter 6)	4
Spotts, Richard		
HJ.1	Project Preference (Chapter 5)	10
HJ.2	General Comments (Chapter 6)	10
Staunton, Marshall		
HK.1	Project Preference (Chapter 5)	10
HK.2	Cumulative Effects	663
HK.3	General Comments (Chapter 6)	27
HK.4	Alternatives, Including the Proposed Action	71
HK.5	General Comments (Chapter 6)	27
Stearns, Howard I.		
HL.1	Project Preference (Chapter 5)	10
HL.2	Introduction and Purpose and Need	7
HL.3	General Comments (Chapter 6)	27
Stauss, Barbara		
HM.1	Project Preference (Chapter 5)	18
HM.2	Project Preference (Chapter 5)	18
HM.3	Project Preference (Chapter 5)	18
Sterner, Don		
HN.1	Project Preference (Chapter 5)	18
HN.2	Project Preference (Chapter 5)	18
HN.3	Project Preference (Chapter 5)	18
Sturgis, Victoria		
HO.1	General Comments (Chapter 6)	27
HO.2	General Comments (Chapter 6)	11
HO.3	Alternatives, Including the Proposed Action	71
HO.4	General Comments (Chapter 6)	27
Swanson, John R.		
HP.1	Project Preference (Chapter 5)	10
HP.2	General Comments (Chapter 6)	27
HP.3	Plans and Policies	435
HP.4	General Comments (Chapter 6)	2
HP.5	General Comments (Chapter 6)	11

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Teague, Donald S.		
HQ.1	Project Preference (Chapter 5)	10
HQ.2	General Comments (Chapter 6)	27
HQ.3	Project Preference (Chapter 5)	15
Teberg, Annabel J.		
HR.1	General Comments (Chapter 6)	27
HR.2	General Comments (Chapter 6)	11
HR.3	Project Preference (Chapter 5)	4
Thompson, Larry H.		
HS.1	Project Preference (Chapter 5)	10
HS.2	General Comments (Chapter 6)	11
HS.3	General Comments (Chapter 6)	35
HS.4	Project Preference (Chapter 5)	15
Thompson, Louise		
HT.1	General Comments (Chapter 6)	11
HT.2	Wildlife	336
HT.3	Wildlife	343
HT.4	Land Use and Recreation	452
HT.5	Land Use and Recreation	457
HT.6	Land Use and Recreation	456
HT.7	Land Use and Recreation	466
HT.8	Air Quality	519
HT.9	Geothermal Resources	226
HT.10	Hydrology	163
HT.11	Socioeconomics	652
HT.12	Alternatives, Including the Proposed Action	45
HT.13	Human Health and Safety	612
HT.14	Cultural Resources	245
HT.15	Traditional Cultural Values	265
HT.16	Visual Quality	402
HT.17	Visual Quality	397
HT.18	Visual Quality	402
HT.19	Visual Quality	393
HT.20	Land Use and Recreation	468
HT.21	Project Preference (Chapter 5)	5
Thompson, Louise		
HU.1	Land Use and Recreation	450
HU.2	Cumulative Effects	663
HU.3	General Comments (Chapter 6)	11
HU.4	Project Preference (Chapter 5)	13
HU.5	General Comments (Chapter 6)	27
HU.6	General Comments (Chapter 6)	28
Thompson, Louise		
HV.1	General Comments (Chapter 6)	28
HV.2	Land Use and Recreation	452
HV.3	Project Preference (Chapter 5)	5
Todd, Joyce T.		
HW.1	Project Preference (Chapter 5)	10
HW.2	General Comments (Chapter 6)	11

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
HW.3	Project Preference (Chapter 5)	13
Tozier, Elizabeth R.		
HX.1	Project Preference (Chapter 5)	10
HX.2	General Comments (Chapter 6)	28
HX.3	Project Preference (Chapter 5)	13
Tseng, Alice		
HY.1	Project Preference (Chapter 5)	10
HY.2	Introduction and Purpose and Need	7
HY.3	Introduction and Purpose and Need	3
HY.4	General Comments (Chapter 6)	35
HY.5	Alternatives, Including the Proposed Action	45
HY.6	Hydrology	87
HY.7	Hydrology	195
HY.8	Wildlife	381
HY.9	Socioeconomics	657
HY.10	Project Preference (Chapter 5)	10
Turner, Richard		
HZ.1	Project Preference (Chapter 5)	10
HZ.2	Introduction and Purpose and Need	7
HZ.3	General Comments (Chapter 6)	28
Turney, Susan		
IA.1	Land Use and Recreation	450
IA.2	General Comments (Chapter 6)	35
IA.3	Project Preference (Chapter 5)	5
Verrill, Wayne		
IB.1	Project Preference (Chapter 5)	5
IB.2	Project Preference (Chapter 5)	5
IB.3	Traditional Cultural Values	255
IB.4	General Comments (Chapter 6)	2
IB.5	General Comments (Chapter 6)	28
IB.6	Cumulative Effects	663
IB.7	Alternatives, Including the Proposed Action	72
IB.8	General Comments (Chapter 6)	4
Villarruel, Sharon		
IC.1	Project Preference (Chapter 5)	10
IC.2	Visual Quality	392
IC.3	General Comments (Chapter 6)	11
Walters, Raquel		
ID.1	General Comments (Chapter 6)	11
Waring, Alysa		
IE.1	Cumulative Effects	663
IE.2	General Comments (Chapter 6)	11
IE.3	General Comments (Chapter 6)	35
IE.4	Alternatives, Including the Proposed Action	54
IE.5	Hydrology	170
IE.6	Hydrology	163
IE.7	Land Use and Recreation	464
IE.8	Cumulative Effects	673

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Webb, A. Jonathan		
IF.1	General Comments (Chapter 6)	11
Webb, Debbie S.		
IG.1	General Comments (Chapter 6)	11
Weber, Jerry and Vicky		
IH.1	General Comments (Chapter 6)	28
IH.2	General Comments (Chapter 6)	11
IH.3	General Comments (Chapter 6)	28
IH.4	General Comments (Chapter 6)	35
Wells, Vivian		
II.1	Cumulative Effects	663
II.2	Project Preference (Chapter 5)	15
Wheeler, Mary Jo		
IJ.1	Project Preference (Chapter 5)	10
IJ.2	General Comments (Chapter 6)	28
IJ.3	Introduction and Purpose and Need	7
IJ.4	Project Preference (Chapter 5)	15
Whitaker, Howard J.		
IK.1	Project Preference (Chapter 5)	13
IK.2	General Comments (Chapter 6)	28
Whitnah, Claudia		
IL.1	Project Preference (Chapter 5)	15
IL.2	General Comments (Chapter 6)	11
Willey, Brenda		
IM.1	Cumulative Effects	673
IM.2	General Comments (Chapter 6)	28
IM.3	General Comments (Chapter 6)	11
IM.4	General Comments (Chapter 6)	28
IM.5	General Comments (Chapter 6)	12
IM.6	Cumulative Effects	663
IM.7	General Comments (Chapter 6)	28
IM.8	Alternatives, Including the Proposed Action	46
IM.9	General Comments (Chapter 6)	28
Williamson, Ray		
IN.1	Land Use and Recreation	460
IN.2	General Comments (Chapter 6)	28
Williamson, Sharon		
IO.1	Land Use and Recreation	460
IO.2	General Comments (Chapter 6)	28
Wilson, Joyce		
IP.1	Project Preference (Chapter 5)	10
IP.2	General Comments (Chapter 6)	29
IP.3	Traditional Cultural Values	252
Woodward, Phil		
IQ.1	General Comments (Chapter 6)	29
IQ.2	Land Use and Recreation	455
IQ.3	Cumulative Effects	663
IQ.4	Project Preference (Chapter 5)	5
IQ.5	Noise	566

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
IQ.6	Hydrology	88
IQ.7	Hydrology	102
IQ.8	Geothermal Resources	214
IQ.9	Geothermal Resources	213
IQ.10	Visual Quality	409
IQ.11	Visual Quality	397
IQ.12	Air Quality	486
IQ.13	Noise	599
IQ.14	Noise	602
IQ.15	Land Use and Recreation	444
IQ.16	Visual Quality	393
IQ.17	Land Use and Recreation	455
IQ.18	Introduction and Purpose and Need	34
IQ.19	Geothermal Resources	222
IQ.20	Project Preference (Chapter 5)	5
Wright, Carol L.		
IR.1	Project Preference (Chapter 5)	10
IR.2	General Comments (Chapter 6)	12
IR.3	Project Preference (Chapter 5)	13
Wynn, Carter		
IS.1	General Comments (Chapter 6)	12
IS.2	General Comments (Chapter 6)	29
IS.3	Project Preference (Chapter 5)	13
Yousie, Grant		
IT.1	Alternatives, Including the Proposed Action	72
IT.2	General Comments (Chapter 6)	29
IT.3	General Comments (Chapter 6)	29
Zanger, Michael		
IU.1	General Comments (Chapter 6)	12
IU.2	Project Preference (Chapter 5)	13
Adams, Shawn		
IV.1	General Comments (Chapter 6)	14
IV.2	Land Use and Recreation	457
Ano, D.		
IW.1	General Comments (Chapter 6)	14
IW.2	Land Use and Recreation	450
Carnell, Dick		
IX.1	General Comments (Chapter 6)	14
IX.2	Land Use and Recreation	457
Denham, Laurie E.		
IY.1	General Comments (Chapter 6)	14
IY.2	Land Use and Recreation	457
Frank, Tobin E.		
IZ.1	General Comments (Chapter 6)	14
IZ.2	Land Use and Recreation	457
Loffmoy, Ross		
JA.1	General Comments (Chapter 6)	14
JA.2	Land Use and Recreation	458

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
Parkhurst, Dawn E.		
JB.1	General Comments (Chapter 6)	14
JB.2	Land Use and Recreation	458
Parkhurst, Matt		
JC.1	General Comments (Chapter 6)	14
JC.2	Land Use and Recreation	458
Piper, Robert J.		
JD.1	General Comments (Chapter 6)	14
JD.2	Land Use and Recreation	458
Sowert, Mark		
JE.1	General Comments (Chapter 6)	14
JE.2	Land Use and Recreation	458
Sowert, Stacey		
JF.1	General Comments (Chapter 6)	14
JF.2	Land Use and Recreation	458
Wallace, Ken		
JG.1	General Comments (Chapter 6)	14
JG.2	Land Use and Recreation	458
Walland, LeRoy		
JH.1	General Comments (Chapter 6)	14
JH.2	Land Use and Recreation	458
Whitmarsh, A. Clayton		
JI.1	General Comments (Chapter 6)	14
JI.2	Land Use and Recreation	458
Wolf, Bob		
JJ.1	General Comments (Chapter 6)	14
JJ.2	Land Use and Recreation	458
Dorris Public Hearing		
PH1.1	Visual Quality	404
PH1.2	Wildlife	381
PH1.3	Introduction and Purpose and Need	34
PH1.4	General Comments (Chapter 6)	35
PH1.5	Socioeconomics	643
PH1.6	Hydrology	143
PH1.7	Hydrology	143
PH1.8	General Comments (Chapter 6)	5
PH1.9	Hydrology	143
PH1.10	Hydrology	144
PH1.11	Hydrology	144
PH1.12	Hydrology	119
PH1.13	Hydrology	119
PH1.14	Geothermal Resources	212
PH1.15	Hydrology	144
PH1.16	NEPA/CEQA Issues (Chapter 4)	15
PH1.17	Hydrology	93
PH1.18	NEPA/CEQA Issues (Chapter 4)	4
PH1.19	NEPA/CEQA Issues (Chapter 4)	17
PH1.20	Hydrology	144
PH1.21	Hydrology	102

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
PH1.22	NEPA/CEQA Issues (Chapter 4)	7
PH1.23	General Comments (Chapter 6)	6
PH1.24	Hydrology	144
PH1.25	Hydrology	144
PH1.26	Geothermal Resources	212
PH1.27	Hydrology	144
PH1.28	Hydrology	88
PH1.29	Hydrology	144
PH1.30	General Comments (Chapter 6)	6
PH1.31	Socioeconomics	643
PH1.32	Socioeconomics	657
Klamath Falls Public Hearing		
PH2.1	Wildlife	356
PH2.2	Vegetation	311
PH2.3	Project Preference (Chapter 5)	16
PH2.4	Air Quality	519
PH2.5	Noise	603
PH2.6	Project Preference (Chapter 5)	16
PH2.7	Project Preference (Chapter 5)	16
PH2.8	Visual Quality	404
PH2.9	General Comments (Chapter 6)	29
PH2.10	Project Preference (Chapter 5)	16
Yreka Public Hearing		
PH3.1	Introduction and Purpose and Need	34
PH3.2	Introduction and Purpose and Need	34
PH3.3	Introduction and Purpose and Need	34
PH3.4	Introduction and Purpose and Need	34
PH3.5	Introduction and Purpose and Need	34
PH3.6	Other Statutory Sections	706
PH3.7	General Comments (Chapter 6)	29
PH3.8	Introduction and Purpose and Need	34
PH3.9	General Comments (Chapter 6)	35
PH3.10	Alternatives, Including the Proposed Action	64
PH3.11	Alternatives, Including the Proposed Action	48
PH3.12	Human Health and Safety	632
PH3.13	Alternatives, Including the Proposed Action	48
PH3.14	General Comments (Chapter 6)	29
PH3.15	Wildlife	359
PH3.16	Vegetation	296
PH3.17	Vegetation	310
PH3.18	Air Quality	489
PH3.19	Alternatives, Including the Proposed Action	48
PH3.20	Alternatives, Including the Proposed Action	48
PH3.21	Alternatives, Including the Proposed Action	48
PH3.22	Vegetation	296
PH3.23	Vegetation	296
PH3.24	Vegetation	297
PH3.25	Alternatives, Including the Proposed Action	64
PH3.26	Alternatives, Including the Proposed Action	64

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
PH3.27	Introduction and Purpose and Need	34
PH3.28	Introduction and Purpose and Need	34
PH3.29	Introduction and Purpose and Need	34
PH3.30	Introduction and Purpose and Need	7
PH3.31	Introduction and Purpose and Need	34
PH3.32	Introduction and Purpose and Need	34
PH3.33	Introduction and Purpose and Need	34
PH3.34	General Comments (Chapter 6)	29
PH3.35	General Comments (Chapter 6)	6
PH3.36	General Comments (Chapter 6)	3
PH3.37	General Comments (Chapter 6)	3
PH3.38	NEPA/CEQA Issues (Chapter 4)	17
PH3.39	Wildlife	343
PH3.40	Land Use and Recreation	452
PH3.41	General Comments (Chapter 6)	29
PH3.42	Geothermal Resources	222
PH3.43	Geothermal Resources	222
PH3.44	Hydrology	88
PH3.45	Air Quality	542
PH3.46	Air Quality	542
PH3.47	Air Quality	542
PH3.48	Air Quality	530
PH3.49	Air Quality	530
PH3.50	Hydrology	170
PH3.51	Introduction and Purpose and Need	34
PH3.52	Cumulative Effects	663
PH3.53	Cumulative Effects	663
PH3.54	Cumulative Effects	663
PH3.55	Cumulative Effects	663
PH3.56	Introduction and Purpose and Need	30
PH3.57	Introduction and Purpose and Need	30
PH3.58	Vegetation	278
PH3.59	General Comments (Chapter 6)	35
PH3.60	General Comments (Chapter 6)	35
PH3.61	General Comments (Chapter 6)	29
PH3.62	Alternatives, Including the Proposed Action	54
PH3.63	Alternatives, Including the Proposed Action	54
PH3.64	Introduction and Purpose and Need	29
PH3.65	General Comments (Chapter 6)	29
PH3.66	General Comments (Chapter 6)	30
PH3.67	Air Quality	487
PH3.68	Air Quality	487
PH3.69	Visual Quality	397
PH3.70	Human Health and Safety	632
PH3.71	Air Quality	487
PH3.72	Geology and Soils	76
PH3.73	Land Use and Recreation	458
PH3.74	Visual Quality	397
PH3.75	Introduction and Purpose and Need	29

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
PH3.76	General Comments (Chapter 6)	30
PH3.77	General Comments (Chapter 6)	30
PH3.78	Mitigation Monitoring and Reporting Program	713
PH3.79	General Comments (Chapter 6)	30
PH3.80	Cumulative Effects	663
PH3.81	Cumulative Effects	664
PH3.82	Cumulative Effects	664
PH3.83	Cumulative Effects	664
PH3.84	Cumulative Effects	664
PH3.85	Visual Quality	393
PH3.86	Visual Quality	393
PH3.87	Visual Quality	393
PH3.88	General Comments (Chapter 6)	30
PH3.89	Introduction and Purpose and Need	34
PH3.90	Introduction and Purpose and Need	35
PH3.91	Introduction and Purpose and Need	35
PH3.92	Introduction and Purpose and Need	35
PH3.93	General Comments (Chapter 6)	30
PH3.94	Socioeconomics	657
PH3.95	Socioeconomics	648
PH3.96	Socioeconomics	648
PH3.97	Socioeconomics	648
PH3.98	General Comments (Chapter 6)	30
PH3.99	Hydrology	116
PH3.100	Hydrology	114
PH3.101	Hydrology	114
PH3.102	Hydrology	114
PH3.103	Air Quality	557
PH3.104	General Comments (Chapter 6)	30
PH3.105	Socioeconomics	656
PH3.106	Socioeconomics	656
PH3.107	General Comments (Chapter 6)	30
PH3.108	General Comments (Chapter 6)	30
PH3.109	General Comments (Chapter 6)	6
PH3.110	General Comments (Chapter 6)	6
PH3.111	Introduction and Purpose and Need	35
PH3.112	NEPA/CEQA Issues (Chapter 4)	7
PH3.113	General Comments (Chapter 6)	30
PH3.114	General Comments (Chapter 6)	30
PH3.115	General Comments (Chapter 6)	30
PH3.116	Alternatives, Including the Proposed Action	61
PH3.117	NEPA/CEQA Issues (Chapter 4)	20
Mount Shasta Public Hearing		
PH4.1	NEPA/CEQA Issues (Chapter 4)	16
PH4.2	NEPA/CEQA Issues (Chapter 4)	20
PH4.3	Project Preference (Chapter 5)	16
PH4.4	Project Preference (Chapter 5)	10
PH4.5	Introduction and Purpose and Need	7
PH4.6	General Comments (Chapter 6)	30

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
PH4.7	Alternatives, Including the Proposed Action	48
PH4.8	Geothermal Resources	222
PH4.9	Alternatives, Including the Proposed Action	71
PH4.10	Hydrology	116
PH4.11	Hydrology	163
PH4.12	Hydrology	144
PH4.13	Hydrology	88
PH4.14	Traditional Cultural Values	252
PH4.15	Traditional Cultural Values	253
PH4.16	Wildlife	359
PH4.17	Wildlife	359
PH4.18	Visual Quality	392
PH4.19	Land Use and Recreation	464
PH4.20	Land Use and Recreation	461
PH4.21	Air Quality	517
PH4.22	Air Quality	512
PH4.23	Human Health and Safety	624
PH4.24	Cumulative Effects	678
PH4.25	Introduction and Purpose and Need	23
PH4.26	Cumulative Effects	686
PH4.27	Introduction and Purpose and Need	24
PH4.28	Introduction and Purpose and Need	25
PH4.29	NEPA/CEQA Issues (Chapter 4)	16
PH4.30	NEPA/CEQA Issues (Chapter 4)	7
PH4.31	Introduction and Purpose and Need	10
PH4.32	General Comments (Chapter 6)	3
PH4.33	General Comments (Chapter 6)	3
PH4.34	Alternatives, Including the Proposed Action	65
PH4.35	Human Health and Safety	632
PH4.36	Hydrology	94
PH4.37	Hydrology	94
PH4.38	Alternatives, Including the Proposed Action	39
PH4.39	Human Health and Safety	612
PH4.40	General Comments (Chapter 6)	35
PH4.41	General Comments (Chapter 6)	35
PH4.42	Alternatives, Including the Proposed Action	48
PH4.43	Hydrology	170
PH4.44	Hydrology	195
PH4.45	Hydrology	195
PH4.46	Alternatives, Including the Proposed Action	39
PH4.47	NEPA/CEQA Issues (Chapter 4)	7
PH4.48	Vegetation	321
PH4.49	Wildlife	346
PH4.50	Plans and Policies	436
PH4.51	Transportation	473
PH4.52	Introduction and Purpose and Need	17
PH4.53	Introduction and Purpose and Need	21
PH4.54	Air Quality	546
PH4.55	Air Quality	548

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
PH4.56	General Comments (Chapter 6)	12
PH4.57	Human Health and Safety	612
PH4.58	Human Health and Safety	619
PH4.59	Socioeconomics	657
PH4.60	Socioeconomics	643
PH4.61	Introduction and Purpose and Need	35
Medicine Lake Public Hearing		
PH5.1	General Comments (Chapter 6)	31
PH5.2	General Comments (Chapter 6)	31
PH5.3	Wildlife	336
PH5.4	Wildlife	343
PH5.5	Land Use and Recreation	452
PH5.6	Land Use and Recreation	458
PH5.7	Land Use and Recreation	456
PH5.8	Land Use and Recreation	466
PH5.9	Air Quality	519
PH5.10	Geothermal Resources	226
PH5.11	Hydrology	163
PH5.12	Socioeconomics	653
PH5.13	Alternatives, Including the Proposed Action	46
PH5.14	Human Health and Safety	612
PH5.15	Cultural Resources	245
PH5.16	Traditional Cultural Values	265
PH5.17	Visual Quality	402
PH5.18	Visual Quality	397
PH5.19	Visual Quality	402
PH5.20	Visual Quality	393
PH5.21	Land Use and Recreation	468
PH5.22	Project Preference (Chapter 5)	5
PH5.23	NEPA/CEQA Issues (Chapter 4)	8
PH5.24	General Comments (Chapter 6)	31
PH5.25	Air Quality	489
PH5.26	Air Quality	489
PH5.27	Alternatives, Including the Proposed Action	48
PH5.28	Alternatives, Including the Proposed Action	54
PH5.29	Alternatives, Including the Proposed Action	54
PH5.30	Cumulative Effects	664
PH5.31	NEPA/CEQA Issues (Chapter 4)	8
PH5.32	Human Health and Safety	630
PH5.33	Human Health and Safety	630
PH5.34	Air Quality	517
PH5.35	General Comments (Chapter 6)	31
PH5.36	Introduction and Purpose and Need	35
PH5.37	NEPA/CEQA Issues (Chapter 4)	20
PH5.38	Cumulative Effects	664
PH5.39	Alternatives, Including the Proposed Action	71
PH5.40	Introduction and Purpose and Need	35
PH5.41	Air Quality	545
PH5.42	Air Quality	545

Note: Comments can be found in Chapter 3, unless otherwise indicated.

Comment #	Volume III Section	Volume III Page
PH5.43	Air Quality	545
PH5.44	General Comments (Chapter 6)	31
PH5.45	Visual Quality	397
PH5.46	Geothermal Resources	207
PH5.47	Project Preference (Chapter 5)	16
PH5.48	Project Preference (Chapter 5)	18
PH5.49	General Comments (Chapter 6)	31
PH5.50	Introduction and Purpose and Need	13
PH5.51	Land Use and Recreation	464
PH5.52	Land Use and Recreation	464
PH5.53	Land Use and Recreation	465
PH5.54	Land Use and Recreation	465
PH5.55	Land Use and Recreation	465
PH5.56	Land Use and Recreation	465
PH5.57	General Comments (Chapter 6)	31
PH5.58	Introduction and Purpose and Need	35
PH5.59	Introduction and Purpose and Need	35
PH5.60	Introduction and Purpose and Need	35
PH5.61	Introduction and Purpose and Need	35
PH5.62	Introduction and Purpose and Need	35
PH5.63	Introduction and Purpose and Need	35
PH5.64	Introduction and Purpose and Need	7
PH5.65	General Comments (Chapter 6)	31
PH5.66	Introduction and Purpose and Need	35
PH5.67	Introduction and Purpose and Need	7
PH5.68	General Comments (Chapter 6)	31
PH5.69	General Comments (Chapter 6)	31
PH5.70	Introduction and Purpose and Need	35
PH5.71	Introduction and Purpose and Need	35
PH5.72	General Comments (Chapter 6)	36
PH5.73	General Comments (Chapter 6)	36
PH5.74	Human Health and Safety	624
PH5.75	General Comments (Chapter 6)	36
PH5.76	General Comments (Chapter 6)	36
PH5.77	Introduction and Purpose and Need	35
PH5.78	General Comments (Chapter 6)	36
PH5.79	Introduction and Purpose and Need	35
PH5.80	Socioeconomics	657
PH5.81	General Comments (Chapter 6)	35
PH5.82	General Comments (Chapter 6)	31
PH5.83	Human Health and Safety	619
PH5.84	Geothermal Resources	207
PH5.85	Geothermal Resources	222
PH5.86	Geothermal Resources	222
PH5.87	Geothermal Resources	222
PH5.88	Alternatives, Including the Proposed Action	48
PH5.89	General Comments (Chapter 6)	31
PH5.90	Alternatives, Including the Proposed Action	48
PH5.91	Introduction and Purpose and Need	30

Comment #	Volume III Section	Volume III Page
Note: Comments can be found in Chapter 3, unless otherwise indicated.		
PH5.92	NEPA/CEQA Issues (Chapter 4)	10
PH5.93	NEPA/CEQA Issues (Chapter 4)	20
PH5.94	Project Preference (Chapter 5)	5
PH5.95	Cumulative Effects	664
PH5.96	Introduction and Purpose and Need	35
PH5.97	Introduction and Purpose and Need	25
PH5.98	General Comments (Chapter 6)	31
PH5.99	Cumulative Effects	664
PH5.100	Socioeconomics	657
PH5.101	NEPA/CEQA Issues (Chapter 4)	8
PH5.102	General Comments (Chapter 6)	6
PH5.103	Project Preference (Chapter 5)	5
PH5.104	General Comments (Chapter 6)	31
PH5.105	General Comments (Chapter 6)	32
PH5.106	General Comments (Chapter 6)	32
PH5.107	General Comments (Chapter 6)	32
PH5.108	General Comments (Chapter 6)	32
PH5.109	NEPA/CEQA Issues (Chapter 4)	8
PH5.110	Hydrology	119
PH5.111	Alternatives, Including the Proposed Action	65
PH5.112	Alternatives, Including the Proposed Action	65
PH5.113	NEPA/CEQA Issues (Chapter 4)	20
PH5.114	General Comments (Chapter 6)	32
PH5.115	NEPA/CEQA Issues (Chapter 4)	20
PH5.116	General Comments (Chapter 6)	32
PH5.117	NEPA/CEQA Issues (Chapter 4)	8
PH5.118	Project Preference (Chapter 5)	10