BLM

United States Department of the Interior
Bureau of Land Management

United States Department of Agriculture
Forest Service

Great Basin Unified Air Pollution Control District

CASA DIABLO IV GEOTHERMAL DEVELOPMENT PROJECT

FINAL
JOINT ENVIRONMENTAL IMPACT STATEMENT AND ENVIRONMENTAL IMPACT REPORT

Volume 2

Appendices

June 2013

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Final
Joint Environmental Impact Statement and Environmental Impact Report
for the
Casa Diablo IV Geothermal Development Project

Volume 2 – Appendices

For the

BLM, Bishop Field Office

US Forest Service, Inyo National Forest

and

Great Basin Unified Air Pollution Control District

Bishop, California

June 2013

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TABLE OF CONTENTS

Casa Diablo IV Geothermal Development Project Final Joint Environmental Impact Statement and Environmental Impact Report

APPENDIX A
Scoping Report

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CASA DIABLO 4 GEOTHERMAL DEVELOPMENT PROJECT

Scoping Report

Prepared for

Bureau of Land Management, United States Forest Service, and Great Basin Unified Air Pollution Control District

July 1, 2011

Prepared by

ESA

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TABLE OF CONTENTS

Casa Diablo 4 Geothermal Development Project – Scoping Report

Page

Appendices

List of Tables

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1.0 Introduction and Background

1.1 Introduction

The Bureau of Land Management (BLM) Bishop Field Office, Bishop, California in coordination with the United States Forest Service (USFS) and the Great Basin Unified Air Pollution Control District (GPUAPCD), hereinafter "the Agencies," intend to prepare a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the development of the Casa Diablo 4 (CD-4) Geothermal Development Project in compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The BLM will be the NEPA Lead Agency; the USFS the NEPA Co-operating Agency; and the GBUAPCD, the CEQA Lead Agency. The agencies have initiated preparation of an EIS/EIR to evaluate the potential impacts of the CD-4 project on the environment.

As part of the EIS/EIR process, BLM, USFS and GBUAPCD conducted a public scoping effort to solicit input from agencies and the public regarding the scope and content of the EIS/EIR. This report describes the public scoping process and summarizes the comments received during scoping.

1.2 Purpose of the Scoping Process

The purpose of scoping is to solicit input from the public and resource agencies on the appropriate scope, focus, and content of the EIS/EIR. The Agencies will consider all of the input received during the scoping process during the preparation of the EIS/EIR.

The EIS/EIR will describe the existing environmental conditions of the area that could be affected by the proposed project and evaluate the potential effects of the CD-4 project in accordance with CEQA and NEPA. The comments provided by the public and resource agencies during scoping will help the Agencies identify pertinent issues, methods of analyses, and level of detail that should be addressed in the EIS/EIR. The scoping comments will also provide the basis for developing a reasonable range of feasible alternatives that will be evaluated in the EIS/EIR.

The scoping comments will augment the information developed by the EIS/EIR team, which includes specialists in each of the environmental subject areas covered in the EIS/EIR. This combined input will result in an EIS/EIR that is both comprehensive and responsive to issues raised by the public and resource agencies, and that meets CEQA and NEPA requirements.

In addition to facilitating public and resource agency input on the scope and focus of the EIS/EIR, scoping allows the Agencies to explain the EIS/EIR process to the public and to identify additional opportunities for public comment and public involvement during the EIS/EIR process. CEQA and NEPA require that the public be informed about the significant environmental effects of a proposed project before the project is approved.

2.0 Notification of Scoping

2.1 Notice of Intent

On March 25, 2010, BLM published in the Federal Register a Notice of Intent (NOI) to prepare an EIS/EIR for the CD-4 Project. The NOI initiated a 45-day public scoping and outreach process under NEPA, and provided information regarding the CD-4 project and details of how to obtain further information and submit scoping comments. A copy of the NOI is presented in **Appendix A**.

2.2 Notice of Preparation

As the first step in the CEQA process, on April 1, 2011, the GBUAPCD submitted a Notice of Preparation (NOP) to the State Clearinghouse, responsible and trustee agencies, and local jurisdictions announcing the anticipated preparation of the EIS/EIR for the project. A copy of the NOP is also presented in Appendix A. The NOP described the components of the proposed CD-4 Project, the purpose of the scoping process and information on the planned public scoping meetings. Entities that received the NOP are listed in **Table 1**.

2.3 Additional Public Notices

The scoping period began on March 25, 2011 with the issuance of the NOI. Two scoping meetings were conducted on April 18 and 19, 2011 and written comments were accepted through May 9, 2011. To notify appropriate parties of the project, a mailing list was compiled for affected federal, state, regional, and local agencies and elected officials; regional and local interest groups; local tribes; media contacts; and interested parties. **Table 2** summarizes the mailing list. The following methods were used to notify agencies and the public about the availability of the NOP, the scoping meeting dates and locations, and details on the comment process:

1. **NOP.** As discussed above, the NOP announced the public meeting dates and was distributed to responsible and trustee agencies, and various other parties.

2. **BLM Website.** Notice about the public scoping meetings was posted on the BLM's website (see the public meeting announcement in Appendix A).

3. **GBUAPCD Website**. On April 1, 2011 the NOP was posted on the Public Notices page of the GBUAPCD website; the CD-4 project was added to the GBUAPCD website home page on April 4, 2011.

4. **Meeting Flyer.** A flyer announcing the availability of the NOP and the dates of the public meetings was sent to various local community groups and organizations approximately two weeks prior to the public scoping meetings. A copy of the meeting flyer is included in Appendix A. Meeting flyer recipients are listed in Table 1.

5. **Media Notification.** The BLM public affairs department provided a news release (included Appendix A) on March 31, 2011 to various media outlets, including those shown in Table 1.

TABLE 1
NOTIFICATION OF SCOPING

NOP Recipients

- U.S. Environmental Protection Agency
- Caltrans District 9
- California Department of Conservation, Division of Oil, Gas and Geothermal Resources
- California Energy Commission
- Office of Historic Preservation
- Department of Water Resources
- Department of Parks and Recreation
- Department of Fish and Game, Region 6
- Native American Heritage Commission
- Public Utilities Commission
- California Highway Patrol
- Air Resources Board, Major Industrial Projects
- Regional Water Quality Control Board, Region 6
- Mono County Community Development Department
- Long Valley Fire Protection District
- Mammoth Lakes Fire Protection District
- Mammoth Community Water District
- Town of Mammoth Lakes

Meeting Flyer Recipients

- Mammoth Nordic
- Sierra Club
- Mammoth Lakes Trails and Public Access Foundation
- Bishop Paiute Tribe
- Eastern Sierra Land Trust
- Eastern Sierra 4WD Club
- High Sierra Equestrian Club
- 395 Fat Tire Council
- Advocates for Mammoth
- High Sierra Triathalon Club
- Disabled Sports Eastern Sierra
- Mammoth Powersports
- Mammoth Pet Shop
- Friends of the Inyo
- Mammoth Snowmobile Association and Town of Mammoth Lakes Tourism & Recreation Commission
- Town of Mammoth Lakes Planning Department

News Release Recipients

- A.C.E. — KMMT-FM Radio Station
- Eastern Sierra News at 11:00 — KSRW-TV
- KBOV-AM Radio Station
- KSRW-FM Radio Station
- KSRW-TV – Television Station
- Mammoth Sierra - Magazine
- Bob.Cochran@mail.house.gov
- bjbranson@lonepinetv.com
- kf6mgq@gbis.com
- sierrascoop@charter.net
- schwabjenell@yahoo.com
- Mammoth Times – Community Newspaper
- Mono Lake Newsletter - Magazine
- Sierra Wave – Online Broadcast Version
- The Spanish Show — KSRW-FM Radio Station Show
- The Sheet
- The Inyo Register
- newsradio@sbcglobal.net
- info@bloggingbishop.com
- colin@eenews.net
-

TABLE 2
MAILING LIST FOR NOP AND NOTICE OF SCOPING MEETINGS

Category	Number of Recipients
Responsible and Trustee Agencies, Other Agencies	14
Organizations and Interested Parties	15
Local and Bordering Jurisdictions	4
Media	21
TOTAL	**57**

3.0 Scoping Meetings

3.1 Public Scoping Meetings

The Agencies held two public scoping meetings near the CD-4 project area during April 2011, approximately two weeks after publication of the NOP, to present information regarding the CD-4 project and to solicit input from the public on potential impacts of the CD-4 project, the significance of impacts, the appropriate scope of the EIS/EIR, mitigation measures, and potential alternatives to the CD-4 project. The first meeting was held on Monday, April 18, 2011 at the Crowley Lake Community Center located at 458 South Landing Road, Crowley Lake, California. The second meeting was held on Tuesday, April 19, 2011 at the Mammoth Lakes Community Center located at 1000 Forest Trail, Town of Mammoth Lakes, California.

Each meeting began with a sign-in session, overview of the purpose of the scoping meeting and agenda by Austin McInerny (facilitator), and opening remarks by the BLM. Following the introductions, ESA Project Manager, Mike Manka, provided an overview of the CD-4 project and the NEPA/CEQA process. Mike also provided instructions to attendees on how to submit written comments during the scoping period. Individuals were invited to ask questions regarding the NEPA/CEQA process and for clarifications regarding the proposed project. The meetings concluded with an open house session which provided an opportunity for attendees to review display boards and discuss any questions regarding the project with the project team. Based on the meeting sign-in sheets, a total of 17 people attended the two scoping meetings (excluding Agency and consultant staff), and they represented the Town of Mammoth Lakes, local citizens, and community groups.

Following the formal meeting, attendees were once again invited to review project display boards, ask questions of the project team, and submit written comments. Appendix B includes copies of the scoping meeting agenda, handout, comment cards, and sign-in sheets.

3.2 Agency Scoping Meetings

During the scoping period for the proposed CD-4 project, the Agencies also conducted meetings with various agencies that had requested individual meetings. The purpose of these meetings was to explain the CD-4 project, the timeline for the environmental review process, and to discuss relevant issues and/or concerns that each agency had relative to the proposed project. Individual meetings were held with Mono County, Town of Mammoth Lakes, Mammoth Community Water District, and the Mammoth Lakes Trails and Public Access. While various concerns were discussed during these meetings, each agency was instructed to submit its scoping comments in writing; their comments are summarized in the following section.

4.0 Summary of Comments

The Agencies received a total of 19 comment letters (including emails) on the CD-4 project, comprising a total of 126 individual comments. **Table 3** lists agencies, organizations and individuals that provided comments. Copies of comment letters and emails are included in Appendix D.

TABLE 3
INDEX OF WRITTEN COMMENTS

Comment Letter No.	Commenter
1. Federal Agencies	
1A	U.S. Environmental Protection Agency
1B	National Park Service
2. State Agencies	
2A	State of California, Department of Fish and Game
2B	State of California, Department of Transportation, District 9
2C	State of California, Regional Water Quality Control Board, Lahontan Region
2D	State of California, Native American Heritage Commission
3. Local/Regional Agencies	
3A	Mammoth Community Water District
3B	Mono County Community Development Department
3C	Town of Mammoth Lakes, Office of the Mayor
4. Organizations	
4A	Advocates for Mammoth
4B	Mammoth Lakes Trails and Public Access Foundation
4C	Mammoth Nordic
4D	Sierra Club, Toiyabe Chapter (Range of Light Group)
5. Individuals	
5A	Malcolm Clark
5B	Lisa Isaacs
5C	Mirza Agha and Matthew Meuser
5D	Liz O'Sullivan
5E	Michael O'Sullivan
5F	Scott Sysum

This section summarizes the issues raised by comments during the scoping period. The comment summaries are presented in two categories: CEQA/NEPA and CD-4. The CEQA/NEPA category pertains to issues related to the environmental resource areas that will be discussed in the EIS/EIR. The CD-4 category refers to comments regarding the project itself. **Table 4** provides a summary of scoping comments by commenter. **Table 5** provides a summary of scoping comments by topic.

TABLE 4
SUMMARY OF COMMENTS BY COMMENTERS

			CEQA/NEPA Comments		CD-4 Comments	
Commenter	**Page (p.), Paragraph**	**Summary of Comment**	**Resource Topics**	**Other CEQA/NEPA Topics**	**Description of the Project**	**Agency Coordination (Permits and Approvals)**
1A U.S Environmental Protection Agency	p. 2, paragraph 3	Identify the purpose and need of the project. Discuss the proposed project in the context of the larger energy market that the project would serve; identify potential purchasers of the power produced; and discuss how the project will assist the state in meeting renewable energy portfolio standards and goals.	Energy		Project Description	
1A U.S Environmental Protection Agency	p. 3, paragraph 1	Describe the development of each alternative was developed, how it addresses each project objective, and how it would be implemented. Identify and analyze an environmentally preferable alternative.		Alternatives		
1A U.S Environmental Protection Agency	p. 3, paragraph 6	Suggest coordination with the Corps to obtain a jurisdictional delineation and confirm the presence of waters of the U.S., in order to determine whether or not a CWA Section 404 permit is needed. If needed, project should comply with the CWA 404(b)(1) Guidelines.	Water Quality			Section 404 permit
1A U.S Environmental Protection Agency	p.4, paragraph 4	Describe the geographic extent of any waters of the U.S. at the project site, as well as drainage patterns at the project location.	Water Quality			Section 404 permit
1A U.S Environmental Protection Agency	p. 4, paragraph 5	Discuss steps that will be taken to avoid and minimize impacts to waters of the U.S.	Water Quality			Section 404 permit
1A U.S Environmental Protection Agency	p. 5, paragraph 2	Describe the availability of water supply for construction and operation of the project and evaluate impacts associated with the selected water supply.	Groundwater			
1A U.S Environmental Protection Agency	p. 5, paragraph 3	Explore the need for a groundwater monitoring plan as a mitigation measure for potential impacts on groundwater, springs, and other surface water features. The monitoring plans should address contingencies to be implemented (i.e., modification of geothermal pumping rates) to address any potential impacts that may be documented during the monitoring program plan for these water resources.	Groundwater			
1A U.S Environmental Protection Agency	p. 5, paragraph 5	Provide information on CWA Section 303(d) impaired waters in the project area and efforts to develop/revise TMDLs.	Water Quality			
1A U.S Environmental Protection Agency	p.5, paragraph 6	Provide discussion of ambient air conditions, NAAQS, criteria pollutant nonattainment areas, and potential air quality impacts including cumulative impacts for each alternative. Address the applicability of CAA Section 176 and EPA's general conformity regulations at 40 CFR Parts 51 and 93.	Air Quality			

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

Commenter		Page (p.), Paragraph	Summary of Comment	CEQA/NEPA Comments		CD-4 Comments	
				Resource Topics	Other CEQA/NEPA Topics	Description of the Project	Agency Coordination (Permits and Approvals)
1A	U.S Environmental Protection Agency	p.6, paragraph 3	Discuss if new source review (NSR) program permits will be required for the geothermal power plant. If so, the EIR/EIS should describe the permitting process and applicable information.	Air Quality			
1A	U.S Environmental Protection Agency	p. 7, paragraph 1	Indicate if Title V operating permits will be required for the geothermal power plant proposed to be constructed in the leased areas. If so, describe permitting process.	Air Quality			
1A	U.S Environmental Protection Agency	p. 7, paragraphs 2 and 3	Identify the need for an Equipment Emissions Mitigation Plan (EMMP) and Fugitive Dust Control Plan. An EEMP will identify actions to reduce diesel particulate, carbon monoxide, hydrocarbons and NO_x associated with construction activities.	Air Quality			
1A	U.S Environmental Protection Agency	p. 8, paragraph 1	Evaluate the need for compliance with the Clean Air Act's Section 112 and the Emergency Planning and Community Right-to-Know Act (EPCRA) Section 303, 311, & 312. Requirements of the CA Hazardous Materials Business Plan may be applicable	Hazards and Hazardous Materials			
1A	U.S Environmental Protection Agency	p. 8, paragraph 3	Discuss design and management measures to minimize adverse impacts to wildlife and native and rare plants. Identify specific measures to reduce impacts to eagles and clarify how the project would comply with the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act.	Biological Resources			
1A	U.S Environmental Protection Agency	p. 9, paragraph 2	Discuss need for an Avian Protection Plan for the transmission lines and equipment. The discussion may include the development of an APP using the Avian Power Line Interaction Committee best practices and FWS Avian Protection Plan Guidelines.	Biological Resources			
1A	U.S Environmental Protection Agency	p. 9, paragraph 4	Recommends that there be full disclosure of impacts to recreational users in the project area. Clarify what general measures will be incorporated to ensure recreational users are not injured due to hazards associated with piping and transmission lines.	Recreation			
1A	U.S Environmental Protection Agency	p. 9, paragraph 6	Include an invasive management plan to monitor and control noxious weeds.	Biological Resources			
1A	U.S Environmental Protection Agency	p. 9, paragraph 7	Assess noise levels from the geothermal plant and well field. Decibel levels should be evaluated as should the effects of noise levels on a variety of species, as well as effects on property values, residences, and recreational use.	Noise			

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

Commenter		Page (p.), Paragraph	Summary of Comment	CEQA/NEPA Comments		CD-4 Comments	
				Resource Topics	Other CEQA/NEPA Topics	Description of the Project	Agency Coordination (Permits and Approvals)
1A	U.S Environmental Protection Agency	p. 9, paragraph 8	Steps should be taken to minimize the visual impacts associated with the new geothermal plant and well field.	Aesthetics			
1A	U.S Environmental Protection Agency	p. 10, paragraph 2	Describe the process and outcome of government-to-government consultation between BLM and other tribal governments within the project area.	Cultural Resources			
1A	U.S Environmental Protection Agency	p. 10, paragraph 5	Address the possibility of Indian sacred sites in the project area. Address Executive Order 13007 and distinguish it from Section 106 of NHPA; discuss how BLM will avoid adverse effects on the physical integrity of sacred sites, if they exist. Summarize coordination with Tribes and with the SHPO/THPO, including identification of NRHP eligible sites, and development of a Cultural Resource Management Plant.	Cultural Resources			
1A	U.S Environmental Protection Agency	p. 11, paragraph 2	Identify projected hazardous materials and waste types and volumes, and expected storage, disposal, and management plans.	Hazards and Hazardous Materials			
1A	U.S Environmental Protection Agency	p. 11, paragraph 3	Describe the health and safety aspects of all hazardous materials used, especially the working fluid.	Hazards and Hazardous Materials			
1A	U.S Environmental Protection Agency	p. 11, paragraph 4	Evaluate appropriate mitigation, including measures to minimize the generation of hazardous waste.	Hazards and Hazardous Materials			
1A	U.S Environmental Protection Agency	p. 11, paragraph 6	Discuss the potential for geological hazards (i.e., induced seismicity or subsidence) and describe how geological hazards would be monitored and mitigation measures.	Geology, Soils, and Seismicity			
1A	U.S Environmental Protection Agency	p. 12, paragraph 1	Identify bonding or financial assurance strategies for decommissioning and reclamation.			Project Description	
1A	U.S Environmental Protection Agency	p. 12, paragraph **3**	Evaluate the conformance of the project with current and reasonably foreseeable land use plans	Land Use, Plans and Policies			
1A	U.S Environmental Protection Agency	p. 12, paragraph 5	Include an evaluation of environmental justice populations within the geographic scope of the project.	Environmental Justice			

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

Commenter	Page (p.), Paragraph	Summary of Comment	CEQA/NEPA Comments		CD-4 Comments	
			Resource Topics	Other CEQA/NEPA Topics	Description of the Project	Agency Coordination (Permits and Approvals)
1A U.S Environmental Protection Agency	p. 12 – 13, paragraph 6	Identify the following: current condition of the resource as a measure of past impacts; the trend in the condition of the resource as a measure of present impacts; all on-going, planned and reasonably foreseeable projects in the project area; future condition of the resource based on an analysis of impacts from cumulative projects.		Cumulative		
1A U.S Environmental Protection Agency	p. 13, paragraph 3	Describe reasonably foreseeable future land use and associated impacts that will result from additional power supply. Estimate the amount of growth, likely location, and biological and environmental resources at risk.		Cumulative		
1A U.S Environmental Protection Agency	p. 14, paragraph 1	Consider how climate change could potentially influence the proposed project (specifically sensitive areas) and assess how the projected impacts could be exacerbated by climate change.	Climate Change			
1A U.S Environmental Protection Agency	p. 14, paragraph 2	Quantify and disclose the anticipated climate change benefits of geothermal plant electrical energy. Suggest quantifying greenhouse gas emissions from different types of generating facilities (i.e., solar, wind, natural gas, coal-burning, and nuclear) and comprising these values.	Greenhouse Gas Emissions			
1A U.S Environmental Protection Agency	p. 14, paragraph 5	Consider adopting a formal adaptive management plan to evaluate and monitor impacted resources and ensure successful implementation of mitigation measures. Recommends BLM review the discussion on Adaptive Management in the NEPA Task Force Report to the Council on Environmental Quality (CEQ) on Modernizing NEPA Implementation.		Mitigation Measures		
1B National Park Service	p.1 paragraph 1	No comment at this time.				
2A State of California, Department of Fish and Game	p. 2, paragraph 9	Should address any potential to alter aquifer temperatures, pressures, surface waters, spring flows, and water quality.	Hydrology / Water Quality; Groundwater			
2A State of California, Department of Fish and Game	p.2, paragraph 10	Explain how the project comports with existing court orders and settlement agreements stemming from the development of the MP1 and PLES plants.			Project Description	

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

Commenter		Page (p.), Paragraph	Summary of Comment	CEQA/NEPA Comments		CD-4 Comments	
				Resource Topics	Other CEQA/NEPA Topics	Description of the Project	Agency Coordination (Permits and Approvals)
2A	State of California, Department of Fish and Game	pp. 3 - 4, paragraphs 1 through 7 and 1 through 3	Include a complete assessment of the flora and fauna within and adjacent to the project area including special status species, locally unique species, and rare natural communities. Refer to the CDFG's November 2009 Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (see Attachment 1 of scoping letter). Assessment should include rare, threatened, and endangered invertebrate, fish, wildlife, reptile, and amphibian species. The assessment should utilize the Department's California Natural Diversity Data Base (CNDDB).	Biological Resources			
2A	State of California, Department of Fish and Game	p. 4, paragraph 4	Include a thorough discussion of direct, indirect, and cumulative impacts expected to adversely affect biological resources with specific measures to offset such impacts included.	Biological Resources	Cumulative Effects		
2A	State of California, Department of Fish and Game	p. 5, paragraph 7	Analyze a range of project alternatives to ensure that the full spectrum of alternatives to the proposed project are fully considered and evaluated. Alternatives which avoid or minimize impacts to sensitive biological resources should be identified.		Alternatives		
2A	State of California, Department of Fish and Game	p. 6, paragraph 2	Mitigation measures for adverse impacts to special-status species should be thoroughly discussed. Mitigation measures should first emphasize avoidance and reduction of project impacts. The feasibility of on-site habitat restoration or enhancement should be discussed for unavoidable impacts.	Biological Resources			
2A	State of California, Department of Fish and Game	p. 7, paragraphs 1 through 3	State whether the project would result in incidental take of any CESA-listed organisms. To expedite the CESA permitting process, the DEIR should address CESA permit requirements.	Biological Resources			CESA permit
2A	State of California, Department of Fish and Game	p. 8, paragraph 2	The EIR should demonstrate that the project will not result in a net loss of wetland habitat values or acreage. If the project site has potential to support aquatic, riparian, or wetland habitat, the project should include a jurisdictional delineation that includes wetland identification. The EIR should address the potential need for a Lake or Streambed Alteration Agreement.	Biological Resources			
2B	State of California, Department of Transportation, District 9	p. 1, paragraph 2	Notes that the permitting process would be simplest if the Mammoth Community Water District serves as the owner/operator of the proposed recycled water pipeline. Ormat could be the permittee but Caltrans Headquarters involvement/approval would be required via the exception process.				Caltrans permitting process

A-18

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

Commenter		Page (p.), Paragraph	Summary of Comment	CEQA/NEPA Comments		CD-4 Comments	
				Resource Topics	Other CEQA/NEPA Topics	Description of the Project	Agency Coordination (Permits and Approvals)
2B	State of California, Department of Transportation, District 9	p. 1, paragraph 3	The recycled water pipeline should be located farther from SR 203 to ensure that the pipe does not impede any future highway work/maintenance.			Project Description	
2B	State of California, Department of Transportation, District 9	p. 1, paragraphs 4 and 5	Encroachment permits (for bore and jack work) would be required for SR 203 and US 395.				Encroachment permit
2C	State of California, Regional Water Quality Control Board, Lahontan Region	p. 2, paragraph 3	Provide an analysis of potentially significant impacts to all drainages, wetlands, surface waters of the State, waters of the U.S., or blue-line streams in and around the Project. Project should also evaluate potential impacts to groundwater as a result of well installation activities and plant operation. The evaluation should also consider the cumulative impact of in-stream filling with regard to downstream development. Project proponent should comply with all applicable water quality standards and prohibitions, including provisions of the Basin Plan.	Hydrology / Water Quality	Cumulative Effects		
2C	State of California, Regional Water Quality Control Board, Lahontan Region	p. 3, paragraph 1	The project should consider Low Impact Development principles to minimize surface runoff and reduce impacts to receiving waters.			Project Description	
2C	State of California, Regional Water Quality Control Board, Lahontan Region	p. 3, paragraph 6	If the project results in disturbance of more than 1.0 acre, then the Project proponent must develop a Storm Water Pollution Prevention Plan (SWPPP) and obtain a National Pollutant Discharge Elimination System (NPDES) General Construction Stormwater Permit. Obtaining a permit and conducting monitoring does not constitute adequate mitigation.	Hydrology / Water Quality			General Construction Permit
2C	State of California, Regional Water Quality Control Board, Lahontan Region	p. 3, paragraph 8	Project should include using recycled wastewater in the evaporative cooling process of the power plant. Analysis should evaluate health impacts to site workers and off-site overspray from these activities. Note that the current State of California Recycling Criteria require submission of an engineering report to the RWQCB and the DHS prior to implementation of recycled water projects.	Hydrology / Water Quality		Project Description	
3A	Mammoth Community Water District	p. 2, paragraph 1	Address potential interaction between existing aquifer levels based on public and ORMAT monitoring data. Address both qualitative and quantitative changes in interaction that would occur form long-term increases in brine pumping and re-injection.	Groundwater			

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

Commenter	Page (p.), Paragraph	Summary of Comment	CEQA/NEPA Comments: Resource Topics	CEQA/NEPA Comments: Other CEQA/NEPA Topics	CD-4 Comments: Description of the Project	CD-4 Comments: Agency Coordination (Permits and Approvals)
3A Mammoth Community Water District	p. 2, paragraph 2	Determine whether the geothermal reservoir computer simulation model boundary conditions for the upper aquifer is consistent with those of the District's groundwater simulation model developed in 2009. Determine whether the models are consistent in terms of mass balance, vertical hydraulic conductivity, upper/lower aquifer boundary conditions, and primary recharge and extraction mechanisms.	Groundwater			
3A Mammoth Community Water District	p. 2, paragraph 3	Determine whether under sustained multi-year drought the contributing upper aquifer zones' decreased recharge to the thermal reservoir, combined with the increase in bring pumping, would cause inter-annual head changes that result in lowering of the overlying upper aquifer heads and water supply well pumping levels.	Groundwater			
3A Mammoth Community Water District	p. 2, paragraph 4	Will there be independent technical review to support conclusions presented by the project's technical specialists regarding impacts to groundwater hydrology? MCWD believes this could be achieved by having other technical staff from USGS, BLM, USFS to provide independent review.	Groundwater	Peer review		
3A Mammoth Community Water District	p. 2, paragraph 5	Determine if the location/selection of the 16 potential well sites influence the changes to the upper aquifer. Questions if the modeling analysis will consider through Monte-Carlo or similar uncertainty/sensitivity analysis, optimization analysis, or similar methods the long term differences in impacts of the final extraction/injection site locations out of the 16 possible locations.	Groundwater			
3A Mammoth Community Water District	p. 2, paragraph 6	Describe design, construction, permitting standards used for abandonment of monitoring, production, and injection wells to ensure there is no vertical "cross connection" between the aquifer layers which would negatively impact municipal water supply and/or shallow groundwater interactions with surface water features	Groundwater			
3A Mammoth Community Water District	p. 2, paragraph 7	Describe the impact of extracting 300 to 400 acre-feet per year from the geothermal reservoir, compared to the current "zero net extraction" practice under ambient cooling only and near 100% re-injection of brine (assuming 1 MG per day of consumptive extraction from the use of reverse osmosis brine supply for cooling water). Impacts of this net groundwater extraction on the aquifer should be evaluated.	Groundwater			

A-20

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

Commenter	Page (p.), Paragraph	Summary of Comment	CEQA/NEPA Comments		CD-4 Comments	
			Resource Topics	Other CEQA/NEPA Topics	Description of the Project	Agency Coordination (Permits and Approvals)
3A Mammoth Community Water District	p. 2, paragraph 8	Describe potential impacts to surface water features in the central and eastern portions of Mammoth Creek based on the results of the groundwater hydrology analysis. Describe whether these changes would adversely affect aquatic habitat and/or water supply reliability to downstream surface water users.	Hydrology			
3A Mammoth Community Water District	p. 2, paragraph 9	Potential impacts associated with using recycled water for hybrid cooling and reduction of the net annual geothermal brine extraction levels. Determine the quantitative impact of this use as measured by the number of required brine extraction wells and resulting disturbance areas, and reduced parasitic loads at the power plant complex from reduced brine pumping loads and/or reduced RO treatment system power consumption.	Hydrology			
3A Mammoth Community Water District	p. 3, paragraph 1	Describe water use associated with construction of the new wells, pipelines, power plant, and related infrastructure. Describe whether construction-related water could be met through use of recycled water available from MCWD to reduce demands on potable supply.	Hydrology			
3A Mammoth Community Water District	p. 3, paragraph 2	Questions whether there are greater or lesser off-sets of carbon based power generation sources based on the future power plant's efficiency and ability to support both base and peak power demands compared to only base power generation. Questions if the power plant could be designed and operated in a manner to maximize off-set use of carbon emitting power sources, taking into account established patterns of regional power generation in relation to major power source types' carbon load per unit power generation. Refers to the National Renewable Energy Laboratory 2011 study (Hybrid Cooling Systems for Low Temperature Geothermal Power Production)	Greenhouse Gas Emissions			
3A Mammoth Community Water District	p. 3, paragraph 4	Evaluate socio-economic impacts of both the overall power generation revenue estimates and the revenue sharing agreements with Mono County to determine the relative impacts of viable revenue sharing options and power generation targets related to base and peak power generation.	Socio-economics			

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

				CEQA/NEPA Comments		CD-4 Comments	
	Commenter	Page (p.), Paragraph	Summary of Comment	Resource Topics	Other CEQA/NEPA Topics	Description of the Project	Agency Coordination (Permits and Approvals)
3A	Mammoth Community Water District	p. 4, paragraphs 2 through 4	MCWD suggests that the following options be evaluated for the power plant use of hybrid cooling component: (1) No use of hybrid cooling, similar to existing power plant systems at the complex, (2) Seasonal use of hybrid cooling with recycled water only, (3) Use of treated geothermal brine only, using RO or similar on-site treatment, and (4) Use of combined RO treatment and recycled water supply.		Alternatives		
3B	Mono County Community Development Department	p. 1, paragraph 2	Notes that a reclamation plan will be required for the proposed power plant and pipeline.			Project Description	
3B	Mono County Community Development Department	p. 1, paragraph 3	Construction of any new wells would require permits from Environmental Health.			Project Description	Environmental Health permits
3B	Mono County Community Development Department	p. 1, paragraph 4	Encroachment and/or grading permits may be needed from the Department of Public Works.			Project Description	Encroachment and grading permits
3C	Town of Mammoth Lakes, Office of the Mayor	p. 1, paragraph 3	Analyze underground and at-grade pipeline options. The Town's General Plan specifically calls out undergrounding of utilities as a desired goal.			Project Description	
3C	Town of Mammoth Lakes, Office of the Mayor	p. 1, paragraph 4	For the aboveground pipeline option, overpasses or buried sections of some type would be needed at 1,000-foot intervals beyond crossings at forest service roads so that trail users and future trail alignments will not have any barriers.			Project Description	
3C	Town of Mammoth Lakes, Office of the Mayor	p. 1, paragraph 5	Analyze the snow melt rate for both underground and at-grade pipeline options.	Recreation			
3C	Town of Mammoth Lakes, Office of the Mayor	p. 1, paragraph 6	Regardless of the location of pipe crossings, installation of aboveground pipelines would result in a significant impact on recreation as visitors and residents would lose their ability to use the Inyo National Forest lands as a whole.	Recreation			
3C	Town of Mammoth Lakes, Office of the Mayor	p. 2, paragraph 1	Analyze needed warning signs, pipeline identifying markers and distance needed from the exposed pipes to prevent collisions amongst nordic skiiers, snowmobilers, motorcylists and other trail users not familiar with the pipe locations.	Recreation			
3C	Town of Mammoth Lakes, Office of the Mayor	p. 2, paragraph 2	Analyze exposed pipes in the event of a pipe break or crack and the level that such a fracture could cause due to super heated steam or liquid escaping.	Hazards and Hazardous Materials			

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

Commenter		Page (p.), Paragraph	Summary of Comment	CEQA/NEPA Comments		CD-4 Comments	
				Resource Topics	Other CEQA/NEPA Topics	Description of the Project	Agency Coordination (Permits and Approvals)
3C	Town of Mammoth Lakes, Office of the Mayor	p. 2, paragraphs 4-5	Analyze the lowest possible background noise level associated with operational noise associated with the new well heads. Analyze the cumulative operational noise impacts associated with the new well heads.	Noise			
3C	Town of Mammoth Lakes, Office of the Mayor	p. 2, paragraphs 7 to 8	Analyze options that limit the time period between drilling, construction and up until capping of the well head so that emissions are minimized. List all potential emissions associated with geothermal areas.	Air Quality			
3C	Town of Mammoth Lakes, Office of the Mayor	p. 2, paragraph 9	Notes that the Town holds a Special Use Permit with the Inyo National Forest for operations at Shady Rest Park. The Town requests to be involved in identifying potential mitigation for any impacts to Shady Rest Park.	Recreation		Project Description	Special Use Permit with Inyo National Forest
3C	Town of Mammoth Lakes, Office of the Mayor	p. 2, paragraph 10	Request that a clear understanding and outline of the approval process amongst the three decision-making bodies (BLM, Inyo National Forest, and Great Basin Unified Air Pollution Control District) be presented.			Project Description	
3C	Town of Mammoth Lakes, Office of the Mayor	p.2, paragraph 11	Request that public field trips are held early within the 45-day comment period to explain the alternatives outlined in the Draft EIS/EIR		Alternatives		
3C	Town of Mammoth Lakes, Office of the Mayor	p. 3, paragraph 1	Requests specific analysis of the amount of water needed for cooling, potential impacts related to the changing function of the Town's aquifer, and a feasibility study for the potential use of recycled water. Consider potential impacts to the aquifer and the immediate vicinity.	Groundwater			
3C	Town of Mammoth Lakes, Office of the Mayor	p. 3, paragraph 2	Clearly describe any pre-existing stipulations from prior approvals for the entire proposed project.			Project Description	
4A	Advocates for Mammoth	p. 2, paragraph 2	Suggests that a realistic estimate of the number of people utilizing Shady Rest Park be conducted. This information would help inform development of meaningful alternatives and mitigation measures.	Recreation			
4A	Advocates for Mammoth	p. 2, paragraph 4	The pipeline alignment should be designed to allow for adequate access and to minimize impacts on wildlife.	Biological Resources		Design/ Project Description	
4A	Advocates for Mammoth	p. 2, paragraph 5	Odors generated from the wells and pipelines would interfere with the enjoyment of the area and indicate possible hazardous conditions.	Air Quality			

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

Commenter	Page (p.), Paragraph	Summary of Comment	CEQA/NEPA Comments: Resource Topics	CEQA/NEPA Comments: Other CEQA/NEPA Topics	CD-4 Comments: Description of the Project	CD-4 Comments: Agency Coordination (Permits and Approvals)
4A Advocates for Mammoth	p. 2, paragraph 6	Determine the current background sound level as part of the determination of acceptable sound levels for the operating wells.	Noise			
4A Advocates for Mammoth	pp. 2-3, paragraph 7	The addition of the proposed project to a recreation area with many diverse users (some which already have conflicts - i.e., motorized vs. quiet sports advocates) calls for development of a comprehensive plan for the area and not a piecemeal approach.	Recreation			
4A Advocates for Mammoth	p. 3, paragraph 1	Due to the project's close proximity to the town, the analysis of potential hazards related to public safety should be conservative. Concerns include potential well blowouts, pressurized pipe rupture, hazardous gas release, and initiation of wild fires.	Hazards and Hazardous Materials			
4A Advocates for Mammoth	p. 3, paragraph 2	Concerns about the appearance of project facilities in the vicinity of Shady Rest Park.	Aesthetics			
4A Advocates for Mammoth	p. 3, paragraph 4	Look at the cumulative effects of the proposed large expansion of the power plant with the continued operation of the existing plant.		Cumulative Effects		
4A Advocates for Mammoth	p. 3, paragraph 5	Concerns about the project's effects on the Town's water supply and local economy as the Town's groundwater represents a potential valuable resource to the Town.	Groundwater; Socio-economics			
4B Mammoth Lakes Trails and Public Access Foundation	p. 1, paragraph 3	Commenter expresses concern regarding potential conflicts between the proposed pipelines and facilities with current and future recreation opportunities in Shady Rest Park. Based on review of local planning documents, commenter produced a map with an accompanying list that identifies 18 potential conflicts.	Recreation			
4B Mammoth Lakes Trails and Public Access Foundation	pp. 1-2, paragraph 4	Recommends that public comments are documented in a report and be considered as part of the environmental process(s) and documented as part of the public record.			Project Description	
4C Mammoth Nordic	p. 1, paragraphs 3 and 4	Concerns regarding the project's impact on Nordic recreation in the Mammoth Lakes area. Implementation of additional wells and pipelines could impact the aesthetic quality, noise environment, and safety of the Nordic user experience.	Aesthetics; Recreation; Noise			

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

				CEQA/NEPA Comments		CD-4 Comments	
Commenter		Page (p.), Paragraph	Summary of Comment	Resource Topics	Other CEQA/NEPA Topics	Description of the Project	Agency Coordination (Permits and Approvals)
4C	Mammoth Nordic	p. 1, paragraph 5	Concerns regarding the project's need to re-route several established Nordic trail alignments. Concerns regarding Mammoth Nordic's ability to conduct their nightly grooming operations. Expresses concerns regarding both above-ground and below-ground pipeline options -- above-ground pipelines could create barriers while the belowground pipeline option could cook the ground above, creating low-snow conditions and could create "hollow snow" conditions and could compromise Nordic recreation safety.	Recreation			
4D	Sierra Club, Toiyabe Chapter, Range of Light Group	p. 1, paragraph 1	Request that site visits are available during the early portion of the Draft EIS/EIR comment period.		Comment Period		
4D	Sierra Club, Toiyabe Chapter, Range of Light Group	pp. 1-2, paragraph 2	Requests that the EIS/EIR considers hydrological effects associated with the continued operation of the current plant in combination with the proposed plant as well as the potential effects on stream, spring, seep flows, and temperatures.	Hydrology / Water Quality			
4D	Sierra Club, Toiyabe Chapter, Range of Light Group	p. 2, paragraph 1	Due to the magnitude of the project and collection of over 30 years of hydrological and monitoring data, commenter requests there be an open review of the hydrological and environmental effects of the current plant along with the analysis of the proposed expansion. Requests that pertinent data from other facilities be included (i.e., ones pertaining to seismic activity, aquifer drawdown, and recharging).	Hydrology / Water Quality		Project Description; Project Background	
4D	Sierra Club, Toiyabe Chapter, Range of Light Group	p. 2, paragraph 2	Questions the applicant's proposed use of supplemental water cooling. Requests that the project description evaluate the following: (1) how much water or brine would be used, (2) the capacity of the RO plant and the recycled water pipeline's capacity, and (3) the alignment of the pipeline.			Project Description	
4D	Sierra Club, Toiyabe Chapter, Range of Light Group	p. 2, paragraph 3	Notes that the Basalt Canyon/Shady Rest area and the plant site were used by the Piaute Tribes (and still may be). Requests that the local Piaute tribe consulted with and that the required state and federal surveys, monitoring, and mitigation be conducted.	Cultural Resources			
4D	Sierra Club, Toiyabe Chapter, Range of Light Group	p. 3, paragraph 1	Requests that construction activities involving tree removal and/or vegetation removal be prohibited during spring or early summer months when there are nesting birds or other animals present. Suggests that the Forest Service provide guidance regarding construction timing.	Biological Resources			

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

Commenter	Page (p.), Paragraph	Summary of Comment	CEQA/NEPA Comments: Resource Topics	CEQA/NEPA Comments: Other CEQA/NEPA Topics	CD-4 Comments: Description of the Project	CD-4 Comments: Agency Coordination (Permits and Approvals)
4D Sierra Club, Toiyabe Chapter, Range of Light Group	p. 3, paragraph 2	Analyze the probability of earthquake activity due to a combination of the project area's recent history of earthquakes and the proposed plant's potential to precipitate an earthquake related to reinjecting water or brine into the wells.	Geology, Soils, and Seismicity			
4D Sierra Club, Toiyabe Chapter, Range of Light Group	p. 3, paragraph 3	Recommend that the maximum distance between passages be 1,000 feet and that the intervals be closer in areas of existing roads, trails or frequent use. Requests that informal access points to the project area near Nordic trails be considered in the analysis.	Recreation			
4D Sierra Club, Toiyabe Chapter, Range of Light Group	p. 3, paragraph 3	Consider impacts not on just the present recreational uses in the project area but the possible impact on the future expanded Nordic system.	Recreation	Cumulative Effects		
4D Sierra Club, Toiyabe Chapter, Range of Light Group	p. 3, paragraph 4	Requests that visual impacts associated with the drill rigs, wells, fencing, plumes from heat exchangers, pipes, plowed roads, and plowing berms be minimized.	Aesthetics			
4D Sierra Club, Toiyabe Chapter, Range of Light Group	p. 4, paragraph 1	Requests that appropriate mitigation be implemented to reduce noise associated with the production wells and drilling operations.	Noise			
4D Sierra Club, Toiyabe Chapter, Range of Light Group	p. 4, paragraph 2	Requests that the release of, detection of, and control of noxious gases from wells and pipes be covered in the analysis with appropriate mitigation measures.	Air Quality			
4D Sierra Club, Toiyabe Chapter, Range of Light Group	p. 4, paragraph 3	Requests that worst case catastrophic hazards be analyzed (i.e., blowouts, poisonous gas release, earthquake rupture of pipes and wells, drill rig explosion, hazardous materials spills). Use of the area by OSV and OHV vehicles could pose a threat to the integrity of high temperature brine pipes.	Hazards and Hazardous Materials			
4D Sierra Club, Toiyabe Chapter, Range of Light Group	p. 4, paragraph 4	Requests that appropriate mitigation measures including compensatory benefits to residents and visitors be implemented due to projected disruption to Town recreational uses. Requests that such mitigation is determined in consultation with the Town government and with all interested groups.	Recreation	Mitigation Measures		
4D Sierra Club, Toiyabe Chapter, Range of Light Group	p. 4, paragraph 5	Address eventual decommissioning of the facilities and restoration of project sites.	All resource topics		Project Description	

A-25

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

Commenter		Page (p.), Paragraph	Summary of Comment	CEQA/NEPA Comments		CD-4 Comments	
				Resource Topics	Other CEQA/NEPA Topics	Description of the Project	Agency Coordination (Permits and Approvals)
4D	Sierra Club, Toiyabe Chapter, Range of Light Group	p. 4, paragraph 7	Requests that commitments for on-going monitoring throughout the life of the project be included in the final environmental document (i.e., on water levels, recreational access, etc.).		Mitigation Measures		
5A	Malcolm Clark	p. 1, paragraph 1	Requests to be added to mailing list.		Mailing List		
5B	Lisa Isaacs	p. 1, paragraph 2	Questions area of each well pad (0.4 acres) and urges that the applicant look for ways to reduce the surface area and or increase use of gravel around a reduced pad area.			Design / Project Description	
5B	Lisa Isaacs	p. 1, paragraph 4	Requests for information about restoration and mitigation to offset impacts associated with well pad construction. Requests detailed information regarding restoration techniques.	Biological Resources	Mitigation Measures		
5B	Lisa Isaacs	p. 1, paragraph 5	Requests information about the total length and surface area of proposed aboveground pipelines.			Design / Project Description	
5B	Lisa Isaacs	p. 1, paragraph 6	Describe mitigation and methods used to offset impacts on the project area's viewshed from the proposed aboveground pipelines. Questions whether the pipeline could be installed belowground in areas of concentrated visual impacts and concentrated recreational areas.	Aesthetics; Recreation			
5B	Lisa Isaacs	p. 1, paragraph 7	Questions if all new proposed transmission lines can be undergrounded as opposed to stringing new aboveground lines.		Alternatives	Project Description	
5B	Lisa Isaacs	p. 2, paragraph 1	Will local, qualified workforce be given preference for construction and facility operations jobs created by the proposed project?		Not a CEQA/ NEPA issue		
5B	Lisa Isaacs	p. 2, paragraph 2	Requests that recycled water be used during the cooling process as opposed to potable, municipal water.			Project Description	
5B	Lisa Isaacs	p. 2, paragraph 3	Describe how air quality impacts and potential leaks will be monitored in areas surrounding wells and new power plants. Describe whether monitoring will be ongoing in real time or occasional.	Air Quality			
5B	Lisa Isaacs	p. 2, paragraph 3	Describe how impacts to archaeological resources will be mitigated by the proposed project.	Cultural Resources			
5B	Lisa Isaacs	p. 2, paragraph 5	What public educational/interpretive programs and displays are planned to 'tell the story' to local residents and residents alike?			Project Description	

TABLE 4 (Continued)
SUMMARY OF COMMENTS BY COMMENTERS

Commenter	Page (p.), Paragraph	Summary of Comment	CEQA/NEPA Comments: Resource Topics	CEQA/NEPA Comments: Other CEQA/NEPA Topics	CD-4 Comments: Description of the Project	CD-4 Comments: Agency Coordination (Permits and Approvals)
5B Lisa Isaacs	p. 2, paragraph 6	How much money will Mono County receive annually from new project revenues if the project is completed as proposed?		Not a CEQA/ NEPA issue		
5B Lisa Isaacs	p. 2, paragraph 7	Describe how the additional noise generated by the project will be mitigated. Describe any studies that have been conducted to evaluate the effects of increased noise levels on local fauna.	Noise			
5B Lisa Isaacs	p. 2, paragraph 8	How will the local region and its residents be guaranteed to benefit from the project other than tax revenues paid to Mono County?		Not a CEQA/ NEPA issue		
5C Mirza Agha and Matthew Meuser	p. 1, paragraph 1	Requests a copy of the project proposal and maps of project area		Not a CEQA/ NEPA issue		
5D Liz O'Sullivan	p. 1, paragraph 3	Consider the development of a Mule deer herd range and migration corridor mitigation fund.	Biological Resources	Mitigation Measures		
5D Liz O'Sullivan	p. 1, paragraph 4	Consider additional geothermal energy production sites in the County.		Alternatives		
5E Michael O'Sullivan	p. 1, paragraph 1	Address impacts the project will have on the Sherwin Mule Deer herd migration corridor and describe mitigation measures that can be taken to lessen the impact on the deer herd.	Biological Resources	Mitigation Measures		
5F Scott Sysum	p.1, paragraph 1	Requests to be added to mailing list. Questions why the EIS is being initiated right now and requests environmental documentation for Casa Diablo units 1-3.			Project Description; Project Background	

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APPENDICES

A. Notices
   1. BLM Notice of Intent (NOI) to prepare an EIS/EIR for the Casa Diablo Geothermal Project
   2. GBUAPCD Notice of Preparation (NOP) of an EIS/EIR for the Casa Diablo Geothermal Project
   3. Meeting Flyer announcing the EIS/EIR Public Scoping Meetings
   4. BLM Press Release

B. Scoping Meeting Materials

C. Comments Received During CD-4 EIS/EIR Scoping Process

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APPENDIX A
Notices

1. BLM Notice of Intent (NOI) to prepare an EIS/EIR for the Casa Diablo Geothermal Project
2. GBUAPCD Notice of Preparation (NOP) of an EIS/EIR for the Casa Diablo Geothermal Project
3. Meeting Flyer announcing the EIS/EIR Public Scoping Meetings
4. BLM Press Release

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ADDRESSES: Nominations should be sent to Teresa Raml, District Manager, Bureau of Land Management, California Desert District Office, 22835 Calle San Juan De Los Lagos, Moreno Valley, California 92553.

FOR FURTHER INFORMATION CONTACT: David Briery, BLM California Desert District External Affairs (951) 697–5220.

SUPPLEMENTARY INFORMATION: The Council is comprised of 15 private individuals who represent different interests and advise BLM officials on policies and programs concerning the management of 11 million acres of BLM-administered public land in southern California's Desert District. The Council meets in formal session three to four times each year in various locations throughout the California Desert District. Council members serve without compensation. Members serve three-year terms and may be nominated for reappointment for an additional three-year term. The terms of six Council members have recently expired. The purpose of this notice is to seek nominations for individuals to fill those positions.

Section 309 of the Federal Land Policy and Management Act (FLPMA) directs the Secretary of the Interior (Secretary) to involve the public in planning and issues related to the management of BLM-administered lands. The Secretary selects Council nominees consistent with the requirements of FLPMA and the Federal Advisory Committee Act (FACA), which require nominees appointed to the Council be balanced in terms of points of view and representative of the various interests concerned with the management of the public lands within the area for which the Council is established.

The Council also is balanced geographically, and the BLM will try to find qualified representatives from areas throughout the California Desert District. The District covers portions of eight counties, and includes more than 11 million acres of public land in the California Desert Conservation Area and 300,000 acres of scattered parcels in San Diego, western Riverside, western San Bernardino, Orange, and Los Angeles Counties (known as the South Coast).

Public notice begins with the publication date of this notice and nominations will be accepted until May 9, 2011. The three-year term would begin immediately upon confirmation by the Secretary.

The six positions to be filled include one representative of recreation groups or organizations, one representative of non-renewable groups or organizations, one representative of wildlife groups or organizations, and three representatives of the public-at-large (including one elected official).

Any group or individual may nominate a qualified person, based upon education, training, and knowledge of the BLM, the California Desert, and the issues involving BLM-administered public lands throughout southern California. Qualified individuals also may nominate themselves.

The nomination form may be found on the Desert Advisory Council webpage: *http://www.blm.gov/ca/st/en/info/rac/dac.html*. The following must accompany the nomination form for all nominations:

Letters of reference from represented interests, or organizations, or elected officials;

A completed background information nomination form to include the nominee's work and home addresses and telephone numbers, a biographical sketch including the nominee's work, applicable outside interests, and public service records; and

Any other information that addresses the nominee's qualifications.

Nominees unable to download the nomination form may contact the BLM California Desert District External Affairs staff at (951) 697–5220 to request a copy.

Advisory Council members are appointed by the Secretary, and will be evaluated based on their education, training, and knowledge of the BLM, the California Desert District, and the issues involving BLM-administered public lands.

The Obama Administration prohibits individuals who are currently federally registered lobbyists to serve on any FACA and non-FACA boards, committees, or councils.

Teresa A. Raml,

California Desert District Manager.

[FR Doc. 2011–6994 Filed 3–24–11; 8:45 am]

BILLING CODE 4310–40–P

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[LLCAC07000 L1310000 EJ0000 LXSIGEOT0000]

Notice of Intent To Prepare an Environmental Impact Statement and Environmental Impact Report for the Proposed Casa Diablo IV Geothermal Development Project, Mammoth Lakes, Mono County, CA

AGENCY: Bureau of Land Management, Interior.

ACTION: Notice of intent.

SUMMARY: In compliance with the National Environmental Policy Act of 1969, as amended, the Federal Land Policy and Management Act of 1976, as amended, and the California Environmental Quality Act of 1970, the Bureau of Land Management (BLM) Bishop Field Office, Bishop, California and the Great Basin Unified Air Pollution Control District (GBUAPCD) (a California state agency) intend to prepare a joint Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) to consider approval of the development of a proposed 33-megawatt (MW) geothermal power plant and associated well field, internal access roads, pipelines, and a transmission line on public and private lands near the Town of Mammoth Lakes, California, and by this notice, are announcing the beginning of the scoping process to solicit public comments and identify issues.

DATES: This notice initiates the public scoping processes for the EIS/EIR. Comments on issues may be submitted in writing until April 25, 2011. The date(s) and location(s) of any scoping meetings will be announced at least 15 days in advance through local media, newspapers and the BLM Web site at: *http://www.blm.gov/ca/st/en/fo/bishop.html.* In order to be included in the Draft EIS/EIR, all comments must be received prior to the close of the scoping period or 15 days after the last public meeting, whichever is later. We will provide additional opportunities for public participation upon publication of the Draft EIS/EIR.

ADDRESSES: You may submit comments related to the Casa Diablo IV Geothermal Development Project by any of the following methods:

- *Web site: http://www.blm.gov/ca/st/en/fo/bishop.html*
- *E-mail: cabipubcom@ca.blm.gov*
- *Fax:* 760–872–5050
- *Mail:* BLM Bishop Field Office, 351 Pacu Lane, Suite 100, Bishop, California 93514, Attn: Casa Diablo IV Development Project, C/O Steven Nelson, Project Manager.

Documents pertinent to this proposal may be examined at the BLM Bishop Field Office and the Mono County Library at 400 Sierra Park Road, Mammoth Lakes, California.

FOR FURTHER INFORMATION CONTACT: For further information and/or to have your name added to our mailing list, contact Margie DeRose, Minerals and Geology Program Manager, Inyo National Forest, telephone (760) 873–2424; or mail to: Steven Nelson, Project Manager, BLM

Bishop Field Office, 351 Pacu Lane, Suite 100, Bishop, California 93514; or e-mail *cabipubcom@ca.blm.gov.*

SUPPLEMENTARY INFORMATION: Mammoth Pacific, L.P. (MPLP) has submitted an application to the BLM to build and operate the Casa Diablo IV Geothermal Development Project in the immediate vicinity of the existing MPLP geothermal projects near the intersection of California State Route 203 and U.S. Highway 395 approximately 3 miles east of Mammoth Lakes, California. The proposed project would be located on Inyo National Forest lands and adjacent private lands within portions of Federal geothermal leases CACA–11667, CACA–11672 and CACA–14408. The proposed project would include construction of a new 33–MW binary geothermal power plant, which would be the fourth geothermal plant in the vicinity; up to 16 wells for production and reinjection, drilled to an approximate 1,600 to 2,000-ft depth; and associated pipelines. A 500-foot transmission line is proposed to interconnect the new power plant to the existing Southern California Edison (SCE) substation at Substation Road. The proposed Casa Diablo IV plant, access roads, well pads, pipelines and transmission line would occupy approximately 100 acres. Of the 16 proposed production/injection well locations, 14 were previously analyzed and approved as slim holes and exploration wells in EA–170–02–15 (2001) and EA–170–05–04 (2005). Three of these exploration wells have already been drilled as of the time of the publication of this notice. The proposed well field area contains two existing production wells and associated pipelines that currently serve three existing power plants in the area.

The leases being developed are already part of a geothermal unit, which is currently producing energy sufficient to operate three existing geothermal plants in the area: The 10–MW "MP–1/G1 plant," the 15–MW "MP–II/G2 plant," and the 15–MW "PLES–I/G3 plant."

The BLM Bishop Field Office will be the lead Federal agency responsible for coordinating the environmental analysis for the Case Diablo IV project under the National Environmental Policy Act of 1969 (NEPA). Authorization of the proposed project would require approval from the BLM as the lead Federal agency responsible for geothermal leasing and development on Federal lands, in coordination with the U.S. Forest Service (FS) as a cooperating agency responsible for surface management and uses on Inyo National Forest lands within the project area. If approved, permits and licenses to be issued by the BLM would include approval of the Plan of Utilization, Geothermal Sundry Notices, Geothermal Drilling Permits, a Commercial Use Permit, a Site License and a Facility Construction Permit. The BLM authorizations would include Conditions of Approval for surface use and occupancy based on recommendations from the FS to ensure consistency with the Inyo National Forest Land and Resource Management Plan. The FS would issue a special use permit for the transmission line. For the BLM, the Bishop Field Manager is the authorized officer. For the FS, the Inyo National Forest Supervisor is the authorized officer. The GBUAPCD will be the lead state agency responsible for coordinating the environmental analysis under the California Environmental Quality Act. The GBUAPCD would issue an Authority to Construct Permit and a Permit to Operate. The approving official is the Air Pollution Control Officer.

The purpose of the public scoping process is to determine relevant issues that will influence the scope of the environmental analysis, including alternatives, and guide the process for developing the EIS/EIR. The BLM, FS and GBUAPCD have identified the following preliminary issues: air quality; social and economic impacts; groundwater quantity and quality; surface water quantity and quality; geology and soils; plants and animals; cultural resources; transportation; noise and vibration; lands with wilderness characteristics; and recreation.

The BLM will use and coordinate the NEPA commenting process to satisfy the public involvement process for Section 106 of the National Historic Preservation Act (16 U.S.C. 470f) as provided for in 36 CFR 800.2(d)(3). Native American tribal consultations will be conducted in accordance with policy, and tribal concerns will be given due consideration, including impacts on any Indian trust assets. Federal, State, and local agencies, along with other stakeholders that may be interested or affected by the BLM's decision on this project are invited to participate in the scoping process and, if eligible, may request or be requested by the BLM to participate as a cooperating agency.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Authority: 40 CFR 1501.7.

Bernadette Lovato,
Bishop Field Manager.

[FR Doc. 2011–7012 Filed 3–24–11; 8:45 am]

BILLING CODE 4310–40–P

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[LLAKA02000–L12200000–EB0000]

Notice of Intent To Collect Fees on Public Land in Tangle Lakes, Alaska, Glennallen Field Office Under the Federal Lands Recreation Enhancement Act

AGENCY: Bureau of Land Management, Interior.

ACTION: Notice of intent.

SUMMARY: Pursuant to applicable provisions of the Federal Lands Recreation Enhancement Act of 2004 (REA), the Bureau of Land Management (BLM) Glennallen Field Office will begin to collect fees in 2011 upon completion of construction at the Tangle Lakes Campground, mile 121.5 Denali Highway, Alaska (Section 34, T. 21 S., R. 9 E., Fairbanks Meridian).

DATES: Submit comments on or before April 25, 2011. The public is encouraged to comment. Effective 6 months after the publication of this notice and upon completion of construction, the BLM Glennallen Field Office will initiate fee collection in the Tangle Lakes Campground, unless the BLM publishes a **Federal Register** notice to the contrary. Future adjustments in the fee amount will be modified in accordance with the Glennallen Field Office's recreation fee business plan; consultation with the BLM Anchorage District Office; and the public being notified prior to any fee increase.

ADDRESSES: Field Manager, Glennallen Field Office, Bureau of Land Management, P.O. Box 147, Mile Post 186.5 Glenn Highway, Glennallen, Alaska 99588.

FOR FURTHER INFORMATION CONTACT: Elijah Waters, Recreation Branch Chief or Marcia Butorac, Outdoor Recreation Planner, 907–822–3217; *address:* P.O. Box 147, Mile Post 186.5 Glenn Highway, Glennallen, Alaska 99588; *e-mail: AK_GFO_GeneralDelivery@blm.gov.*

Theodore D. Schade
Air Pollution Control Officer

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT
157 Short Street, Bishop, California 93514-3537 www.gbuapcd.org
Tel: 760-872-8211 Fax: 760-872-6109 info@gbuapcd.org

NOTICE OF PREPARATION

Date: April 1, 2011

To: State Clearinghouse, Responsible and Trustee Agencies, and Interested Individuals and Organizations

Subject: Notice of Preparation of an Environmental Impact Statement/Environmental Impact Report for the Casa Diablo IV Geothermal Development Project

Project Title: Casa Diablo IV Geothermal Development Project

The Great Basin Unified Air Pollution Control District (GBUAPCD) will be the Lead Agency pursuant to the California Environmental Quality Act (CEQA) and will prepare an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Casa Diablo IV (CD-4) Geothermal Development Project. The Bureau of Land Management (BLM), Bishop Office will be the Lead Agency and the U.S. Forest Service will be a Cooperating Agency pursuant to the National Environmental Policy Act of 1969, as amended (NEPA), and the Federal Land Policy and Management Act of 1976, as amended. The EIS/EIR is being prepared to evaluate potentially significant environmental effects related to approval of this project.

GBUAPCD is requesting the views of your agency as to the scope and content of the environmental information that is pertinent to your agency's statutory responsibilities in connection with the proposed project. To the extent that your agency has authority to issue permits or take other actions related to the project, your agency will be able to use the EIS/EIR when considering your permit or other approval for the project. GBUAPCD is also requesting comments regarding environmental issues associated with the proposed project from interested individuals and organizations.

As required by NEPA, the BLM published on March 25, 2011 in the Federal Register a Notice of Intent (NOI) to prepare a joint EIR/EIS for the Project. Similar to this NOP, the intent of the NOI will be to initiate the public scoping for the EIR/EIS, provide information about the proposed Project, and also serve as an invitation for other cooperating agencies to provide comments on the scope and content of the EIR/EIS.

PROJECT LOCATION

The CD-4 power plant would be located on public land (BLM Geothermal Lease # CA-11667 and CA-11667A) in Sections 29 and 32, Township 3 South, and Range 28 East MD B&M. This location is east of U.S. Highway 395 at Casa Diablo (SR 203), approximately two miles east of the town of Mammoth Lakes in Mono County, California. A location map of the project area is attached to this NOP as **Figure 1**. The Project would include construction, operation and maintenance of up to 18 geothermal resource wells (some new and some existing) and associated pipelines west of U.S. Highway 395 on portions of BLM Geothermal Leases CA-11667, CA-14408and CA-11672 located within the Inyo National Forest in Section 25 of T3S, R27E and Sections 30, 31 and 32 of T3S, R28E, MD B&M. The Project would be located entirely within the Mono-Long Valley Known Geothermal Resource Area (KGRA) in Mono County, California.

PROJECT DESCRIPTION

Mammoth Pacific, L.P. (MPLP) proposes to build, and following the expected 30-year useful life, decommission the Casa Diablo IV Geothermal Development Project (CD-4) ("Project" or "Proposed Action") in the vicinity of the existing MPLP geothermal project. The Project would consist of the following facilities:

- A geothermal power plant consisting of two (2) Ormat Energy Converters (OEC) binary generating units (21.2 MW gross each) with vaporizers, turbines, generators, air-cooled condensers, preheaters, pumps and piping, and related ancillary equipment. The gross power generation of the CD-4 plant would be 42.4 MW. The estimated auxiliary and parasitic loads (power used within the project for circulation pumps, fans, well pumps, loss in transformers and cables) is about 9.4 MW, thus providing a net power output of about 33 MW.

- A motive fluid system consisting of motive fluid (isopentane) storage vessels (either one or two vessels in the range of 9,000 to 12,000 gallons) and a motive fluid vapor recovery system (VRU). The VRU would consist of a diaphragm pump, a vacuum pump, and activated carbon canisters.

- An air cooling system for the power plant. The predominant method of cooling would be dry cooling which would be employed during most months and during cooler times of the day during warmer months. During the warmer months, the power plant may also employ an evaporative assist system to increase cooling efficiency. Evaporative assist involves spraying air-cooled condensers with water in order to decrease the temperature of air flowing through the air bays. The evaporative assist system would use either recycled water from the Mammoth Community Water District (MCWD) wastewater treatment plant, or treated brine (geothermal fluid). The use of recycled water would require installing a water supply pipeline from the MCWD treatment plant to the CD-4 plant. The use of treated brine would require installing an onsite reverse osmosis (RO) system to treat geothermal fluid.

- An RO water treatment facility and equalization storage tank. The RO water treatment facility would be intended to treat and desalinate a portion of the spent geothermal brine after it has passed through the OEC units. The RO process consists of a heat exchanger to cool the water, pretreatment train with chemical dosing and microfiltration, RO membranes, and a 350,000 gallon storage tank for storing the treated water. The RO capacity would be 225 gallons per minute (gpm) of product water.

- Up to 18 geothermal wells (some new and some existing) are proposed. Sixteen of the wells would be located in the Basalt Canyon Area and two wells would be located southeast of the proposed power plant east of Hwy 395. The specific locations for these wells would be selected out of the possible locations shown in Figure 2. The actual number of wells may be less depending upon the productivity of the wells. Approximately half of the wells would be production wells and the other half would be injection wells. Each production well would range in depth from 1,600 to 2,000 feet below ground surface (bgs), and each new injection well would be drilled to approximately 2,500 feet bgs. Production wells would be equipped with a down-hole pump powered by a surface electric motor.

- Piping from production wells to the power plant and from the power plant to the individual injection wells. Two main pipelines would parallel MPLP's existing Basalt Canyon pipeline through Basalt Canyon, and would cross beneath U.S. Highway 395 between the well field and the CD-4 power plant site.

- A new substation that would be connected to the Southern California Edison Casa Diablo Substation at Substation Road with a half-mile-long buried 33 kilovolt (kV) transmission line.

POTENTIAL ENVIRONMENTAL EFFECTS

Based on the preliminary analysis, the potential environmental effects of the proposed project that will be addressed in the EIS/EIR will include, but may not be limited to, the following: air quality, social and economic impacts, groundwater and surface water quantity and quality impacts; geology and soils; plant and animal species; cultural resources; transportation; noise and vibration; and recreation.

PUBLIC COMMENT PERIOD

The public comment period for this NOP will commence on April 1, 2011 and conclude on May 9, 2011. Copies of the NOP will be available for review at the following locations:

- BLM Bishop Field Office, 351 Pacu Lane, Suite 100, Bishop CA 93514;
- Mono County Library, 400 Sierra Park Road, Mammoth Lakes, CA 93546
- GPUAPCD, 157 Short Street, Bishop, CA 93514

A copy of the NOP will be posted online at http://www.gbuapcd.org. Please submit comments in writing to the address below. Comment letters must be received by 5pm on May 9, 2011.

Great Basin Unified Air Pollution Control District
157 Short Street
Bishop, CA 93514-3537
Contact: Ms. Jan Sudomier
Fax: 760-872-6109

If there are any questions regarding this NOP, please contact Ms. Jan Sudomier at (760) 872-8211.

PUBLIC MEETINGS

Two public scoping meetings will be held to solicit input from interested parties on the proposed content of the EIS/EIR. The scoping meetings will be held at the following:

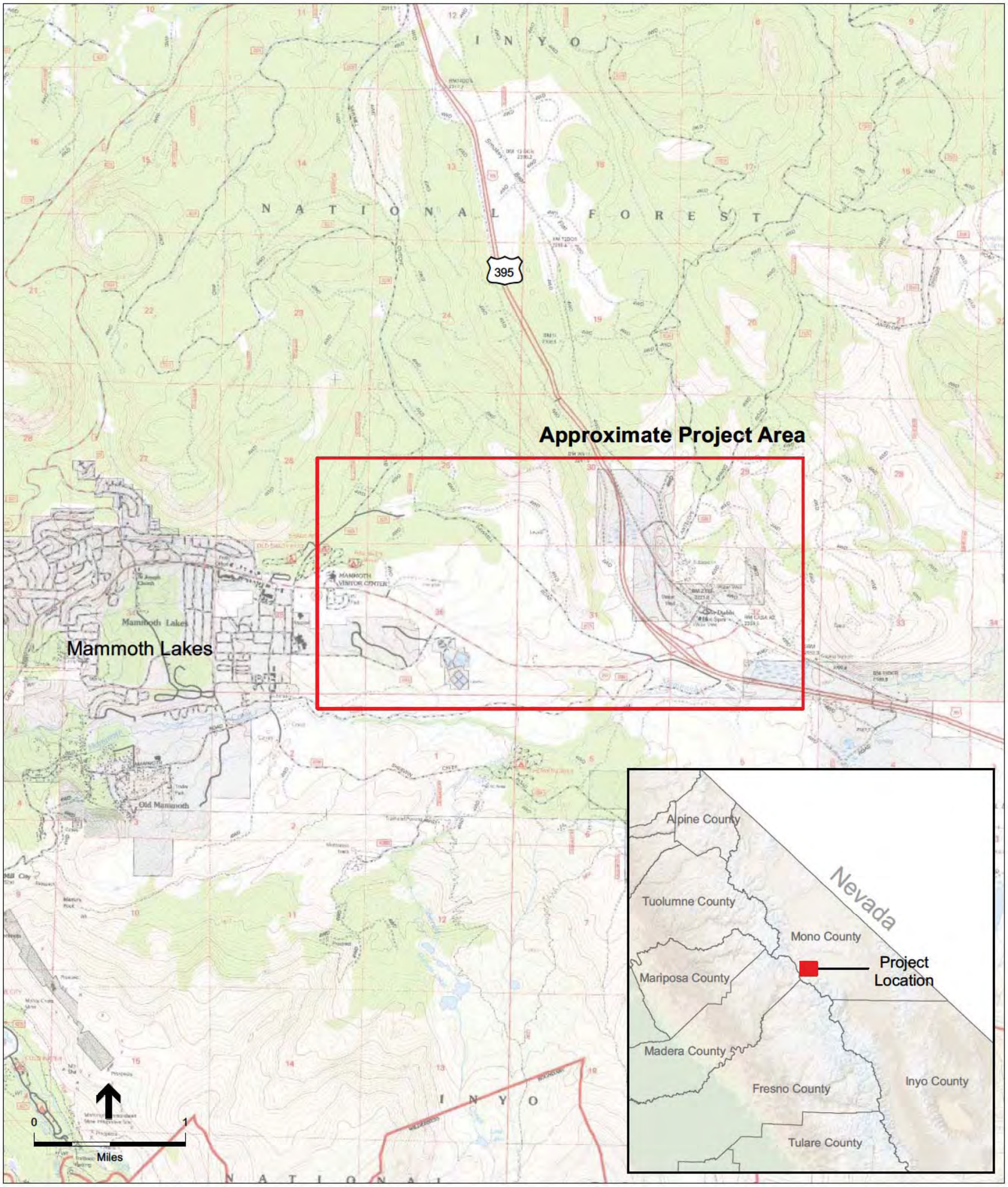
Crowley Lake: Monday April 18, 2011 at 6 p.m.
Crowley Lake Community Center
458 South Landing Road
Crowley Lake, California

Mammoth Lakes: Tuesday April 19, 2011 at 6 pm
Mammoth Lakes Community Center
1000 Forest Trail (adjacent to the Mono County Library)
Town of Mammoth Lakes, California

For more information, please contact Ms. Jan Sudomier at the phone number listed above.

Date: 30 Mar 11

Signature: S8. [signature]



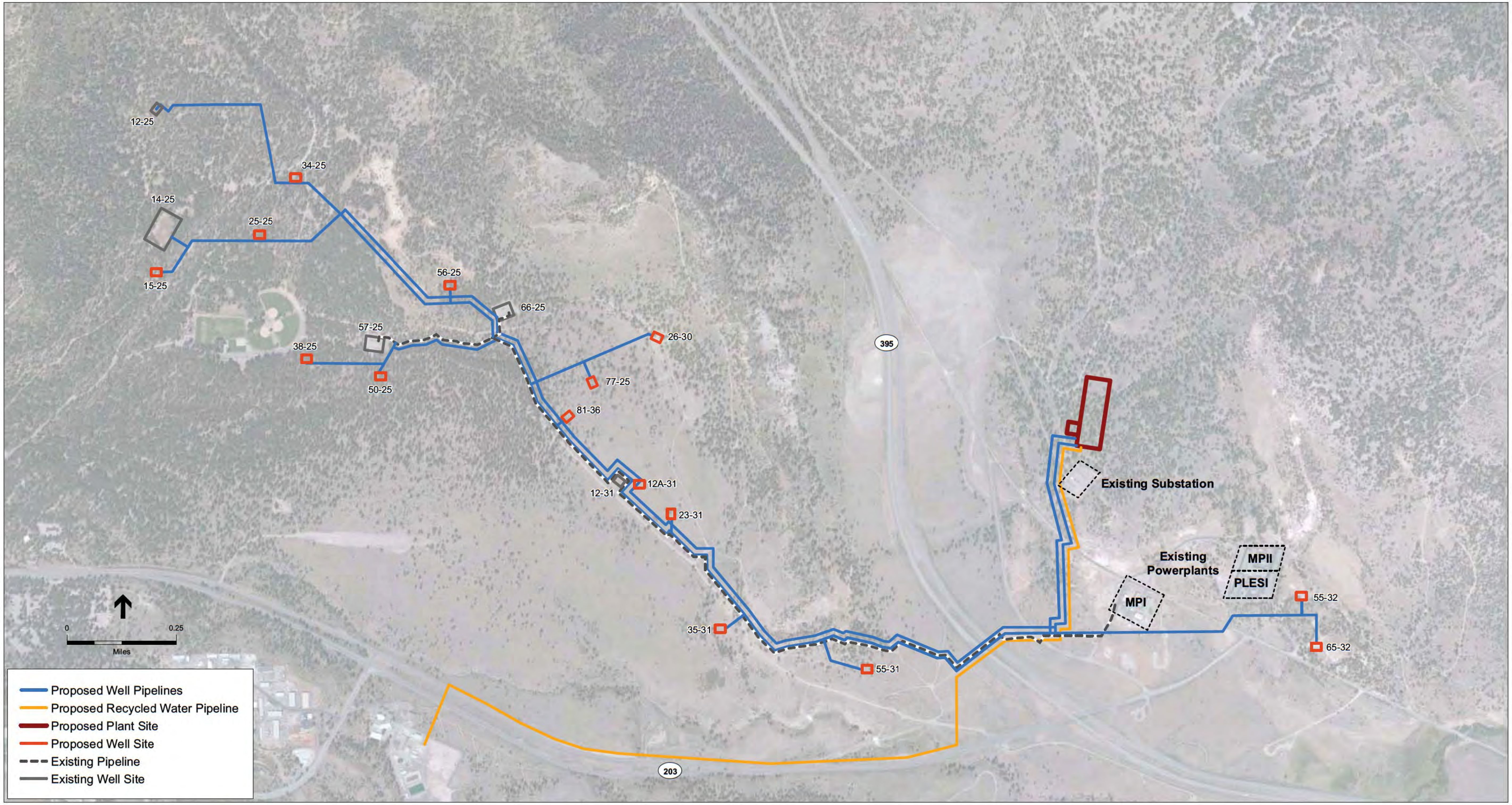
SOURCE: USGS 7.5- minute Old Mammoth topographic quadrangle, 1984

Casa Diablo IV Geothermal Project

Figure 1

Project Vicinity Map

Mono County, California



SOURCE: Ormat, 2010

Casa Diablo IV Geothermal Project

Figure 2

Project Layout

Preliminary - Subject to Revision

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CASA DIABLO 4 GEOTHERMAL DEVELOPMENT PROJECT

PUBLIC SCOPING MEETINGS

April 18, 2010, 6 pm

Crowley Lake Community Center, 458 South Landing Road, Crowley Lake

April 19, 2010, 6 pm

Mammoth Lakes Community Center, 1000 Forest Trail, Mammoth Lakes

All meetings will be held between 6:00 p.m. and 8:00 p.m. with a brief presentation at 6:10 p.m. and an opportunity to discuss the project with staff.

For more information on the project or how to submit comments, please visit http://www.blm.gov/ca/st/en/fo/bishop.html or phone Steven Nelson, Bureau of Land Management,
Bishop Field Office at 760-872-5006 or snelson@blm.gov

The facility and its parking are wheelchair accessible. Sign language interpreters, assistive listening devices, or other auxiliary aids and/or other services may be provided upon request. To ensure availability of services, please make your request no later than three working days (72 hours) prior to the meeting by calling 760-872-5006.

The Bureau of Land Management, Inyo National Forest, and Great Basin Unified Air Pollution Control District invite you to attend a scoping meeting to help identify the range or scope of issues related to the proposed Casa Diablo IV Geothermal Expansion Project. The issues identified during the scoping process will be considered and addressed during preparation of the joint Environmental Impact Statement/Report.

The proposed project includes construction of a new 33 net megawatt power plant east of Highway 395 and the Town of Mammoth Lakes and north of the existing facility. The project will also include an expanded geothermal well field, pipelines to bring the geothermal brine to the power plant, pipelines to take the cooled brine to injection wells, and an electric transmission line to interconnect to the existing substation at Substation Road.

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

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

Great Basin Unified Air Pollution Control District

U.S. Department of the Interior
Bureau of Land Management

News Release

For Immediate Release: March 31, 2011 CA-CC-11-43
Contact: David Christy (916) 941-3146

Public Scoping Meetings Scheduled, Comment Period Extended, on the Proposed Casa Diablo IV Geothermal Development Project

The Bureau of Land Management (BLM), in cooperation with the Inyo National Forest and the Great Basin Unified Air Pollution Control District, will hold two public scoping meetings to gather input on a proposal to develop additional geothermal resources near Mammoth Lakes in Mono County.

The BLM also has extended the public comment period 15 days to May 9, 2011.

These meetings will provide an opportunity for the public, interested groups and local, state and federal agencies to learn about the proposed project and comment on potential environmental issues or concerns. Information gathered during public scoping will help shape the content of a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) that is being developed for the proposed project. Public scoping meetings have been scheduled for both the community of Crowley Lake and the Town of Mammoth Lakes.

The proposed Casa Diablo IV Geothermal Development Project would include construction of a new 33- megawatt geothermal power plant east of U.S. Highway 395 and the Town of Mammoth Lakes. The new plant would be located north of existing geothermal facilities in the area. The proposed project would also include an expanded geothermal well field, pipelines to transport geothermal brine to the new power plant and cooled brine to post-production injection wells, and an electric transmission line to interconnect to the existing Southern California Edison substation at Substation Road.

To learn more about the project proposal and to provide written comments in person, the public is encouraged to attend either of the following scheduled meetings:

Crowley Lake: April 18, 6 p.m.

Crowley Lake Community Center
458 South Landing Road
Crowley Lake

Mammoth Lakes: April 19, 6 p.m.

Mammoth Lakes Community Center
1000 Forest Trail (adjacent to the Mono County Library)
Town of Mammoth Lakes

For more information about these planned public scoping meetings please visit http://www.blm.gov/ca/st/en/fo/bishop.html or contact Steven Nelson, BLM Supervisory Natural Resource Specialist at (762) 872-5006.

Written comments on the proposed Casa Diablo IV Geothermal Development Project may also be submitted to the BLM Bishop Field Office, Attn: Casa Diablo IV Geothermal Development Project, 351 Pacu Lane, Suite 100, Bishop, Calif. 93514; or by email to cabipubcom@ca.blm.gov; or by Fax to (760) 872-5050. Comments must be postmarked by May 9, 2011.

The BLM manages more land - more than 245 million acres - than any other Federal agency. This land, known as the National System of Public Lands, is primarily located in 12 Western states, including Alaska. The Bureau, with a budget of about $1 billion, also administers 700 million acres of sub-surface mineral estate throughout the nation. The BLM's multiple-use mission is to sustain the health and productivity of the public lands for the use and enjoyment of present and future generations. The Bureau accomplishes this by managing such activities as outdoor recreation, livestock grazing, mineral development, and energy production, and by conserving natural, historical, cultural, and other resources on public lands.

-BLM-

Central California District, 2800 Cottage Way, Sacramento, CA 95825

U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT NEWS RELEASE
Central California District

Release Date: 04/01/11
Contacts: David Christy, (916) 941-3146

News Release No. CC-11-43

Public Scoping Meetings Scheduled, Comment Period Extended for Proposed Geothermal Project near Mammoth

The Bureau of Land Management, in cooperation with the Inyo National Forest and the Great Basin Unified Air Pollution Control District, will hold two public scoping meetings to gather input on a proposal to develop additional geothermal resources near Mammoth Lakes in Mono County, California.

The BLM also has extended the public comment period 15 days to May 9, 2011.

The meetings will provide an opportunity for the public, interested groups and local, state and federal agencies to learn about the proposed project and comment on potential environmental issues or concerns. Information gathered during public scoping will help shape the content of a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) that is being developed for the proposed project. Public scoping meetings have been scheduled for both the community of Crowley Lake and the Town of Mammoth Lakes.

The proposed Casa Diablo IV Geothermal Development Project would include construction of a new 33- megawatt geothermal power plant east of U.S. Highway 395 and the Town of Mammoth Lakes. The new plant would be located north of existing geothermal facilities in the area. The proposed project would also include an expanded geothermal well field, pipelines to transport geothermal brine to the new power plant and cooled brine to post-production injection wells, and an electric transmission line to interconnect to the existing Southern California Edison substation at Substation Road.

To learn more about the project proposal and to provide written comments in person, the public is encouraged to attend either of the following scheduled meetings:

Crowley Lake: April 18, 6 p.m.

Crowley Lake Community Center
458 South Landing Road
Crowley Lake

Mammoth Lakes: April 19, 6 p.m.

Mammoth Lakes Community Center
1000 Forest Trail
Town of Mammoth Lakes

For more information about these planned public scoping meetings please visit http://www.blm.gov/ca/st/en/fo/bishop.html or contact Steven Nelson, BLM Supervisory Natural Resource Specialist at (760) 872-5006.

Written comments on the proposed Casa Diablo IV Geothermal Development Project may also be submitted to the BLM Bishop Field Office, Attn: Casa Diablo IV Geothermal Development Project, 351 Pacu Lane, Suite 100, Bishop, Calif. 93514; or by email to cabipubcom@ca.blm.gov; or by Fax to (760) 872-5050. Comments must be postmarked by May 9, 2011.

--BLM--

Central California District 2800 Cottage Way, Sacramento, CA 95825

Last updated: 04-07-2011

APPENDIX B

Scoping Meeting Materials

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Casa Diablo IV Geothermal Development Project

Joint Environmental Impact Statement/Environmental Impact Report

Public Scoping Meeting

April 18-19, 2011

Public Scoping Meeting Agenda

Agenda

- Overview of Meeting Purpose and Agenda
- Welcome and Opening Remarks (BLM)
- Description of EIS/EIR Process and the Casa Diablo IV Geothermal Development Project (ESA)
- Questions and Answers
- Open House

Welcome & Opening Remarks

Participants and their Roles

Preparation of a Joint Environmental Impact Statement (NEPA) and Environmental Impact Report (CEQA)

- BLM - Manages subsurface mineral estate - Lead NEPA agency
- US Forest Service - Manages surface uses - Cooperating NEPA agency
- Great Basin Air Pollution and Control District - Lead CEQA agency
- Mammoth Pacific L.P. (Ormat Nevada subsidiary) - Project applicant
- ESA (Environmental Science Associates) - Consultant hired to prepare third party EIS/EIR*

* *Environmental Impact Statement/Environmental Impact Report*

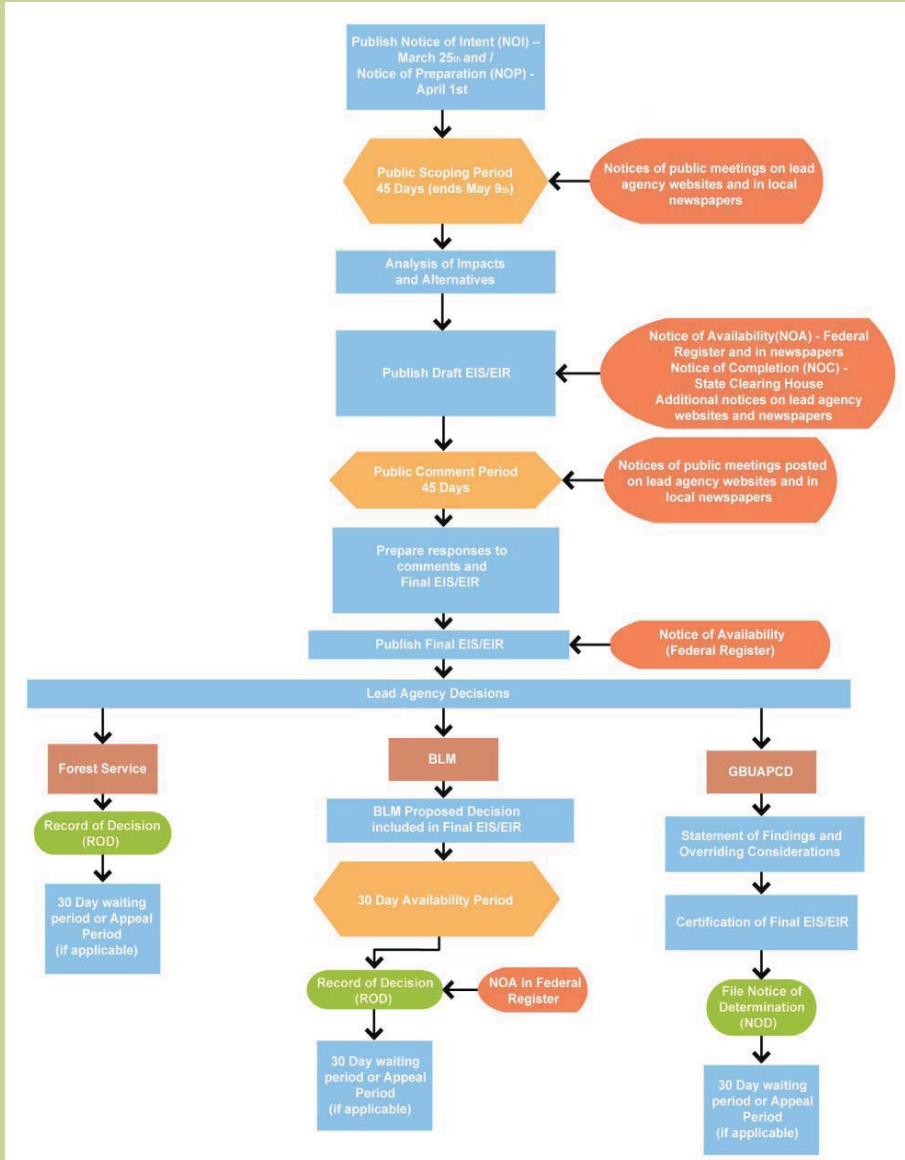
Lead Agency Decisions

Three separate decisions will be made

- **BLM** – issuance of permit to construct Casa Diablo IV power plant and facilities, wells, and pipelines (including routes)
- **US Forest Service** – issuance of use permit for access routes (including any re-routing of existing roads)
- **Great Basin Unified Air Pollution and Control District** – issuance of an air permit for project construction and operation

Overview of the EIS/EIR Process

NEPA/CEQA Process



Draft EIS/EIR Analysis

- ✓ Aesthetics
- ✓ Air Quality
- ✓ Biological Resources
- ✓ Cultural Resources
- ✓ Geological Resources
- ✓ Land Use
- ✓ Hazardous Materials
- ✓ Hydrology and Water Quality
- ✓ Noise
- ✓ Traffic
- ✓ Recreation
- ✓ Public Services and Utilities

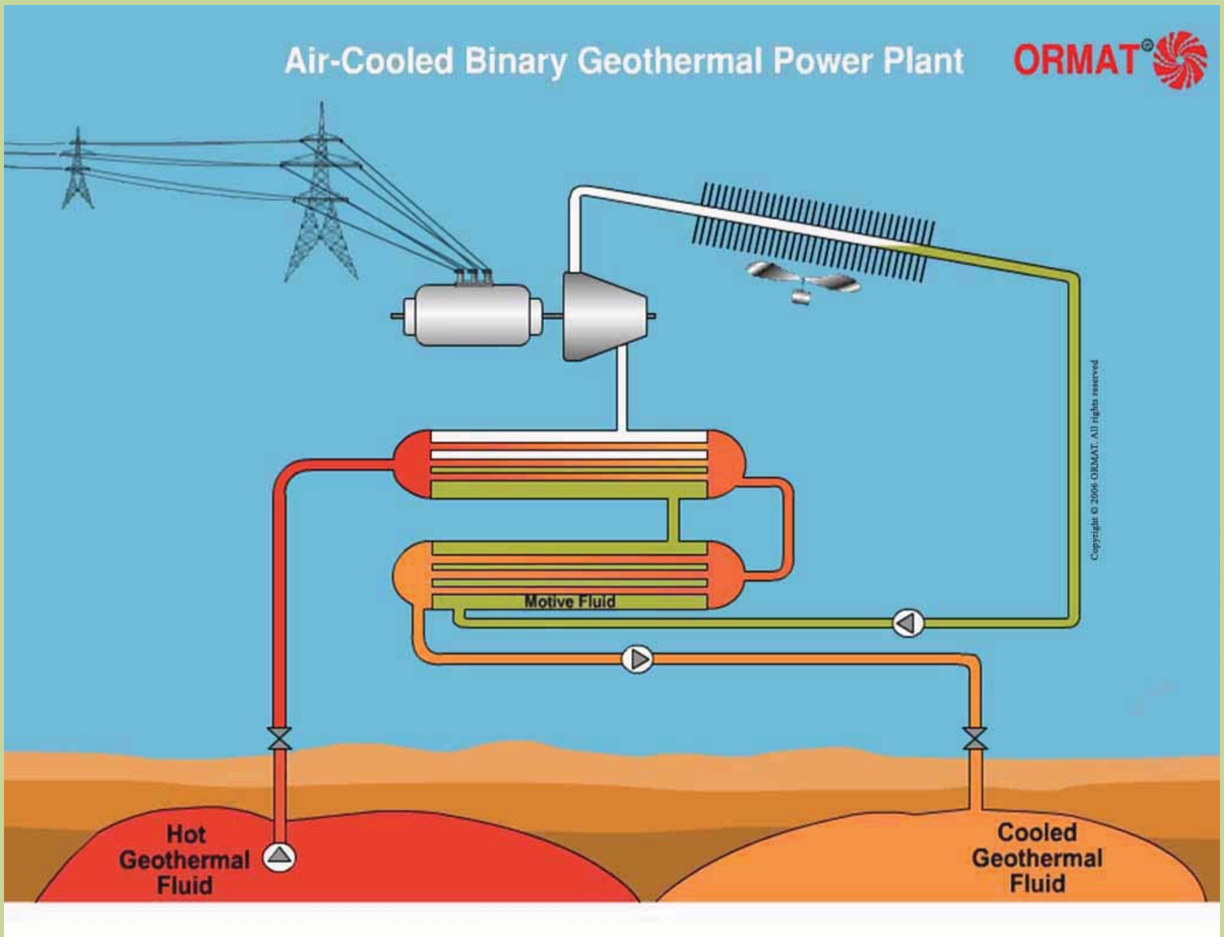
Purpose of Public Scoping

Provide the public and agencies an opportunity to provide input into the scope and content of the EIS/EIR by identifying:

- ✓ Specific environmental concerns to be analyzed
- ✓ Potential impacts resulting from project construction and increased geothermal production
- ✓ Scope and range of alternatives

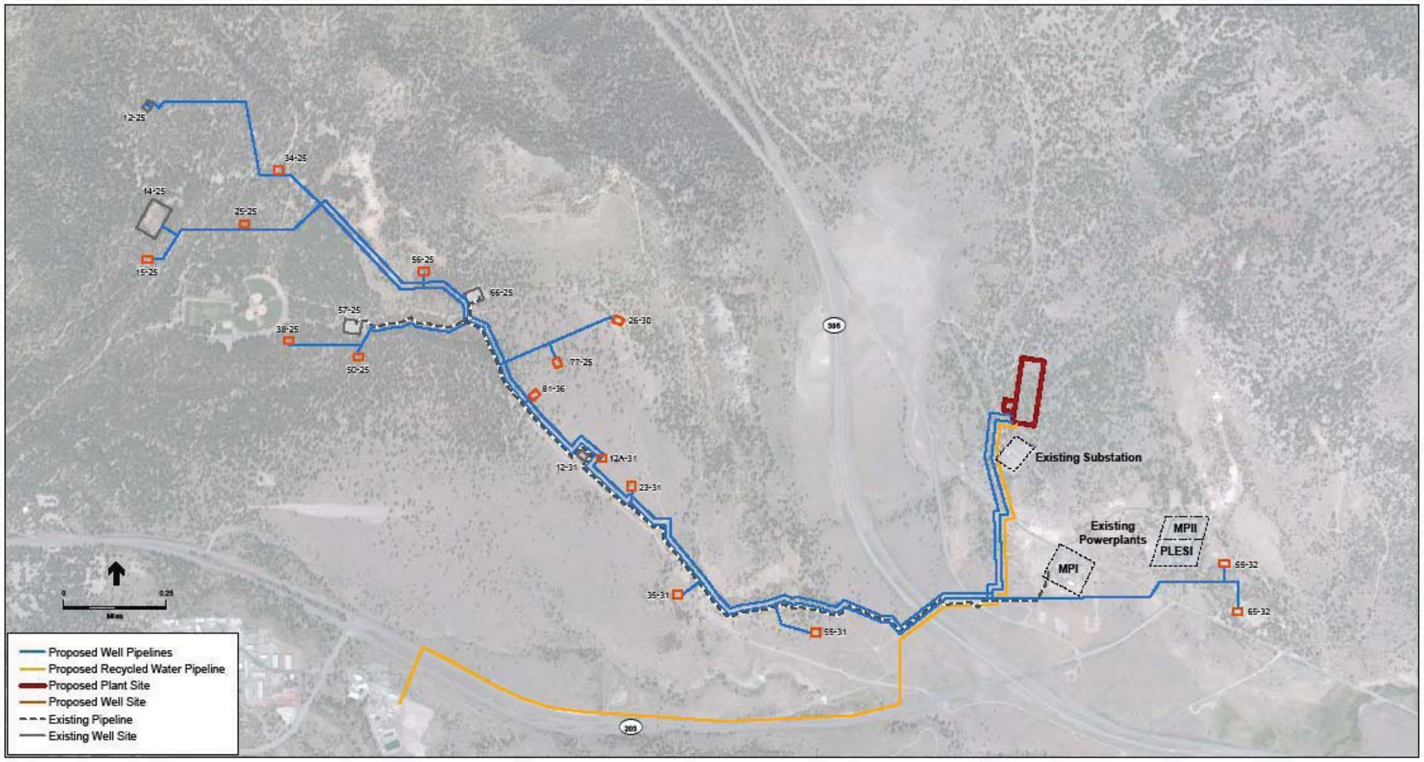
Project Overview

Geothermal Power



Key Project Components

- New Power Plant
- Geothermal Wells
- Pipelines
- Transmission Line



SOURCE: Ormat, 2010

Casa Diablo IV Geothermal Project
Figure
Project Layout

Power Plant

New 33 net megawatt (MW) binary power plant

- ✓ Located north of SCE Substation (not visible from Highway)
- ✓ Two (2) Ormat Energy Converters
- ✓ An underground electric transmission line to interconnect to the SCE Substation.

May include evaporative assist cooling in summer

- ✓ Reverse osmosis water treatment plant
- ✓ Recycled water pipeline from MCWD

Would supply enough electricity for approximately 33,000 people.

Wellfield

An expanded geothermal well field

- ✓ Total of up to 16 wells (18 potential locations being considered)
- ✓ Two of the 16 wells already exist (drilled in 2010 as part of exploratory project
- ✓ Up to 14 new wells to be drilled

Well pads

- ✓ 120x150 feet (0.4 acre) completed size
- ✓ Fenced enclosure
- ✓ Wellhead and small control building
- ✓ 2.5-acre disturbance during construction

Typical Well Pad

Pipelines

Production and Injection Pipelines

- ✓ Similar to and parallel existing Basalt Canyon pipeline
- ✓ Up to 28 inches diameter with insulation
- ✓ 12 – 18 inches off the ground
- ✓ Buried beneath USFS roads, Highway 395

Pipeline Undercrossing

Next Steps and How to Comment

Next Steps and Timeline

Public Scoping Period ends	May 9, 2011
Public Review of Draft EIS/EIR (including public hearings)	Summer 2011
Final EIS/EIR - Response to Comments	Early winter 2011
Certification of the EIS/EIR	Winter 2012
File Notice of Determination and Findings	Winter 2012
Agencies consider Project Approval	

How to Comment

- Place Scoping Comment Form in the boxes provided tonight or provide comments no later than **May 9, 2011**
- Send comments to:

  Bureau of Land Management
  Bishop Field Office
  Attn: Casa Diablo IV Geothermal Development Project
  351 Pacu Lane, Suite 100
  Bishop, CA 93514
  FAX: (760) 872-5050
  Email: cabipubcom@ca.blm.gov
  Subject Line: Casa Diablo IV Project Scoping Comments
- Include name, address, and contact number for future correspondence related to the project (Be advised that your entire comment – including your personal information – may be made publicly available at any time. You can ask us to withhold from public review your personal identifying information, but we cannot guarantee that we will be able to do so.)

Effective Commenting

- Substantive and focused on the EIS/EIR analysis - what should be analyzed?
- Why you think the project has the potential to result in a significant environmental impact
- Scoping report will be prepared which summarizes comments received

B-26
A-70

Questions and Answers

A-71

B-27

Open House

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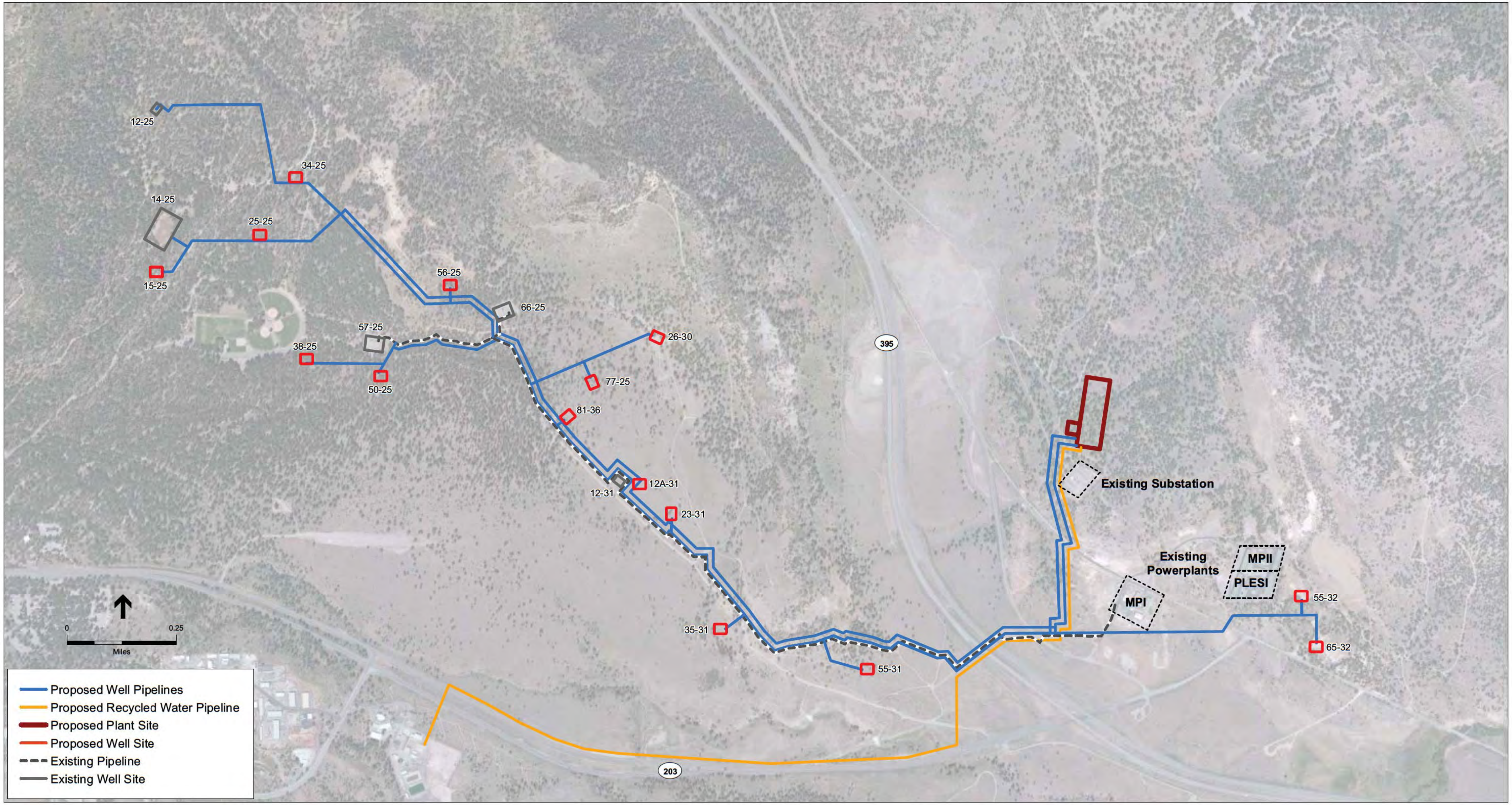


SOURCE: Ormat, 2010

Casa Diablo IV Geothermal Project

Figure 2

Project Layout

Preliminary - Subject to Revision

Casa Diablo IV Geothermal Development Project Overview


* Photo is of two units on one site across from each other. CD-4 will be two units together lengthwise

Power Plant

33 net megawatt binary power plant located north of existing plant

- Two (2) Ormat Energy Converters
- May include evaporative assist cooling
- May include reverse osmosis treatment of geothermal brine for cooling water source

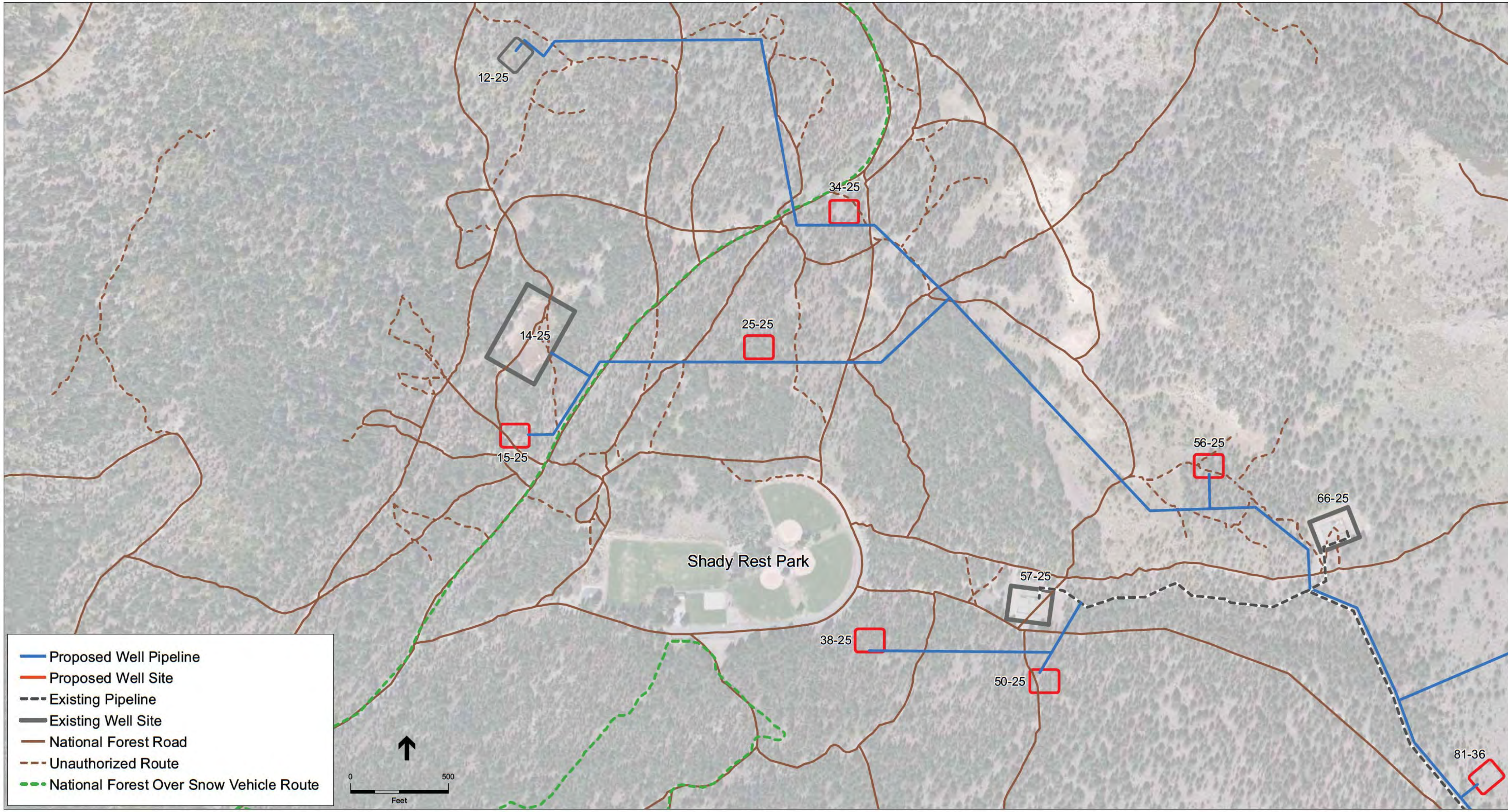
Wellfield

- Up to 16 new geothermal wells
- Completed well pads approximately 0.4 acre in size with well head, small control building and fencing

Pipelines

- Two pipelines parallel to the existing Basalt Canyon pipeline: one for produced geothermal fluid; one for brine to be reinjected to the reservoir

ESA



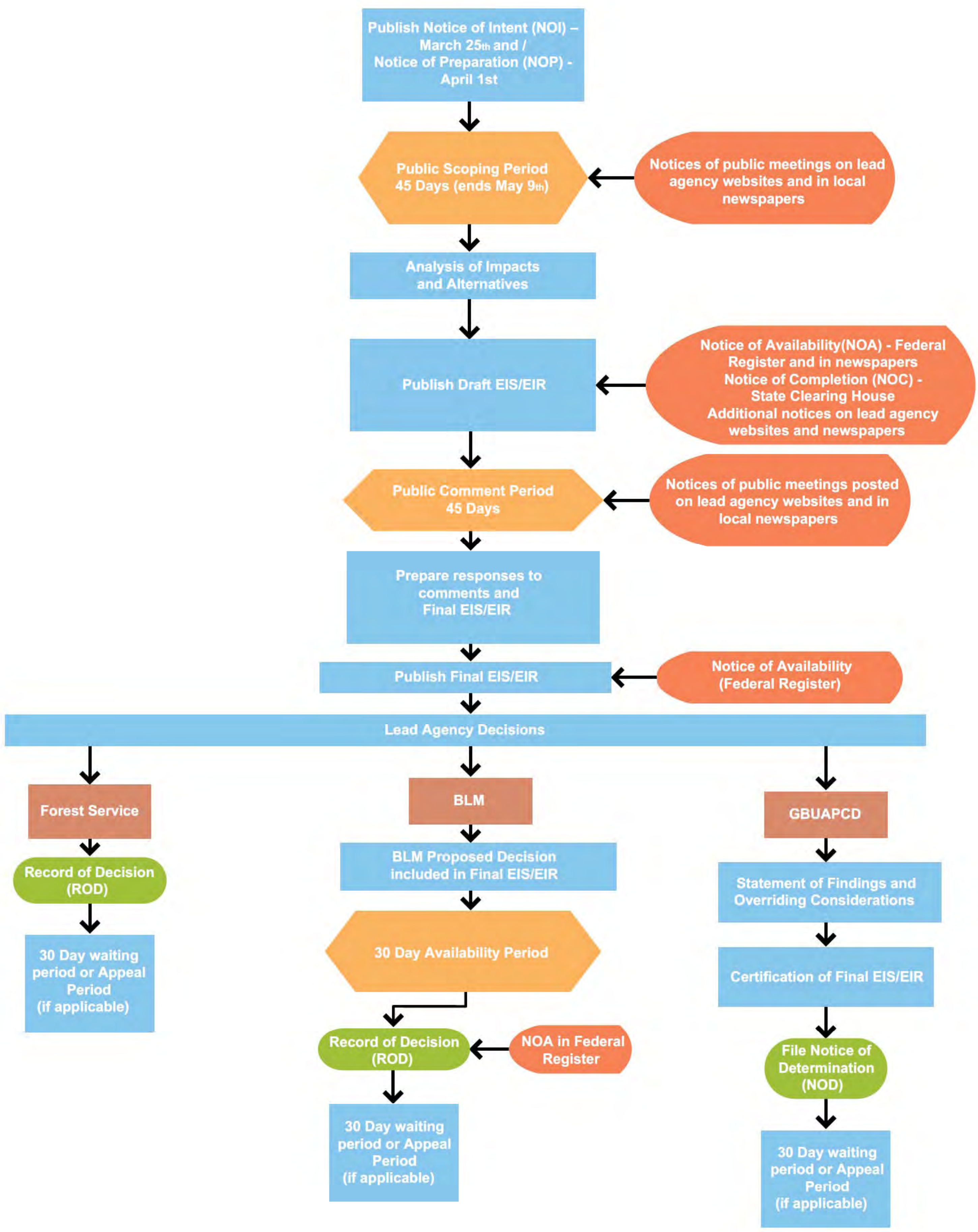
SOURCE: Ormat, 2010; USFS, 2010

Casa Diablo IV Geothermal Project

Figure

Shady Rest Park Transportation Network

Casa Diablo IV Geothermal Power Plant Project
NEPA/CEQA Process



ESA

CASA DIABLO 4 GEOTHERMAL DEVELOPMENT PROJECT

PROJECT FACT SHEET

For more information on the project, please visit http://www.blm.gov/ca/st/en/fo/bishop.html

Documents pertinent to this proposal may be examined at the BLM Bishop office and the Mono County Library at 400 Sierra Park Road, Mammoth Lakes, California.

You may submit scoping comments related to the Casa Diablo IV Geothermal Development Project by any of the following methods:

- Submit a Comment Form at the scoping meetings
- Email: cabipubcom@ca.blm.gov
- Fax: 760-872-5050
- Mail: BLM Bishop Field Office, Attn: Casa Diablo IV Project 351 Pacu Lane, Suite 100 Bishop CA 93514

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, be advised that your entire comment - including your personal identifying information - may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

Project Description

Mammoth Pacific, L.P. (MPLP) has applied to the Bureau of Land Management (BLM) to build, operate and, following the expected 30-year useful life, decommission the CD-4 geothermal development project in the vicinity of the existing MPLP geothermal project near the Town of Mammoth Lakes, California. The CD-4 Project would include the following:

- A new 33 MW geothermal power plant comprised of two binary generating units, turbines, condensers, reverse osmosis water treatment plant, pumps, piping, ancillary equipment, and an underground electric transmission line to interconnect to Southern California Edison substation.
- Up to 16 geothermal resource wells over the life of the project drilled to a depth of 1,500 to 2,500 feet below ground surface. Each well facility would be located on an approximately 0.4-acre well pad and include a small pump building.
- Pipelines to bring the geothermal brine to the power plant and to take cooled brine to the injection wells.

Environmental Review Process

The BLM, Inyo National Forest Service, and Great Basin Unified Air Pollution and Control District (GBUAPCD) will prepare an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) in order to assess the potential environmental effects of the project. This joint document will serve to meet the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) requirements for the three lead agencies. A preliminary review of the project identified the following issues: affects on air quality, social and economic impacts, groundwater and surface water quantity and quality impacts; geology and soils; plant and animal species; cultural resources; transportation; noise and vibration; hazards and hazardous materials and recreation.

The purpose of the public scoping process is to determine relevant issues that will influence the scope of the environmental analysis, including alternatives, and guide the process for developing the EIS/EIR.

Great Basin Unified Air Pollution Control District

CASA DIABLO IV GEOTHERMAL DEVELOPMENT PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT
Scoping Comment Form

Name:
Mailing Address:
Telephone No. (optional):
Email (optional):

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, be advised that your entire comment - including your personal identifying information - may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

Comments/Issues:

Please use additional sheets if necessary.

SUBMIT WRITTEN COMMENTS (POSTMARKED BY MAY 9, 2011) TO:

Mail: Bureau of Land Management, Bishop Field Office, Attn: Casa Diablo IV Geothermal Development Project, 351 Pacu Lane, Suite 100, Bishop, CA 93514

Email: cabipubcom@ca.blm.gov, Attn: Casa Diablo IV Geothermal Development Project

Fax: (760) 872-5050, Attn: Casa Diablo IV Geothermal Development Project

Questions? Please call Steven Nelson, BLM Supervisory Natural Resource Specialist at (760) 872-5006.

Place
Stamp
Here

Bureau of Land Management
Bishop Field Office
Attn: Casa Diablo IV Geothermal Development Project
351 Pacu Lane, Suite 100
Bishop, CA 93514

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Tape
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Do Not
Staple

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APPENDIX C

Comment Letters Received During CD-4 EIS/EIR Scoping Process

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From:	Sysum.Scott@epamail.epa.gov
To:	cabipubcom@ca.blm.gov
Cc:	Plenys.Thomas@epamail.epa.gov
Subject:	EPA Region 9 NOI Comment Letter for the Casa Diablo IV Geothermal Development Project
Date:	05/09/2011 12:43 PM
Attachments:	Casa Diablo IV EPAR9 NOI Comment letter May 9 2011.PDF

Dear Sir
I have been assigned as the lead reviewer for U.S. EPA Region 9 for the Casa Diablo IV Geothermal Development Project Notice of Intent (NOI) to prepare an EIS/EIR. I have attached a pdf file of our comments. The signed letter was mailed today to Mr. Steven Nelson.

Thanks for providing us the opportunity to comment on this interesting project.

v/r
Scott Sysum

NOWCC-Energy Specialist
U.S. EPA Region IX
Environmental Review Office
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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

MAY 0 9 2011

Steven Nelson, Project Manager,
Casa Diablo IV Development Project,
BLM Bishop Field Office
351 Pacu Lane, Suite 100,
Bishop, California 93514

Subject: Notice of Intent to prepare an Environmental Impact Statement and Environmental Impact Report for the Proposed Casa Diablo IV Geothermal Development Project, Mammoth Lakes, Mono County, California

Dear Mr. Nelson:

The Environmental Protection Agency (EPA) has reviewed the March 25, 2011 Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) and Environmental Impact Report (EIR) for the Proposed Casa Diablo IV Geothermal Development Project, Mammoth Lakes, Mono County, California. Our comments are provided pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and our NEPA review authority under Section 309 of the Clean Air Act.

To assist in the scoping process for this project, we have identified several issues for your attention in the preparation of the Draft EIS/ EIR. We have identified the following issues for consideration: purpose and need, alternatives analysis, water resources, air quality, emergency planning, biological resources & habitat, recreational use, invasive species, noise & visual impacts, cultural resources, hazardous materials, solid & hazardous wastes, geological hazards, land use planning, environmental justice, indirect & cumulative impacts, climate change, and adaptive management. We believe that early analyses of key resource areas (e.g. estimation of the extent of state jurisdictional waters and Waters of the US, quantification of potential impacts to endangered species, identification of compensatory mitigation lands) should be completed as early as possible to determine the project's viability and avoid potential project delays.

We appreciate the opportunity to provide comments on the preparation of the Draft EIS/EIR and look forward to continued participation in the process. We are available to discuss our comments. Please send two hard copies of the Draft EIS/EIR and two CD- ROM copies to this office at the same time it is officially filed with our Washington D.C. Office. If you have any questions, please contact me at (415) 972-3238, or contact Scott Sysum, the lead reviewer for this project. Scott can be reached at (415) 972-3742 or sysum.scott@epa.gov.

Sincerely,

Thomas Plenys
Environmental Review Office
Communities and Ecosystems Division

Enclosure: EPA's Detailed Comments

US ENVIRONMETAL PROTECTION AGENCY (EPA) DETAILED COMMENTS ON THE NOTICE OF INTENT (NOI) TO PREPARE AN ENVIRONMENTAL IMPACT STATEMENT (EIS) AND ENVIRONMENTAL IMPACT REPORT (EIR) FOR THE PROPOSED CASA DIABLO IV GEOTHERMAL DEVELOPMENT PROJECT, MAMMOTH LAKES, MONO COUNTY, CALIFORNIA, MAY 9, 2011

Project Description

Mammoth Pacific, L.P. (MPLP) proposes to build a new 33-megawatt (MW) geothermal power plant (Casa Diablo IV) in the immediate vicinity of its three existing power plants. The project will be on existing MPLP geothermal leases near the intersection of California State Route 203 and U.S. Highway 395 approximately 2.5 miles east of the town of Mammoth Lakes in Mono County, California. In addition to the construction of the power plant, there will be an associated well field (up to 16 wells), internal access roads, pipelines, and a 500 ft long transmission line that will connect to an existing substation. The proposed Casa Diablo IV plant, access roads, well pads, pipelines and transmission line would occupy approximately 100 acres. MPLP currently generates 45 MW from the existing power plants. This project will nearly double the MPLP geothermal development complex power output. The projected lifetime of the project is 30 years, at which time MPLP will decommission the project.

Authorization of the proposed project would require approval from the Bureau of Land management (BLM) as the lead Federal agency responsible for geothermal leasing and development on Federal lands, in coordination with the U.S. Forest Service (FS) as a cooperating agency responsible for surface management and uses on Inyo National Forest lands within the project area. The BLM Bishop Field Office will serve as the lead Federal agency responsible for compliance with the National Environmental Policy Act (NEPA). The Great Basin Unified Air Pollution Control District (GBUAPCD) will be the lead state agency responsible for complying with the California Environmental Quality Act (CEQA). A joint EIS/EIR will be the environmental document prepared for the project.

Statement of Purpose and Need

The Draft EIS/EIR should clearly identify the underlying purpose and need to which BLM and the FS are responding in proposing the alternatives (40 CFR 1502.13). The *purpose* of the proposed action is typically the specific objectives of the activity, while the *need* for the proposed action may be to eliminate a broader underlying problem or take advantage of an opportunity.

Recommendation:
The purpose and need should be a clear, objective statement of the rationale for the proposed project. The Draft EIS/EIR should discuss the proposed project in the context of the larger energy market that this project would serve; identify potential purchasers of the power produced; and discuss how the project will assist the state in meeting its renewable energy portfolio standards and goals.

Alternatives Analysis

NEPA requires evaluation of reasonable alternatives, including those that may not be within the jurisdiction of the lead agency (40 CFR Section 1502.14(c)). A robust range of alternatives will include options for avoiding significant environmental impacts. The Draft EIS/EIR should provide a clear discussion of the reasons for the elimination of alternatives which are not evaluated in detail. Reasonable alternatives should include, but are not necessarily limited to, alternative sites, capacities, and technologies as well as alternatives that identify and avoid environmentally sensitive areas or areas with potential use conflicts. The alternatives analysis should describe the approach used to identify environmentally sensitive areas and describe the process that was used to designate them in terms of sensitivity (low, medium, and high).

The environmental impacts of the proposal and alternatives should be presented in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public (40 CFR 1502.14). The potential environmental impacts of each alternative should be quantified to the greatest extent possible (e.g., acres of wetlands impacted, tons per year of emissions produced, etc.).

Recommendations:
The Draft EIS/EIR should describe how each alternative was developed, how it addresses each project objective, and how it would be implemented. The alternatives analysis should include a discussion of locations, including on-site alternatives that demonstrate a reduction of undesirable impacts. Options such as reducing the footprint of the proposed project within the project area or relocating sections/components of the project to other areas, including private land, to reduce environmental impacts should be examined.

The Draft EIS/EIR should clearly describe the rationale used to determine whether impacts of an alternative are significant or not. Thresholds of significance should be determined by considering the context and intensity of an action and its effects (40 CFR 1508.27).

EPA recommends that the Draft EIS/EIR identify and analyze an environmentally preferable alternative.

Water Resources

Clean Water Act Section 404

The project applicant should coordinate with the U.S. Army Corps of Engineers (Corps) to determine if the proposed project requires a Section 404 permit under the Clean Water Act (CWA). Section 404 regulates the discharge of dredged or fill material into waters of the United States (WOUS), including wetlands and other *special aquatic sites*. The Draft EIS/EIR should describe all WOUS that could be affected by the project alternatives, and include maps that clearly identify all waters within the project area. The discussion should include acreages and channel lengths, habitat types, values, and functions of these waters. In addition, EPA suggests that BLM include a jurisdictional delineation for all WOUS, including ephemeral drainages, in accordance with the 1987 *Corps of Engineers Wetlands Delineation Manual* and the December 2006 *Arid West Region Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region*. A jurisdictional delineation will confirm the presence of WOUS in the project area and help determine impact avoidance or if state and federal permits would be required for activities that affect WOUS.

If a permit is required, EPA will review the project for compliance with *Federal Guidelines for Specification of Disposal Sites for Dredged or Fill Materials* (40 CFR 230), promulgated pursuant to Section 404(b)(1) of the CWA ("404(b)(1) Guidelines"). Pursuant to 40CFR 230, any permitted discharge into WOUS must be the least environmentally damaging practicable alternative (LEDPA) available to achieve the project purpose. The Draft EIS/EIR should include an evaluation of the project alternatives in this context in order to demonstrate the project's compliance with the 404(b)(1) Guidelines. If, under the proposed project, dredged or fill material would be discharged into WOUS, the Draft EIS/EIR should discuss alternatives to avoid those discharges.

The Draft EIS/EIR should describe the original (natural) drainage patterns in the project locale, as well as the drainage patterns of the area during project operations, and identify whether any components of the proposed project are within a 50 or 100-year floodplain. We also recommend the Draft EIS/EIR include information on the functions and locations of WOUS and their direct relationship to waters downstream.

Recommendations:
The applicant should coordinate with the Corps to obtain a jurisdictional delineation and confirm the presence of WOUS, in order to determine whether or not a CWA Section 404 permit is needed. If a permit is needed, the Draft EIS/EIR should demonstrate the project's compliance with the CWA 404(b)(1) Guidelines.

The Draft EIS/EIR should describe the geographic extent of any WOUS at the project site, as well as drainage patterns at the project location.

The Draft EIS/EIR should discuss the steps taken to avoid and minimize impacts to WOUS. To the extent any aquatic features that could be affected by the project are determined not to constitute WOUS, EPA recommends that the Draft EIS/EIR characterize the functions of such features and discuss potential mitigation.

Water Supplies

Public drinking water supplies and/or their source areas often exist in many watersheds. Source water is water from streams, rivers, lakes, springs, and aquifers that is used as a supply of drinking water. Source water areas are delineated and mapped by the state for each federally-regulated public water system. The 1996 amendments to the Safe Drinking Water Act (SDWA) require federal agencies to protect sources of drinking water for communities. Therefore, EPA recommends that the EIS identify:

a) source water protection areas within the project area;

b) activities that could potentially affect source water areas;
c) potential contaminants that may result from the proposed project; and
d) measures that would be taken to protect the source water protection areas.

The Draft EIS/EIR should discuss the potential for impacts on groundwater, springs, and other surface water features during construction and operation of the project. Geothermal development activities have the potential for impacting groundwater unless proper controls are in place. This can be mitigated or monitored by development of monitoring plans for these water resources. The plans would provide for the collection and evaluation of data necessary to document baseline conditions and impacts on the resources (i.e., water quantity, quality, and temperature). Contingencies can be developed (e.g., modification of geothermal pumping rates) to address any potential impacts that may be documented during the monitoring program.

Recommendations:
The Draft EIS/EIR should describe the availability of a water supply for construction and operation of the proposed project and fully evaluate the environmental impacts associated with using the selected water supply.

The Draft EIS/EIR should explore the need for a groundwater monitoring plan as a mitigation measure for potential impacts on groundwater, springs, and other surface water features. The monitoring plans should address contingencies to be implemented (e.g., modification of geothermal pumping rates) to address any potential impacts that may be documented during the monitoring program plan for these water resources.

Clean Water Act Section 303(d)

The Clean Water Act (CWA) requires States to develop a list of impaired waters that do not meet water quality standards, establish priority rankings, and develop action plans, called Total Maximum Daily Loads (TMDLs), to improve water quality.

Recommendation:
The Draft EIS/EIR should provide information on CWA Section 303(d) impaired waters in the project area, if any, and efforts to develop and revise TMDLs. The Draft EIS/EIR should describe existing restoration and enhancement efforts for those waters, how the proposed project will coordinate with on-going protection efforts, and any mitigation measures that will be implemented to avoid further degradation of impaired waters.

<u>Air Quality</u>

The Draft EIS/EIR should provide a detailed discussion of ambient air conditions (baseline or existing conditions), National Ambient Air Quality Standards (NAAQS), criteria pollutant nonattainment areas, and potential air quality impacts of the project (including cumulative and indirect impacts) for each fully evaluated alternative. Construction related impacts should also be discussed. Below are specific recommendations on general conformity, new source review, Title V operating permits and construction emissions.

General Conformity

Mono County is located within the Great Basin Valleys Air Basin (GBVAB), which also includes Inyo and Alpine Counties. Air quality in Mono County is governed by the Great Basin Unified Air Pollution Control District (GBUAPCD) and the California Air Resources Board (CARB). The Mono County portion of the GBVAB has a non-attainment status for ozone (State standards only); non-attainment of ozone is associated with the effect of transported pollution from outside of Mono County, rather than local generation of ozone or ozone precursors. All of the GBVAB is designated non-attainment for the PM10 State standard.

Recommendation:
The Draft EIS/EIR should address the applicability of CAA Section 176 and EPA's general conformity regulations at 40 CFR Parts 51 and 93. Federal agencies need to ensure that their actions, including construction emissions subject to state jurisdiction, conform to an approved implementation plan. Emissions authorized by a CAA permit issued by the State or the local air pollution control district would not be assessed under general conformity but through the permitting process.

New Source Review (NSR) Construction Permit Program

New major stationary sources of air pollution and major modifications to sources are required by the CAA to obtain an air pollution permit before commencing construction. This process is called new source review (NSR) and is required whether the major source or modification is planned for an area where the NAAQS are exceeded (nonattainment areas) or an area where air quality is acceptable (attainment and unclassifiable areas).

Permits for sources in attainment areas are referred to as prevention of significant air quality deterioration (PSD) permits, while permits for sources located in nonattainment areas are referred to as nonattainment (NAA) permits. The entire program, including both PSD and NAA permit reviews, is referred to as the NSR program and is established in Parts C and D of Title I of the CAA. Based upon an area's attainment/nonattainment designations and a proposed project's anticipated criteria pollutant emission rates, a project may require both a PSD and NAA permit.

Recommendation:
The Draft EIS/EIR should discuss if NSR program permits will be required for the geothermal power plant proposed for construction in the leased areas. If so, the Draft EIS/EIR should describe the permitting process and the information that must be addressed in the permits.

Title V Operating Permit

Title V of the CAA requires all new major sources and some minor sources of air pollution to apply for an operating permit within 12 months of commencing operation. When granted, the permit includes all air pollution requirements that apply to the source, including emissions limits and monitoring, record keeping, and reporting requirements. It also requires that the source report its compliance status with respect to permit conditions to the agency that issued the permit and if the permit is issued by a state or local agency, reports should also be submitted to EPA.

Recommendation:
The Draft EIS/EIR should indicate if Title V operating permits will be required for the geothermal power plant proposed to be constructed in the leased areas. If so, it should describe which agency will issue the operating permit and should describe the permitting process, including opportunities for public involvement.

Construction Emissions Mitigation

EPA recommends an evaluation of the following measures to reduce construction emissions of criteria air pollutants and hazardous air pollutants (air toxics). The Draft EIS/EIR should address the use of these or similar measures during construction.

Recommendations:

- *Equipment Emissions Mitigation Plan (EEMP)* – The Draft EIS/EIR should identify the need for an EEMP. An EEMP will identify actions to reduce diesel particulate, carbon monoxide, hydrocarbons, and NOx associated with construction activities. We recommend that the EEMP require that all construction-related engines:
    - are tuned to the engine manufacturer's specification in accordance with an appropriate time frame;
    - do not idle for more than five minutes (unless, in the case of certain drilling engines, it is necessary for the operating scope);
    - are not tampered with in order to increase engine horsepower;
    - include particulate traps, oxidation catalysts and other suitable control devices on all construction equipment used at the project site;
    - use diesel fuel having a sulfur content of 15 parts per million or less, or other suitable alternative diesel fuel, unless such fuel cannot be reasonably procured in the market area; and
    - include control devices to reduce air emissions. The determination of which equipment is suitable for control devices should be made by an independent Licensed Mechanical Engineer. Equipment suitable for control devices may include drilling equipment, generators, compressors, graders, bulldozers, and dump trucks.

- *Fugitive Dust Control Plan* - The Draft EIS/EIR should identify the need for *Fugitive Dust Control Plan.* We recommend that it include these general recommendations:
    - Stabilize open storage piles and by covering and/or applying water or chemical/organic dust palliative where appropriate. This applies to both inactive and active sites, during workdays, weekends, holidays, and windy conditions.

- o Install wind fencing and phase grading operations where appropriate, and operate water trucks for stabilization of surfaces under windy conditions; and
- o When hauling material and operating non-earthmoving equipment, prevent spillage and limit speeds to 15 miles per hour (mph). Limit speed of earth-moving equipment to 10 mph.

Emergency Planning and Community Right-to-Know Act and CAA §112(r)

The Draft EIS/EIR should evaluate the need for compliance with CAA §112(r), and, as applicable, Emergency Planning and Community Right-to-Know Act (EPCRA) § 303, 311, & 312. Additionally the requirements of the California Hazardous Materials Business Plan (CA HMBP) may be applicable.

Recommendation:
The Draft EIS/EIR should discuss compliance with CAA §112(r), EPCRA §§ 303, 311, 312, and CA HMBP if applicable.

Biological Resources, Habitat and Wildlife

During construction of the proposed project, vegetation would be cleared and soils moved during the construction of roads, well pads, substation, transmission line, and other facilities. The Draft EIS/EIR should describe the current quality and capacity of habitat and its use by wildlife in the proposed project area. The Draft EIS/EIR should describe the critical habitat for the species; identify any impacts the proposed project will have on the species and their critical habitats; and how the proposed project will meet all requirements under the Endangered Species Act, including consultation with the U.S. Fish and Wildlife Service (FWS) and California Department of Fish and Game (CDFG).

The Draft EIS/EIR should identify all petitioned and listed threatened and endangered species that might occur within the project area. The Draft EIS/EIR should identify and quantify which species might be directly or indirectly affected by each alternative. All raptor and owl species are protected under the Migratory Bird Treaty Act (MBTA). The golden eagle and bald eagle also receive protection under the Bald and Golden Eagle Protection Act (BGEPA). The MBTA, however, has no provision for allowing unauthorized take. In September 2009, the FWS finalized permit regulations[1] under the BGEPA for the take of bald and golden eagles on a limited basis, provided that the take is compatible with preservation of the eagle and cannot be practicably avoided.

Recommendations:
Discuss design and management measures to minimize adverse impacts to wildlife and native and rare plants.

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[1] See Eagle Permits, 50 CFR parts 13 and 22, issued Sept. 11, 2009. See internet address: http://www.fws.gov/migratorybirds/CurrentBirdIssues/BaldEagle/Final%20Disturbance%20Rule%209%20Sept%20 2009.pdf

Identify specific measures to reduce impacts to eagles and clarify how the proposed project will comply with the MBTA and BGEPA.

The Draft EIS/EIR should discuss the potential need for an Avian Protection Plan (APP) for the transmission lines and equipment. The discussion may include the development of an Avian Protection Plan (APP) using the Avian Power Line Interaction Committee (APLIC) best practices and FWS Avian Protection Plan Guidelines.

Recreational Use

BLM is entrusted with the multiple-use management of natural resources on public land, and that public land must be managed for outdoor recreation and natural, scenic, scientific, and historical values.

Recommendation:
EPA recommends that there be full disclosure of the impacts to recreational users in the project area. The Draft EIS/EIR should clarify what general measures will be incorporated to ensure that recreational users are not injured due to hazards associated with piping, and transmission lines.

Invasive Species

Executive Order 13112, *Invasive Species* (February 3, 1999), mandates that federal agencies take actions to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause. Executive Order 13112 also calls for the restoration of native plants and tree species.

Recommendation:
The Draft EIS/EIR should include an invasive plant management plan to monitor and control noxious weeds.

Noise Impacts

The Draft EIS/EIR should include an assessment of noise levels from the geothermal plant and well field. Decibel levels for the project should be evaluated as should the effects of noise levels on a variety of species, as well as effects on property values, residences, and recreational use, if applicable.

Visual Impacts

Careful attention should be given to how the geothermal plant and associated well field is set against the landscape. Steps should be taken to minimize the visual impacts and make the power plant and well field less obtrusive.

Coordination with Tribal Governments

Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* (November 6, 2000), was issued in order to establish regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, and to strengthen the United States government-to-government relationships with Indian tribes.

Recommendation:
The Draft EIS/EIR should describe the process and outcome of government-to-government consultation between BLM and each of the tribal governments within the project area, issues that were raised (if any), and how those issues were addressed in the selection of the proposed alternative.

National Historic Preservation Act and Executive Order 13007

Consultation for tribal cultural resources is required under Section 106 of the National Historic Preservation Act (NHPA). Historic properties under the National Historic Preservation Act (NHPA) are properties that are included in the National Register of Historic Places (NRHP) or that meet the criteria for the National Register. Section 106 of the NHPA requires a federal agency, upon determining that activities under its control could affect historic properties, consult with the appropriate State Historic Preservation Officer/Tribal Historic Preservation Officer (SHPO/THPO). Under NEPA, any impacts to tribal, cultural, or other treaty resources must be discussed and mitigated. Section 106 of the NHPA requires that Federal agencies consider the effects of their actions on cultural resources, following regulation in 36 CFR 800.

Executive Order 13007, *Indian Sacred Sites* (May 24, 1996), requires federal land managing agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian Religious practitioners, and to avoid adversely affecting the physical integrity of such sacred sites. It is important to note that a sacred site may not meet the National Register criteria for a historic property and that, conversely, a historic property may not meet the criteria for a sacred site.

Recommendation:
The Draft EIS/EIR should address the possibility of Indian sacred sites in the project area. It should address Executive Order 13007, distinguish it from Section 106 of the NHPA, and discuss how BLM will avoid adversely affecting the physical integrity of sacred sites, if they exist. The Draft EIS/EIR should provide a summary of all coordination with Tribes and with the SHPO/THPO, including identification of NRHP eligible sites, and development of a Cultural Resource Management Plan.

Hazardous Materials/Hazardous Waste/Solid Waste & Health and Safety

Geothermal drilling, construction activities and plant operations involve the use of hazardous materials which could include: drilling additives and mud, diesel fuel, lubricants, solvents, oil, equipment/vehicle emissions, geothermal water, laboratory materials, and an organic working fluid for the binary plant Organic Rankine Cycle (ORC). The Draft EIS/EIR should address potential direct, indirect and cumulative impacts of hazardous waste from construction and operation of the proposed project. The document should identify projected hazardous waste types and volumes, and expected storage, disposal, and management plans. It should address the applicability of state and federal hazardous waste requirements. Mitigation measures should also be evaluated to reduce the volume or toxicity of hazardous materials requiring management and disposal as hazardous waste.

Recommendations:
The Draft EIS/EIR should identify projected hazardous materials and waste types and volumes, and expected storage, disposal, and management plans.

The Draft EIS/EIR should describe the health and safety aspects of all hazardous materials used, especially the working fluid.

The Draft EIS/EIR should evaluate appropriate mitigation, including measures to minimize the generation of hazardous waste (i.e., pollution prevention and hazardous waste minimization) and alternate industrial processes using less toxic materials.

Geological Hazards

The same attributes that make the Casa Diablo area a prime area for geothermal energy generation also may raise geological hazard risks. Various studies[2] in other areas have raised concerns about induced seismicity and/or subsidence as a result of water injection and production. In the case of geothermal induced seismicity withdrawal of fluids as well as injection of fluids can cause seismicity, though there is not a strict one to one correlation with injection. In most regions where there are economic geothermal resources there is usually tectonic activity, such as in the western United States. These areas are more prone to induced seismicity than in more stable areas of the United States[3]. Potential geological hazards, in particular, induced seismicity and subsidence should be discussed in the Draft EIS/EIR

Recommendation:
The Draft EIS/EIR should discuss the potential for geological hazards such as induced seismicity or subsidence especially in light of the number of projects nearby and the evidence of geologic activity. The discussion should include how geological hazards would be monitored and mitigation measures would be employed if detrimental geological hazards are manifested by the operation of the plants.

Project Decommissioning

Geothermal power plants are designed for life spans of 20 to 30 years. With proper resource management the life can exceed design values. The life of the proposed project should be taken into consideration regarding decommissioning and reclamation.

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[2] Oppenheimer, D. H. (1986), Extensional Tectonics at The Geysers Geothermal Area, California, *J. Geophys. Res.*, 91(B11), 11,463–11,476, doi:10.1029/JB091iB11p11463
[3] Majer, E.L. 2008. White Paper: Induced Seismicity and Enhanced Geothermal Systems. Center for Computational Seismology, Ernest Orlando Lawrence Berkeley National Laboratory.

Recommendation:
EPA recommends that the Draft EIS/EIR identify bonding or financial assurance strategies for decommissioning and reclamation.

Coordination with Land Use Planning Activities

The Draft EIS/EIR should discuss how the proposed action would support or conflict with the objectives of federal, state, tribal or local land use plans, policies and controls in the project area. The term "land use plans" includes all types of formally adopted documents for land use planning, conservation, zoning and related regulatory requirements. Proposed plans not yet developed should also be addressed it they have been formally proposed by the appropriate government body in a written form (CEQ's Forty Questions, #23b).

Recommendation:
The Draft EIS/EIR should evaluate the conformance of the project with current and reasonably foreseeable land use plans.

Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994), directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects on minority and low-income populations, allowing those populations a meaningful opportunity to participate in the decision-making process. Guidance[4] by CEQ clarifies the terms low-income and minority population (which includes American Indians) and describes the factors to consider when evaluating disproportionately high and adverse human health effects.

Recommendation:
The Draft EIS/EIR should include an evaluation of environmental justice populations within the geographic scope of the project. If such populations exist, the Draft EIS/EIR should address the potential for disproportionate adverse impacts to minority and low-income populations, and the approaches used to foster public participation by these populations. Assessment of the project's impact on minority and low-income populations should reflect coordination with those affected populations.

Indirect and Cumulative Impacts

This will be the fourth geothermal plant in the immediate MPLP facility. The cumulative impacts analysis should provide the context for understanding the magnitude of the impacts of the alternatives by analyzing the impacts of other past, present, and reasonably foreseeable projects or actions and then considering those cumulative impacts in their entirety (CEQ's Forty Questions, #18). The Draft EIS/EIR should clearly identify the resources that may be cumulatively impacted, the time over which impacts are going to occur, and the geographic area that will be impacted by the proposed project. The Draft EIS/EIR should focus on resources of

[4]Environmental Justice Guidance under the National Environmental Policy Act, Appendix A (Guidance for Federal Agencies on Key Terms in Executive Order 12898), CEQ, December 10, 1997.

concern – those resources that are "at risk" and/or are significantly impacted by the proposed project, before mitigation. In the introduction to the *Cumulative Impacts Section*, identify which resources are analyzed, which ones are not, and why. For each resource analyzed, the Draft EIS/EIR should:

- Identify the current condition of the resource as a measure of past impacts. For example, the percentage of species habitat lost to date.
- Identify the trend in the condition of the resource as a measure of present impacts. For example, the health of the resource is improving, declining, or in stasis.
- Identify all on-going, planned, and reasonably foreseeable projects in the study area that may contribute to cumulative impacts.
- Identify the future condition of the resource based on an analysis of impacts from reasonably foreseeable projects or actions added to existing conditions and current trends.
- Assess the cumulative impacts contribution of the proposed alternatives to the long-term health of the resource, and provide a specific measure for the projected impact from the proposed alternatives.
- Disclose the parties that would be responsible for avoiding, minimizing, and mitigating those adverse impacts.
- Identify opportunities to avoid and minimize impacts, including working with other entities.

As an indirect result of providing additional power, it can be anticipated that this project will allow for development and population growth to occur in those areas that receive the generated electricity.

Recommendations:
The Draft EIS/EIR should describe the reasonably foreseeable future land use and associated impacts that will result from the additional power supply. The document should provide an estimate of the amount of growth, its likely location, and the biological and environmental resources at risk.

The Draft EIS/EIR should consider the direct and indirect effects of the inter-connecting transmission line for the proposed project, as well as the cumulative effects associated with the transmission needs of other reasonably foreseeable projects.

<u>Climate Change</u>

Scientific evidence supports the concern that continued increases in greenhouse gas emissions resulting from human activities will contribute to climate change. Global warming is caused by emissions of carbon dioxide and other heat-trapping gases. Global warming can affect weather patterns, sea level, ocean acidification, chemical reaction rates, and precipitation rates, resulting in climate change. Reports also indicate that deserts may store as much carbon as temperate forests.

Recommendations:

The Draft EIS/EIR should consider how climate change could potentially influence the proposed project, specifically within sensitive areas, and assess how the projected impacts could be exacerbated by climate change.

The Draft EIS/EIR should quantify and disclose the anticipated climate change *benefits* of geothermal plant electrical energy. We suggest quantifying greenhouse gas emissions from different types of generating facilities including solar, wind, natural gas, coal-burning, and nuclear and compiling and comparing these values.

Implementation of Adaptive Management Techniques for Mitigation Measures

Adaptive management is an iterative process that requires selecting and implementing management actions, monitoring, comparing results with management and project objectives, and using feedback to make future management decisions. The process recognizes the importance of continually improving management techniques through flexibility and adaptation instead of adhering rigidly to a standard set of management actions. Although adaptive management is not a new concept, it may be relatively new in its application to specific projects. The effectiveness of adaptive management monitoring depends on a variety of factors including:

a) The ability to establish clear monitoring objectives;
b) Agreement on the impact thresholds being monitored;
c) The existence of a baseline or the ability to develop a baseline for the resources being monitored;
d) The ability to see the effects within an appropriate time frame after the action is taken;
e) The technical capabilities of the procedures and equipment used to identify and measure changes in the affected resources and the ability to analyze the changes;
f) The resources needed to perform the monitoring and respond to the results.

Recommendation:
EPA recommends that BLM consider adopting a formal adaptive management plan to evaluate and monitor impacted resources and ensure the successful implementation of mitigation measures. EPA recommends that BLM review the specific discussion on Adaptive Management in the NEPA Task Force Report to the Council on Environmental Quality (CEQ) on Modernizing NEPA Implementation[5].

[5] Council on Environmental Quality (U.S.). Modernizing NEPA Implementation. Washington D.C. NEPAnet web site. http://ceq.hss.doe.gov/ntf/report/finalreport.pdf. Accessed April 28, 2011.

From: Debbie_Allen@nps.gov
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Cc: Alan_Schmierer@nps.gov; waso_eqd_extrev@nps.gov; oepcsfn@aol.com; susmita_pendurthi@ios.doi.gov
Subject: Re: DEC-11/0079:Casa Diablo IV Geothermal Development Project (CACA 11667), Mammoth Lakes
Date: 05/06/2011 06:45 PM

PWR has no comment regarding subject document.

Debbie Allen
National Park Service
Partnerships Programs, PWR
1111 Jackson Street #700
Oakland, CA 94607
510/817-1446
510/817-1505 Fax

"Don't dwell on what went wrong. Instead, focus on what to do next. Spend your energies on moving forward toward finding the answer." -- Denis Waitley

Dale_Morlock@nps.gov
05/03/2011 07:53 AM

To: Debbie_Allen@nps.gov
cc:
Subject: DEC-11/0079:Casa Diablo IV Geothermal Development Project (CACA 11667), Mammoth Lakes

NPS External Affairs Program: ER2000 Program Email Instruction Sheet
United States Department of the Interior
National Park Service Environmental Quality Division
7333 W. Jefferson Avenue
Lakewood, CO 80235-2017

EIS/Related Document Review: Detail View
http://er2000/detail.cfm?ernum=15597

Document Information

Record #15597

ER Document Number: DEC-11/0079

Document Title: Casa Diablo IV Geothermal Development Project (CACA 11667), Mammoth Lakes

Location:

State	County
California	Mono County

Document Type: Notice of Intent, Prepare Environmental Impact Statement, Environmental Report

Doc. Classification:

Applicant: Bureau of Land Management

Web Review Address:

http://edocket.access.gpo.gov/2011/2011-7012.htm

http://www.blm.gov/ca/st/en/prog/energy/fasttrack/casadiablo.html

http://www.blm.gov/ca/st/en/fo/bishop.html

http://www.blm.gov/ca/st/en/prog/energy/fasttrack/casadiablo/fedstatus

.html

Document Reviewers

WASO Lead Reviewer

WASO Reviewers

Thomas Flanagan(2310), Kerry Moss(2360), Fred Sturniolo(2420), David Vana-Miller(2380), Carl Wang(2420), Steven Elkinton(2220), Bill Commins(2200), Lee Dickinson(2460), Dave Kreger(2033), Dale Morlock(2310), Wayne Strum(2225), Tokey Boswell(2510)

Regional Lead Reviewer

Alan Schmierer (PWR-O)

Regional Reviewers

Alan Schmierer(PWR-O), Debbie Allen(PWR-O), Martha Crusius(PWR-O), Michael Elliott(IMDE), Elaine_Jackson-Retondo(PWR-O), Lee Kreutzer(PWR-O), Michael Taylor(PWR-O)

Cultural Lead Reviewer

Daniel Odess

Cultural Reviewers

Daniel Odess

Action

Lead Bureau

Bureau of Land Management

Response Type

Regional Response

Instructions

Comments to Lead DOI Bureau. NPS Lead consolidates NPS comments, prepares comment/no comment memo, and emails to Lead DOI Bureau with copy to EQD (WASO-2310). See DI Remarks Section below for specifics.

Topic Context

Mammoth Pacific, L.P. (MPLP) has submitted an application to the BLM to build and operate the Casa Diablo IV Geothermal Development Project in the immediate vicinity of the existing MPLP geothermal projects near the intersection of California State Route 203 and U.S. Highway 395 approximately 3 miles east of Mammoth Lakes, California.

The proposed project would be located on Inyo National Forest lands and adjacent private lands within portions of Federal geothermal leases CACA-11667, CACA-11672 and CACA-14408.

A 500-foot transmission line is proposed to interconnect the new power plant to the existing Southern California Edison (SCE) substation at Substation Road.

The development will include a 33-megawatt (MW) geothermal power plant and associated well field, internal access roads, pipelines, and a transmission line on public and private lands near the Town of Mammoth Lakes, California.

DI Remarks

Public Comment: Scoping period ends 5/9/11.

Interagency coorporation: USFS, FWS, BLM and NPS.

Reviewers: Please Email comments to NPS Lead Alan Schmierer (PWR-O), Alan_Schmierer@nps.gov by May 5, 2011.

NPS Lead: Alan Schmierer please consolidate NPS comments (no comment) in memo format and send directly to FWS, Willows, CA, cabipubcom@ca.blm.gov
by May 9, 2011, with copy to: waso_eqd_extrev@nps.gov, Susmita_Pendurthi@ios.doi.gov and oepcsfn@aol.com

Applicant Address for Alan Schmierer: BLM Bishop Field Office, 351 Pacu Lane, Suite 100, Bishop, California 93514, Attn: Casa Diablo IV Development Project, C/O Steven Nelson, Project Manager.

BLM CONTACT: Steven Nelson, Project Manager.

USFS CONTACT: Margie DeRose, Minerals and Geology Program Manager, Inyo National Forest.

* Telephone: (760) 873-2424.

* FAX: (760) 872-5050.

* e-mail cabipubcom@ca.blm.gov

Comment Web Address
http://www.blm.gov/ca/st/en/fo/bishop.html
Email Comment Address
cabipubcom@ca.blm.gov

Workflow

Send Comments to Lead Office: PWR-O
Send to: Alan Schmierer (PWR-O) by 05/05/11

Lead DOI Bureau: Bureau of Land Management
DUE TO: Lead Bureau by 05/09/11
DATE DUE OUT: 05/09/11

OEPC Memo to EQD: 05/03/11
Comments Due To Lead WASO Div:
Comments Due Out to
OEPC/Wash or Applicant: 05/09/11
Comments Due To Lead Region: 05/05/11
Comments Due in EQD:
Comments Due to REO:

Tracking Dates

Rcvd. Region Comments:
Comments Sent to OEPC, REO, or Applicant:
New Instructions:
Recvd. Ext. Letter:
Reg. Cmts. to Bureau:
Cmts. Called In:
Comments Sent to EQD Chief:
Comment Letter/Memo Signed:
Recvd. Extension:
Sent Add. Info:
Reg. Cmts. Listed:
Rcvd. Bureau Cmts:

Tracking Notes

Reviewer Notes

Documentation

Document Last Modified: 05/03/2011
Complete: False
Date Created: 05/03/2011
Date Last Email Sent:

State of California -The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
Inland Deserts Region (IDR)
407 West Line Street
Bishop, CA 93514
(760) 872-1171
(760) 872-1284 FAX

May 2, 2011

Ms. Jan Sudomier
Great Basin Unified Air Pollution Control District
157 Short Street
Bishop, CA 93514

Subject: Casa Diablo IV Geothermal Development Project, Notice of Preparation (State Clearinghouse Number: 2011041008)

Dear Ms. Sudomier:

The Department of Fish and Game, hereinafter referred to as Department has reviewed the Notice of Preparation (NOP) of the Draft Environmental Impact Report (DEIR) for the above mentioned project relative to impacts to biological resources. The Department appreciates this opportunity to comment on the above-referenced project, relative to impacts to biological resources.

The Department is a Trustee Agency pursuant to the California Environmental Quality Act (CEQA). A Trustee Agency has jurisdiction over certain resources held in trust for the people of California. Trustee agencies are generally required to be notified of CEQA documents relevant to their jurisdiction, whether or not these agencies have actual permitting authority or approval power over aspects of the underlying project (CEQA Guidelines, Section 15386). As the trustee agency for fish and wildlife resources, the Department provides requisite biological expertise to review and comment upon CEQA documents, and makes recommendations regarding those resources held in trust for the people of California.

The Department may also assume the role of Responsible Agency. A Responsible Agency is an agency other than the lead agency that has a legal responsibility for carrying out or approving a project. A Responsible Agency actively participates in the Lead Agency's CEQA process, reviews the Lead Agency's CEQA document and uses that document when making a decision on the project. The Responsible Agency must rely on the Lead Agency's environmental document to prepare and issue its own findings regarding the project (CEQA Guidelines, Sections 15096 and 15381). The Department most often becomes a responsible agency when a 1600 Streambed Alteration Agreement or a 2081(b) California Endangered Species Act Incidental Take Permit is needed for a project. The Department relies on the environmental document prepared by the Lead Agency to make a finding and decide whether or not to issue permit or agreement. It is important that the Lead

Agency's EIR considers the Department's responsible agency requirements. For example, CEQA requires the Department to include additional feasible alternatives or feasible mitigation measures within its powers that would substantially lessen or avoid any significant effect the project would have on the environment (CEQA Guidelines, section 15096 (g) (2). In rare cases, the Department may need to prepare additional CEQA analysis.

Pursuant to California Fish and Game Code section 711.4, the Department collects a filing fee for all projects subject to CEQA. These filing fees are collected to defray the costs of managing and protecting fish and wildlife resources including, but not limited to, consulting with public agencies, reviewing environmental documents, recommending mitigation measures, and developing monitoring programs. Project applicants need not pay a filing fee in cases where a project will have no effect on fish and wildlife, as determined by the Department, or where their project is statutorily or categorically exempt from CEQA.

Mammoth Pacific, LP, hereinafter referred to as MPLP, proposes to build, and following the expected 30-year useful life, decommission the Casa Diablo IV Geothermal Development Project in the vicinity of the existing MPLP geothermal project. The Project would consist of the following facilities:

- A geothermal power plant consisting of two Ormat Energy Converts binary generating units (21.2 MW gross each) with vaporizers, turbines, generators, air-cooled condensers, preheaters, pumps and piping, and related ancillary equipment.

- A motive fluid system consisting of motive fluid (isopentane) storage vessels, either one or two vessels in the range of 9,000 to 12,000 gallons) and a motive fluid vapor recovery system (VRU).

- An air cooling system for the power plant.

- An RO water treatment facility and equalization storage tank.

To enable Department staff to adequately review and comment on the proposed project, we recommend the following information be included in the DEIR, as applicable:

1. The project description should address any potential to alter aquifer temperatures, pressures, surface waters, spring flows, and water quality.

2. Explain how the proposed project comports with existing court orders and settlement agreements stemming from the development of the MP1 and PLES plants.

3. A complete assessment (direct, indirect, and cumulative impacts) of the flora and fauna within and adjacent to the project area, with particular emphasis upon identifying special status species including, but not limited to rare, threatened, and endangered species. This assessment should also address locally unique species and rare natural communities.

   a. A thorough assessment of potential impacts to the sage grouse (*Centrocercus urophasianus*), a Federal Candidate species, and the Federal and State endangered Owens tui chub (*Siphateles bicolor snyderi*).

   b. A thorough site-specific study for mule deer (*Odocoileus hemionus* ssp. *hemionus*) conducted during the appropriate time of year (April 15-June15) by a qualified biologist. The purpose is to quantify the timing and amount of migratory deer use and to determine potential impacts to deer foraging and summer range fawning habitat.

   c. The DEIR should include survey methods, dates, and results; and should list all plant and animal species detected within the project study area. Special emphasis should be directed toward describing the status of rare, threatened, and endangered species in all areas potentially affected by the project. All necessary biological surveys should be conducted in advance of DEIR circulation, and should not be deferred.

   d. Rare, threatened, and endangered species to be addressed should include all those which meet the California Environmental Quality Act (CEQA) definition (see CEQA Guidelines, § 15380).

   e. Species of Special Concern status applies to animals generally not listed under the federal Endangered Species Act or the California Endangered Species Act, but which nonetheless are declining at a rate that could result in listing, or historically occurred in low numbers and known threats to their persistence currently exist. At a minimum, Species of Special Concern are considered to be "rare" under CEQA.

   f. A thorough assessment of rare plants and rare natural communities, following the Department's November 2009 *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (Attachment 1).

g. A detailed vegetation map should be prepared, preferably overlaid on an aerial photograph. The map should be of sufficient resolution to depict the locations of the project site's major vegetation communities, and view project impacts relative to vegetation communities. The vegetation classification system used to name the polygons should be described.

h. A complete assessment of rare, threatened, and endangered invertebrate, fish, wildlife, reptile, and amphibian species should be presented in the DEIR. Seasonal variations in use of the project area should also be addressed. Focused species-specific surveys, conducted at the appropriate time of year and time of day when the species are active or otherwise identifiable, are required. Acceptable species-specific survey procedures should be developed in consultation with the Department and the U.S. Fish and Wildlife Service.

i. The Department's California Natural Diversity Data Base (CNDDB) in Sacramento should be searched to obtain current information on previously reported sensitive species and habitat, including Significant Natural Areas identified under Chapter 12 of the Fish and Game Code. In order to provide an adequate assessment of special-status species potentially occurring within the project vicinity, the search area for CNDDB occurrences should include all U.S.G.S 7.5-minute topographic quadrangles with project activities, and all adjoining 7.5-minute topographic quadrangles. The EIR should discuss how and when the CNDDB search was conducted, including the names of each quadrangle queried.

4. A thorough discussion of direct, indirect, and cumulative impacts expected to adversely affect biological resources, with specific measures to offset such impacts, should be included.

a. The EIR should present clear thresholds of significance to be used by the Lead Agency in its determination of the significance of environmental effects. A threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect.

b. CEQA Guidelines, § 15125(a), direct that knowledge of the regional setting is critical to an assessment of environmental impacts and that special emphasis should be placed on resources that are rare or unique to the region.

c. Impacts associated with initial project implementation as well as long-term operation and maintenance of a project should be addressed in the EIR.

d. In evaluating the significance of the environmental effect of a project, the Lead Agency should consider direct physical changes in the environment which may be caused by the project and reasonably foreseeable indirect physical changes in the environment which may be caused by the project. Expected impacts should be quantified (e.g., acres, linear feet, number of individuals taken, volume or rate of water extracted, etc. to the extent feasible).

e. Project impacts should be analyzed relative to their effects on off-site habitats. Specifically, this may include public lands, open space, downstream aquatic habitats, or any other natural habitat that could be affected by the project.

f. Impacts to and maintenance of wildlife corridor/movement areas and other key seasonal use areas should be fully evaluated and provided.

g. A discussion of impacts associated with increased lighting, noise, human activity, changes in drainage patterns, changes in water volume, velocity, quantity, and quality, soil erosion, and/or sedimentation in streams and water courses on or near the project site, with mitigation measures proposed to alleviate such impacts should be included. Special considerations applicable to linear projects include ground disturbance that may facilitate infestations by exotic and other invasive species over a great distance.

h. A cumulative impacts analysis should be developed as described under CEQA Guidelines, § 15130. General and specific plans, as well as past, present, and anticipated future projects, should be analyzed relative to their impacts to similar plant communities and wildlife habitats.

5. A range of project alternatives should be analyzed to ensure that the full spectrum of alternatives to the proposed project are fully considered and evaluated. Alternatives which avoid or otherwise minimize impacts to sensitive biological resources should be identified.

a. If the project will result in any impacts described under the Mandatory Findings of Significance (CEQA Guidelines, § 15065) the impacts must be analyzed in depth in the EIR, and the Lead Agency is required to make detailed findings on the feasibility of alternatives or mitigation measures to substantially lessen or avoid the significant effects on the environment. When mitigation measures or project changes are found to be feasible, the project should be changed to substantially lessen or avoid the significant effects.

6. Mitigation measures for adverse project-related impacts to special status species including, but not limited to rare, threatened and endangered species, sensitive plants, animals, and habitats should be thoroughly discussed. Mitigation measures should first emphasize avoidance and reduction of project impacts. For unavoidable impacts, the feasibility of on-site habitat restoration or enhancement should be discussed. If on-site mitigation is not feasible, off-site mitigation through habitat creation, enhancement, land acquisition and preservation in perpetuity should be addressed.

a. The Department generally does not support the use of relocation, salvage, and/or transplantation as mitigation for impacts to rare, threatened, or endangered species. Studies have shown that these efforts are experimental in nature and largely unsuccessful.

b. Areas reserved as mitigation for project impacts should be legally protected from future direct and indirect impacts. Potential issues to be considered include limitation of access, conservation easements, monitoring and management programs, water pollution, and fire.

c. Plans for restoration and revegetation should be prepared by persons with expertise in the eastern Sierra environment, and native plant revegetation techniques. Each plan should include, at a minimum: (a) the location of the mitigation site; (b) the plant species to be used, container sizes, and seeding rates; (c) a schematic depicting the mitigation area; (d) planting schedule; (e) a description of the irrigation methodology; (f) measures to control exotic vegetation on site; (g) specific success criteria; (h) a detailed monitoring program; (i) contingency measures should the success criteria not be met; and (j) identification of the party responsible for meeting the success criteria and providing for long-term conservation of the mitigation site.

7. Take of species of plants or animals listed as endangered or threatened under the California Endangered Species Act (CESA) is unlawful unless authorized by the Department. However, a CESA 2081(b) Incidental Take Permit may authorize incidental take during project construction or over the life of the project. The DEIR must state whether the project would result in incidental take of any CESA listed organisms. CESA Permits are issued to conserve, protect, enhance, and restore State-listed threatened or endangered species and their habitats. Early consultation is encouraged, as significant modification to a project and mitigation measures may be required in order to obtain a CESA Permit.

   The Department's issuance of a CESA Permit for a project that is subject to CEQA will require CEQA compliance actions by the Department as a responsible agency. The Department as a responsible agency under CEQA may consider the local jurisdiction's (lead agency) Negative Declaration or Environmental Impact Report for the project. The Department may issue a separate CEQA document for the issuance of a CESA Permit unless the project CEQA document addresses all project impacts to listed species and specifies a mitigation monitoring and reporting program that will meet the requirements of a CESA Permit.

   To expedite the CESA permitting process, the Department recommends that the DEIR addresses the following CESA Permit requirements:

   a. The impacts of the authorized take are minimized and fully mitigated;
   b. The measures required to minimize and fully mitigate the impacts of the authorized take and: (1) are roughly proportional in extent to the impact of the taking on the species; (2) maintain the applicant's objectives to the greatest extent possible, and (3) are capable of successful implementation;
   c. Adequate funding is provided to implement the required minimization and mitigation measures and to monitor compliance with and the effectiveness of the measures; and
   d. Issuance of the permit will not jeopardize the continued existence of a State-listed species.

8. The Department has responsibility for wetland and riparian habitats. It is the policy of the Department to strongly discourage development in wetlands or conversion of wetlands to uplands. We oppose any development or conversion which would result in a reduction of wetland acreage or wetland habitat values, unless, at a minimum, project mitigation assures there will be "no net loss" of either wetland habitat

values or acreage. The EIR should demonstrate that the project will not result in a net loss of wetland habitat values or acreage.

a. If the project site has the potential to support aquatic, riparian, or wetland habitat, a jurisdictional delineation of lakes, streams, and associated riparian habitats potentially affected by the project should be provided for agency and public review. This report should include a jurisdictional delineation that includes wetlands identification pursuant to the U. S. Fish and Wildlife Service wetland definition[1] as adopted by the Department[2]. Please note that some wetland and riparian habitats subject to the Department's authority may extend beyond the jurisdictional limits of the U.S. Army Corps of Engineers. The jurisdictional delineation should also include mapping of ephemeral, intermittent, and perennial stream courses potentially impacted by the project. In addition to federally protected wetlands, the Department considers impacts to wetlands (as defined by the Department) potentially significant.

b. The project may require a Lake or Streambed Alteration Agreement, pursuant to Section 1600 et seq. of the Fish and Game Code, with the applicant prior to the applicant's commencement of any activity that will substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank (which may include associated riparian resources) of a river, stream or lake, or use material from a streambed. The Department's issuance of a Lake or Streambed Alteration Agreement for a project that is subject to CEQA will require CEQA compliance actions by the Department as a responsible agency. The Department as a responsible agency under CEQA may consider the local jurisdiction's (lead agency) Negative Declaration or Environmental Impact Report for the project. To minimize additional requirements by the Department pursuant to Section 1600 et seq. and/or under CEQA, the document should fully identify the potential impacts to the lake, stream or riparian resources and provide adequate avoidance, mitigation, monitoring and reporting commitments for issuance of the agreement.

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[1] Cowardin, Lewis M., et al. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service.

[2] California Fish and Game Commission Policies: Wetlands Resources Policy; Wetland Definition, Mitigation Strategies, and Habitat Value Assessment Strategy; Amended 1994

Thank you for the opportunity to comment. Questions regarding this letter and further coordination on these issues should be directed to Mr. Steve Parmenter, Senior Biologist, at (760) 872-1123 or by email at spar@dfg.ca.gov.

Sincerely,

Steve Parmenter

for Brad Henderson
Habitat Conservation Supervisor

Attachment 1: Department's November 2009 *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities.*

cc: Department of Fish and Game
Chron, Bishop
William Condon, Renewable Energy Program, CDFG
State Clearinghouse, Sacramento

Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities

State of California
CALIFORNIA NATURAL RESOURCES AGENCY
Department of Fish and Game
November 24, 2009[1]

INTRODUCTION AND PURPOSE

The conservation of special status native plants and their habitats, as well as natural communities, is integral to maintaining biological diversity. The purpose of these protocols is to facilitate a consistent and systematic approach to the survey and assessment of special status native plants and natural communities so that reliable information is produced and the potential of locating a special status plant species or natural community is maximized. They may also help those who prepare and review environmental documents determine when a botanical survey is needed, how field surveys may be conducted, what information to include in a survey report, and what qualifications to consider for surveyors. The protocols may help avoid delays caused when inadequate biological information is provided during the environmental review process; assist lead, trustee and responsible reviewing agencies to make an informed decision regarding the direct, indirect, and cumulative effects of a proposed development, activity, or action on special status native plants and natural communities; meet California Environmental Quality Act (CEQA)[2] requirements for adequate disclosure of potential impacts; and conserve public trust resources.

DEPARTMENT OF FISH AND GAME TRUSTEE AND RESPONSIBLE AGENCY MISSION

The mission of the Department of Fish and Game (DFG) is to manage California's diverse wildlife and native plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. DFG has jurisdiction over the conservation, protection, and management of wildlife, native plants, and habitat necessary to maintain biologically sustainable populations (Fish and Game Code §1802). DFG, as trustee agency under CEQA §15386, provides expertise in reviewing and commenting on environmental documents and makes protocols regarding potential negative impacts to those resources held in trust for the people of California.

Certain species are in danger of extinction because their habitats have been severely reduced in acreage, are threatened with destruction or adverse modification, or because of a combination of these and other factors. The California Endangered Species Act (CESA) provides additional protections for such species, including take prohibitions (Fish and Game Code §2050 *et seq.*). As a responsible agency, DFG has the authority to issue permits for the take of species listed under CESA if the take is incidental to an otherwise lawful activity; DFG has determined that the impacts of the take have been minimized and fully mitigated; and, the take would not jeopardize the continued existence of the species (Fish and Game Code §2081). Surveys are one of the preliminary steps to detect a listed or special status plant species or natural community that may be impacted significantly by a project.

DEFINITIONS

Botanical surveys provide information used to determine the potential environmental effects of proposed projects on all special status plants and natural communities as required by law (i.e., CEQA, CESA, and Federal Endangered Species Act (ESA)). Some key terms in this document appear in **bold font** for assistance in use of the document.

For the purposes of this document, **special status plants** include all plant species that meet one or more of the following criteria[3]:

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1 This document replaces the DFG document entitled "Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened and Endangered Plants and Natural Communities."

2 http://ceres.ca.gov/ceqa/

3 Adapted from the East Alameda County Conservation Strategy available at http://www.fws.gov/sacramento/EACCS/Documents/080228_Species_Evaluation_EACCS.pdf

- Listed or proposed for listing as threatened or endangered under ESA or candidates for possible future listing as threatened or endangered under the ESA (50 CFR §17.12).

- Listed[4] or candidates for listing by the State of California as threatened or endangered under CESA (Fish and Game Code §2050 *et seq.*). A species, subspecies, or variety of plant is **endangered** when the prospects of its survival and reproduction in the wild are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, over-exploitation, predation, competition, disease, or other factors (Fish and Game Code §2062). A plant is **threatened** when it is likely to become endangered in the foreseeable future in the absence of special protection and management measures (Fish and Game Code §2067).

- Listed as rare under the California Native Plant Protection Act (Fish and Game Code §1900 *et seq.*). A plant is **rare** when, although not presently threatened with extinction, the species, subspecies, or variety is found in such small numbers throughout its range that it may be endangered if its environment worsens (Fish and Game Code §1901).

- Meet the definition of rare or endangered under CEQA §15380(b) and (d). Species that may meet the definition of rare or endangered include the following:

  - Species considered by the California Native Plant Society (CNPS) to be "rare, threatened or endangered in California" (Lists 1A, 1B and 2);

  - Species that may warrant consideration on the basis of local significance or recent biological information[5];

  - Some species included on the California Natural Diversity Database's (CNDDB) *Special Plants, Bryophytes, and Lichens List* (California Department of Fish and Game 2008)[6].

- Considered a **locally significant species,** that is, a species that is not rare from a statewide perspective but is rare or uncommon in a local context such as within a county or region (CEQA §15125 (c)) or is so designated in local or regional plans, policies, or ordinances (CEQA Guidelines, Appendix G). Examples include a species at the outer limits of its known range or a species occurring on an uncommon soil type.

Special status natural communities are communities that are of limited distribution statewide or within a county or region and are often vulnerable to environmental effects of projects. These communities may or may not contain special status species or their habitat. The most current version of the Department's *List of California Terrestrial Natural Communities*[7] indicates which natural communities are of special status given the current state of the California classification.

Most types of wetlands and riparian communities are considered special status natural communities due to their limited distribution in California. These natural communities often contain special status plants such as those described above. These protocols may be used in conjunction with protocols formulated by other agencies, for example, those developed by the U.S. Army Corps of Engineers to delineate jurisdictional wetlands[8] or by the U.S. Fish and Wildlife Service to survey for the presence of special status plants[9].

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4 Refer to current online published lists available at: http://www.dfg.ca.gov/biogeodata.

5 In general, CNPS List 3 plants (plants about which more information is needed) and List 4 plants (plants of limited distribution) may not warrant consideration under CEQA §15380. These plants may be included on special status plant lists such as those developed by counties where they would be addressed under CEQA §15380. List 3 plants may be analyzed under CEQA §15380 if sufficient information is available to assess potential impacts to such plants. Factors such as regional rarity vs. statewide rarity should be considered in determining whether cumulative impacts to a List 4 plant are significant even if individual project impacts are not. List 3 and 4 plants are also included in the California Natural Diversity Database's (CNDDB) *Special Plants, Bryophytes, and Lichens List.* [Refer to the current online published list available at: http://www.dfg.ca.gov/biogeodata.] Data on Lists 3 and 4 plants should be submitted to CNDDB. Such data aids in determining or revising priority ranking.

6 Refer to current online published lists available at: http://www.dfg.ca.gov/biogeodata.

7 http://www.dfg.ca.gov/biogeodata/vegcamp/pdfs/natcomlist.pdf. The rare natural communities are asterisked on this list.

8 http://www.wetlands.com/regs/tlpge02e.htm

9 U.S. Fish and Wildlife Service Survey Guidelines available at http://www.fws.gov/sacramento/es/protocol.htm

BOTANICAL SURVEYS

Conduct botanical surveys prior to the commencement of any activities that may modify vegetation, such as clearing, mowing, or ground-breaking activities. It is appropriate to conduct a botanical field survey when:

- Natural (or naturalized) vegetation occurs on the site, and it is unknown if special status plant species or natural communities occur on the site, and the project has the potential for direct or indirect effects on vegetation; or
- Special status plants or natural communities have historically been identified on the project site; or
- Special status plants or natural communities occur on sites with similar physical and biological properties as the project site.

SURVEY OBJECTIVES

Conduct field surveys in a manner which maximizes the likelihood of locating special status plant species or special status natural communities that may be present. Surveys should be **floristic in nature**, meaning that every plant taxon that occurs on site is identified to the taxonomic level necessary to determine rarity and listing status. "Focused surveys" that are limited to habitats known to support special status species or are restricted to lists of likely potential species are not considered floristic in nature and are not adequate to identify all plant taxa on site to the level necessary to determine rarity and listing status. Include a list of plants and natural communities detected on the site for each botanical survey conducted. More than one field visit may be necessary to adequately capture the floristic diversity of a site. An indication of the prevalence (estimated total numbers, percent cover, density, etc.) of the species and communities on the site is also useful to assess the significance of a particular population.

SURVEY PREPARATION

Before field surveys are conducted, compile relevant botanical information in the general project area to provide a regional context for the investigators. Consult the CNDDB[10] and BIOS[11] for known occurrences of special status plants and natural communities in the project area prior to field surveys. Generally, identify vegetation and habitat types potentially occurring in the project area based on biological and physical properties of the site and surrounding ecoregion[12], unless a larger assessment area is appropriate. Then, develop a list of special status plants with the potential to occur within these vegetation types. This list can serve as a tool for the investigators and facilitate the use of reference sites; however, special status plants on site might not be limited to those on the list. Field surveys and subsequent reporting should be comprehensive and floristic in nature and not restricted to or focused only on this list. Include in the survey report the list of potential special status species and natural communities, and the list of references used to compile the background botanical information for the site.

SURVEY EXTENT

Surveys should be comprehensive over the entire site, including areas that will be directly or indirectly impacted by the project. Adjoining properties should also be surveyed where direct or indirect project effects, such as those from fuel modification or herbicide application, could potentially extend offsite. Pre-project surveys restricted to known CNDDB rare plant locations may not identify all special status plants and communities present and do not provide a sufficient level of information to determine potential impacts.

FIELD SURVEY METHOD

Conduct surveys using **systematic field techniques** in all habitats of the site to ensure thorough coverage of potential impact areas. The level of effort required per given area and habitat is dependent upon the vegetation and its overall diversity and structural complexity, which determines the distance at which plants can be identified. Conduct surveys by walking over the entire site to ensure thorough coverage, noting all plant taxa

10 Available at http://www.dfg.ca.gov/biogeodata/cnddb

11 http://www.bios.dfg.ca.gov/

12 Ecological Subregions of California, available at http://www.fs.fed.us/r5/projects/ecoregions/toc.htm

observed. The level of effort should be sufficient to provide comprehensive reporting. For example, one person-hour per eight acres per survey date is needed for a comprehensive field survey in grassland with medium diversity and moderate terrain[13], with additional time allocated for species identification.

TIMING AND NUMBER OF VISITS

Conduct surveys in the field at the time of year when species are both evident and identifiable. Usually this is during flowering or fruiting. Space visits throughout the growing season to accurately determine what plants exist on site. Many times this may involve multiple visits to the same site (e.g. in early, mid, and late-season for flowering plants) to capture the floristic diversity at a level necessary to determine if special status plants are present[14]. The timing and number of visits are determined by geographic location, the natural communities present, and the weather patterns of the year(s) in which the surveys are conducted.

REFERENCE SITES

When special status plants are known to occur in the type(s) of habitat present in the project area, observe reference sites (nearby accessible occurrences of the plants) to determine whether those species are identifiable at the time of the survey and to obtain a visual image of the target species, associated habitat, and associated natural community.

USE OF EXISTING SURVEYS

For some sites, floristic inventories or special status plant surveys may already exist. Additional surveys may be necessary for the following reasons:

- Surveys are not current[15]; or
- Surveys were conducted in natural systems that commonly experience year to year fluctuations such as periods of drought or flooding (e.g. vernal pool habitats or riverine systems); or
- Surveys are not comprehensive in nature; or fire history, land use, physical conditions of the site, or climatic conditions have changed since the last survey was conducted[16]; or
- Surveys were conducted in natural systems where special status plants may not be observed if an annual above ground phase is not visible (e.g. flowers from a bulb); or
- Changes in vegetation or species distribution may have occurred since the last survey was conducted, due to habitat alteration, fluctuations in species abundance and/or seed bank dynamics.

NEGATIVE SURVEYS

Adverse conditions may prevent investigators from determining the presence of, or accurately identifying, some species in potential habitat of target species. Disease, drought, predation, or herbivory may preclude the presence or identification of target species in any given year. Discuss such conditions in the report.

The failure to locate a known special status plant occurrence during one field season does not constitute evidence that this plant occurrence no longer exists at this location, particularly if adverse conditions are present. For example, surveys over a number of years may be necessary if the species is an annual plant having a persistent, long-lived seed bank and is known not to germinate every year. Visits to the site in more

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13 Adapted from U.S. Fish and Wildlife Service kit fox survey guidelines available at www.fws.gov/sacramento/es/documents/kitfox_no_protocol.pdf

14 U.S. Fish and Wildlife Service Survey Guidelines available at http://www.fws.gov/sacramento/es/protocol.htm

15 Habitats, such as grasslands or desert plant communities that have annual and short-lived perennial plants as major floristic components may require yearly surveys to accurately document baseline conditions for purposes of impact assessment. In forested areas, however, surveys at intervals of five years may adequately represent current conditions. For forested areas, refer to "Guidelines for Conservation of Sensitive Plant Resources Within the Timber Harvest Review Process and During Timber Harvesting Operations", available at https://r1.dfg.ca.gov/portal/Portals/12/THPBotanicalGuidelinesJuly2005.pdf

16 U.S. Fish and Wildlife Service Survey Guidelines available at http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/docs/botanicalinventories.pdf

than one year increase the likelihood of detection of a special status plant especially if conditions change. To further substantiate negative findings for a known occurrence, a visit to a nearby reference site may ensure that the timing of the survey was appropriate.

REPORTING AND DATA COLLECTION

Adequate information about special status plants and natural communities present in a project area will enable reviewing agencies and the public to effectively assess potential impacts to special status plants or natural communities[17] and will guide the development of minimization and mitigation measures. The next section describes necessary information to assess impacts. For comprehensive, systematic surveys where no special status species or natural communities were found, reporting and data collection responsibilities for investigators remain as described below, excluding specific occurrence information.

SPECIAL STATUS PLANT OR NATURAL COMMUNITY OBSERVATIONS

Record the following information for locations of each special status plant or natural community detected during a field survey of a project site.

- A detailed map (1:24,000 or larger) showing locations and boundaries of each special status species occurrence or natural community found as related to the proposed project. Mark occurrences and boundaries as accurately as possible. Locations documented by use of global positioning system (GPS) coordinates must include the datum[18] in which they were collected;
- The site-specific characteristics of occurrences, such as associated species, habitat and microhabitat, structure of vegetation, topographic features, soil type, texture, and soil parent material. If the species is associated with a wetland, provide a description of the direction of flow and integrity of surface or subsurface hydrology and adjacent off-site hydrological influences as appropriate;
- The number of individuals in each special status plant population as counted (if population is small) or estimated (if population is large);
- If applicable, information about the percentage of individuals in each life stage such as seedlings vs. reproductive individuals;
- The number of individuals of the species per unit area, identifying areas of relatively high, medium and low density of the species over the project site; and
- Digital images of the target species and representative habitats to support information and descriptions.

FIELD SURVEY FORMS

When a special status plant or natural community is located, complete and submit to the CNDDB a California Native Species (or Community) Field Survey Form[19] or equivalent written report, accompanied by a copy of the relevant portion of a 7.5 minute topographic map with the occurrence mapped. Present locations documented by use of GPS coordinates in map and digital form. Data submitted in digital form must include the datum[20] in which it was collected. If a potentially undescribed special status natural community is found on the site, document it with a Rapid Assessment or Relevé form[21] and submit it with the CNDDB form.

VOUCHER COLLECTION

Voucher specimens provide verifiable documentation of species presence and identification as well as a public record of conditions. This information is vital to all conservation efforts. Collection of voucher specimens should

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17 Refer to current online published lists available at: http://www.dfg.ca.gov/biogeodata. For Timber Harvest Plans (THPs) please refer to the "Guidelines for Conservation of Sensitive Plant Resources Within the Timber Harvest Review Process and During Timber Harvesting Operations", available at https://r1.dfg.ca.gov/portal/Portals/12/THPBotanicalGuidelinesJuly2005.pdf

18 NAD83, NAD27 or WGS84

19 http://www.dfg.ca.gov/biogeodata

20 NAD83, NAD27 or WGS84

21 http://www.dfg.ca.gov/biogeodata/vegcamp/veg_publications_protocols.asp

be conducted in a manner that is consistent with conservation ethics, and is in accordance with applicable state and federal permit requirements (e.g. incidental take permit, scientific collection permit). Voucher collections of special status species (or suspected special status species) should be made only when such actions would not jeopardize the continued existence of the population or species.

Deposit voucher specimens with an indexed regional herbarium[22] no later than 60 days after the collections have been made. Digital imagery can be used to supplement plant identification and document habitat. Record all relevant permittee names and permit numbers on specimen labels. A collecting permit is required prior to the collection of State-listed plant species[23].

BOTANICAL SURVEY REPORTS

Include reports of botanical field surveys containing the following information with project environmental documents:

- **Project and site description**
  - A description of the proposed project;
  - A detailed map of the project location and study area that identifies topographic and landscape features and includes a north arrow and bar scale; and,
  - A written description of the biological setting, including vegetation[24] and structure of the vegetation; geological and hydrological characteristics; and land use or management history.
- **Detailed description of survey methodology and results**
  - Dates of field surveys (indicating which areas were surveyed on which dates), name of field investigator(s), and total person-hours spent on field surveys;
  - A discussion of how the timing of the surveys affects the comprehensiveness of the survey;
  - A list of potential special status species or natural communities;
  - A description of the area surveyed relative to the project area;
  - References cited, persons contacted, and herbaria visited;
  - Description of reference site(s), if visited, and phenological development of special status plant(s);
  - A list of all taxa occurring on the project site. Identify plants to the taxonomic level necessary to determine whether or not they are a special status species;
  - Any use of existing surveys and a discussion of applicability to this project;
  - A discussion of the potential for a false negative survey;
  - Provide detailed data and maps for all special plants detected. Information specified above under the headings "Special Status Plant or Natural Community Observations," and "Field Survey Forms," should be provided for locations of each special status plant detected;
  - Copies of all California Native Species Field Survey Forms or Natural Community Field Survey Forms should be sent to the CNDDB and included in the environmental document as an Appendix. It is not necessary to submit entire environmental documents to the CNDDB; and,
  - The location of voucher specimens, if collected.

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22 For a complete list of indexed herbaria, see: Holmgren, P., N. Holmgren and L. Barnett. 1990. Index Herbariorum, Part 1: Herbaria of the World. New York Botanic Garden, Bronx, New York. 693 pp. Or: http://www.nybg.org/bsci/ih/ih.html

23 Refer to current online published lists available at: http://www.dfg.ca.gov/biogeodata.

24 A vegetation map that uses the National Vegetation Classification System (http://biology.usgs.gov/npsveg/nvcs.html), for example *A Manual of California Vegetation*, and highlights any special status natural communities. If another vegetation classification system is used, the report should reference the system, provide the reason for its use, and provide a crosswalk to the National Vegetation Classification System.

- **Assessment of potential impacts**
  - A discussion of the significance of special status plant populations in the project area considering nearby populations and total species distribution;
  - A discussion of the significance of special status natural communities in the project area considering nearby occurrences and natural community distribution;
  - A discussion of direct, indirect, and cumulative impacts to the plants and natural communities;
  - A discussion of threats, including those from invasive species, to the plants and natural communities;
  - A discussion of the degree of impact, if any, of the proposed project on unoccupied, potential habitat of the species;
  - A discussion of the immediacy of potential impacts; and,
  - Recommended measures to avoid, minimize, or mitigate impacts.

QUALIFICATIONS

Botanical consultants should possess the following qualifications:

- Knowledge of plant taxonomy and natural community ecology;
- Familiarity with the plants of the area, including special status species;
- Familiarity with natural communities of the area, including special status natural communities;
- Experience conducting floristic field surveys or experience with floristic surveys conducted under the direction of an experienced surveyor;
- Familiarity with the appropriate state and federal statutes related to plants and plant collecting; and,
- Experience with analyzing impacts of development on native plant species and natural communities.

SUGGESTED REFERENCES

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Bonham, C.D. 1988. Measurements for terrestrial vegetation. John Wiley and Sons, Inc., New York, NY.

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U.S. Fish and Wildlife Service. 1996. Guidelines for conducting and reporting botanical inventories for federally listed plants on the Santa Rosa Plain. Sacramento, CA.

U.S. Fish and Wildlife Service. 1996. Guidelines for conducting and reporting botanical inventories for federally listed, proposed and candidate plants. Sacramento, CA.

Van der Maarel, E. 2005. Vegetation Ecology. Blackwell Science Ltd., Malden, MA.

DEPARTMENT OF TRANSPORTATION
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500 South Main Street
Bishop, CA 93514
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Flex your power!
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April 19, 2011

File: 09-FED
NOI/NOP
SCH #: 2011041008

Bernadette Lovato, Field Manager
Bureau of Land Management (BLM)
351 Pacu Lane, Suite 100
Bishop, California 93514

Jan Sudomier
Great Basin Air Pollution Control District (GBUAPCD)
157 Short Street
Bishop, California 93514

Dear Ms. Lovato and Ms. Sudomier:

Casa Diablo Geothermal IV - Notice of Intent/Preparation of an Environmental Impact Report/Environmental Impact Statement (EIR/EIS)

The California Department of Transportation (Caltrans) appreciates the opportunity to comment on the geothermal power project, for which the BLM and GBUAPCD are Lead Agencies, located near US-395 and State Route 203 (SR-203). We interacted with project proponents last year. We offer the following regarding environmental analysis and design.

- SR-203 Recycled Water Pipeline - In March 2011 we had provided comments for the route currently shown. The Caltrans permitting process would be simplest if the Mammoth Community Water District (a public utility) was the owner/operator (e.g. permitee) of the water line, instead of a private utility company (i.e. ORMAT). ORMAT could be the permitee, but Caltrans Headquarters involvement/approval would be required via the exception process.

  Although ground has already been disturbed closer to the highway shoulder, the pipeline must be located farther from the highway - near the edge of the right-of-way (R/W). This ensures the pipe would not impede any future highway work/maintenance. However, such a location could trigger more environmental clearance and have some terrain challenges (hill/rocky outcrops, etc.).

  A transverse Caltrans encroachment (via bore and jack) for SR-203 would be required.

- US-395 Recycled Water and Well Pipelines - For the transverse crossing under US-395, the design, permitting and construction (bore and jack) would be similar to what was done for the existing pipeline. A new encroachment permit would be required.

- All work within State R/W shall be to Caltrans standards under encroachment permit. You may contact Mark Reistetter, our Encroachment Permit Engineer at (760) 872-0674 or mark.reistetter@dot.ca.gov. Also see:

  Caltrans Encroachment Permits page (manual - esp. chapter 600, application, etc.): http://www.dot.ca.gov/hq/traffops/developserv/permits/

  Caltrans Highway Design Manual (esp. chapter 800): http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm

We value a cooperative working relationship regarding project impacts upon State highways. If you have any questions, please call me at (760) 872-0785.

Sincerely,

Gayle J. Rosander

GAYLE J. ROSANDER
IGR/CEQA Coordinator

c: State Clearinghouse
Steve Wisniewski, Caltrans

California Regional Water Quality Control Board
Lahontan Region

Linda s. Adams
Acting Secretary for Environmental Protection

Victorville Office
14440 Civic Drive, Suite 200, Victorville, California 92392-2306
(760) 241-6583 • Fax (760) 241-7308
http://www.waterboards.ca.gov/lahontan

Edmund G. Brown Jr.
Governor

FAX TRANSMITTAL PAGE

DATE: May 9, 2011

TO: **JAN SUDOMIER**

ORGANIZATION: GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

PHONE NO: 760-872-8211

FAX NO: 760 872-6109

FROM: CHRISTY HUNTER **PHONE:** 760 241-7373

SUBJECT: COMMENTS - NOTICE OF PREPARATION FOR THE CASA DIABLO IV GEOTHERMAL DEVELOPMENT PROJECT OF AN ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT, MONO COUNTY, STATE CLEARINGHOUSE NO. 2011041008

No. of pages, including cover sheet: - 5 -

_____ PER YOUR REQUEST
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COMMENTS:

x: Forms/ FAX FRM

California Regional Water Quality Control Board
Lahontan Region

Linda S. Adams
Acting Secretary for Environmental Protection

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Edmund G. Brown Jr.
Governor

May 9, 2011

File: Environmental Doc Review
Mono County

Jan Sudomier
Great Basin Unified Air Pollution Control District
157 Short Street
Bishop, CA 93514-3537

COMMENTS - NOTICE OF PREPARATION FOR THE CASA DIABLO IV GEOTHERMAL DEVELOPMENT PROJECT OF AN ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT, MONO COUNTY, STATE CLEARINGHOUSE NO. 2011041008

California Regional Water Quality Control Board, Lahontan Region (Water Board) staff received a Notice of Preparation (NOP) of an environmental document for the above-referenced project (Project) on April 5, 2011. The Great Basin Air Pollution Control District will be the lead agency and preparer of the environmental document pursuant to the California Environmental Quality Act (CEQA). The U.S. Bureau of Land Management (BLM), Bishop Office, will be the lead agency and the U.S. Forest Service will be the Cooperating Agency pursuant to the National Environmental Policy Act (NEPA), as amended. The resulting environmental document is anticipated to be a joint Environmental Impact Report (EIR) and Environmental Impact Statement (EIS) to satisfy the requirements of CEQA and NEPA, respectively.

Water Board staff provide the following comments in compliance with CEQA Guidelines, California Code of Regulations (CCR), title 14, section 15096, which requires responsible agencies to specify the scope and content of the environmental information germane to their statutory responsibilities. We request that the following comments be addressed and incorporated into the draft and final environmental documents prepared for the Project.

Project Description

As summarized, the Project involves building and operating a geothermal power plant (with a net power output of about 33 megawatts), a motive fluid system that uses a motive fluid (isopentane) and storage vessels (9,000 to 12,000 gallons), an air cooling system, a reverse osmosis (RO) water treatment facility and storage tank (treatment of geothermal brine for reuse), eighteen geothermal wells, associated geothermal pipelines, and a reclaimed wastewater pipeline. This Project also includes decommissioning of the power plant following the plants' 30-year operation. The air cooling system would rely on dry cooling during most months; however an evaporative assist system would also be used during the warmer months. The evaporative assist system would involve spraying air-cooled condensers with either recycled water from the Mammoth Community Water District (MCWD) wastewater treatment plant, or treated brine (geothermal brine). Recycled wastewater would be piped from the MCWD plant through a pipeline.

The Project would be located on public land managed by the BLM on leases No. CA-11667 and CA-11667A and in sections 29 and 32, Township 3 South, and Range 28 East MD Base and Meridian. This site is east of U.S. Highway 395 at State Route 203, about two miles east of the Town of Mammoth Lakes in Mono County.

Basin Plan

State law assigns responsibility for protection of water quality in the Lahontan Region to the Lahontan Water Board. The *Water Quality Control Plan for the Lahontan Region* (Basin Plan) contains policies that the Water Board uses with other laws and regulations to protect water quality within the region. All surface waters are considered waters of the State, which include, but are not limited to, drainages, streams, washes, ponds, pools, or wetlands, and may be permanent or intermittent. All waters of the State are protected under California law. Additional protection is provided for waters of the United States (U.S.) under the Federal Clean Water Act (CWA). For Project activities that involve alteration, dredging, filling, and/or excavating activities in waters of the State, such activities may constitute a discharge of waste[1], as defined in California Water Code (CWC), section 13050, and could affect the quality of waters of the State.

The EIR should provide an analysis of potentially significant impacts to all drainages, wetlands, surface waters of the State, waters of the U.S., or blue-line streams in and around the Project. Activities associated with this project should also be evaluated with respect to potential impact to groundwaters beneath the Project as a result of well installation activities and plant operation. Impacts to surface water bodies should be evaluated with regard to changes in channel form, flow regime, and sediment supply, as appropriate. Mitigation measures must be identified and discussed in the environmental document. The evaluation should also consider the cumulative impact of in-stream filling with regard to down stream development. For more information, please see the Basin Plan, which can be accessed through our website at http://www.waterboards.ca.gov/lahontan.

We request that the environmental documents reference the Basin Plan in the water quality impact analysis for the Project and require that the Project proponent comply with all applicable water quality standards and prohibitions, including provisions of the Basin Plan.

[1] "Waste" is defined in the Basin Plan to include any waste or deleterious material including, but not limited to, waste earthen materials (such as soil, silt, sand, clay, rock, or other organic or mineral material) and any other waste as defined in the California Water Code, section 13050(d).

Low-Impact Development

The foremost method of reducing impacts to watersheds from development is "Low Impact Development" (LID), the goals of which are to maintain a landscape functionally equivalent to predevelopment hydrologic conditions and to minimize generation of non-point source pollutants. LID results in less surface runoff and potentially less impacts to receiving waters, the principles of which include:

- Maintaining natural drainage paths and landscape features to slow and filter runoff and maximize groundwater recharge;
- Reducing the impervious cover created by development and the associated transportation network; and,
- Managing runoff as close to the source as possible.

Planning tools and manuals to implement the above principles are readily available to provide specific guidance regarding LID.

Permitting Requirements

If this Project involves land disturbance of more than 1.0 acre in aerial extent, then the Project proponent must develop a Storm Water Pollution Prevention Plan (SWPPP) and obtain a National Pollutant Discharge Elimination System (NPDES) General Construction Storm Water Permit and/or NPDES General Industrial Storm Water Permit (for commercial projects). For activates that involve discharge of fill material in water bodies, then water quality certification for federal waters; or Waste Discharge Requirements for non-federal waters may be required. Waters of the State or waters of the U.S. may be permanent or intermittent. Waters of the State may include waters determined to be isolated or otherwise non-jurisdictional by the USACE.

We request that appropriate sections of the environmental documents be revised to reflect the potential permitting requirements, as outlined above. Information regarding these permits, including application forms, can be downloaded from our website at http://www.waterboards.ca.gov/lahontan.

Recycled Wastewater Reuse

The Project would include using recycled wastewater in the evaporative cooling process of the power plant. Environmental impacts from this use should evaluate health impacts to site workers and off-site overspray from these activities. Also please note that the current State of California Water Recycling Criteria (adopted in December 2000) require the submission of an engineering report to the California Regional Water Quality Control Board (RWQCB) and the Department of Health Services (DHS) before recycled water projects are implemented. These reports must also be amended prior to any modification to existing projects. The purpose of an engineering report is to describe the manner by which a project will comply with the Water Recycling Criteria. The Water Recycling Criteria are contained in Sections 60301 through 60355, inclusive, of the California Code of Regulations, Title 22.

Please note that obtaining a permit and conducting monitoring does not constitute adequate mitigation. Development and implementation of acceptable mitigation is required.

Thank you for providing Water Board staff with the opportunity to review and comment on this document. If you have any questions or need more information, please contact me at (760) 241-7373 or chunter@waterboards.ca.gov, or Patrice Copeland, Senior Engineering Geologist at (760) 241-7404 or pcopeland@waterboards.ca.gov.

Sincerely,

Patrice J. Copeland

for: Christy Hunter, P.G.
Engineering Geologist

cc: State Clearinghouse

CH\rc\U:\CEQA\draft_CasaDiabloGeo_NOP_EIRApril2011ch.doc

MAMMOTH COMMUNITY WATER DISTRICT
Post Office Box 597
Mammoth Lakes, California 93546
(760) 934-2596 ext. 222
Website: www.mcwd.dst.ca.us

May 10, 2011

Great Basin Unified Air Pollution Control District
Attention: Ms. Jan Sudomier
157 Short Street
Bishop, CA. 93514

Dear Ms. Sudomier,

The Mammoth Community Water District (MCWD) is submitting the following scoping comments for the ORMAT Casa Diablo VI Development Project (Project), in response to the federal Notice of Intent published March 25, 2011. MCWD is responsible for safe, reliable, affordable water supply to the community of Mammoth Lakes and the surrounding area. MCWD provides municipal drinking water supply, wastewater collection and treatment, and recycled water supply services within its service area. Our primary areas of concern regarding the resource studies (scoping) and Project alternatives involve potential impacts to regional hydrology and groundwater resources, and the potential benefits to both the Project owner and the local community from the use of recycled water as a component of the Project alternatives. This letter provides comments on scoping and Alternatives below.

Resource Categories for Analysis, Project Linkage, and Potential Impacts of Concern

Hydrology and Water Quality

Groundwater hydrology: Based on the approximately 200% increase in power production noted in the Project Description (NOI/NOP), the project is expected to result in a proportional increase (with some-setting reductions through more efficient power plant design) in the extraction and re-injection of a large volume of geothermal brine from the deep layers of the Mammoth Groundwater Basin. This level of pumping and re-injection, in differing areas of the aquifer, has the potential to cause negative impacts by changes in hydraulic head between upper and lower aquifer layers. This in turn could cause changes in water quality and water supply availability to MCWD water supply wells which operate in the upper (approximately 700 feet) layers of the aquifer. The MCWD groundwater wells are a critical part of the current and long term water supply for the community of Mammoth Lakes. Questions to be addressed should include:

- Do pubic and proprietary ORMAT monitoring data show a potentially significant interaction between the aquifer levels under current conditions? What changes in inter-action, both qualitative and quantitative, will occur from the long term increase in brine pumping and re-injection?
- Are the geothermal reservoir computer simulation model boundary conditions for the upper aquifer consistent with those of the District's groundwater simulation model developed in 2009? Are the models consistent in terms of mass balance, vertical hydraulic conductivity, upper/lower aquifer boundary conditions, and primary recharge and extraction mechanisms?
- Under sustained multi-year drought, will the contributing upper aquifer zones' decreased recharge to the thermal reservoir, combined with the large increase in brine pumping, cause inter-annual head changes that result in lowering of the overlying upper aquifer heads and water supply well pumping levels?
- Will there be independent technical review to support conclusions presented by the project owner's contracted or in-house technical specialists regarding impacts to groundwater hydrology? MCWD believes that this could be achieved by having the respective technical staff of the USGS, BLM, and USFS who support the Long Valley Hydrologic Advisory Committee (LVHAC) provide this independent review.
- Will the final location / selection of the 16 potential extraction / re-injection well sites influence the changes to the upper aquifer in the context of the above questions? Will the modeling analysis consider through Monte-Carlo or similar uncertainty / sensitivity analysis, optimization analysis, or similar methods the long term differences in impacts of the final extraction / injection site locations, out of the 16 possible locations?
- What design, construction, and permitting standards will be followed for abandonment of monitoring, production, and injection wells to ensure there is not vertical "cross connection" between the aquifer layers which would negatively impact municipal water supply and / or shallow groundwater interactions with surface water features?
- Assuming about 1 MG per day of consumptive extraction from the use of Reverse Osmosis (RO) brine supply for cooling water supply, what would be the impact of extracting 300 to 400 ac-ft per year from the geothermal reservoir, compared to the current "zero net extraction" practice under ambient cooling only and near 100% re-injection of brine? For context, the current average annual groundwater pumping by MCWD is approximately 1,600 ac-ft. Therefore, a 25% increase in net extraction of groundwater resources would be expected with the consumptive use of brine for evaporative cooling. The impacts of this net groundwater extraction on the aquifer should be evaluated.
- Surface Water Hydrology- Based on the results of the groundwater hydrology analysis, will there be impacts to surface water features in the central and eastern portions of Mammoth Creek, due to lowered seasonal groundwater levels? Will these changes in turn impact aquatic habitat and/or water supply reliability to downstream surface water users?
- Use of Recycled Water for Hybrid Cooling- could the use of recycled water for hybrid cooling reduce the net annual geothermal brine extraction levels (for the target annual power production), and utilize the brine resource more efficiently to off-set any of the above potential impacts from net consumptive geothermal brine use? What is the quantitative impact of this use as measured by the

number of required brine extraction wells and resulting disturbance areas, and reduced parasitic loads at the power plant complex from reduced brine pumping loads and / or reduced RO treatment system power consumption?

- Use of Recycled Water for Construction- will the construction of the new wells, pipelines, power plant, and related infrastructure result in a signficant amount of consumptive water use? Can that water supply need be met through use of recycled water available from MCWD, to reduce demands on potable supply?

Greenhouse Gas Emissions and Climate Variability

Based on the future power plant's efficiency and ability to support both base and peak power demands compared to only base power generation, are there greater or lesser off-sets of carbon based power generation sources? GHG emissions, climate variability, and water supply in the Easter Sierra are firmly linked by established climate models. Can the power plant be designed and operated in a manner to maximize off-setting use of carbon emitting power sources, taking into account established patterns of regional power generation in relation to major power source types' carbon load per unit power generation (tons of GHS emission per MW-hr)? For example, the past study by Mammoth Pacific for this same power plant complex, submitted several years ago to the California Energy Commission, estimated that increased power production of 15 Giga-watt hours (GWh) from use of recycled water for hybrid cooling could offset 7,700 tons of carbon dioxide emissions annually, compared to conventional natural gas power plant emissions.

Please see the National Renewable Energy Laboratory 2011 study executive summary (*Hybrid Cooling Systems for Low Temperature Geothermal Power Production*), attached, for conclusions supporting the increased efficiency and favorable financial payback for use of hybrid cooling systems. The "project fact sheet" for the previously noted CEC/Mammoth Pacific study is also attached.

Socio-Economic Impacts

Based on the future power plant's power generation profile and revenue generation, there may be some change to the financial impact of the project through the federal royalties allocation to Mono County. MCWD is located in and serves a significant portion of the population of Mono County. The socio-economic condition of the Mono County population, and the District's service area, is potentially influenced by the socio-economic impacts of the project through its financial impacts to Mono County. Although future power revenues can only be estimated at this time, it is assumed that they have already been roughly estimated by the Project owner in order to confirm the financial viability of the Project. The responsible federal agency should evaluate the socio-economic impacts of both the overall power generation revenue estimates and the revenue sharing agreements with Mono County to determine the relative impacts of viable revenue sharing options and power generation targets related to base and peak power generation. This evaluation should consider the impacts of both peak power generation targets and base load generation targets and the related fiscal impacts to Mono County.

Again, please see the attached National Renewable Energy Laboratory 2011 study executive summary, attached, for conclusions supporting the financial payback for use of hybrid cooling systems relative to time of use (TOU) power pricing and financial benefits to the Project owner.

Project Alternatives

Regarding the scope and range of Project Alternatives, MCWD believes the following alternatives should be considered.

- Power plant use of hybrid cooling- the following options should be evaluated, each of which has the potential to significantly impact the power plant's overall efficiency and use of limited resources. These options would be expected to influence power production for a fixed level of brine pumping, or conversely, reduce brine pumping and parasitic plant loads for a fixed power output target.

    - No use of hybrid cooling, similar to existing power plant systems at the complex.
    - Seasonal use of hybrid cooling with recycled water only, during times when ambient air temperatures support water-based evaporative cooling. Up to 1 million gallons per day (1 MGD) of cooling water may be needed, based on information released to date.
    - Use of treated geothermal brine only, using RO or similar on-site treatment.
    - Use of combined RO treatment and recycled water supply.

MCWD and ORMAT have had preliminary discussions in 2009 and 2010 regarding the feasibility and benefits of recycled water use for hybrid cooling. However, the detailed technical analyses to confirm the infrastructure features, capital and operating costs, and related regulatory clearances has not been completed.

MCWD looks forward to working with the BLM, USFS, ORMAT, and the various state and local agencies in their respective efforts in support of the NEPA EIS for this Project. Please contact me at 760-934-2596 or gnorby@mcwd.dst.ca.us if you have questions or would like to discuss further any of the information presented in this letter.

Sincerely,

MAMMOTH COMMUNITY WATER DISTRICT

Gregory J. Norby
General Manager

Attachments (2)

CC: Mr. Steve Nelson
US Bureau of Land Management

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Hybrid Cooling Systems for Low-Temperature Geothermal Power Production

Andrea Ashwood and Desikan Bharathan

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

Technical Report
NREL/TP-5500-48765
March 2011

Contract No. DE-AC36-08GO28308

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Hybrid Cooling Systems for Low-Temperature Geothermal Power Production

Andrea Ashwood and Desikan Bharathan

Prepared under Task No. ARGT.0910

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

National Renewable Energy Laboratory
1617 Cole Boulevard
Golden, Colorado 80401
303-275-3000 • www.nrel.gov

Technical Report
NREL/TP-5500-48765
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NOTICE

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Acknowledgements

The authors would like to thank Dr. Chuck Kutscher, Mike Wagner, and Tom Williams of the National Renewable Energy Laboratory for their constructive comments and suggestions. This project was funded under the American Recovery and Reinvestment Act of 2009, with funding provided by Dr. Jay Nathwani, Program Manager, U. S. Department of Energy Geothermal Technologies Program.

List of Acronyms

ACC	air-cooled condenser
ACHX	air-cooled heat exchanger
C	Celsius
DCC	direct-contact condenser
EPRI	Electric Power Research Institute
Hg	Mercury
kg/s	kilograms per second
kW	kilowatt
kW/K	kilowatt per Kelvin
kWe	kilowatt electric
m^2	meter squared
MPR	market price reference
MW	megawatt
MWe	megawatt electric
MW/K	megawatt per Kelvin
NERC	North American Electric Reliability Corporation
RMOTC	Rocky Mountain Oilfield Testing Center
Pa	Pascal (metric unit for pressure)
psi	pounds per square inch
TOD	time-of-delivery
TMY	Typical Meteorological Year
UA	overall heat transfer coefficient times the heat transfer area
μm	micrometer
WCHX	water-cooled heat exchanger
W/m^2K	watt per meter squared Kelvin

Executive Summary

The overall objective of this investigation is to identify and evaluate methods by which the net power output of an air-cooled geothermal power plant can be enhanced during hot ambient conditions using minimal amounts of water.

Geothermal power plants that use air-cooled heat rejection systems experience a decrease in power production during hot periods of the day. This decrease in power output typically coincides with the time when utilities need power to address high air conditioning loads. Hybrid cooling options, which use both air and water, have been studied for this report to assess how they might mitigate the net power decrease.

Hybrid cooling options can be used in sites where some water is present for supplemental cooling, though not enough for a fully wet-cooled system. This report addresses binary power plants that use a hydrocarbon as the working fluid and utilize an air-cooled condenser (ACC) for heat load rejection. We considered two configurations to mitigate losses in power production: 1) evaporative pre-cooling of the ACC inlet air (without the use of any added heat exchanger) and 2) the use of a water-cooled condenser/heat exchanger in parallel or series with the ACC (or an air-cooled heat exchanger (ACHX)) to split the total condenser load.

Steam cycles, though not currently used in industry for low temperature geothermal resources, were also analyzed.

An indirect method of cooling, called the Heller system (which is currently not utilized in geothermal power production), was analyzed for both steam and binary plants. In the wet-cooling assisted Heller system, an ACHX is placed in series with a water-cooled heat exchanger. The Heller system can also be used with pre-cooled inlet air, though it was not explicitly studied in this analysis. This report contains analyses of the following:

1) ACC and Heller dry-cooled systems. These options were modeled for both binary and steam power plants as baseline cases. Water-assisted systems were then modeled for comparison to the baseline.

2) Systems that pre-cool the inlet air to the ACC, such as using wetted-media, fogging, and spray systems. The deluging of an ACC was also studied. These methods do not use an added heat exchanger. Since low temperature geothermal plants are typically binary cycle power plants, these analyses were only performed for the binary cycle power plants.

3) An ACC in parallel with a wet-cooled surface condenser (hybrid ACC system) was studied for both the binary and steam cycle power plants.

4) A wet-cooled heat exchanger in series with the ACHX used in the Heller system (hybrid Heller system) was analyzed for both the binary and steam cycle power plants.

In this study, we looked at using water to carry a nominal 30% of the heat rejection load from the power plant. By limiting the duration of operation with wet-assist to 1,000 hours during a year, the overall water consumption by the plant was capped at less than 3.5% of the water use in a fully wet-cooled power system.

A basic air-cooled plant requires added equipment to implement wet-assist schemes. For the various schemes, we evaluated the cost for the added equipment. We also evaluated the incremental power produced and the associated incremental revenue for these schemes. The overall benefit of the wet-assist is evaluated in terms of payback periods. The shorter the payback, the better the system is in an economic sense.

The payback periods for each system are detailed below.

Binary Systems

- Hybrid ACC System: The payback period for the hybrid ACC 125°C resource temperature plant varies from 4.5 to 4.7 years (as the water cost was varied from $0.3-$2.46 per thousand gallons). For the 158°C resource temperature hybrid ACC plant the payback periods are longer, varying from 5.7 to 6.1 years (as the water cost was varied from $0.3-$2.46 per thousand gallons).
- Hybrid Heller System: The payback for the 158°C resource temperature hybrid Heller plant varies from 3.8 to 4.0 years (as the water cost was varied from $0.3-$2.46 per thousand gallons). For the colder resource temperature plant, the payback periods are somewhat longer, ranging from 6.6 to 7.2 years (as the water cost was varied from $0.3-$2.46 per thousand gallons).
- Fogging System: The high cost of the system results in payback periods of 6.1 years (assuming a water cost of $1.38 per thousand gallons and that time-of-delivery (TOD) rates apply) for the 158°C resource temperature. The payback period for the 125°C resource temperature plant was 6.5 years (assuming a water cost of $1.38 per thousand gallons and that TOD rates apply).
- Spray System: The payback period for the 158°C resource temperature plant was 0.60 years (assuming a water cost of $1.38 per thousand gallons and that TOD rates apply). The payback for the 125°C resource temperature plant was 1 year (assuming a water cost of $1.38 per thousand gallons and that TOD rates apply).
- Deluge System: The payback period for the 158°C resource temperature deluge system plant was 0.13 years (assuming a water cost of $1.38 per thousand gallons and that TOD rates apply). The payback period for the 125°C resource temperature plant was 0.10 years (assuming a water cost of $1.38 per thousand gallons and that TOD rates apply).
- Wetted-Media System: Payback periods were 9.4 years for the 158°C resource temperature plant and 7.4 years for the 125°C resource temperature plant (assuming a water cost of $1.38 per thousand gallons and that TOD rates apply).

Steam Systems

- Hybrid ACC System: The payback period for the hybrid ACC system varies from 1.12-1.14 years (as the water cost was varied from $0.3-$2.46 per thousand gallons).
- Hybrid Heller System: The payback period from the hybrid Heller plant is 1.2-1.24 years (as the water cost was varied from $0.3-$2.46 per thousand gallons).

The payback period, however, does not tell the whole story. For each of the evaluated schemes, there are many advantages and disadvantages. One of the key considerations in our evaluation is that the wet-assist system should not interfere with the normal plant operation when the wet-assist is not operational (or needed).

With these criteria in mind, we find the following two systems as the most practical for use.

1) Pre-cooling the inlet air to the air-cooled heat rejection system using sprays. In this scheme, commercially available misting nozzles are placed in a grid in the path of the intake air. Mist eliminators are introduced downstream of the sprays to capture un-evaporated water droplets. The mist eliminators must be carefully selected to minimize air-side pressure loss. Pre-cooling of the inlet air has the potential to cool the air down close to its wet-bulb temperature with an effectiveness of about 75%. This scheme is effective in dry climates where there is a large difference between the air dry-bulb and wet-bulb temperatures. Payback for these systems was less than 2 years for both resource temperatures, assuming TOD rates are applicable.
2) Introduction of a wet-assist heat exchanger/surface condenser (hybrid ACC). In this scheme a conventional wet cooling tower is added to the system. Water from the tower takes heat away from either an added surface condenser or from the hot coolant. The tower and water streams are sized to handle about 30% of the overall heat rejection load from the plant. The other 70% of the load is carried by the air-cooled heat rejection system. This scheme uses conventional technology with readily available off-the-shelf commercial equipment. It is easy to implement. The payback period for this type of system was estimated to range from 4.5 to 6.1 years.

Considering the above two schemes, we find that the second approach requires little in terms of research and development. The first scheme, however, is suitable as a retrofit to existing air-cooled power plants. It requires evaluation of spray nozzles, manifolding, mist eliminators, and their effectiveness in actual plant operation. We propose to implement the pre-cooling inlet air approach at the air-cooled power plant currently operational at the Rocky Mountain Oilfield Testing Center (RMOTC).

Project Fact Sheet

Evaporative Cooling of Geothermal Power Plants with Recycled Water

GOAL

- Increase power production by up to 10 MWe during the summer months by utilizing evaporative cooling.

PROJECT DESCRIPTION

This project will increase power production of the combined G1/G2/G3 power plants by up to 10 MWe during the summer months by modifying the existing power plants to utilize evaporative cooling. Phase 1 testing of this project will include the evaluation of three different evaporative cooling technologies. Phase 2 of this project is the construction of permanent power plant modifications and the needed support systems to utilize evaporative cooling. Mammoth Pacific Limited Partnership (MPLP) owns and operates three geothermal binary power plants with a combined on-line power generation of 32 MWe.

BENEFITS TO CALIFORNIA

This project benefits California and electricity customers by providing increased production of up to 15 GWhs of emission free electricity per year. The increased generation will come from a clean, renewable, non-fossil fuel source. California's air quality will be improved, saving the equivalent emissions of 15,450,000 lbs., of CO_2 from a gas turbine. This increased output will not emit any sulfur or nitrogen oxide emissions.

This project will improve California's electricity reliability in the near term by 1) supplying increased power, 2) reducing consumption by lowering electrical demand, 3) reducing the state's reliance on fossil fuels; and, 4) supplying more electricity from an existing facility, mitigating environmental impacts of new plant construction. The project has the potential to supply sufficient electricity for up to 10,000 households during the hottest hours of the day. The pipeline will also supply MPLP more than 800 gpm of secondarily treated waste water during the summer months for the power plants and evaporative cooling systems.

The modification of the existing power plants is of high interest to the entire power industry and may lead to a new more efficient use of water, and construction of more efficient power plants. The demonstration of this technology can significantly increase cost/value, reliability and quality of electricity.

The project also adds value added components to geothermal power development by using power plant rejection heat. During the winter months, recycled wastewater from Mammoth Community Water District's (MCWD) will be pumped to MPLP facilities. The recycled waste water will be heated and returned as supplemental heat to the MCWD digesters. In addition, the recycled wastewater will be piped to the City of Mammoth Lakes as a heat source for district heating. District heating can reduce electrical resistive power consumption and improve local air quality.

Project construction, such as the evaporative cooling system, pipeline, building foundations, interiors, painting, landscaping, paving, grading, fencing and general labor will be done with local labor. Payroll is estimated to be slightly below $1,000,000. Local purchases of supplies and services would exceed $100,000. Tax revenues to the county would also increase.

FUNDING AMOUNT

Commission	$1,000,000
Match	$4,571,678

PROJECT STATUS

Ongoing.

FOR MORE INFORMATION

Pablo Gutiérrez S.
California Energy Commission
1516 Ninth Street, MS-43
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916-654-4663
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Mono County
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760.924.1800, fax 924.1801
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Planning Division

PO Box 8
Bridgeport, CA 93517
760.932.5420, fax 932.5431
www.monocounty.ca.gov

May 9, 2011

To: Jan Sudomier
Great Basin Air Pollution Control District
171 Short Street
Bishop, CA 93514-3537

Re: Casa Diablo IV Geothermal Development Project Notice of Preparation

Dear Ms. Sudomier:

Mono County has the following comments to make regarding the Notice of Preparation for the Casa Diablo IV Geothermal Development Project:

1) A reclamation plan will be required for the proposed power plant and pipeline;

2) Any new wells are required to be permitted by Environmental Health ; and

3) Encroachment and/or grading permits may be necessary from the Department of Public Works.

We look forward to participating as this project moves forward. Please contact me by e-mail at glefrancois@mono.ca.gov or by phone at 760 924-1810 if you have any questions.

Sincerely,

Gerry Le Francois, Principal Planner

Agenda Item 10

10-20-20

OFFICE OF THE MAYOR

Skip Harvey, Mayor

P.O. Box 1609, Mammoth Lakes, CA 93546
(760) 934-8989 x267 Fax: (760) 934-8608

May 4, 2011

Bureau of Land Management
Bishop Field Office
Attn: Casa Diablo IV Scoping Comments
351 Pacu Lane, Suite 100
Bishop, Ca 93514

To Whom It May Concern:

As an active participant and partner in the proposed Casa Diablo IV Geothermal Development Project, the Town of Mammoth Lakes submits the following scoping comments for consideration in the drafting of the NEPA/CEQA documents.

The proposed pipeline alignment, both those crossing land within the Town's Municipal Boundary and those within the Town's Planning Area have the potential to directly impact recreational opportunities. Maintaining open access to the Inyo National Forest lands is a major component in our recognition of recreation as the economic engine for our community. In light of this, the following comments are submitted:

- Options need to be included to analyze underground and at grade options for the pipelines within any alternatives presented. The Town sees both alternatives as necessary options to reduce the barriers created by the existing above ground pipeline. The Town's General Plan has specifically called out undergrounding of utilities as a desired goal.
- In analyzing above ground pipelines, overpasses or buried sections of some type at 1,000 foot intervals will be needed beyond crossings at forest service roads so that existing user paths and future trail alignments will not face barriers.
- It has been noted that where the current pipeline is buried, the winter recreational opportunities are limited due to these sections melting faster than the surrounding snow coverage, which has directly impacted both motorized and non-motorized recreation. Further, the above ground sections also melt faster, presumably due to absorbing heat. Please analyze the snow melt rate for all alternatives.
- Regardless of the location of pipe crossings, if the pipes are above ground there will be a significant impact on recreation. Visitors and residents will lose their ability to use the entire area as a whole, as the purpose of recreating in this area is not to get over the pipes to recreate on one side or the other, it's to enjoy the entire area for recreation. The goal should not be to find a way to merely cross over the pipes just to get someplace else.

- Exposed pipes potentially pose health and safety hazards to a snowmobiler, Nordic skier, motorcycle rider or trail user not familiar with the location of the pipes who may ride into a pipe or pipe well during flat light or inclement weather conditions. Please analyze needed warning signs, pipeline identifying markers and distance needed from the pipe to prevent collisions.
- Exposed pipes also need to be analyzed for the event of a pipe break or crack and the level that such a fracture could cause due to super heated steam or liquid escaping.

Operational noise issues are also of concern to our community. Please include analysis of the following:

- Operational noise at the two existing well heads is noticeable now, due to the difference between a very low background level due to the absence of any noise sources in the forest. Please analyze against the lowest possible background noise level.
- Cumulative operational noise as additional well heads are put into operation must also be analyzed in light of the surrounding recreational uses at the lowest possible background noise level.

Air Quality at the well heads is of concern for residents and visitors recreating in this area year-round.

- Please analyze options that limit the time period between drilling, construction and up until capping of the well head so that emissions are minimized.
- Also, please list all potential emissions associated with geothermal areas.

The Town also holds a Special Use Permit with the Inyo National Forest for operations at Shady Rest Park. This facility is used for activities ranging from picnics and community gatherings to organized recreational team sports. The Town will expect to be involved in identifying potential mitigations for any impacts to Shady Rest Park that may be identified through the NEPA/CEQA process.

A clear understanding and outline of the approval process for the three decision-making bodies (BLM, Inyo National Forest, Great Basin Unified Air Pollution Control District) must be presented. During the public scoping meeting in Mammoth Lakes on April 19th, the diagram provided and the consultant response to a question did not fully explain how the potential for differing preferred alternatives among these three bodies would be resolved. This is of direct importance to the Town, as one Council member sits on the Great Basin Unified Air Pollution Control District, as well as our community representation by the two Mono County Board of Supervisors members who also sit on that Board.

We also officially request that public field trips to explain the alternatives that will be outlined in the draft EIS/EIR documents be held early within the 45 day comment period which will start once the draft documents are released. This is of vital importance to our residents and recreational user groups to fully understand and be able to fully comment on the identified alternatives.

Our community is also concerned with impacts to our groundwater wells, having adequate supplies of water to support our economic interests, and proposed uses of water by the project. The Town would like to request specific analysis of the amount of water needed for cooling, the potential impact to the charging function of our aquifer, and a feasibility study for the potential use of recycled water. The analysis should also consider the potential impacts to the aquifer in general and at the immediate vicinity. We anticipate supporting the Mammoth Community Water District in any additional concerns they identify as part of our continuing liaison with this special district whose boundaries and sphere of influence encompass nearly all of the Town's Municipal boundary.

Finally, any pre-existing stipulations from prior approvals for the entire geothermal project need to be clearly stated within the draft documents. The Town understands that there might have been such stipulations either within documents prepared for the leasing and exploration phases, which need to be fully understood.

Please note that the Town has reviewed the Pre-Scoping Stakeholder Assessment prepared by Austin McInerny Consulting, November 2010, and is in agreement with the issues noted in that document. We have included sections of that report as an attachment to this letter, so that all of those comments will be part of the official record.

In later discussions throughout the community, it has been noted that impacts on summer recreation need to be more fully identified. This area is used for a variety of recreational activities ranging from passive recreation to mountain biking, hiking and running groups/camps hosted by elite athletes.

The scoping comments detailed in this letter are a result of community meetings and the Town's on-going collaboration with many of the jurisdictions involved in this project. We look forward to working towards realization of this important renewable energy project without significant impacts to our Town and community.

Sincerely,

Skip Harvey,

Mayor, Town of Mammoth Lakes

Excerpted from Casa Diablo 4 Geothermal Development Project Pre-Scoping Stakeholder Assessment – November 2010 [edited to remove references to figures in that document.]

Major Concerns

Most interviewees expressed a need for consideration of the already completed comprehensive recreation planning that considered the needs of both summer and winter visitors to the geographic area surrounding both the proposed CD-4 power plant and its ancillary facilities.

Citing the Town of Mammoth Lakes' General Plan (2007), Draft Parks and Recreation Master Plan (January 2008), and Trail System Master Plan (2009) which all lay out goals and policies directed towards providing for a comprehensive integrated trail system, individuals wonder how the proposed geothermal project might potentially hinder future opportunities and needs, as identified by the public, for the Shady Rest Park area. Interviewees stressed that the Shady Rest Park area is open to the public and consists of motorized and non-motorized trails and that Sawmill Cutoff Road is groomed and designated for motorized and non-motorized use and provides access to an extensive network of trails and there is concern regarding potential impacts to this system.

Stakeholders are very concerned that the proposed project's piping will result in impacts to current and planned trails in and around Shady Rest Park. Stakeholders from all interest groups articulated a strong need to understand the alignment of the proposed geothermal piping from production wells to the power plant and from the power plant to the individual injection wells. With both existing summer (mountain biking, hiking, and dog walking) and winter (snowmobile, cross country skiing, and snowshoeing) activities increasing, the pipe alignment has the potential to negatively affect users of the existing trails.

Moreover, a number of interests are pursuing and have desires to see enhanced winter recreation trail opportunities and facilities for all users in the area of the proposed wells. Specifically, there are concerns with locations for the proposed wells causing conflicts in an open area, as cross country skiers do not have to follow signed trails.

Recreation interests share concerns with how the snowplowing was conducted last winter season and would like to see improvements in the future if this activity is to be included in proposed project. According to some interviewees, the snow removal along and at the end of the access road to Shady Rest Park caused both dangerous situations for snowmobilers and parking challenges for larger vehicles. Conversely, a few respondents stated that the plowing provided for increased separation between snowmobilers and quiet sport enthusiasts and they would like to see more of this. One interviewee stated that extension of the plowed road to the test wells made access to the territory to the northeast more difficult and that it was also challenging for skiers to access the blue diamond trails that go up the knolls.

Recreation interests are concerned that the CD-4 proposed transmission pipes will force increased mixing of various user groups and produce undesirable conflicts. Shady Rest is seen as a key area of user conflict and some interviewees expressed a desire for greater separation of motorized and non-motorized uses. As stated in the Trail System Master Plan, a number of interviewees expressed their belief that separation of users was seen as a key way to have everyone's needs equitably and aesthetically met. As part of this discussion, some expressed a desire for increased discussion and consideration of possible new and expanded motorized staging areas at various locations near Shady Rest Park as well as concerns regarding the tunnel near the present courthouse construction site that provides connectivity between the north and south sides of Highway 203.

Potential future land-use changes in proposed project area raise concern. The Town of Mammoth Lakes Boundary extends beyond the Urban Growth Boundary and covers an area of approximately 25 square miles. The area within the Town Boundary, but outside the UGB includes Shady Rest Park. While the majority of the land in this area is administered by the U.S. Forest Service, the Town's General Plan does consider possible future annexation of lands within the larger planning area and, thus, there is concern about proposed uses in these areas (Goal L.6). As one interviewee observed, "we do not want to pre-empt the best use and design of the area by allowing this project before the needs of the community are taken into account."

Participants question the cumulative effects from increased water use that the CD-4 Project will require. Stakeholders are unclear as to how much water will be required for the proposed CD-4 Plant and where this water will come from. In addition, the interaction between the thermal aquifer and the somewhat shallower cool water aquifer is not well understood and increased groundwater pumping could affect the shallower aquifer which provides a significant amount of the Town's water.

Stakeholders would like to see enhanced water management integrated into the overall planning considerations for the CD-4 Project. Many interviewees stressed that the CD-4 Project might provide an opportunity to use reclaimed water from Mammoth Community Water District instead of relying on groundwater pumping. Additionally, some wondered if the project might be able to provide heat at a reduced cost to certain buildings within the Town of Mammoth Lakes.

Need for regional look at renewable energy resources. Environmental and energy interests agree that renewable energy resources should be explored and utilized to the greatest extent practicable, but question the pace at which various efforts are currently being pursued in the Eastern Sierra region. Stating that several proposals are currently winding their way through the review and approval process, a couple interviewees wondered how the CD-4 Project fits within the context of the larger region and how this would be explored in the forthcoming NEPA/CEQA process. What are the potential cumulative effects resulting from the various projects if they were all implemented?

Information Gathering and Data Analysis

Participants were asked about technical information needed to facilitate a comprehensive public review of the proposed project. While all interviewees understood that the NEPA/CEQA environmental review process must disclose and evaluate potential impacts to a standard list of resource topics, a few participants expressed keen interest in a range of questions, highlighted below.

- What might the impacts from the increased geothermal production be on the Long Valley Caldera? Citing previous hydrologic studies undertaken by the Long Valley Hydrologic Advisory Committee Monitoring Program, one interviewee noted that decreases in thermal-spring discharge at sites within about 5 km to the east of Casa Diablo were determined to be caused by subsurface pressure declines at the geothermal well field. This study apparently also detected an increase in steam discharge at Casa Diablo and sites farther west due to increased boiling in the geothermal reservoir caused by geothermal production.
- What role with the Long Valley Hydrologic Advisory Committee play in developing and reviewing the water related needs of the proposed project?
- Exactly how much water will be required and where will needed water for the CD-4 Project come from? What is the potential for increased use of recycled water?
- How is wastewater from the CD-4 going to be being handled?
- How would decommissioned wells and the surrounding lands be restored?
- What are the potential visual/aesthetic impacts resulting from construction of the new CD-4 plant and the supporting facilities? Will the plant be visible from Highway 395?
- Exactly how large are the well pads and what will the proposed facilities look like? Will the transmission pipes be run underground?
- What is the timing of and impacts resulting from necessary construction?

- Will there be any increased noise resulting from either construction or plant operations?
- Will there be any air quality impacts resulting from either construction or plant operation?
- Will the project produce any greenhouse gases?
- What cultural resources and practices might be disturbed by the placement of the proposed plant and pipelines? How will tribal interests be involved in construction monitoring?
- What flora and fauna exist in the proposed developed areas and what are the proposed mitigations for any impacts to these species? Are sage grouse present in any of the areas?
- Does the proposed project present any impacts to public roads, including Highway 395?
- Might the proposed plant be able to provide heat for general use within the Town of Mammoth Lakes?
- What level of increased fire protection and emergency response services will be required as a result of the proposed CD-4 project?
- How might the project be affected by earthquakes and is there any chance that the increased geothermal extraction could cause an earthquake?
- Will there be any increase in surface water runoff from any of the proposed project facilities and, if so, what will be done to protect receiving waters and the surrounding lands? What is the direct effect on Mammoth Creek?
- What is the proposed snowplowing program to access the new facilities and how will this impact winter recreationalists? Will a contingency plowing program/funding be established in case Ormat ceases to plow?
- Will the project include any improvements to the Shady Rest Park? What are the anticipated levels of future recreation use in the impacted areas?
- What role is the Town of Mammoth Lakes and Mono County playing in the review of the project?

Interviewees' Suggestions

In response to questions aimed at learning what stakeholders could offer to help enhance the likelihood of successfully reviewing and implementing the proposed project, a number of useful ideas were raised, including:

- Interviewees asked for an open and collaborative process aimed at developing a comprehensive recreation plan for Shady Rest Park that provides for the many differing recreational needs. One recommended related idea is to develop motorized recreation staging at the north side of Shady Rest and non-motorized to the south side while snowplay could occur on the site of the actual park.

- There is a strong desire from all participants to see a comprehensive snow removal program that increases parking opportunities as well as provides for increased "line of sight" at crossing of the plowed routes.
- Some suggested that the community has a need for education to raise awareness about the benefits of geothermal power so concerned parties can understand what might be achieved by successfully implementing the proposed project.
- Share technical information early to help build understanding as to any potential impacts and how these have been evaluated and would be mitigated.
- Involve and expand membership of the Long Valley Hydrologic Advisory Committee in undertaking relevant analysis to estimate potential impacts to Long Valley Caldera.
- Get interested parties involved early, seek consensus and compromise. Consider undertaking a sub-regional planning effort for Shady Rest similar to what was completed for the Sherwins Area and is being initiated for the Lakes Basin area.
- Need for more outreach to engage the community and ensure participation at all future public meetings.
- Help interested parties understand technical findings and analysis by providing easy to comprehend materials.

From:	john walter
To:	CasaDiabloScoping
Subject:	Casa Diablo IV Geothermal Development Project
Date:	05/09/2011 03:33 PM
Attachments:	Scoping for Shady Rest Park area-2.doc Scoping for Shady Rest Park area-2.pdf

Attached are the scoping comments from the Advocates for Mammoth on the Casa Diablo IV Geothermal Development Project. We Will Follow up with a hard copy by snail mail. One of the files is MS Word and the other PDF- same content. If you have any trouble with the files or have any questions feel free to contact me at 760-934-1767 or at Salt1143@gmail.com.   John Walter   Chairperson AfM

ADVOCATES FOR MAMMOTH
PO BOX 2005 MAMMOTH LAKES CA 93546

May 9, 20ll

Bureau of Land Management
Bishop Field Office
351 Pacu Lane
Bishop, CA 93514

Attn. Casa Diablo Scoping Comments

To Whom it May Concern:

The Advocates for Mammoth is an informal organization with an emailing list of about 700 Mammoth Lakes residents and second home owners. We are dedicated to trying to preserve the quality of life for the residents and second home owners while keeping Mammoth a welcoming place for our visitors. In the past we have worked closely with the Town on zoning and planning issues with an emphasis on smart growth and strong citizen involvement in planning issues. The proposed Casa Diablo IV project has the potential to strongly impact the Town of Mammoth Lakes, hopefully for the better but possibly for the worse. We are therefore pleased to be able to offer the following scoping comments on the proposed Casa Diablo IV project.

One of the focal points for the resident's and second home owner's recreation the year around is the Shady Rest Park and the area around it. The park itself is used for a host of organized sports, principally soccer and baseball, and unorganized activities, such as skateboarding and picnicking. On a typical weekend day the number of people participating and watching must number in the many hundreds and over the course of the year they must reach the high five digits. Radiating out from the park are roads and trails, both officially recognized and user created, that receive heavy use during all seasons of the year. Other users include cyclists, OHVs, hikers, skiers, snowshoers, snowmobilers, dog walkers, birders, animal watchers, and peace-and- quiet seeking strollers. During the winter the parking lot for the park serves as a major staging area for snowmobiles who generally exit to the north. A groomed cross country ski trail system lies to the south of the park and many groups and individuals that prefer off trail exploration exit this area to the north and east. The area is also a gateway to the forest for the users of the large Inyo National Forest Campgrounds to the south of the park. There are not many alternatives for residents and visitors who want to enjoy the public lands to the north of Mammoth Lakes since much of the northern Town boundary is privately owned with no public access.

Placing a major expansion of wells and connecting pipes into this setting represents a challenge if it is to be done without causing major impacts on the residents and visitors to Mammoth Lakes. These impacts must be fully evaluated, all reasonable alternatives considered , and meaningful mitigations adopted if there is a hope of achieving an acceptable situation of coexistence.

A good starting point would be a realistic estimation of the number of people utilizing the area for both formal and informal activities. The anecdotal data gathered by Austin McInerny Consulting is a good starting point but it should be expanded to arrive at numerical year round estimates by activity. Then meaningful alternatives or adaptations to allow for continued use and or mitigations can be planned.

Some of our specific areas of interest on the interaction of the proposed project and recreation that we think should be extensively covered in the analyses are as follows:

Pipe routing: Pipes should be designed so as not to limit access and to minimize their impact on wildlife.

Odors: Any noticeable odors from the wells and pipes would interfere with the enjoyment of the area and indicate a possible hazardous conditions.

Noise: Part of the enjoyment of an area like that around Shady Rest Park is a sense of solitude. The current background sound level should be determined as part of the determination of acceptable sound levels from the operating wells.

Recreation and Access planning: The addition of the proposed project to a recreation area with many diverse users, some of which already have conflicts (i.e. motorized vs quiet sports advocates) calls for the development of a comprehensive plan for the area, not a piecemeal approach.

Hazards to public: The large number of people utilizing the area and the proximity to the Town should demand an extremely conservative approach to potential hazards to the public safety. Our concerns include, but are not limited to well blowouts, pressurized pipe rupture, hazardous gas release, and initiation of wild fires.

Visual: An unobtrusive and attractive appearance is one the concerns most often expressed to us by citizens and second home owners.

These above comments are concentrated on the situation around Shady Rest Park, but should also be considered all along the pipelines and well fields stretching down to US 395 as this entire area is utilized for recreation.

We think that due to the extreme environmental sensitivity of the region and since Mammoth Lakes is the center of a major recreation area for the state of California, all the normal NEPA/CEQA subjects need to be completely covered, considering the well field, the pipelines and the new generating plant. It is particularly important to look at the cumulative effects of the proposed large expansion added to the continued operation of the existing plant. Wherever possible the analyses should consider the data from the many decades of operation of the existing plant and any environmental changes that have occurred during this long term operation.

As Advocates for the citizens of Mammoth Lakes we are particularly concerned with anything that would effect the quantity and quality of our water supply and impacts on our local economy. We and many others will look forward to the complete analysis and evaluation of the effects of the cumulative brine withdrawals and re-injections on the hydrology of the basin. The hot water under the Town also represents a potential valuable resource to the Town. It has potential for use as community heating, for snow melt on streets and sidewalks and/or in large hot water spas such as those in Glenwood Springs Colorado. Effects of the Project on this potential Town resource should be included in the evaluations.

We look forward to reviewing the results of the studies, particularly in the area of proposed mitigations to the conflict between the Project and the vital Town recreation area. Any significant hazard to the citizens that can not be mitigated should be considered unacceptable. We consider mitigation of any negative impacts on the potential Town use of the hot water under the town to also be a subject of high interest. If you have any questions on these scoping comments or if we can help in any way in insuring that this project is fully evaluated feel free to contact us.

Sincerely yours,

JOHN WALTER

Chair, Advocates for Mammoth

From:	MLTPA - John Wentworth
To:	cabipubcom@ca.blm.gov
Cc:	Drew Blankenbaker; Bill Taylor
Subject:	MLTPA - Comments on Casa Diablo IV Geothermal Development Project - Attention Steve Nelson
Date:	05/09/2011 10:28 PM
Attachments:	025_MLTPA_CD4_110509.zip mltpa_emaillogo.jpg

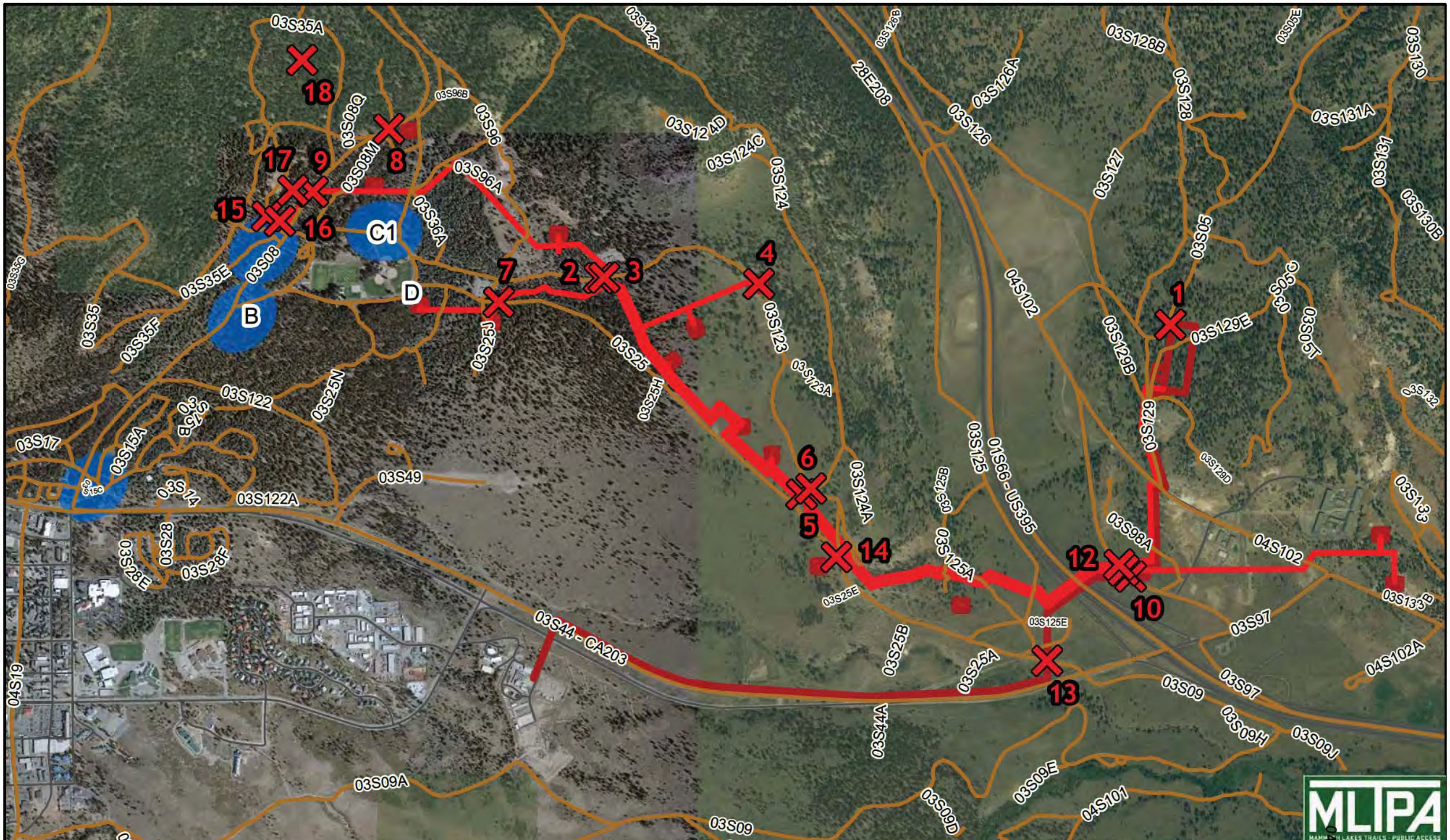
Dear BLM -

Please find attached a Zip file containing a comment letter from MLTPA (Mammoth Lakes Trails and Public Access Foundation) and three reference documents that constitute MLTPA's comments on the Cas Diablo IV Geothermal Development Project. The attached ZIP file is about 2.5 MB.

Please acknowledge receipt of this email - I will try to call in the morning as well - thanks!

john

John Wentworth
CEO/Board President
Mammoth Lakes Trails and Public Access Foundation
www.mltpa.org
(760) 934 3154 [office]
(760) 934 1279 [direct]
(213) 309 5637 [cel]



Mammoth Trails- Casa Diablo 4 Potential Recreation Conflicts Analysis

Potential Mammoth Trails Recreation Conflicts

Potential Shady Rest Motorized Staging Area Locations

CD4 Proposed Pipelines

Proposed Well and Plant Locations

Inyo National Forest Roads

Map Prepared 4/29/11

MAMMOTH TRAILS
RECREATION FOR ALL

Potential Conflict Number	Description
1	The proposed Plant site is adjacent to High sierra striders Route "Chalk Bluff Run", "Sunday Run", "Little Antelope Valley", and a Snowmobile "Unsigned Route"
2	Proposed facility crosses the High Sierra Striders "Shady Rest Park 4K Loop" and "Knolls Loop"
3	Proposed facility crosses the High Sierra Striders "Shady Rest Park 4K Loop" and "Knolls Loop
4	Proposed facility crosses the High Sierra Striders "Shady Rest Park 4K Loop" and "Knolls Loop"
5	Proposed facility crosses the High Sierra Striders "Shady Rest Park 4K Loop"
6	Proposed facility crosses the High Sierra Striders "Shady Rest Park 4K Loop"
7	High Sierra Striders "Shady Rest Park 4K Loop" and "Footloose Sports Loop" and snowmobile "unsigned route"
8	Proposed Facility crosses the High Sierra Striders "Lookout/Chalk Bluff Long Run" and snowmobile "A" and is adjacent to "Knolls Loop"
9	The proposed facility crosses the High Sierra Striders "Lookout/Chalk Bluff Long Run" as well as the Snowmobile "A" route
10	The proposed facility crosses High Sierra Striders "Geothermal short loop"
11	The proposed facility crosses High Sierra Striders "Geothermal short loop"
12	The proposed facility crosses High Sierra Striders "Geothermal short loop"
13	The proposed facility crosses High Sierra Striders "Footloose Sports Loop" and a snowmobile "unsigned route"
14	the proposed facility crosses the High Sierra Striders "Footloose Sports Loop" and snowmobile "unsigned route"
15	The proposed facility is adjacent to "Knolls Loop"
16	The proposed facility crosses TSMP Recommended Trails "Shady Rest-West"
17	The proposed facility crosses TSMP Recommended Trails "Shady Rest-West"
18	The proposed facility crosses TSMP Recommended Trails "Shady Rest-West"

MLTPA
MAMMOTH LAKES TRAILS + PUBLIC ACCESS

May 9, 2011

Bureau of Land Management
Bishop Field Office, Attn: Casa Diablo IV Geothermal Development Project
351 Pacu Lane, Suite 100
Bishop, CA 93514

Subject: Casa Diablo IV Geothermal Development Project

Dear Bureau of Land Management

On behalf of the Mammoth Lakes Trails and Public Access Foundation (MLTPA), thank you for the opportunity to provide comments at the initiation of the drafting of relevant CEQA/NEPA environmental documents regarding the proposed Casa Diablo IV Geothermal Development Project.

Shady Rest (the proposed location of the project) is home to a plethora of recreation opportunities. MLTPA is providing as comments on this initial phase of the project three documents that articulate issues that MLTPA believes should be addressed and analyzed as the project's design may be further refined in anticipation of implementation.

"Identified Potential Conflicts between proposed Casa Diablo 4 Infrastructure and Existing and Proposed Recreation Opportunities in Shady Rest" – *(2_MLTPA_CD4_ConflictAnalysis_110509) MLTPA*

> Using data collected from a variety of user groups through "Mammoth Trails", a confederation of local user groups, as well as analysis of the Town's draft "Trail System Master Plan" and other planning documents, MLTPA has produced a map and an accompanying list that identifies 18 potential conflicts between the proposed Casa Diablo 4 pipelines and infrastructure and current and future recreation opportunities in Shady Rest. The identified potential conflicts should be reviewed and analysis of the opportunities for potential mitigation measures should be undertaken so as to successfully accommodate existing and proposed future recreation activity and opportunities.

"Casa Diablo 4 Geothermal Development Project Pre-Scoping Stakeholder Asessment" – *(3_CD-4_Pre-scoping_Summary_Final) Austin McInerny Consulting*

> MLTPA believes that the "Interview Findings" section of this document is excellent documentation of a full variety of the potential issues and concerns that should be considered as the project moves forward.

MLTPA recommends that the full variety of concerns documented in this report be reviewed and considered as part of the environmental process(s) and documented as part of the public record.

"Comments from the Town of Mammoth Lakes" –
(4_TOML_DraftCD4Comments_110430.pdf) - Town of Mammoth Lakes

MLTPA has had the opportunity to review the Town's letter of comment dated May 4, 2011 as it was part of the Town Council agenda on May 4, 2011. MLTPA supports the comments made by the Town, believing that the Town's comments adequately represent the interests and needs of the community and its recreation opportunities and infrastructure. MLTPA supports the analysis and response by the project to the concerns and issues identified in the Town's letter of comment.

Many thanks for this opportunity to be involved in the initial stages of the environmental analysis of the Casa Diablo 4 project, and we look forward to participating throughout the process as draft documents are prepared and circulated for public comment.

Sincerely,

John Wentworth
CEO/Board President
Mammoth Lakes Trails and Public Access Foundation

From: Brian Knox
To: cabipubcom@ca.blm.gov; jan@gbuapcd.org
Cc: 'Kim Stravers'
Subject: Mammoth Nordic comments, re: Casa Diablo IV
Date: 05/09/2011 11:17 AM
Attachments: Casa Diablo IV comments-4.28.11.pdf

Good morning BLM & Great Basin Unified Air Pollution Control District:
May 9, 2011

Please find attached our comments concerning the proposed Casa Diablo IV Geothermal Development Project.

- Your reply to confirm receiving this email is appreciated.

Thank you, & sincerely,

Brian Knox,
Mammoth Nordic Foundation
P.O. Box 1046
Mammoth Lakes, CA 93546
760.914.2637 cel
brian@mammothnordic.com

Bureau of Land Management
Bishop Field Office
Attn: Casa Diablo IV Project
351 Pacu Lane, Suite 100
Bishop, CA 93514
760.872.5006
cabipubcom@ca.blm.gov

RE: Casa Diablo IV Geothermal Development Project

Good afternoon: April 28, 2011

On behalf of our community and our membership, thank you for the opportunity to provide comments regarding the proposed Casa Diablo IV Geothermal Development Project.

I was interviewed by Austin McInerny last fall regarding this proposal by Mammoth Pacific, L.P. and provided input for a Pre-Scoping Stakeholder Assessment Report, dated November 2010.
Since that time, more project information has become available, allowing me to be more specific in addressing our concerns.

Our primary concern is the overall degree of impact this proposal will have on Nordic recreation in the Mammoth Lakes area. Due to the very limited area designated for non-motorized winter recreation, the impact of additional wells and pipelines will, on a percentage basis of the approximately 300 acres available for our Community Nordic Trail System, seriously impact the aesthetic quality and safety of the Nordic user experience.

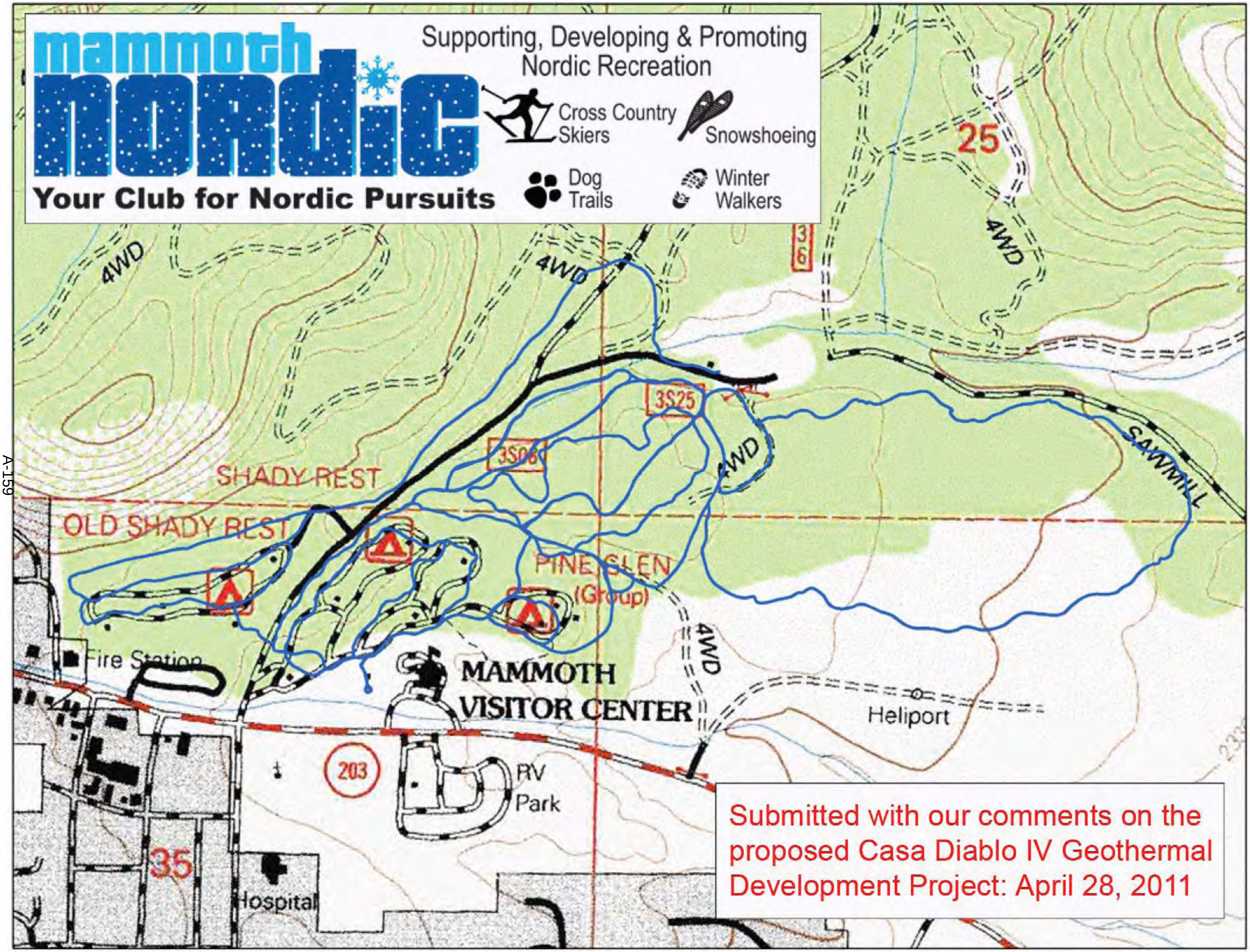
Two wells currently installed, #57-25 and #66-25, are audible and visible to XC skiers using the Nordic Trail System. Proposed wells #55-31, #35-31, #23-31, #12A-31, #81-36 and #77-25 will also impact the Nordic experience in similar ways.

More significantly, proposed wells #38-25, #50-25 and #15-25 will require re-routing several established Nordic trail alignments. The installation of pipelines will create serious limitations to the manner in which we conduct our nightly grooming operations. Above-ground pipelines create barriers that cannot be navigated around. Below-ground pipelines effectively cook the ground above them, creating low-snow conditions that make our grooming operations much more costly. The installation of pipeline infrastructure, whether above or below ground, also creates "hollow snow" conditions: a false sense of stable snowpack underneath XC skis or snowshoes that can suddenly break and cause the person to abruptly stop or fall to the pipe or ground level, seriously compromising Nordic recreation safety.

Please find included our Map of the Nordic Trail System as a reference to our comments. We appreciate the opportunity to provide our input, and trust it will lead to the best outcome for all concerned. Please feel free to contact me with any questions you may have.

Sincerely,

Brian Knox
760.914.2637 cel
brian@mammothnordic.com



Submitted with our comments on the proposed Casa Diablo IV Geothermal Development Project: April 28, 2011

From:	Malcolm Clark
To:	cabipubcom@ca.blm.gov
Subject:	Attn: Casa Diablo IV Geothermal Development Project
Date:	05/09/2011 04:26 PM
Attachments:	MP Geothermal Expansion ROLG scoping letter.pdf

To whom it may concern:

Attached are the scoping comments of the Range of Light Group, Toiyabe Chapter, Sierra Club on the Casa Diablo IV Geothermal Development Project.

I will also follow-up with a snail mail copy for your written records.

Sincerely,

Malcolm Clark, chair
Range of Light Group
Toiyabe Chapter, Sierra Club
rangeoflight.sc@gmail.com
760-924-5639

Range of Light Group
Toiyabe Chapter, Sierra Club
Counties of Inyo and Mono, California
P.O. Box 1973, Mammoth Lakes, CA, 93546
Rangeoflight.sc@gmail.com

May 9, 2011

Bureau of Land Management
Bishop Field Office
Attn: Casa Diablo IV Scoping Comments
351 Pacu Lane, Suite 100
Bishop, CA 93514

To whom it may concern:

Thank you for the opportunity to comment on the proposed Casa Diablo IV Geothermal Development project. The lack of specific details concerning the final well locations, pipeline details, and plant flow rates and mass balances makes it difficult to make many detailed recommendations on the effects of the proposed expansion on the local environment or the Town of Mammoth Lakes prime recreation area. As I am sure you are aware, both the National Organization of the Sierra Club and our local Range of Light Group are firmly committed to the development of renewable energy resources. We are equally committed to working with agencies and project developers to minimize any negative impacts of such development. While we are pleased that the proponent, BLM and INF are participating in the development of alternative non-greenhouse gas producing energy sources, we feel this proposed project raises many potential problems that should be fully evaluated and resolved before it proceeds at the scope proposed. The principal potential problems revolve around conflict with the Town of Mammoth Lakes recreation areas, potential hydrological impacts of doubling the amount of water withdrawn and reinjected into the local aquifers and conducting potentially hazardous operations in an area used for large organized youth sports activities. Use of supplemental cooling water either from MLCWD or processed brine is a new feature not fully evaluated in the past and therefore should be carefully analyzed. We hope the following scoping comments will assist you in your detailed design and analysis of the project and the preparation of the NEPA/CEQA documents. It would have been useful if there had been a site visit prior to the scoping meetings as had been held prior to past Casa Diablo Geothermal Plant Expansions. We hope that the comment sessions on the draft NEPA/CEQA documents will include site visits early in the comment period.

Hydrological Effects: The analyses, studies and recommended mitigations must take into account the continued operation of the current plant. The combination of the two plants will essentially double the amount of water withdrawn from the various aquifers and reinjected into different aquifers (if the mode of operation done at the existing plant is continued at the new facility) in addition to introducing new production wells removing water from new depths and locations. This situation should demand a complete rework and revalidation of the hydrological models used. We are particularly concerned about potential effects on stream, spring and seep flows and temperatures. In the time that the current plant has been operating, there have been specific changes in the visible activity (tree kills and vapor vents) in the Basalt Canyon area. How do these fit into the models used? The operation of the current plant has been closely followed by the Long Valley Hydrological Advisory Committee; unfortunately, much of this data and analysis is considered proprietary and is not even shared by all of the committee members. Due to the magnitude of the changes proposed (essentially doubling everything and reinjecting less water) and the collection of over 30 years of hydrological and other monitoring data, it is time for a major open review of the hydrological and environmental effects of the current plant along with the analysis of the proposed expansion. Pertinent data and studies from other facilities (Coso, Geysers, Imperial Valley etc.) should be included on critical areas such as induced earthquake activity and aquifer drawdown and recharging. Sufficient data should be made available to allow the studies, conclusions, models, designs and proposed mitigations to be independently peer reviewed. Recent questioning of the adequacy of the engineering and procedures associated with the Gulf of Mexico deep water well blowout and the fracking of natural gas wells show the wisdom of making sure everything is being done right and in an open process.

Supplemental Wet Cooling: The proposed use of supplemental water cooling raises new questions that should be carefully studied and the effects mitigated if significant. During a recent speech at the Andrea Lawrence memorial dinner the new General Manager of LADWP made a strong point that they were going completely away from wet cooling to 100% dry cooling. Casa Diablo I seems to be going the opposite direction. Why? We would like to see the following evaluated on the proposed supplemental cooling. How much water or brine will be used? What will be the capacity of the RO plant and the capacity of the recycled pipe from Town? Where will the pipe from MLCWD be run? The same comments as those in the following sections concerning the effect of pipe routing on recreation opportunities apply to the routing of supplemental water pipes. What will be the effect on the wildlife, particularly birds, if water is diverted from the Sherwin Ponds? (Take into account the water committed to future gulf courses and the conservation plans of MLCWD). What will be the visual and physical impacts of the potential plume from the supplemental cooling? If brine is used after treatment by the OS plant, less water will be injected compared to the amount of water withdrawn. What will the effect of this change be on springs, seeps, stream flows and draw down of aquifers? Please recommend appropriate mitigations for any negative impacts.

Cultural Recourses: In addition to being in close proximity to identified Native American village and obsidian quarry sites, the Basalt Canyon/Shady Rest area and the proposed new Casa Diablo plant site were used (and still may be) by the local Piaute Tribes to gather and prepare Piagi, the larva of the Pandora Moth. The local Piaute tribe should be consulted, and in addition to the State and Federal statutorily required surveys, monitoring, and mitigations it is recommended that local tribal monitors be used whenever there is vegetation clearing or ground disturbance.

Nesting Birds and other fauna: Activities that involve tree clearances and/or vegetation removal should be prohibited when there are tree or ground nesting birds or other critters nesting their young. This will be in the spring or early summer and the local Forest Service should provide guidance as to the exact timing.

Earthquakes from reinjecting water or brine: Going back to the discovery that injecting fluid into wells at Rocky Mountain Arsenal near Denver was causing earthquakes there have been scattered reports of this phenomena occurring. Since our local area has a history of earthquakes, the probability of the combination of the existing and the proposed plant precipitating an earthquake should be analyzed. Hopefully the data USGS and others have been collecting with down hole seismographs will assist this analysis.

Impacts on Town Recreation: The proposed well field and associated pipes essentially blanket a Town prime recreation area. As many others including the Town will be commenting on the specifics of these impacts we will limit our comments to the areas where we feel there may be specific interference with our Club activities and/or may cause environmental impacts. In addition to the use of this area by our members in their individual activates, we lead summer hikes and winter ski tours in the immediate area of the proposed project. These activities are advertised and are available free to the general public. Over the course of a year several hundred people participate in these activities in the immediate area of the proposed project. Unless there are frequent ways of getting over or under the pipes and across the canyons created by plowed roads used to access the wells it will be impossible for us to continue these activities as we have in the past. Frequent burial of the pipe at all potential crossing has been recommended by many. Some have suggested that these passage spots be at 1000 foot intervals. We recommend that the maximum distance between passages be 1000feet and that the intervals be closer in areas of existing roads, trails or frequent use. Separation between motorized and non-motorized use should be considered mandatory. Consideration of the effect on trail use (especially winter) should include recognition that while some trails are mainly within the project areas, others have their traditional points of departure in or near the project area in order to access more outlying areas. Also because various groups are concerned to expand the Nordic trails as part of a more comprehensive Nordic system in Mammoth and beyond, consideration should be given to impact on not just present use but possible impact on expanded Nordic system. Since the exact number and location of production wells will not be known until the test wells are completed, what is needed is a commitment by the operator to insure proper access and the establishment of an empowered user group to work out the details and monitor the operation of an access plan.

Visual: Particularly consider the impacts on the Town's prime recreation area -- drill rigs, wells, fencing, plumes from heat exchangers, pipes, plowed roads, and plowing berms all represent negative impacts on the residents and visitors recreation experience. Minimalizing these impacts should have a high priority.

Noise: Again consider particularly the impacts on the Town's prime recreation area. Quiet solitude is one of the treasured features of our forest around the proposed drill and production sites. The two new production wells have a distinct hum that penetrates the quiet particularly in winter. The drilling operations also produce noise and it appears that drilling will take place over a considerable time span. Please propose appropriate mitigations.

Odors: The smell of noxious gases not only indicates a potentially hazardous situation it detracts from the usefulness of the area as a recreation resource. Distinct odors were evident near the two new production wells this winter. The release of, detection of, and control of noxious gases from wells and pipes should be covered in the analyses and proposed mitigations.

Major Catastrophic Hazards: Although a major incident that would cause potentially catastrophic environmental effects or threats to the health and safety of the population is probably unlikely, the pristine and sensitive nature of the local environment and the close proximity to the general population, a major Town youth sports center and an area of widespread general recreation area; the worst case situations need to be analyzed, emergency procedures developed and mitigations proposed if warranted. Blowouts, poisonous gas release, earthquake rupture of pipes and wells, drill rig explosion, and hazardous materials spills should be included. The uncontrolled use of the area by OSV and OHV vehicles may represent a unique threat to the integrity of the high temperature brine pipes.

In view of the significant disruption to Town recreational possibilities even when the best efforts are made in layout of pipelines and roads, appropriate mitigation measures that offer some compensatory benefit to the residents and visitors should be implemented. These should be determined in consultation with the Town government but also in consultation with all interested user groups and individuals in the area.

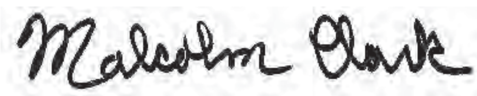
Although there is a projected life span, we realize that this span is uncertain but finite. Therefore attention should be given at this time to eventual decommissioning of the facilities. Given the impact on trail use and the visual impact in the immediate area of the Town, removal of pipelines, and restoration of well pads and roads to their pre-construction state should be ensured.

Although additional wells will be phased in over time, to minimize impact on the Town and local users it is desirable that initial construction and start of operation of the new and expanded facilities be completed within as short a time as possible. One year would be idea although the uncertainty of the winter snow season and the possible need to avoid construction in some areas during nesting times may make this unfeasible.

Specific procedures and commitments for on-going monitoring during the life of the project should be included in the final environmental documents – e.g., on water levels, recreational access, etc.

We will be happy to discuss any of these concerns in detail with you and thank you again for the opportunity to comment. Our thanks also go to Mammoth Pacific's outreach in meeting with us both individually and at one of our monthly group meetings and for the opportunity given to discuss our concerns of our members who were among those interviewed by the consultant, Austin McInerny.

Sincerely,



Malcolm Clark, chair
Range of Light Group
Toiyabe Chapter, Sierra Club
760-924-5639

From:	Malcolm Clark
Reply To:	wmalcolm.clark@gmail.com
To:	cabipubcom@ca.blm.gov
Subject:	Casa Diablo Geothermal Project
Date:	04/18/2011 02:46 PM

Please add my email contact to your mailing list for the Casa Diablo Geothermal Project. I already have the NOP (GBUAPCD) and the NOI, and intend to attend tonight's public scoping meeting.

Thank you,

Malcolm Clark
Wmalcolm.clark@gmail.com
PO Box 3328, Mammoth Lakes, CA 93546
760-924-5639

To: cabipubcom@ca.blm.gov
Attention: *Casa Diablo IV Geothermal Development Project*

Re. Casa Diablo IV Geothermal Development Project Scoping Comments

- **Submitted May 9, 2011**

Submitted by: Lisa Isaacs
Mailing Address: P.O. Box 1303, Mammoth Lakes, CA 93546
Email Address: lisaisaacs@earthlink.net

To whom it may concern,
After attending the April 18th and April 20th public scoping meetings addressing the EIR/EIS process for the above project, I have the following comments and questions for your attention and consideration:

1. Why are the proposed finished production and injection well pad areas as large as ~.4 acres each? Considering the total amount of 16 proposed well sites, what can be done to reduce the total area of permanent impacts? How can the surface area of each finished well site be reduced? Can the pad surface area be reduced and/or permeable in areas that don't support direct weight or machinery? Can gravel be used around a reduced pad area vs. paving the whole area? .4 acres per pad seems a bit large considering the use.

2. Is it necessary to disturb and negatively impact a total area of ~2.5 acres per well pad during construction? What practices can be employed to reduce this impact area?

3. What will be done to restore/mitigate the impacted construction area of each well pad once completed? Can flora and other natural materials that are disturbed, scraped and removed during construction be replaced/replanted once pad is completed? What techniques are being considered for construction area restoration?

4. What is the total length and surface area of proposed above-ground pipelines?

5. Considering the negative impacts on the local viewshed from the proposed above-ground pipelines, how will Ormat offset this impact? Can pipelines be undergrounded in areas of concentrated visual impacts, such as within the Hwy. 395 viewshed corridor, and/or in areas adjacent to concentrated recreation uses, such as near established biking, XC skiing and walking corridors and trails? If not, what will be done to mitigate and offset this negative viewshed impact?

6. Can all new necessary proposed transmission lines be undergrounded as other Mammoth Lakes power lines are, as opposed to stringing new lines?

7. Will local, qualified workforce be given preference for construction and facilities operations jobs created by proposed project? How will this be accomplished?

8. Can reclaimed/recycled water be used in cooling process vs. potable, municipal water source?

9. How will air quality impacts and potential leaks be monitored in areas surrounding wells and new power plants? Will monitoring be ongoing in real time or occasional?

10. Considering the archeological significance and richness of proposed pipeline and power plant sites, how will impacts to archeological resources be mitigated?

11. What public educational/interpretive programs and displays are planned to ‘tell the story’ to local residents and visitors alike?

12. How much money will Mono County annually receive from new project revenues if completed as proposed?

13. Considering current levels of auditory impacts created by existing Ormat geothermal facilities, how will additional, increased noise impacts be offset? What studies have been completed to access increased noise levels on local fauna? What were the findings?

14. Considering the Casa Diablo project’s large monetary value to the project proponent, Ormat, how will the local region and its residents be guaranteed to benefit from the project other than tax revenues paid to Mono County?

Thank you very much for your time and consideration. I look forward to your response.

Respectfully submitted,
Lisa Isaacs

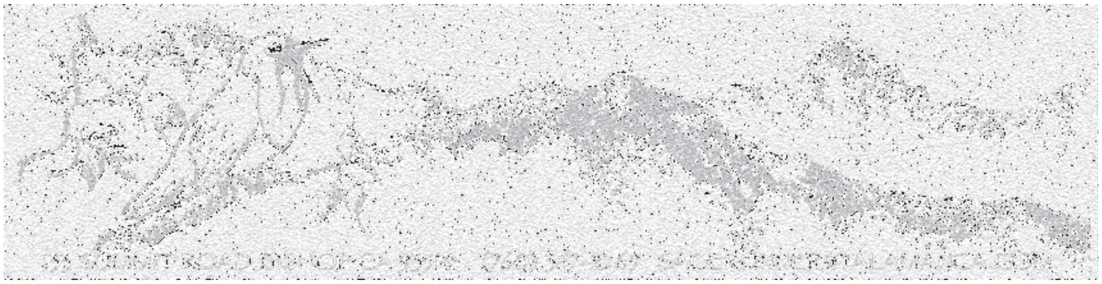
From: Agha, Mirza
To: cabipubcom@ca.blm.gov
Subject: Casa Diablo IV Project 2011
Date: 04/07/2011 08:05 PM

Dear Steven Nelson,

We are an Environmental Assessment group of students from the University of Redlands conducting a class study for your new Casa Diablo IV Geothermal Development Project (CACA 11667). If possible we would like access to the project proposal, and maps of the area. We plan to use the information to better our understanding of Geothermal Development Projects in the state of California.

Your help would be greatly appreciated,

Mirza Agha and Matthew Meuser



May 9, 2011

Ms. Bernadette Lovato
Field Office Manager
Bureau of Land Management
351 Pacu Lane, Suite 100
Bishop, CA 93514

Dear Ms. Lovato:

I strongly support the expansion of geothermal energy in the Eastern Sierra. Binary geothermal energy production is one of the most benign ways of producing energy in California and in the Eastern Sierra.

This form of energy production is most in keeping with the wild nature of our area and far surpasses wind farms on the ridges of the Eastern Sierra or a solar farm on the dry Owens Lake. Unlike these proposed wind and solar energy alternatives, Mammoth Pacific Geothermal blends into the landscape and operates almost unnoticed in the background of the Mammoth Lakes area.

While any energy production facility is going to have impacts on the area, this is the most benign alternative. I want to urge the Mono County Supervisors to consider the development of a Mule deer herd range and migration corridor mitigation fund. This fund would provide developers in or adjacent to the Mule deer winter range, summer range, and migration corridors a way to meaningfully mitigate their projects' impacts on deer mortality by funding highway fencing and undercrossings.

I also want to urge BLM and Mono County to consider other geothermal energy production sites in the County. This kind of development will provide County residents with green jobs in the future while retaining the wild and natural qualities that make the Eastern Sierra such a unique landscape.

Thank you,

Liz O'Sullivan

1

From:	Michael O'Sullivan
To:	cabipubcom@ca.blm.gov
Subject:	Casa Diablo IV Project Scoping Comments
Date:	05/09/2011 10:10 AM

BLM
Bishop Office

Hello:

The public scoping period for the Casa Diablo IV Project ends today. I would like the EIR to address impacts the project will have on the Sherwin Mule Deer herd migration corridor and what mitigations can be taken to lessen the impact on the deer herd.

Other than the deer herd issue, which I think can be mitigated, I am an enthusiastic supporter of the proposed geothermal power well field and new power plant. While I do not normally endorse industrial development on our public lands, I feel that the geothermal resources in our area should be used to maximum capacity for electrical generation. The current Mammoth Pacific geothermal well sites, pipeline, and power plant are blended into the landscape so well that most tourists are not even aware of the plant.

I will comment once the EIR is released for public comment.

Michael O'Sullivan
133 Summit Road
Bishop, CA 93514
toucan@endemic.com

From: Sysum.Scott@epamail.epa.gov
To: cabipubcom@ca.blm.gov
Subject: Mailing List
Date: 04/01/2011 06:55 AM

Hi

I would like my name added to your mailing list for the Casa Diablo IV Development Project.
Also we were wondering why you are initiating and EIS now, and what environmental documents were prepared for Casa Diablo units 1-3.

v/r
Scott Sysum

NOWCC-Energy Specialist
U.S. EPA Region IX
Environmental Review Office
75 Hawthorne Street CED-2
San Francisco, CA 94105
voice-415-972-3742; fax-415-947-3562
Email: sysum.scott@epa.gov

APPENDIX B

Recommendations for Snow Plowing on Native Surface Roads

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Best Management Practices for snow plowing on native surface roads

Compiled by Erin Lutrick, Inyo National Forest Hydrologist, August 2012
(updated February 2013)

The following is the “Snow Removal and Storage” Best Management Practice (BMP) (12.21 Exhibit 09, BMP 2.9) from the Soil and Water Conservation Handbook, Chapter 10, Water Quality Management Handbook (R5 FSH 2509.22), modified to be specific to the CD-4 access roads that will be plowed for year-round access. In this location, there is no surface water or riparian areas, so erosion of the roads and adjacent undisturbed lands are the focus of these recommendations.

Objective: Prevent or reduce erosion, sedimentation, and chemical pollution that may result from snow removal and storage activities.

Explanation: Forest roads and parking areas are sometimes used in areas that receive snow. Snow removal from these facilities may adversely affect water; aquatic, and riparian resources in several ways. Plowing may physically displace native or engineered surfaces on roads, damage drainage structures, or alter drainage patterns. Plowing may also remove protective soil cover (for example, vegetation and mulch). Further, when snow begins to melt, water can preferentially run down the road because snow berms prevent it from draining off of the road. These changes can result in concentrated flow, increased erosion, and a greater risk of sediment delivery to water bodies.

Snow piled in large heaps or in sensitive areas may contribute to increased run-off, hill slope erosion, and mass slope instability. Additionally, both snow removal and storage may result in additions of nutrients or fine aggregates used for de-icing or traction control directly to surface water and indirectly to both surface water and groundwater during runoff.

Sale administrators, contracting officer’s representatives, engineering representatives, inspectors, permit administrators, and force account crew supervisors are responsible for implementing snow removal and storage operations. The line officer is responsible for approving and assuring implementation of the snow removal plan, and the winter road maintenance plan. The risk from snow removal and storage can be managed by using the appropriate techniques from the following list adapted as needed to local site conditions.

Implementation:

Road construction and improvement

1. All roads that will be plowed, including existing roads, must have a hardened surface. Hardening includes aggregate, road base or paving. There can be no plowing on native surface roads that do not have some sort of improved and hardened surface. This will reduce erosion and road rutting.

2. Where roads are currently incised below the surrounding ground surface, they must be built up to allow for proper road drainage, to allow for outsloping, crowning, or insloping to carry water off of the road surface. Otherwise, snowmelt will concentrate on the road and lead to muddy areas and road surface degradation because the road cannot drain. Designs must be submitted to the Forest Engineers and Watershed specialists for approval.

3. For roads that run through topographic low spots, such as swales or bowls, the road will need to be constructed as a causeway, with large rocks under the road base, and geotextile fabric between the ground surface and rocks, and between the rocks and road base, to allow for water to flow freely under the road without saturating the road fill.

4. Roads should be outsloped where possible, and where topography allows. Where not possible or practical, roads should be crowned. If neither outsloping or crowning is possible, inside ditches, regularly maintained, and with sufficient sized culverts, may be used. In any of these cases, roads will be re-graded to their specified configuration/slope every spring after snowmelt, so that they continue to function as designed.

5. Roads must be constructed with rolling dips where possible, to allow for drainage off of the road surface. The rolling dip outlet may need to be armored if it discharges onto a slope, particularly a fill slope. Approximate location of rolling dips must be pre-planned and design submitted to the Forest Engineers and Watershed Specialists.

Road Maintenance

1. When re-grading roads each spring, care must be taken to keep them at their designed grade, and not lower the road grade or create berms that affect runoff. This will take more time than simply flattening the road with a grader, and may require importing fill, although proper maintenance should retain most of the existing road material and very little should be lost annually. Outsloping, crowning, or insloping must be maintained as designed.

2. Conduct frequent inspections at the earliest possible opportunity during snowmelt to ensure road drainage is not adversely affecting soil or water resources.

Snow removal practices

1. Snow to be left on road:

    If roads are plowed with loaders, bulldozers, or snowcats, at least 6 inches of snow must be left on the road, or a sufficient amount to prevent the equipment blade from disturbing the road surface. The remaining snow should be removed with a snowblower to avoid scraping the road surface. At least 3 inches of snow should remain on the road after all snow removal, even after blowing, to protect the road surface (and the snow blower). Those needing to access the well sites may need to chain up to drive the roads, even after snow removal.

2. Snow Storage:

   a. Plowed snow piles should be stored in relatively flat areas. This can usually be just off of the roadway or in pull outs. However, in the case of low lying areas, where the road is below the surrounding grade or runs through a swale or other low point, and subject to collecting water, all plowed snow should be pushed out of the low spot and to an area where it will flow away from the low spot when it melts.

   b. Portions of the road will likely have fill when they are constructed for proper drainage. Snow should not be piled (stored) on top of or directly adjacent to a fill slope.

   c. Keep snow piles away from culverts, major rolling dips, ditches, or other drainage features. These features must be marked in advance so that the plow/snow blower operator knows where they are when snow is deep. Use of a snow blower will reduce the size of piles. It is important to clear these features before major snowmelt so that runoff can drain properly rather than remaining on the road and destabilizing the road surface and associated fill.

3. Retaining Road Drainage Features:

   When plowing, construct regular openings in berms as needed to allow for road drainage over major rolling dips or other drainage features. Install snow berms where such placement will preclude concentration of snowmelt runoff and will serve to rapidly dissipate melt water. During spring snowmelt, the proponent will likely need to clean out culverts, rolling dips, waterbars, and ditches to allow for snowmelt to drain through the designed drainage features. Mark drainage structures to avoid damage during plowing.

4. Limit use of approved deicing and traction-control materials, but do not compromise in areas where safety is critical (intersections and approaches, steep segments, corners).

5. Forest Service watershed staff or designated personnel will monitor plowed roads each fall before snowfall to determine whether drainage and road condition appears adequate to protect the road from erosion in spring. They will monitor the plowed roads again during spring snowmelt to determine whether the snow removal practices and road maintenance was sufficient.

6. Modify snow removal procedures as necessary to meet erosion concerns.

7. If erosion on the roads or surrounding areas continues after implementation of BMPs, pave the entire road or portions of the road.

APPENDIX C

Air Quality and GHG

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C.1 Air Pollutant Emission Estimates

1a. Construction Emissions Summaries

Maximum Day Construction Emissions

	Maximum Day Emissions (pounds/day)					
Emissions Source	**ROG**	**NOx**	**CO**	**SO2**	**PM10**	**PM2.5**
Power Plant Construction Offroad Equipment	3	32	27	0	2	2
Power Plant Construction Onroad Vehicle	3	20	63	0	1	1
Power Plant Construction Exhaust Subtotal	7	53	90	0	3	2
Well Construction Offroad Equipment	11	206	118	0	7	6
Well Construction Onroad Vehicle	3	44	26	0	2	1
Well Construction Exhaust Subtotal	14	251	144	0	8	8
Pipeline Construction Offroad Equipment	3	32	28	0	2	2
Pipeline Construction Onroad Vehicle	2	8	31	0	0	0
Pipeline Construction Subtotal	5	40	59	0	2	2
Total Fugitive Dust	---	---	---	---	85	12
Total (maximum pounds/day)	**25**	**343**	**292**	**1**	**98**	**24**

Maximum Annual Construction Emissions

	Maximum Annual Emissions (tons/year)					
Emissions Source	**ROG**	**NOx**	**CO**	**SO2**	**PM10**	**PM2.5**
Power Plant Construction Offroad Equipment	0	2	1	0	0	0
Power Plant Construction Onroad Vehicle	0	2	6	0	0	0
Power Plant Construction Subtotal	1	4	7	0	0	0
Well Construction Offroad Equipment	1	11	7	0	0	0
Well Construction Onroad Vehicle	0	3	2	0	0	0
Well Construction Subtotal	1	14	9	0	1	0
Pipeline Construction Offroad Equipment	0	1	1	0	0	0
Pipeline Construction Onroad Vehicle	0	1	2	0	0	0
Pipeline Construction Subtotal	0	2	3	0	0	0
Total Fugitive Dust	---	---	---	---	4	1
Total (maximum tons/year)	**2**	**20**	**19**	**0**	**5**	**1**

1b. Operation and Maintenance Emissions Summaries

Maximum Day Operation and Maintenance Emissions

	Maximum Day Emissions (pounds/day)					
Emissions Source	**ROG**	**NOx**	**CO**	**SO2**	**PM10**	**PM2.5**
Power Power Plant Fugitive n-pentane	410.0	---	---	---	---	---
Off-site Vehicle Emissions	0.1	0.6	2.5	0.0	0.0	0.0
Emergency Generator and Firewater Pump*	0.1	7.9	1.2	0.8	0.2	0.2
Total (maximum pounds/day)	**410.2**	**8.5**	**3.7**	**0.8**	**0.2**	**0.2**

*Obtained from Mono County, 2012.

Annual Operation and Maintenance Emissions

	Annual Emissions (tons/year)					
Emissions Source	**ROG**	**NOx**	**CO**	**SO2**	**PM10**	**PM2.5**
Power Power Plant Fugitive n-pentane	74.8	---	---	---	---	---
Off-site Vehicle Emissions	0.0	0.1	0.4	0.0	0.0	0.0
Emergency Generator and Firewater Pump*	0.0	0.2	0.0	0.0	0.0	0.0
Total (maximum tons/year)	**74.8**	**0.3**	**0.4**	**0.0**	**0.0**	**0.0**

*Obtained from Mono County, 2012.

2. Offroad Construction Equipment Inventory

Onsite Equipment Usage for Power Plant Constructio

			For Each Phase				P 1 and II
Equipment (hp)	No.	hrs/ day	wks	days	annual hrs	max day hrs	total hrs*
Excavator (157 hp)	1	8	4	24	192	8	384
Grader (162 hp)	1	8	4	24	192	8	384
Loader (87 hp)	2	7	28	168	2,352	14	4704
Backhoe (75 hp)	1	8	4	24	192	8	384
Crane (208 hp)	1	7	28	168	1,176	0	2352
Concrete Mixer (9 hp)	2	6	28	168	2,016	0	4032
Drill Rig (82 hp)	1	8	4	24	192	8	384
Roller Compactor (84 hp)	1	8	4	24	192	8	384
Generator (84 hp)	1	8	28	168	1,344	0	2688

*It is assumed that the construction emissions for Phases I and II would be approximately the same.

Onsite Equipment Usage for Well Developmen

			Each Well Site				Maximum Day*	Max Annual hrs**	Total hrs***
Equipment (hp)	No.	hrs/ day	wks	days	annual hrs	max day hrs	hrs/day	hrs/year	hrs
Excavator (157 hp)	1	8	4	24	192	0	0	1,152	2,688
Grader (162 hp)	1	8	4	24	192	0	0	1,152	2,688
Loader (87 hp)	2	7	4	24	336	0	0	2,016	4,704
Backhoe (75 hp)	1	8	4	24	192	0	0	1,152	2,688
Drill Rig - Unit No. 1 (1,354 hp)	2	5	4	30	150	5	10	900	2,100
Drill Rig - Unit No. 2 (1,354 hp)	2	5	4	30	150	5	10	900	2,100
Drill Rig - Unit No. 3 (1,354 hp)	2	5	4	30	150	5	10	900	2,100
Drill Rig - Unit No. 4 (197 hp)	2	1	4	30	30	1	2	180	420

*The maximum day for well development assumes simultaneous drilling of two wells.

**The maximum annual emissions assume that 6 wells would be drilled per year.

***The total hours assume that 14 wells would be drilled.

Onsite Equipment Usage for Pipeline

			2013*				2014**			2015***			Total hrs
Equipment (hp)	No.	hrs/ day	wks	days	annual hrs	max day hrs	weeks	days	annual hrs	weeks	days	annual hrs	hrs
Crane (208 hp)	1	7	24	144	1,008	7	4	24	168	2	12	84	1,260
Backhoe Loader (87 hp)	2	8	24	144	2,304	16	4	24	384	2	12	192	2,880
Fork Lift (149 hp)	1	8	24	144	1,152	8	4	24	192	2	12	96	1,440
Excavator (157 hp)	1	8	2	12	96	8	0	0	0	0	0	0	96
Loader (87 hp)	1	7	2	12	84	7	0	0	0	0	0	0	84
Jack and Bore Rig (164 hp)	1	8	2	12	96	8	0	0	0	0	0	0	96

*It is assumed that the main pipelines, including the Highway 395 crossings, would be constructed in 2013.

**It is assumed that pipeline construction in 2014 would be limited to the pipeline segments associated with 6 well sites.

**It is assumed that pipeline construction in 2015 would be limited to the pipeline segments associated with 2 well sites.

Notes: Equipment types and weeks of use are based on the Project Description; equipment amounts, horsepower, hours per day, and total weeks of activity were obtained from SCAQMD, 2011, CalEEMond User's Manual Appendix D - Default Data Tables. It is assumed that the equipment would operate 5 days each week. Total hours for all well sites combined is estimated by multiplying the equipment total hours for each well site by six to represent the six well sites.

3. Maximum Day Offroad Construction Exhaust Emissions

Off-road Construction Equipment Emission Factors

Equipment	Offroad HP Range	Equipment Emission Rates (lb/hour)					
		ROG	NOx	CO	SOx	PM10	PM2.5
Excavator (157 hp)	120-175	0.055	0.627	0.666	0.001	0.031	0.029
Grader (162 hp)	120-175	0.120	1.178	0.734	0.001	0.066	0.061
Loader (87 hp)	50-120	0.066	0.516	0.415	0.001	0.045	0.042
Backhoe (75 hp)	50-120	0.044	0.396	0.353	0.001	0.032	0.029
Crane (208 hp)	175-250	0.099	1.125	0.294	0.001	0.052	0.048
Concrete Mixer (9 hp)	0-50	0.108	0.258	0.081	0.000	0.030	0.028
Drill Rig (82 hp)	50-120	0.033	0.413	0.469	0.001	0.025	0.023
Roller Compactor (84 hp)	50-120	0.056	0.489	0.406	0.001	0.037	0.034
Generator (84 hp)	50-120	0.059	0.511	0.527	0.001	0.040	0.037
Backhoe Loader (87 hp)	50-120	0.066	0.516	0.415	0.001	0.045	0.042
Fork Lift (149 hp)	120-175	0.030	0.458	0.725	0.001	0.018	0.017
Jack and Bore Rig (164 hp)	120-175	0.055	0.710	0.753	0.002	0.033	0.030
Drill Rig - Unit No. 1 (1,354 hp)	>1,000	0.360	6.840	3.900	0.009	0.225	0.207
Drill Rig - Unit No. 2 (1,354 hp)	>1,000	0.360	6.840	3.900	0.009	0.225	0.207
Drill Rig - Unit No. 3 (1,354 hp)	>1,000	0.360	6.840	3.900	0.009	0.225	0.207
Drill Rig - Unit No. 4 (197 hp)	175-250	0.033	0.622	0.567	0.002	0.033	0.030

Notes: ROG, NOx, CO, and PM10 emission factors for Drill Rig Units 1 -4 are based on Tier 2 standards with revised CARB load factors (see Table 9, Tier 2 Emission Factors). PM10 and PM2.5 emissions are based on PM emissions with PM10 and PM2.5 fractions applied to the PM EF (SCAQMD, 2006). All other emission rates were derived using Offroad2011 and Offroad2007 (for CO and Sox only

References:

SCAQMD (South Coast Air Quality Management District). 2006. Final Methodology to Calculate PM2.5 and PM2.5 Significance Thresholds, Appendix A - Updated CEIDARS Table with PM2.5 Fractions

Maximum Day Onsite Power Plant Construction Exhaust Emissions

Equipment	Total Hours	Total Emissions (pounds/day)					
		ROG	NOx	CO	SOx	PM10	PM2.5
Excavator (157 hp)	8	0.44	5.02	5.33	0.01	0.25	0.23
Grader (162 hp)	8	0.96	9.43	5.87	0.01	0.53	0.49
Loader (87 hp)	14	0.92	7.22	5.81	0.01	0.63	0.58
Backhoe (75 hp)	8	0.35	3.17	2.82	0.00	0.25	0.23
Crane (208 hp)	0	0.00	0.00	0.00	0.00	0.00	0.00
Concrete Mixer (9 hp)	0	0.00	0.00	0.00	0.00	0.00	0.00
Drill Rig (82 hp)	8	0.27	3.30	3.75	0.01	0.20	0.19
Roller Compactor (84 hp)	8	0.45	3.91	3.25	0.01	0.29	0.27
Generator (84 hp)	0	0.00	0.00	0.00	0.00	0.00	0.00
Maximum (pounds/day) =		**3.38**	**32.05**	**26.83**	**0.05**	**2.16**	**1.99**

Maximum Annual Onsite Power Plant Construction Exhaust Emissions

Equipment	Total Hours	Total Emissions (tons/year; 2013)					
		ROG	NOx	CO	SOx	PM10	PM2.5
Excavator (157 hp)	192	0.01	0.06	0.06	0.00	0.00	0.00
Grader (162 hp)	192	0.01	0.11	0.07	0.00	0.01	0.00
Loader (87 hp)	2,352	0.08	0.61	0.49	0.00	0.05	0.00
Backhoe (75 hp)	192	0.00	0.04	0.03	0.00	0.00	0.00
Crane (208 hp)	1,176	0.06	0.66	0.17	0.00	0.03	0.00
Concrete Mixer (9 hp)	2,016	0.11	0.26	0.08	0.00	0.03	0.00
Drill Rig (82 hp)	192	0.00	0.04	0.05	0.00	0.00	0.00
Roller Compactor (84 hp)	192	0.01	0.05	0.04	0.00	0.00	0.00
Generator (84 hp)	1,344	0.04	0.34	0.35	0.00	0.03	0.00
Maximum (tons/year) =		**0.31**	**2.17**	**1.35**	**0.00**	**0.16**	**0.00**

Maximum Day Onsite Well Development Construction Exhaust Emissions

Equipment	Total Hours	Total Emissions (pounds/day)					
		ROG	NOx	CO	SOx	PM10	PM2.5
Excavator (157 hp)	0	0.00	0.00	0.00	0.00	0.00	0.00
Grader (162 hp)	0	0.00	0.00	0.00	0.00	0.00	0.00
Loader (87 hp)	0	0.00	0.00	0.00	0.00	0.00	0.00
Backhoe (75 hp)	0	0.00	0.00	0.00	0.00	0.00	0.00
Drill Rig - Unit No. 1 (1,354 hp)	10	3.60	68.40	39.00	0.09	2.25	2.07
Drill Rig - Unit No. 2 (1,354 hp)	10	3.60	68.40	39.00	0.09	2.25	2.07
Drill Rig - Unit No. 3 (1,354 hp)	10	3.60	68.40	39.00	0.09	2.25	2.07
Drill Rig - Unit No. 4 (197 hp)	2	0.07	1.24	1.13	0.00	0.07	0.06
Maximum (pounds/day) =		**10.87**	**206.44**	**118.13**	**0.28**	**6.82**	**6.27**

Maximum Annual Onsite Well Development Construction Exhaust Emissions

Equipment	Total Hours	Total Emissions (tons/year; 2013)					
		ROG	NOx	CO	SOx	PM10	PM2.5
Excavator (157 hp)	1,152	0.03	0.36	0.38	0.00	0.02	0.02
Grader (162 hp)	1,152	0.07	0.68	0.42	0.00	0.04	0.04
Loader (87 hp)	2,016	0.07	0.52	0.42	0.00	0.05	0.04
Backhoe (75 hp)	1,152	0.03	0.23	0.20	0.00	0.02	0.02
Drill Rig - Unit No. 1 (1,354 hp)	900	0.16	3.08	1.75	0.00	0.10	0.09
Drill Rig - Unit No. 2 (1,354 hp)	900	0.16	3.08	1.75	0.00	0.10	0.09
Drill Rig - Unit No. 3 (1,354 hp)	900	0.16	3.08	1.75	0.00	0.10	0.09
Drill Rig - Unit No. 4 (197 hp)	180	0.00	0.06	0.05	0.00	0.00	0.00
Maximum (tons/year) =		**0.68**	**11.08**	**6.74**	**0.02**	**0.43**	**0.39**

Maximum Day Onsite Pipeline Construction Exhaust Emissions

Equipment	Total Hours	Total Emissions (pounds/day)					
		ROG	NOx	CO	SOx	PM10	PM2.5
Crane (208 hp)	7	0.69	7.87	2.06	0.01	0.36	0.33
Backhoe Loader (87 hp)	16	0.70	6.33	5.64	0.01	0.50	0.46
Fork Lift (149 hp)	8	0.24	3.66	5.80	0.01	0.14	0.13
Excavator (157 hp)	8	0.44	5.02	5.33	0.01	0.25	0.23
Loader (87 hp)	7	0.46	3.61	2.90	0.00	0.32	0.29
Jack and Bore Rig (164 hp)	8	0.44	5.68	6.02	0.01	0.26	0.24
Maximum (pounds/day) =		**2.97**	**32.17**	**27.76**	**0.06**	**1.84**	**1.69**

Maximum Annual Onsite Pipeline Construction Exhaust Emissions

Equipment	Total Hours	Total Emissions (tons/year; 2013)					
		ROG	NOx	CO	SOx	PM10	PM2.5
Crane (208 hp)	1,008	0.05	0.57	0.15	0.00	0.03	0.02
Backhoe Loader (87 hp)	2,304	0.05	0.46	0.41	0.00	0.04	0.03
Fork Lift (149 hp)	1,152	0.02	0.26	0.42	0.00	0.01	0.01
Excavator (157 hp)	96	0.00	0.03	0.03	0.00	0.00	0.00
Loader (87 hp)	84	0.00	0.02	0.02	0.00	0.00	0.00
Jack and Bore Rig (164 hp)	96	0.00	0.02	0.04	0.00	0.00	0.00
Maximum (tons/year) =		**0.13**	**1.36**	**1.06**	**0.00**	**0.08**	**0.07**

4. Construction Onroad Criteria Pollutant Emissions

Emission Factors

Vehicle Type	Units	Running Exhaust Emission Factors					
		ROG	CO	NOx	SO2	PM10	PM2.5
Light duty truck (LDT1 gas)*	g/mile	0.3900	8.9920	0.8900	0.0040	0.0080	0.0070
Light duty truck (LDT1 gas)	lb/mile	0.0009	0.0198	0.0020	0.0000	0.0000	0.0000
Heavy duty truck (T7 diesel)*	g/mile	0.4810	2.1790	8.8120	0.0170	0.3070	0.2820
Heavy duty truck (T7 diesel)	lb/mile	0.0011	0.0048	0.0194	0.0000	0.0007	0.0006

* Emission factor obtained online from EMFAC 2011, for Mono County, average model years, and average speed

Power Plant Construction - Worker and Material Delivery Trips

Vehicle Type	Trips/day	miles/trip	ROG	CO	NOx	SO2	PM10	PM2.5
Light duty truck	300	10	2.58	59.47	5.89	0.03	0.05	0.05
Heavy duty truck	30	25	0.80	3.60	14.57	0.03	0.51	0.47
Maximim Day Emissions (lbs/day)			**3.37**	**63.08**	**20.46**	**0.05**	**0.56**	**0.51**
Annual Emissions (tons/year)			**0.32**	**6.06**	**1.96**	**0.01**	**0.05**	**0.05**

Well Development Construction - Worker and Material Delivery Trips

Vehicle Type	Trips/day	miles/trip	ROG	CO	NOx	SO2	PM10	PM2.5
Light duty truck	76	10	0.65	15.07	1.49	0.01	0.01	0.01
Heavy duty truck	88	25	2.33	10.57	42.74	0.08	1.49	1.37
Maximim Day Emissions (lbs/day)			**2.99**	**25.63**	**44.23**	**0.09**	**1.50**	**1.38**
Annual Emissions (tons/year)			**0.22**	**1.85**	**3.18**	**0.01**	**0.11**	**0.10**

Pipeline Construction - Worker and Material Delivery Trips

Vehicle Type	Trips/day	miles/trip	ROG	CO	NOx	SO2	PM10	PM2.5
Light duty truck	150	10	1.29	29.74	2.94	0.01	0.03	0.02
Heavy duty truck	10	25	0.27	1.20	4.86	0.01	0.17	0.16
Maximim Day Emissions (lbs/day)			**1.55**	**30.94**	**7.80**	**0.02**	**0.20**	**0.18**
Annual Emissions (tons/year)			**0.11**	**2.23**	**0.56**	**0.00**	**0.01**	**0.01**

All trips per day are one-way trips obtained from Table 4.16-1.
The light-duty truck trips represent construction worker commute trips. Heavy duty truck trips represent material and fill haul trips
Annual emissions are estimated by multiplying the maximum day emissions by the workdays (6 workdays per week)

5. Fugitive Dust Emissions

Fugitive dust from Soil Disturbance

Construction Source	Area Disturbed (acres/day) [1]	days/year [2]	Emission Factor (pounds/acre) [3] PM10	Emissions (pounds/day) PM10	PM2.5 [4]	Emissions (tons/year) PM10	PM2.5 [4]
Power Plant	2.00	24.00	10.00	20.00	4.16	0.24	0.05
Well Development	1.00	24.00	10.00	10.00	2.08	0.12	0.02
Pipeline Construction	0.50	144.00	10.00	5.00	1.04	0.36	0.07
			Total	35.00	7.28	0.72	0.15

[1] It is assumed that up to 2, 1, and 0.5 acres per day would be disturbed during power plant, well development, and pipeline construction, respectively.

[2] Soil disturbance would occur for one month (24 days) at the power plant and well sites, and for six months related to pipeline construction (63 days).

[3] The Midwest Research Institute has derived a value of 0.11 tons/acre/month, which converts to 10 pounds per acre per day, assuming 22 workdays per month. The California Air Resources Board review has reviewed this factor and concluded that it represents PM10 emissions with watering. (CARB, 2002; http://www.arb.ca.gov/ei/areasrc/fullpdf/full7-7.pdf)

[4] PM2.5 fractions for soil disturbance and earth moving were obtained from SCAQMD, 2006.

Unpaved Road Fugitive Dust from Trucks

VMT [1] (miles/day)	days/year	Emission Factors (pounds/VMT) [2] PM10	PM2.5	Emissions (pounds/day) PM10	PM2.5	Emissions (tons/year) PM10	PM2.5
162	144	1.2	0.1	197.7	19.8	14.2	1.4
	Controlled (water twice/day and 25 mph speed limit)			49.8	5.0	3.6	0.4
			Control Efficiency	74.8	74.8	74.8	74.8

[1] Assumes that each trip associated with well development and pipeline construction (see table below) would include one half mile travel on unpaved roads.

[2] Based on AP-42 Emission Factor (USEPA, 2006): E (lbs/VMT) = k (s/12)^a (W/3)^b

Where:

E = emission rate in pounds per vehicle mile traveled

k = particle size multiplier (assumed 1.5 lb/VMT for PM10 and 0.15 lb/VMT for PM2.5 per AP-42, Table 13.2.2-2)

a = 0.9

b = 0.45

s = silt content (assumed 5.1% for a plant road site per AP-42, Table 13.2.2-1)

W = average weight (tons) of vehicles (assumed 5.9 tons; 70% small trucks weigh 2 tons, 30% trucks weigh 30 tons) associated with pipeline and well site development

Unpaved Road Trips Summary

Trips Source	Light duty trucks	Heavy trucks	percent or ave. weight
Well Development	76	88	
Pipeline Construction	150	10	
Total	226	98	
Grand Total		324	
Percentage	**% 2 tons**	**0.697530864**	1.395061728
Percentage	**%30 tons**	**0.302469136**	9.074074074
Average Weight (W)			10.4691358

Total Controlled Fugitive Dust

	lbs/day		tons/year	
Construction Source	**PM10**	**PM2.5**	**PM10**	**PM2.5**
Total Project	84.82	12.26	4.31	0.51

6. Operation and Maintenance

Onroad Criteria Pollutant Emissions

Emission Factors

Vehicle Type	Units	Running Exhaust Emission Factors					
		ROG	CO	NOx	SO2	PM10	PM2.5
Light duty truck (LDT1 gas)*	g/mile	0.3900	8.9920	0.8900	0.0040	0.0080	0.0070
Light duty truck (LDT1 gas)	lb/mile	0.0009	0.0198	0.0020	0.0000	0.0000	0.0000
Heavy duty truck (T7 diesel)*	g/mile	0.4810	2.1790	8.8120	0.0170	0.3070	0.2820
Heavy duty truck (T7 diesel)	lb/mile	0.0011	0.0048	0.0194	0.0000	0.0007	0.0006

* Emission factor obtained online from EMFAC 2011, for Mono County, average model years, and average speed.

Worker and Material Delivery Trips

Vehicle Type	Trips/day	miles/trip	ROG	CO	NOx	SO2	PM10	PM2.5
Light duty truck	12	10	0.10	2.38	0.24	0.00	0.00	0.00
Heavy duty truck	1	20	0.02	0.10	0.39	0.00	0.01	0.01
Maximim Day Emissions (lbs/day)			**0.12**	**2.47**	**0.62**	**0.00**	**0.02**	**0.01**

Vehicle Type	Trips/year	miles/trip	ROG	CO	NOx	SO2	PM10	PM2.5
Light duty truck	4,380	10	0.02	0.43	0.04	0.00	0.00	0.00
Heavy duty truck	40	20	0.00	0.00	0.01	0.00	0.00	0.00
Maximim Annual Emissions (ton/year)			**0.02**	**0.44**	**0.05**	**0.00**	**0.00**	**0.00**

All trips per day are one-way trips.

The light-duty truck trips represent employee commute trips. Heavy duty truck trips represent road plowing event (2 per week for 5 months)

Fugitive N-Pentane

Emission Source	lbs/day*	tons/year
Fugitive n-pentane	410	74.825

* Obtained from Section 2, description of the Proposed Action

7. Offroad2011 Output

Calendar Year	AirBasin	Equipment Class	Equipment Type ID	Equipment Type	Horse power Bin	BaseBSFC (pounds/yr)	FC (liter/hr)	BaseNOx	NOx (lb/hr)	BasePM	PM (lb/hour)	BaseHC	HC (lb/hr)	Base Activity (hr/yr)	Scen Activity	Population
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	50	132.629384	4.455621725	0.00188098	0.23683866	0.00013755	0.01731907	0.00024456	0.03079279	15.8840722	15.8840722	0.05029321
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	120	799.827225	7.822972277	0.01125956	0.41275915	0.00069368	0.02542926	0.00072121	0.02643865	54.5575432	54.5575432	0.15405605
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	175	944.597175	14.84910471	0.01205044	0.7099966	0.0005588	0.03292406	0.00074079	0.04364649	33.9450761	33.9450761	0.12070371
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	250	1337.85469	20.38707155	0.01629999	0.93096389	0.00050418	0.02879568	0.00081012	0.04626971	35.0174495	35.0174495	0.12017431
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	500	1482.10272	33.60623457	0.01594049	1.35469903	0.00052454	0.04457814	0.00082613	0.07020885	23.5336268	23.5336268	0.08417495
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	750	2042.43167	61.20442071	0.01555171	1.74667825	0.00052979	0.05950324	0.00080755	0.09069977	17.8071804	17.8071804	0.04182278
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	1000	160.93776	90.54059885	0.00167379	3.52928861	3.9578E-05	0.08345146	5.3767E-05	0.11336999	0.94851675	0.94851675	0.00158821
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	9999	544.625396	262.4226254	0.00690924	12.4776636	0.00016552	0.29892245	0.00022046	0.39813861	1.10745739	1.10745739	0.00158821
2013	GBV	Construction and Mining	12	Cranes	50	42.9338213	2.515894727	0.0007177	0.15762831	7.1707E-05	0.01574899	0.00020772	0.04562128	9.10620647	9.10620647	0.02329603
2013	GBV	Construction and Mining	12	Cranes	120	1024.06214	4.993552462	0.03258066	0.5954465	0.00241325	0.04410472	0.00326049	0.0595889	109.432698	109.432698	0.28088351
2013	GBV	Construction and Mining	12	Cranes	175	2703.50713	8.393163206	0.07130176	0.82965585	0.0038472	0.04476538	0.00550898	0.06410164	171.882739	171.882739	0.42132526
2013	GBV	Construction and Mining	12	Cranes	250	4565.36719	12.26886299	0.11164573	1.12452811	0.00512886	0.05165936	0.00772921	0.07785087	198.564593	198.564593	0.47324212
2013	GBV	Construction and Mining	12	Cranes	500	6991.70936	18.95928364	0.13728006	1.39522936	0.00569361	0.05786627	0.00867782	0.08819599	196.784939	196.784939	0.4539397
2013	GBV	Construction and Mining	12	Cranes	750	1843.51667	31.94557626	0.02422505	1.57335955	0.00083345	0.05413051	0.00126201	0.08196454	30.7940461	30.7940461	0.06656007
2013	GBV	Construction and Mining	12	Cranes	1000	431.401727	52.58734771	0.01512433	6.90995487	0.00074925	0.34231577	0.0011199	0.5116568	4.3775491	4.3775491	0.00998401
2013	GBV	Construction and Mining	12	Cranes	9999	33.227182	58.11349039	0.00065125	4.26902081	1.5847E-05	0.1038786	2.7896E-05	0.18286084	0.30510334	0.30510334	0.0006656
2013	GBV	Construction and Mining	13	Crawler Tractors	50	130.81781	3.900419898	0.00231206	0.25837023	0.00027062	0.03024123	0.00076441	0.08542248	17.8972343	17.8972343	0.05907552
2013	GBV	Construction and Mining	13	Crawler Tractors	120	5798.69583	7.370706198	0.13197319	0.62872981	0.01097501	0.05228572	0.01279505	0.06095656	419.8089	419.8089	1.01668974
2013	GBV	Construction and Mining	13	Crawler Tractors	175	6306.9677	12.55200153	0.13367336	0.99709566	0.00722979	0.0539284	0.01003814	0.07487644	268.125449	268.125449	0.66519038
2013	GBV	Construction and Mining	13	Crawler Tractors	250	6363.79041	17.08212702	0.12179298	1.22531548	0.00473129	0.04759983	0.00728829	0.07332487	198.794486	198.794486	0.48619155
2013	GBV	Construction and Mining	13	Crawler Tractors	500	17068.9753	28.84378064	0.29834339	1.8895602	0.01152533	0.07299575	0.01785628	0.11309291	315.78077	315.78077	0.78156916
2013	GBV	Construction and Mining	13	Crawler Tractors	750	6639.77192	47.99621327	0.10168875	2.75502972	0.00365384	0.09899272	0.00579829	0.15709177	73.820435	73.820435	0.16009467
2013	GBV	Construction and Mining	13	Crawler Tractors	1000	878.300743	69.98629996	0.01936237	5.78266257	0.00056705	0.16935284	0.00102104	0.30493893	6.6966967	6.6966967	0.01417813
2013	GBV	Construction and Mining	13	Crawler Tractors	9999	464.308325	123.1812091	0.00870273	8.65352587	0.00022689	0.22561102	0.00039817	0.39591676	2.0113721	2.0113721	0.00354453
2013	GBV	Construction and Mining	14	Excavators	50	5238.2946	2.976417842	0.07142463	0.15210784	0.00556071	0.01184223	0.0097851	0.0208386	939.131556	939.131556	1.44689745
2013	GBV	Construction and Mining	14	Excavators	120	6800.5909	6.051060106	0.11097363	0.37008731	0.00835603	0.02786664	0.00917349	0.03059278	599.715946	599.715946	1.04652796
2013	GBV	Construction and Mining	14	Excavators	175	14326.9617	10.92686733	0.21938095	0.6271047	0.01093226	0.03125008	0.01509379	0.04314589	699.662898	699.662898	1.32962947
2013	GBV	Construction and Mining	14	Excavators	250	18227.8154	16.36074429	0.27300949	0.91842938	0.00877678	0.0295259	0.01481969	0.04985482	594.513851	594.513851	1.14306676
2013	GBV	Construction and Mining	14	Excavators	500	30238.2962	24.50723236	0.34345832	1.04330329	0.01117384	0.03394212	0.01893507	0.05751795	658.405518	658.405518	1.16261142
2013	GBV	Construction and Mining	14	Excavators	750	2733.90653	42.80220812	0.03362718	1.97320654	0.00110694	0.06495415	0.00182517	0.10709878	34.0837916	34.0837916	0.05922626
2013	GBV	Construction and Mining	14	Excavators	1000	306.851855	62.8145822	0.00634119	4.86521332	0.00020487	0.15718454	0.00033603	0.25781819	2.60674585	2.60674585	0.0047381
2013	GBV	Construction and Mining	14	Excavators	9999	598.303719	116.234019	0.00729298	5.3102666	0.0002015	0.14672251	0.0003344	0.24349001	2.74674828	2.74674828	0.00414584
2013	GBV	Construction and Mining	15	Graders	50	34.5929525	3.270657966	0.00065437	0.2318841	8.7072E-05	0.03085487	0.00025743	0.09122501	5.64394684	5.64394684	0.01845368
2013	GBV	Construction and Mining	15	Graders	120	935.116778	7.273411945	0.02880737	0.8397993	0.0023889	0.0696419	0.00302501	0.08818585	68.6053647	68.6053647	0.19644244
2013	GBV	Construction and Mining	15	Graders	175	8685.88924	12.10897464	0.22552062	1.17836251	0.01264069	0.06604858	0.01808666	0.09450419	382.769505	382.769505	0.91911251
2013	GBV	Construction and Mining	15	Graders	250	15071.42	16.53836916	0.25727109	1.05810576	0.00828106	0.03405838	0.01417384	0.05829424	486.286154	486.286154	0.72981343
2013	GBV	Construction and Mining	15	Graders	500	4297.76034	23.50084446	0.04784786	0.98062601	0.00182179	0.03733695	0.00321891	0.06597039	97.5863645	97.5863645	0.13631915
2013	GBV	Construction and Mining	15	Graders	1000	41.5524289	63.71096499	0.00115973	6.66461399	4.0361E-05	0.23194298	7.3182E-05	0.42055444	0.34802677	0.34802677	0.00059528
2013	GBV	Construction and Mining	15	Graders	9999	585.35262	159.2113649	0.0115005	11.7239185	0.00034517	0.35187314	0.00062485	0.63698494	1.96188666	1.96188666	0.0029764
2013	GBV	Construction and Mining	16	Off-Highway Tractors	50	2164.19315	3.562259802	0.03390881	0.20919037	0.00344469	0.02125102	0.00836013	0.05157537	324.190915	324.190915	0.55422268
2013	GBV	Construction and Mining	16	Off-Highway Tractors	120	2770.47208	6.414184185	0.05680998	0.4929602	0.0047231	0.04098396	0.00533276	0.0462742	230.485052	230.485052	0.40296486
2013	GBV	Construction and Mining	16	Off-Highway Tractors	175	2359.99679	13.51709534	0.03832734	0.82277342	0.00198613	0.04263636	0.00267255	0.05737159	93.1662142	93.1662142	0.15300984
2013	GBV	Construction and Mining	16	Off-Highway Tractors	250	1977.53834	18.17854282	0.03649315	1.25731774	0.00130802	0.04506588	0.00210855	0.07264704	58.0492027	58.0492027	0.0998652
2013	GBV	Construction and Mining	16	Off-Highway Tractors	500	5586.19806	28.52191073	0.07450981	1.42585484	0.00267461	0.05118251	0.00425232	0.08137448	104.512474	104.512474	0.17169807
2013	GBV	Construction and Mining	16	Off-Highway Tractors	750	1407.31733	49.09373588	0.01909988	2.49726353	0.00067536	0.08830106	0.00106801	0.13964028	15.2966513	15.2966513	0.0251123
2013	GBV	Construction and Mining	16	Off-Highway Tractors	1000	39.7643736	85.28735326	0.00146574	11.7827774	7.4573E-05	0.59947929	0.00010247	0.823731	0.24879401	0.24879401	0.00058401
2013	GBV	Construction and Mining	16	Off-Highway Tractors	9999	310.075939	143.2340943	0.0092943	16.0914226	0.00034957	0.60522267	0.00061344	1.06205667	1.15518642	1.15518642	0.00233603
2013	GBV	Construction and Mining	17	Off-Highway Trucks	50	207.0882	2.346321463	0.00333583	0.14165615	0.00034659	0.01471787	0.00078271	0.03323792	47.0975433	47.0975433	0.03298396
2013	GBV	Construction and Mining	17	Off-Highway Trucks	120	254.312388	6.41977601	0.00559577	0.52943422	0.00045071	0.04264302	0.00056355	0.05331897	21.1386893	21.1386893	0.01851731
2013	GBV	Construction and Mining	17	Off-Highway Trucks	175	4920.2522	11.83193362	0.08583419	0.773621	0.00490059	0.0441689	0.00692467	0.06241186	221.902428	221.902428	0.17707178
2013	GBV	Construction and Mining	17	Off-Highway Trucks	250	10092.8055	15.67990629	0.18769026	1.09288102	0.00818566	0.04766339	0.01345046	0.07831919	343.477943	343.477943	0.30322096
2013	GBV	Construction and Mining	17	Off-Highway Trucks	500	42890.2159	28.07981061	0.65221334	1.60038768	0.02543301	0.062407	0.04498649	0.11038693	815.06918	815.06918	0.67356718
2013	GBV	Construction and Mining	17	Off-Highway Trucks	750	15411.1437	49.60659679	0.2922414	3.52570434	0.012535	0.15122668	0.02078719	0.2507841	165.777601	165.777601	0.15392515
2013	GBV	Construction and Mining	17	Off-Highway Trucks	1000	10664.4786	67.27576451	0.22022299	5.20692419	0.00655735	0.15504108	0.01204964	0.28490019	84.5885146	84.5885146	0.07059725
2013	GBV	Construction and Mining	17	Off-Highway Trucks	9999	15357.1994	133.3633757	0.28765543	9.36260524	0.00922694	0.30031843	0.01701219	0.55371267	61.447732	61.447732	0.04571461
2013	GBV	Construction and Mining	18	Other Construction Equipment	50	1173.0864	3.464555449	0.01762026	0.19504257	0.00160041	0.01771535	0.00343241	0.03799412	180.681172	180.681172	0.42799367
2013	GBV	Construction and Mining	18	Other Construction Equipment	120	3664.40755	6.614087286	0.07559261	0.51138159	0.0058842	0.03980642	0.00686841	0.04646456	295.640727	295.640727	0.75518129
2013	GBV	Construction and Mining	18	Other Construction Equipment	175	1998.64688	12.35057801	0.04038332	0.93530401	0.00212878	0.04930402	0.00296924	0.06876956	86.353352	86.353352	0.23502209
2013	GBV	Construction and Mining	18	Other Construction Equipment	250	2567.64518	17.7914945	0.04828464	1.25396674	0.00184442	0.04790019	0.00283479	0.07362029	77.0110406	77.0110406	0.21082864
2013	GBV	Construction and Mining	18	Other Construction Equipment	500	8785.78562	29.36064138	0.13565857	1.69915016	0.00515557	0.06457457	0.00807993	0.10120268	159.678144	159.678144	0.40956056
2013	GBV	Construction and Mining	18	Other Construction Equipment	750	3411.67439	48.69529263	0.04531111	2.4239504	0.00153208	0.08195972	0.00242584	0.12977207	37.3861728	37.3861728	0.08467708
2013	GBV	Construction and Mining	18	Other Construction Equipment	1000	398.05402	67.4298423	0.00594059	3.77172008	0.00016231	0.10305168	0.00026143	0.16598643	3.15007057	3.15007057	0.00748845
2013	GBV	Construction and Mining	18	Other Construction Equipment	9999	247.091303	89.32839828	0.00503944	6.82832784	0.0001668	0.22600614	0.00027508	0.37272189	1.47604068	1.47604068	0.00345621

Calendar Year	AirBasin	Equipment Class	Equipment Type ID	Equipment Type	Horse power Bin	BaseBSFC (pounds/yr)	FC (liter/hr)	BaseNOx	NOx (lb/hr)	BasePM	PM (lb/hour)	BaseHC	HC (lb/hr)	Base Activity (hr/yr)	Scen Activity	Population
2013	GBV	Construction and Mining	19	Pavers	50	143.739185	3.51100379	0.00225704	0.20663118	0.00023381	0.02140495	0.00061062	0.05590152	21.8461189	21.8461189	0.06937073
2013	GBV	Construction and Mining	19	Pavers	120	1389.5678	6.4410681	0.02706553	0.47021269	0.00210632	0.0365933	0.00247162	0.04293975	115.120393	115.120393	0.33702615
2013	GBV	Construction and Mining	19	Pavers	175	1888.46684	12.87513726	0.03450248	0.88164234	0.00173145	0.04424389	0.00249432	0.0637373	78.2686619	78.2686619	0.22776724
2013	GBV	Construction and Mining	19	Pavers	250	1275.24342	17.4208662	0.01614542	0.8266574	0.00040566	0.02077015	0.00065126	0.03334489	39.0619357	39.0619357	0.09827521
2013	GBV	Construction and Mining	19	Pavers	500	480.572913	26.37485393	0.00494764	1.0177195	0.00017126	0.03522858	0.00024589	0.05057824	9.72298551	9.72298551	0.02427976
2013	GBV	Construction and Mining	19	Pavers	750	55.5335657	61.01326041	0.00040389	1.66316369	1.7106E-05	0.07044107	2.1853E-05	0.08998669	0.48569288	0.48569288	0.00115618
2013	GBV	Construction and Mining	20	Paving Equipment	50	178.688963	2.669372622	0.00259033	0.14503268	0.00022643	0.01267776	0.0004603	0.0257725	35.7206159	35.7206159	0.08541965
2013	GBV	Construction and Mining	20	Paving Equipment	120	811.914564	6.179960324	0.0162587	0.46383213	0.00123911	0.03534951	0.00143637	0.04097724	70.105979	70.105979	0.17430226
2013	GBV	Construction and Mining	20	Paving Equipment	175	764.825394	10.28872802	0.01291291	0.65106315	0.00062408	0.03146608	0.00085163	0.04293878	39.6671525	39.6671525	0.09523137
2013	GBV	Construction and Mining	20	Paving Equipment	250	401.181012	15.00455335	0.00689348	0.96631977	0.00025521	0.0357749	0.00039228	0.0549897	14.2674944	14.2674944	0.03462959
2013	GBV	Construction and Mining	20	Paving Equipment	500	565.76557	23.40695605	0.00820781	1.27272675	0.00029311	0.04544987	0.00045368	0.0703495	12.8979886	12.8979886	0.03116663
2013	GBV	Construction and Mining	20	Paving Equipment	750	268.281161	42.08682722	0.0031573	1.85639976	7.1844E-05	0.04224211	0.00014037	0.08253556	3.40153077	3.40153077	0.00750308
2013	GBV	Construction and Mining	20	Paving Equipment	1000	52.4642361	58.62525993	0.00117776	4.93260669	3.4059E-05	0.14264232	6.3827E-05	0.26731675	0.47753915	0.47753915	0.00115432
2013	GBV	Construction and Mining	21	Rollers	50	2949.0204	2.922402438	0.04373549	0.16244106	0.00397898	0.01477862	0.00884028	0.03283432	538.478253	538.478253	1.75259363
2013	GBV	Construction and Mining	21	Rollers	120	4609.14743	6.413097826	0.09377738	0.48904063	0.00700892	0.0365509	0.00845332	0.04408329	383.515701	383.515701	1.30701898
2013	GBV	Construction and Mining	21	Rollers	175	4760.89882	10.5607629	0.0737989	0.61355824	0.00344278	0.02862303	0.00471169	0.0391726	240.560365	240.560365	0.75569461
2013	GBV	Construction and Mining	21	Rollers	250	751.542757	15.70390756	0.01338415	1.04820097	0.00047914	0.03752426	0.00077476	0.06067641	25.5373822	25.5373822	0.09267953
2013	GBV	Construction and Mining	21	Rollers	500	473.573917	24.86693974	0.00843141	1.65933627	0.00034723	0.06833551	0.00052442	0.10320838	10.1623897	10.1623897	0.03802237
2013	GBV	Construction and Mining	21	Rollers	750	23.1359399	38.3028594	0.0005946	3.68952231	2.2026E-05	0.13667127	3.5033E-05	0.21737902	0.32231934	0.32231934	0.0011882
2013	GBV	Construction and Mining	22	Rough Terrain Forklifts	50	150.166535	4.145494908	0.00216298	0.22379768	0.00018372	0.0190094	0.00040143	0.0415347	19.3297922	19.3297922	0.079602
2013	GBV	Construction and Mining	22	Rough Terrain Forklifts	120	12077.9528	7.593355959	0.17901099	0.42181275	0.01087783	0.02563198	0.01189268	0.02802332	848.769923	848.769923	3.41053389
2013	GBV	Construction and Mining	22	Rough Terrain Forklifts	175	2220.668	10.19133174	0.02662071	0.45789558	0.00105305	0.01811321	0.00136239	0.02343402	116.274133	116.274133	0.45633904
2013	GBV	Construction and Mining	22	Rough Terrain Forklifts	250	182.77542	16.44614611	0.00347638	1.17239249	0.00015337	0.05172387	0.00023357	0.07876936	5.93040098	5.93040098	0.02676274
2013	GBV	Construction and Mining	22	Rough Terrain Forklifts	500	77.3990236	29.15285687	0.00108447	1.530951	3.3003E-05	0.04659002	5.4579E-05	0.07705035	1.41672245	1.41672245	0.00617602
2013	GBV	Construction and Mining	22	Rough Terrain Forklifts	750	12.1103316	49.20424226	0.00054701	8.32989268	2.8967E-05	0.44111119	4.3708E-05	0.66558318	0.13133603	0.13133603	0.00068622
2013	GBV	Construction and Mining	23	Rubber Tired Dozers	50	129.238139	3.527458463	0.00234714	0.24010983	0.0003076	0.03146669	0.00085934	0.0879098	19.55056	19.55056	0.02319536
2013	GBV	Construction and Mining	23	Rubber Tired Dozers	120	616.682615	6.369598915	0.01752676	0.67850263	0.00156155	0.06045141	0.00185654	0.07187108	51.6630489	51.6630489	0.06902034
2013	GBV	Construction and Mining	23	Rubber Tired Dozers	175	516.52205	11.62608878	0.01518962	1.2814196	0.00086757	0.07318988	0.00122274	0.10315214	23.7074937	23.7074937	0.03564165
2013	GBV	Construction and Mining	23	Rubber Tired Dozers	250	538.794905	16.43940927	0.01303458	1.49059344	0.00063502	0.07261861	0.00096021	0.10980675	17.4891091	17.4891091	0.02772128
2013	GBV	Construction and Mining	23	Rubber Tired Dozers	500	6176.78619	27.86536544	0.15212976	2.57226643	0.00711375	0.12028196	0.01094922	0.18513342	118.284609	118.284609	0.18499714
2013	GBV	Construction and Mining	23	Rubber Tired Dozers	750	725.574082	45.31949827	0.01628928	3.81333303	0.00059739	0.13984896	0.00096896	0.22683438	8.54332802	8.54332802	0.01131481
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	50	409.499268	3.282929829	0.00686749	0.20635084	0.00077125	0.02317414	0.00200368	0.0602054	66.5613227	66.5613227	0.0872716
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	120	9988.31479	6.041658141	0.22762838	0.51604778	0.01990634	0.04512893	0.02301056	0.05216639	882.198849	882.198849	1.0849983
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	175	23658.5207	10.61021799	0.47129124	0.79218327	0.02631654	0.04423491	0.03721064	0.06254657	1189.85405	1189.85405	1.42170158
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	250	32609.9746	14.52499597	0.56628601	0.94536816	0.01932828	0.03226699	0.03395053	0.05667763	1198.02216	1198.02216	1.26366922
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	500	42590.8313	22.50463827	0.70963583	1.40537116	0.02701352	0.05349789	0.04663628	0.09235905	1009.89098	1009.89098	1.17403893
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	750	7510.19773	41.20243916	0.11653523	2.39622921	0.00464605	0.09553331	0.00795124	0.16351404	97.2655076	97.2655076	0.10378245
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	1000	2187.12994	59.14209548	0.04391224	4.45048438	0.00127106	0.12882169	0.00221625	0.22461579	19.7336896	19.7336896	0.01886954
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	9999	869.614744	107.0551141	0.01661775	7.66747315	0.00047414	0.21877149	0.00087828	0.40524169	4.33460861	4.33460861	0.00412771
2013	GBV	Construction and Mining	25	Scrapers	50	9.38006365	3.779840013	0.00017028	0.25717625	2.2528E-05	0.03402381	6.6077E-05	0.09979661	1.32422804	1.32422804	0.0040796
2013	GBV	Construction and Mining	25	Scrapers	120	428.19473	8.168343969	0.00889076	0.63566918	0.00065658	0.04694364	0.00074116	0.05299116	27.9729143	27.9729143	0.05886287
2013	GBV	Construction and Mining	25	Scrapers	175	4523.25525	15.93542239	0.11171424	1.47509711	0.00587802	0.07761459	0.00834275	0.11015927	151.466967	151.466967	0.37823766
2013	GBV	Construction and Mining	25	Scrapers	250	5195.04797	21.11036614	0.14458184	2.20201126	0.00664614	0.10122214	0.01007128	0.15338766	131.317985	131.317985	0.36716444
2013	GBV	Construction and Mining	25	Scrapers	500	45502.4864	36.08123064	0.89358984	2.65573061	0.03619174	0.10756112	0.05628611	0.16728115	672.952174	672.952174	1.61377515
2013	GBV	Construction and Mining	25	Scrapers	750	20829.1839	53.45956739	0.33521474	3.22460014	0.01282578	0.12337763	0.02016697	0.19399633	207.910886	207.910886	0.45982975
2013	GBV	Construction and Mining	25	Scrapers	1000	325.603468	89.74853789	0.01309703	13.530399	0.00061063	0.63083667	0.00094862	0.98000826	1.93594072	1.93594072	0.00757641
2013	GBV	Construction and Mining	25	Scrapers	9999	1183.49329	185.6718966	0.02520093	14.8182349	0.00093657	0.55070821	0.00143022	0.84097363	3.40133994	3.40133994	0.00757641
2013	GBV	Construction and Mining	26	Skid Steer Loaders	50	2228.45155	3.504004716	0.02907181	0.17132991	0.00202782	0.01195064	0.00379305	0.02235371	339.366467	339.366467	1.21416335
2013	GBV	Construction and Mining	26	Skid Steer Loaders	120	11841.9825	5.094233387	0.15810773	0.25492187	0.00965222	0.01556256	0.01001998	0.01615552	1240.44065	1240.44065	3.91819001
2013	GBV	Construction and Mining	26	Skid Steer Loaders	175	80.0850149	10.96170167	0.00105007	0.53869623	4.7537E-05	0.02438715	6.3462E-05	0.03255663	3.89855527	3.89855527	0.01625305
2013	GBV	Construction and Mining	26	Skid Steer Loaders	250	61.529677	14.24518582	0.00085244	0.73968129	3.376E-05	0.02929468	4.9856E-05	0.04326132	2.30487262	2.30487262	0.00902947
2013	GBV	Construction and Mining	26	Skid Steer Loaders	500	16.894127	19.44304444	0.0001598	0.68931534	5.6059E-06	0.02418098	9.5306E-06	0.04111022	0.46366242	0.46366242	0.00180589
2013	GBV	Construction and Mining	26	Skid Steer Loaders	750	17.8210775	38.24809765	0.00012795	1.02920678	5.2442E-06	0.04218463	6.0181E-06	0.04840997	0.24863057	0.24863057	0.00060196
2013	GBV	Construction and Mining	26	Skid Steer Loaders	1000	29.0807997	72.16622199	0.00072034	6.69988652	2.5828E-05	0.24022211	4.5941E-05	0.42729141	0.21503185	0.21503185	0.00120393
2013	GBV	Construction and Mining	27	Surfacing Equipment	50	20.524422	2.375477954	0.00030266	0.13129223	2.4982E-05	0.01083704	5.5237E-05	0.02396141	4.6105246	4.6105246	0.02129816
2013	GBV	Construction and Mining	27	Surfacing Equipment	120	161.242978	5.230957144	0.00281964	0.34284199	0.00020117	0.0244599	0.00023549	0.02863296	16.4486425	16.4486425	0.06826333
2013	GBV	Construction and Mining	27	Surfacing Equipment	175	83.5588533	8.899523406	0.00149593	0.59715098	7.2728E-05	0.02903186	0.00010304	0.04113101	5.01021237	5.01021237	0.02293648
2013	GBV	Construction and Mining	27	Surfacing Equipment	250	177.39144	12.88779391	0.00312112	0.84987748	0.00010004	0.02724096	0.00016254	0.04425919	7.34487637	7.34487637	0.03440472
2013	GBV	Construction and Mining	27	Surfacing Equipment	500	560.381763	21.26713592	0.00692968	0.98568359	0.00022244	0.03163954	0.00033982	0.04833636	14.0606501	14.0606501	0.05679509
2013	GBV	Construction and Mining	27	Surfacing Equipment	750	518.449943	36.25609729	0.00539895	1.41508744	0.00017082	0.04477374	0.00023327	0.06114206	7.63055612	7.63055612	0.02839755
2013	GBV	Construction and Mining	27	Surfacing Equipment	1000	84.5543101	48.25062538	0.00144698	3.09476834	3.5155E-05	0.07518899	6.1661E-05	0.13187845	0.93511111	0.93511111	0.00382275
2013	GBV	Construction and Mining	27	Surfacing Equipment	9999	29.6376276	66.31030171	0.0003454	2.89640306	7.7276E-06	0.06480071	1.1955E-05	0.10024992	0.23850245	0.23850245	0.00109221
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	50	4401.11355	3.012784229	0.06693674	0.17173927	0.00634495	0.0162792	0.01453185	0.03728429	779.515864	779.515864	1.69912977
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	120	71376.5494	6.050381911	1.24537508	0.39566442	0.09924569	0.03153105	0.10843419	0.0344503	6295.10783	6295.10783	11.5369135
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	175	12316.5568	10.33705821	0.19812423	0.62322493	0.01002883	0.03154695	0.01392483	0.04380231	635.803284	635.803284	1.29062819
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	250	7136.032	14.70168306	0.11246826	0.86844003	0.00362854	0.02801827	0.00605085	0.04672254	259.012156	259.012156	0.51625127

Calendar Year	AirBasin	Equipment Class	Equipment Type ID	Equipment Type	Horse power Bin	BaseBSFC (pounds/yr)	FC (liter/hr)	BaseNOx	NOx (lb/hr)	BasePM	PM (lb/hour)	BaseHC	HC (lb/hr)	Base Activity (hr/yr)	Scen Activity	Population
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	500	9619.69215	23.17124981	0.13782374	1.2442622	0.00468572	0.04230232	0.00774901	0.06995745	221.534887	221.534887	0.46592862
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	750	1353.24984	40.87989952	0.01779509	2.01479843	0.000639	0.07234863	0.00102284	0.1158077	17.6643873	17.6643873	0.03256172
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	1000	229.403715	63.54434554	0.00298088	3.09471655	5.5837E-05	0.0579698	0.00011503	0.11942106	1.92643317	1.92643317	0.00296016
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	9999	3217.41335	144.9548752	0.05621732	9.49282912	0.00175053	0.29559389	0.00280866	0.4742695	11.8441649	11.8441649	0.02190516
2013	GBV	Construction and Mining	29	Trenchers	50	1563.18112	4.378077469	0.02313121	0.24281312	0.00213778	0.02244067	0.00448403	0.04706974	190.526888	190.526888	0.55720309
2013	GBV	Construction and Mining	29	Trenchers	120	1132.57135	8.13985555	0.02514927	0.67744817	0.0019668	0.05297978	0.0023697	0.06383285	74.2470646	74.2470646	0.25833962
2013	GBV	Construction and Mining	29	Trenchers	175	230.925329	14.02909666	0.00594583	1.35384814	0.00030859	0.07026433	0.00044545	0.10142861	8.78359446	8.78359446	0.03419201
2013	GBV	Construction and Mining	29	Trenchers	250	452.704995	21.54676325	0.0095794	1.70885316	0.0003767	0.0671993	0.00059182	0.10557433	11.2114984	11.2114984	0.04052386
2013	GBV	Construction and Mining	29	Trenchers	500	764.528953	35.26639553	0.01057265	1.82789194	0.00039029	0.06747757	0.00060031	0.10378739	11.5681331	11.5681331	0.03672475
2013	GBV	Construction and Mining	29	Trenchers	750	344.757478	61.29361883	0.0021163	1.41018916	7.249E-05	0.04830352	0.00010318	0.06875578	3.00143433	3.00143433	0.00759822
2013	GBV	Construction and Mining	29	Trenchers	1000	20.3623551	84.63129669	0.00079993	12.4610559	3.6107E-05	0.56246702	5.6874E-05	0.88596442	0.12838888	0.12838888	0.00063319
2013	GBV	Construction and Mining	36	Sweepers/Scrubbers	50	1358.84241	3.533426938	0.02126878	0.20728565	0.00223916	0.02182288	0.00544053	0.05302346	205.212301	205.212301	0.32706033
2013	GBV	Construction and Mining	36	Sweepers/Scrubbers	120	2100.136	6.947367198	0.04489367	0.55661835	0.00393035	0.04873085	0.00444799	0.05514881	161.308621	161.308621	0.2662792
2013	GBV	Construction and Mining	36	Sweepers/Scrubbers	175	523.857809	14.26083139	0.0153277	1.56389614	0.00085827	0.08756958	0.00122325	0.12480921	19.6019371	19.6019371	0.03068
2013	GBV	Construction and Mining	36	Sweepers/Scrubbers	250	279.195098	18.16363483	0.00561071	1.36808252	0.00022143	0.05399266	0.00034548	0.08424083	8.20229604	8.20229604	0.01273509
2013	GBV	Construction and Mining	36	Sweepers/Scrubbers	500	77.8917806	26.99016702	0.00140304	1.8221441	6.0293E-05	0.07830285	8.6704E-05	0.11260314	1.53998494	1.53998494	0.00231547
2013	GBV	Construction and Mining	36	Sweepers/Scrubbers	1000	54.5886198	75.66169136	0.00065579	3.40674259	1.6339E-05	0.08487785	1.955E-05	0.10155687	0.38499623	0.38499623	0.00057887

8. Offroad2007 Output

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Activity	Consumption	ROG Exhaust	CO Exhaust	CO (lb/hr)	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	SO2 (lb/hr)	PM Exhaust	N2O Exhaust	CH4 Exhaust
2013	Annual	Mon-Sun	2270002003	Pavers	D	25	5.98E-02	5.08E-02	7.36E-07	2.39E-06	7.98E-02	4.48E-06	5.57E-04	7.07E-09	2.37E-04	2.24E-07	0.00E+00	6.64E-08
2013	Annual	Mon-Sun	2270002003	Pavers	D	50	3.53E+00	4.62E+00	2.41E-04	6.33E-04	3.59E-01	5.20E-04	4.93E-02	6.38E-07	3.62E-04	5.44E-05	0.00E+00	2.17E-05
2013	Annual	Mon-Sun	2270002003	Pavers	D	120	4.16E+00	1.32E+01	2.89E-04	1.05E-03	5.05E-01	1.74E-03	1.44E-01	1.69E-06	8.11E-04	1.52E-04	0.00E+00	2.60E-05
2013	Annual	Mon-Sun	2270002003	Pavers	D	175	2.59E+00	1.52E+01	2.30E-04	1.01E-03	7.78E-01	1.78E-03	1.66E-01	1.86E-06	1.44E-03	9.95E-05	0.00E+00	2.07E-05
2013	Annual	Mon-Sun	2270002003	Pavers	D	250	3.12E-01	2.75E+00	3.22E-05	9.46E-05	6.07E-01	3.03E-04	3.03E-02	3.40E-07	2.19E-03	1.18E-05	0.00E+00	2.91E-06
2013	Annual	Mon-Sun	2270002003	Pavers	D	500	3.20E-01	3.39E+00	3.63E-05	1.48E-04	9.23E-01	3.37E-04	3.72E-02	3.66E-07	2.29E-03	1.30E-05	0.00E+00	3.28E-06
2013	Annual	Mon-Sun	2270002009	Plate Compactors	D	15	9.38E-01	1.85E-01	2.35E-06	1.23E-05	2.63E-02	1.47E-05	2.02E-03	3.15E-08	6.71E-05	5.77E-07	0.00E+00	2.12E-07
2013	Annual	Mon-Sun	2270002015	Rollers	D	15	2.04E+00	5.89E-01	7.50E-06	3.94E-05	3.86E-02	4.70E-05	6.45E-03	1.00E-07	9.83E-05	1.82E-06	0.00E+00	6.77E-07
2013	Annual	Mon-Sun	2270002015	Rollers	D	25	8.54E-01	5.18E-01	6.88E-06	2.34E-05	5.49E-02	4.36E-05	5.69E-03	7.22E-08	1.69E-04	1.75E-06	0.00E+00	6.21E-07
2013	Annual	Mon-Sun	2270002015	Rollers	D	50	2.68E+00	3.24E+00	1.37E-04	3.90E-04	2.91E-01	3.46E-04	3.48E-02	4.50E-07	3.36E-04	3.28E-05	0.00E+00	1.24E-05
2013	Annual	Mon-Sun	2270002015	Rollers	D	120	1.44E+01	3.89E+01	7.10E-04	2.92E-03	4.06E-01	4.50E-03	4.24E-01	4.98E-06	6.91E-04	3.84E-04	0.00E+00	6.41E-05
2013	Annual	Mon-Sun	2270002015	Rollers	D	175	5.79E+00	2.85E+01	3.61E-04	1.79E-03	6.19E-01	2.93E-03	3.13E-01	3.52E-06	1.22E-03	1.59E-04	0.00E+00	3.26E-05
2013	Annual	Mon-Sun	2270002015	Rollers	D	250	8.21E-01	5.70E+00	5.18E-05	1.59E-04	3.88E-01	5.39E-04	6.28E-02	7.06E-07	1.72E-03	1.85E-05	0.00E+00	4.67E-06
2013	Annual	Mon-Sun	2270002015	Rollers	D	500	5.76E-01	5.72E+00	4.76E-05	1.81E-04	6.30E-01	4.84E-04	6.30E-02	6.18E-07	2.15E-03	1.70E-05	0.00E+00	4.29E-06
2013	Annual	Mon-Sun	2270002018	Scrapers	D	120	2.11E-01	9.07E-01	1.98E-05	7.31E-05	6.94E-01	1.17E-04	9.88E-03	1.16E-07	1.10E-03	1.04E-05	0.00E+00	1.78E-06
2013	Annual	Mon-Sun	2270002018	Scrapers	D	175	1.93E+00	1.30E+01	2.00E-04	8.77E-04	9.10E-01	1.50E-03	1.43E-01	1.60E-06	1.66E-03	8.52E-05	0.00E+00	1.80E-05
2013	Annual	Mon-Sun	2270002018	Scrapers	D	250	1.88E+00	1.79E+01	2.11E-04	6.01E-04	6.40E-01	1.92E-03	1.97E-01	2.21E-06	2.35E-03	7.42E-05	0.00E+00	1.91E-05
2013	Annual	Mon-Sun	2270002018	Scrapers	D	500	5.17E+00	7.55E+01	8.23E-04	3.13E-03	1.21E+00	7.31E-03	8.31E-01	8.15E-06	3.15E-03	2.84E-04	0.00E+00	7.43E-05
2013	Annual	Mon-Sun	2270002018	Scrapers	D	750	3.61E+00	9.12E+01	9.98E-04	3.78E-03	2.09E+00	9.00E-03	1.00E+00	1.01E-05	5.58E-03	3.46E-04	0.00E+00	9.00E-05
2013	Annual	Mon-Sun	2270002021	Paving Equipment	D	25	1.05E-01	6.01E-02	7.98E-07	2.72E-06	5.19E-02	5.06E-06	6.60E-04	8.38E-09	1.60E-04	2.03E-07	0.00E+00	7.20E-08
2013	Annual	Mon-Sun	2270002021	Paving Equipment	D	50	8.93E-02	1.00E-01	5.21E-06	1.36E-05	3.05E-01	1.12E-05	1.07E-03	1.38E-08	3.09E-04	1.17E-06	0.00E+00	4.70E-07
2013	Annual	Mon-Sun	2270002021	Paving Equipment	D	120	1.29E+00	3.22E+00	7.00E-05	2.54E-04	3.96E-01	4.22E-04	3.50E-02	4.11E-07	6.39E-04	3.69E-05	0.00E+00	6.31E-06
2013	Annual	Mon-Sun	2270002021	Paving Equipment	D	175	6.05E-01	2.79E+00	4.20E-05	1.84E-04	6.07E-01	3.27E-04	3.05E-02	3.43E-07	1.14E-03	1.82E-05	0.00E+00	3.79E-06
2013	Annual	Mon-Sun	2270002021	Paving Equipment	D	250	1.70E-01	9.47E-01	1.09E-05	3.20E-05	3.76E-01	1.04E-04	1.04E-02	1.17E-07	1.37E-03	3.98E-06	0.00E+00	9.82E-07
2013	Annual	Mon-Sun	2270002024	Surfacing Equipme	D	50	4.40E-02	2.87E-02	1.05E-06	3.08E-06	1.40E-01	2.98E-06	3.10E-04	4.00E-09	1.82E-04	2.61E-07	0.00E+00	9.45E-08
2013	Annual	Mon-Sun	2270002024	Surfacing Equipme	D	120	8.79E-03	2.56E-02	4.27E-07	1.85E-06	4.21E-01	2.87E-06	2.80E-04	3.28E-09	7.47E-04	2.27E-07	0.00E+00	3.85E-08
2013	Annual	Mon-Sun	2270002024	Surfacing Equipme	D	175	6.59E-03	2.58E-02	2.95E-07	1.56E-06	4.73E-01	2.55E-06	2.82E-04	3.18E-09	9.64E-04	1.29E-07	0.00E+00	2.66E-08
2013	Annual	Mon-Sun	2270002024	Surfacing Equipme	D	250	1.32E-02	8.06E-02	6.75E-07	2.22E-06	3.37E-01	7.37E-06	8.88E-04	1.00E-08	1.52E-03	2.48E-07	0.00E+00	6.09E-08
2013	Annual	Mon-Sun	2270002024	Surfacing Equipme	D	500	1.10E-01	1.10E+00	8.41E-06	3.52E-05	6.41E-01	9.11E-05	1.21E-02	1.19E-07	2.17E-03	3.11E-06	0.00E+00	7.59E-07
2013	Annual	Mon-Sun	2270002024	Surfacing Equipme	D	750	2.81E-01	4.42E+00	3.43E-05	1.41E-04	1.01E+00	3.74E-04	4.87E-02	4.90E-07	3.49E-03	1.26E-05	0.00E+00	3.09E-06
2013	Annual	Mon-Sun	2270002027	Signal Boards	D	15	1.03E+01	2.89E+00	3.68E-05	1.93E-04	3.76E-02	2.30E-04	3.16E-02	4.92E-07	9.59E-05	8.99E-06	0.00E+00	3.32E-06
2013	Annual	Mon-Sun	2270002027	Signal Boards	D	50	3.64E-02	6.09E-02	2.09E-06	6.28E-06	3.45E-01	6.20E-06	6.57E-04	8.50E-09	4.67E-04	5.38E-07	0.00E+00	1.89E-07
2013	Annual	Mon-Sun	2270002027	Signal Boards	D	120	5.95E-01	2.18E+00	3.50E-05	1.55E-04	5.21E-01	2.32E-04	2.38E-02	2.80E-07	9.40E-04	1.92E-05	0.00E+00	3.16E-06
2013	Annual	Mon-Sun	2270002027	Signal Boards	D	175	3.69E-01	2.60E+00	2.83E-05	1.54E-04	8.33E-01	2.46E-04	2.85E-02	3.20E-07	1.74E-03	1.26E-05	0.00E+00	2.56E-06
2013	Annual	Mon-Sun	2270002027	Signal Boards	D	250	7.79E-02	9.00E-01	6.36E-06	2.08E-05	5.34E-01	7.78E-05	9.94E-03	1.12E-07	2.87E-03	2.26E-06	0.00E+00	5.74E-07
2013	Annual	Mon-Sun	2270002030	Trenchers	D	15	2.25E-01	8.69E-02	1.11E-06	5.81E-06	5.16E-02	6.94E-06	9.52E-04	1.48E-08	1.32E-04	2.71E-07	0.00E+00	9.99E-08
2013	Annual	Mon-Sun	2270002030	Trenchers	D	25	2.37E-01	3.55E-01	4.70E-06	1.60E-05	1.35E-01	2.97E-05	3.90E-03	4.95E-08	4.17E-04	1.15E-06	0.00E+00	4.24E-07
2013	Annual	Mon-Sun	2270002030	Trenchers	D	50	9.21E+00	1.42E+01	7.21E-04	1.88E-03	4.08E-01	1.58E-03	1.51E-01	1.96E-06	4.25E-04	1.63E-04	0.00E+00	6.51E-05
2013	Annual	Mon-Sun	2270002030	Trenchers	D	120	1.25E+01	3.72E+01	8.00E-04	2.92E-03	4.68E-01	4.90E-03	4.05E-01	4.75E-06	7.61E-04	4.17E-04	0.00E+00	7.22E-05
2013	Annual	Mon-Sun	2270002030	Trenchers	D	175	1.37E+00	8.98E+00	1.34E-04	5.89E-04	8.62E-01	1.06E-03	9.82E-02	1.11E-06	1.62E-03	5.80E-05	0.00E+00	1.21E-05
2013	Annual	Mon-Sun	2270002030	Trenchers	D	250	1.23E-01	1.24E+00	1.44E-05	4.33E-05	7.08E-01	1.38E-04	1.36E-02	1.54E-07	2.51E-03	5.38E-06	0.00E+00	1.30E-06
2013	Annual	Mon-Sun	2270002030	Trenchers	D	500	1.56E-01	2.21E+00	2.33E-05	1.01E-04	1.30E+00	2.22E-04	2.43E-02	2.38E-07	3.05E-03	8.62E-06	0.00E+00	2.10E-06
2013	Annual	Mon-Sun	2270002030	Trenchers	D	750	7.84E-02	2.09E+00	2.22E-05	9.60E-05	2.45E+00	2.14E-04	2.30E-02	2.31E-07	5.90E-03	8.22E-06	0.00E+00	2.00E-06
2013	Annual	Mon-Sun	2270002033	Bore/Drill Rigs	D	15	3.94E-02	1.86E-02	2.37E-07	1.24E-06	6.31E-02	1.48E-06	2.03E-04	3.17E-09	1.61E-04	5.76E-08	0.00E+00	2.14E-08
2013	Annual	Mon-Sun	2270002033	Bore/Drill Rigs	D	25	1.18E-01	8.59E-02	1.14E-06	3.88E-06	6.58E-02	7.23E-06	9.43E-04	1.20E-08	2.03E-04	2.90E-07	0.00E+00	1.03E-07
2013	Annual	Mon-Sun	2270002033	Bore/Drill Rigs	D	50	5.36E-01	7.60E-01	7.74E-06	6.11E-05	2.28E-01	6.88E-05	8.31E-03	1.07E-07	4.01E-04	3.20E-06	0.00E+00	6.98E-07
2013	Annual	Mon-Sun	2270002033	Bore/Drill Rigs	D	120	1.64E+00	5.77E+00	3.67E-05	3.86E-04	4.69E-01	3.76E-04	6.34E-02	7.43E-07	9.04E-04	2.11E-05	0.00E+00	3.31E-06
2013	Annual	Mon-Sun	2270002033	Bore/Drill Rigs	D	175	3.80E-01	2.44E+00	1.34E-05	1.43E-04	7.53E-01	1.32E-04	2.68E-02	3.02E-07	1.59E-03	5.73E-06	0.00E+00	1.21E-06
2013	Annual	Mon-Sun	2270002033	Bore/Drill Rigs	D	250	3.27E-01	2.78E+00	1.30E-05	5.61E-05	3.43E-01	1.25E-04	3.08E-02	3.46E-07	2.11E-03	3.61E-06	0.00E+00	1.17E-06
2013	Annual	Mon-Sun	2270002033	Bore/Drill Rigs	D	500	7.28E-01	1.02E+01	4.71E-05	2.01E-04	5.51E-01	4.26E-04	1.13E-01	1.11E-06	3.05E-03	1.31E-05	0.00E+00	4.25E-06
2013	Annual	Mon-Sun	2270002033	Bore/Drill Rigs	D	750	1.62E+00	4.51E+01	2.08E-04	8.83E-04	1.09E+00	1.90E-03	4.98E-01	5.01E-06	6.18E-03	5.81E-05	0.00E+00	1.88E-05
2013	Annual	Mon-Sun	2270002033	Bore/Drill Rigs	D	1000	2.72E+00	1.14E+02	5.66E-04	2.26E-03	1.67E+00	8.09E-03	1.26E+00	1.27E-05	9.33E-03	2.10E-04	0.00E+00	5.11E-05
2013	Annual	Mon-Sun	2270002036	Excavators	D	25	2.51E-01	1.88E-01	2.48E-06	8.48E-06	6.76E-02	1.57E-05	2.06E-03	2.61E-08	2.08E-04	5.88E-07	0.00E+00	2.24E-07
2013	Annual	Mon-Sun	2270002036	Excavators	D	50	9.62E+00	1.12E+01	3.93E-04	1.37E-03	2.84E-01	1.18E-03	1.20E-01	1.55E-06	3.23E-04	1.02E-04	0.00E+00	3.54E-05
2013	Annual	Mon-Sun	2270002036	Excavators	D	120	2.61E+01	8.80E+01	1.42E-03	6.76E-03	5.17E-01	8.87E-03	9.61E-01	1.13E-05	8.63E-04	7.67E-04	0.00E+00	1.28E-04
2013	Annual	Mon-Sun	2270002036	Excavators	D	175	5.04E+01	2.58E+02	3.05E-03	1.68E-02	6.66E-01	2.25E-02	2.82E+00	3.18E-05	1.26E-03	1.29E-03	0.00E+00	2.75E-04
2013	Annual	Mon-Sun	2270002036	Excavators	D	250	2.05E+01	1.47E+02	1.27E-03	3.63E-03	3.54E-01	1.16E-02	1.62E+00	1.83E-05	1.78E-03	3.81E-04	0.00E+00	1.15E-04
2013	Annual	Mon-Sun	2270002036	Excavators	D	500	1.48E+01	1.56E+02	1.28E-03	3.89E-03	5.26E-01	1.09E-02	1.73E+00	1.69E-05	2.29E-03	3.81E-04	0.00E+00	1.16E-04
2013	Annual	Mon-Sun	2270002036	Excavators	D	750	1.38E+00	2.43E+01	2.00E-04	6.04E-04	8.73E-01	1.74E-03	2.68E-01	2.69E-06	3.89E-03	6.01E-05	0.00E+00	1.80E-05
2013	Annual	Mon-Sun	2270002039	Concrete/Industrial	D	25	1.15E-02	8.62E-03	1.14E-07	3.90E-07	6.78E-02	7.22E-07	9.46E-05	1.20E-09	2.09E-04	2.80E-08	0.00E+00	1.03E-08
2013	Annual	Mon-Sun	2270002039	Concrete/Industrial	D	50	9.86E-02	1.38E-01	4.71E-06	1.44E-05	2.92E-01	1.41E-05	1.49E-03	1.92E-08	3.90E-04	1.22E-06	0.00E+00	4.25E-07
2013	Annual	Mon-Sun	2270002039	Concrete/Industrial	D	120	1.72E-01	5.82E-01	9.15E-06	4.15E-05	4.83E-01	6.14E-05	6.36E-03	7.46E-08	8.69E-04	5.06E-06	0.00E+00	8.26E-07
2013	Annual	Mon-Sun	2270002039	Concrete/Industrial	D	175	5.63E-03	4.11E-02	4.42E-07	2.45E-06	8.69E-01	3.83E-06	4.51E-04	5.07E-09	1.80E-03	1.99E-07	0.00E+00	3.99E-08
2013	Annual	Mon-Sun	2270002042	Cement and Morta	D	15	7.44E-01	2.15E-01	2.77E-06	1.43E-05	3.86E-02	1.75E-05	2.35E-03	3.66E-08	9.83E-05	7.93E-07	0.00E+00	2.50E-07
2013	Annual	Mon-Sun	2270002042	Cement and Morta	D	25	6.70E-02	5.36E-02	9.05E-07	2.72E-06	8.12E-02	5.05E-06	5.88E-04	7.46E-09	2.23E-04	2.78E-07	0.00E+00	8.16E-08
2013	Annual	Mon-Sun	2270002045	Cranes	D	50	2.11E-01	2.29E-01	1.07E-05	3.05E-05	2.89E-01	2.53E-05	2.45E-03	3.17E-08	2.99E-04	2.53E-06	0.00E+00	9.68E-07
2013	Annual	Mon-Sun	2270002045	Cranes	D	120	2.32E+00	5.33E+00	1.07E-04	4.19E-04	3.62E-01	6.38E-04	5.81E-02	6.82E-07	5.88E-04	5.72E-05	0.00E+00	9.62E-06
2013	Annual	Mon-Sun	2270002045	Cranes	D	175	2.32E+00	8.51E+00	1.20E-04	5.59E-04	4.82E-01	9.01E-04	9.31E-02	1.05E-06	9.03E-04	5.16E-05	0.00E+00	1.08E-05
2013	Annual	Mon-Sun	2270002045	Cranes	D	250	4.50E+00	2.29E+01	2.34E-04	6.62E-04	2.94E-01	2.24E-03	2.52E-01	2.83E-06	1.26E-03	7.88E-05	0.00E+00	2.11E-05
2013	Annual	Mon-Sun	2270002045	Cranes	D	500	1.65E+00	1.35E+01	1.28E-04	4.35E-04	5.28E-01	1.17E-03	1.48E-01	1.45E-06	1.77E-03	4.27E-05	0.00E+00	1.15E-05
2013	Annual	Mon-Sun	2270002045	Cranes	D	750	5.17E+00	7.11E+01	6.78E-04	2.30E-03	8.89E-01	6.34E-03	7.83E-01	7.87E-06	3.04E-03	2.28E-04	0.00E+00	6.11E-05

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Activity	Consumption	ROG Exhaust	CO Exhaust	CO (lb/hr)	NOX Exhaust	CO2 Exhaust	SO2 Exhaust	SO2 (lb/hr)	PM Exhaust	N2O Exhaust	CH4 Exhaust
2013	Annual	Mon-Sun	2270002045	Cranes	D	9999	6.49E+00	2.86E+02	3.08E-03	1.08E-02	3.33E+00	3.36E-02	3.15E+00	3.16E-05	9.75E-03	1.03E-03	0.00E+00	2.78E-04
2013	Annual	Mon-Sun	2270002048	Graders	D	50	6.46E-02	8.28E-02	3.49E-06	1.05E-05	3.26E-01	8.95E-06	8.89E-04	1.15E-08	3.56E-04	8.47E-07	0.00E+00	3.15E-07
2013	Annual	Mon-Sun	2270002048	Graders	D	120	4.31E+00	1.48E+01	2.70E-04	1.14E-03	5.31E-01	1.67E-03	1.61E-01	1.89E-06	8.79E-04	1.46E-04	0.00E+00	2.44E-05
2013	Annual	Mon-Sun	2270002048	Graders	D	175	1.47E+01	8.33E+01	1.08E-03	5.40E-03	7.34E-01	8.24E-03	9.12E-01	1.03E-05	1.39E-03	4.65E-04	0.00E+00	9.75E-05
2013	Annual	Mon-Sun	2270002048	Graders	D	250	9.14E+00	7.13E+01	6.81E-04	1.98E-03	4.33E-01	6.48E-03	7.86E-01	8.84E-06	1.93E-03	2.25E-04	0.00E+00	6.15E-05
2013	Annual	Mon-Sun	2270002048	Graders	D	500	2.58E-01	2.69E+00	2.40E-05	8.11E-05	6.28E-01	2.18E-04	2.96E-02	2.91E-07	2.25E-03	7.85E-06	0.00E+00	2.16E-06
2013	Annual	Mon-Sun	2270002048	Graders	D	750	5.90E-02	1.30E+00	1.16E-05	3.92E-05	1.33E+00	1.08E-04	1.43E-02	1.44E-07	4.88E-03	3.85E-06	0.00E+00	1.05E-06
2013	Annual	Mon-Sun	2270002051	Off-Highway Truck	D	175	6.28E-01	3.58E+00	4.52E-05	2.38E-04	7.57E-01	3.23E-04	3.92E-02	4.41E-07	1.41E-03	1.89E-05	0.00E+00	4.08E-06
2013	Annual	Mon-Sun	2270002051	Off-Highway Truck	D	250	4.63E+00	3.50E+01	3.24E-04	8.88E-04	3.83E-01	2.87E-03	3.86E-01	4.34E-06	1.87E-03	9.55E-05	0.00E+00	2.92E-05
2013	Annual	Mon-Sun	2270002051	Off-Highway Truck	D	500	6.53E+00	8.05E+01	7.07E-04	2.07E-03	6.35E-01	5.83E-03	8.88E-01	8.72E-06	2.67E-03	2.07E-04	0.00E+00	6.38E-05
2013	Annual	Mon-Sun	2270002051	Off-Highway Truck	D	750	2.59E+01	5.18E+02	4.58E-03	1.33E-02	1.03E+00	3.86E-02	5.72E+00	5.75E-05	4.44E-03	1.35E-03	0.00E+00	4.13E-04
2013	Annual	Mon-Sun	2270002051	Off-Highway Truck	D	1000	1.21E+01	3.44E+02	3.32E-03	1.01E-02	1.67E+00	3.62E-02	3.79E+00	3.81E-05	6.28E-03	1.09E-03	0.00E+00	3.00E-04
2013	Annual	Mon-Sun	2270002054	Crushing/Proc. Equ	D	50	7.42E-01	1.52E+00	6.46E-05	1.86E-04	5.01E-01	1.62E-04	1.63E-02	2.11E-07	5.69E-04	1.57E-05	0.00E+00	5.83E-06
2013	Annual	Mon-Sun	2270002054	Crushing/Proc. Equ	D	120	2.09E+00	7.96E+00	1.47E-04	6.02E-04	5.76E-01	8.94E-04	8.68E-02	1.02E-06	9.74E-04	8.15E-05	0.00E+00	1.32E-05
2013	Annual	Mon-Sun	2270002054	Crushing/Proc. Equ	D	175	8.86E-01	6.76E+00	8.60E-05	4.25E-04	9.61E-01	6.75E-04	7.40E-02	8.33E-07	1.88E-03	3.83E-05	0.00E+00	7.76E-06
2013	Annual	Mon-Sun	2270002054	Crushing/Proc. Equ	D	250	8.81E-02	9.75E-01	8.14E-06	2.39E-05	5.42E-01	8.90E-05	1.08E-02	1.21E-07	2.75E-03	2.73E-06	0.00E+00	7.34E-07
2013	Annual	Mon-Sun	2270002054	Crushing/Proc. Equ	D	500	4.96E-01	8.39E+00	6.47E-05	2.10E-04	8.47E-01	6.72E-04	9.26E-02	9.09E-07	3.66E-03	2.19E-05	0.00E+00	5.84E-06
2013	Annual	Mon-Sun	2270002054	Crushing/Proc. Equ	D	750	9.88E-02	2.64E+00	2.04E-05	6.52E-05	1.32E+00	2.19E-04	2.91E-02	2.92E-07	5.92E-03	6.99E-06	0.00E+00	1.85E-06
2013	Annual	Mon-Sun	2270002054	Crushing/Proc. Equ	D	9999	9.88E-02	5.86E+00	5.56E-05	1.82E-04	3.68E+00	6.57E-04	6.46E-02	6.49E-07	1.31E-02	1.92E-05	0.00E+00	5.02E-06
2013	Annual	Mon-Sun	2270002057	Rough Terrain For	D	50	6.10E-01	9.59E-01	3.61E-05	1.15E-04	3.78E-01	1.01E-04	1.03E-02	1.33E-07	4.37E-04	9.17E-06	0.00E+00	3.26E-06
2013	Annual	Mon-Sun	2270002057	Rough Terrain For	D	120	2.92E+01	8.35E+01	1.40E-03	6.32E-03	4.32E-01	8.76E-03	9.12E-01	1.07E-05	7.32E-04	7.75E-04	0.00E+00	1.26E-04
2013	Annual	Mon-Sun	2270002057	Rough Terrain For	D	175	3.74E+00	2.13E+01	2.53E-04	1.36E-03	7.25E-01	1.96E-03	2.34E-01	2.63E-06	1.40E-03	1.11E-04	0.00E+00	2.29E-05
2013	Annual	Mon-Sun	2270002057	Rough Terrain For	D	250	2.09E-01	1.62E+00	1.35E-05	3.96E-05	3.79E-01	1.35E-04	1.78E-02	2.01E-07	1.92E-03	4.34E-06	0.00E+00	1.22E-06
2013	Annual	Mon-Sun	2270002057	Rough Terrain For	D	500	1.37E-01	1.60E+00	1.25E-05	3.92E-05	5.71E-01	1.17E-04	1.76E-02	1.73E-07	2.52E-03	4.01E-06	0.00E+00	1.13E-06
2013	Annual	Mon-Sun	2270002060	Rubber Tired Load	D	25	6.50E-02	5.01E-02	6.64E-07	2.27E-06	6.96E-02	4.20E-06	5.50E-04	6.98E-09	2.15E-04	1.63E-07	0.00E+00	5.99E-08
2013	Annual	Mon-Sun	2270002060	Rubber Tired Load	D	50	1.29E+00	1.87E+00	7.73E-05	2.34E-04	3.64E-01	2.01E-04	2.00E-02	2.59E-07	4.02E-04	1.88E-05	0.00E+00	6.97E-06
2013	Annual	Mon-Sun	2270002060	Rubber Tired Load	D	120	3.50E+01	9.44E+01	1.70E-03	7.26E-03	4.15E-01	1.05E-02	1.03E+00	1.21E-05	6.90E-04	9.20E-04	0.00E+00	1.53E-04
2013	Annual	Mon-Sun	2270002060	Rubber Tired Load	D	175	1.97E+01	9.57E+01	1.22E-03	6.18E-03	6.27E-01	9.38E-03	1.05E+00	1.18E-05	1.20E-03	5.28E-04	0.00E+00	1.10E-04
2013	Annual	Mon-Sun	2270002060	Rubber Tired Load	D	250	1.96E+01	1.32E+02	1.23E-03	3.61E-03	3.68E-01	1.19E-02	1.46E+00	1.64E-05	1.67E-03	4.09E-04	0.00E+00	1.11E-04
2013	Annual	Mon-Sun	2270002060	Rubber Tired Load	D	500	8.17E+00	8.77E+01	7.62E-04	2.61E-03	6.39E-01	7.00E-03	9.67E-01	9.49E-06	2.32E-03	2.50E-04	0.00E+00	6.87E-05
2013	Annual	Mon-Sun	2270002060	Rubber Tired Load	D	750	2.44E+00	5.37E+01	4.69E-04	1.60E-03	1.31E+00	4.40E-03	5.92E-01	5.96E-06	4.88E-03	1.56E-04	0.00E+00	4.24E-05
2013	Annual	Mon-Sun	2270002060	Rubber Tired Load	D	1000	2.62E-01	7.06E+00	6.80E-05	2.41E-04	1.84E+00	7.81E-04	7.78E-02	7.82E-07	5.97E-03	2.35E-05	0.00E+00	6.13E-06
2013	Annual	Mon-Sun	2270002063	Rubber Tired Doze	D	175	7.90E-02	4.68E-01	8.38E-06	3.34E-05	8.45E-01	6.15E-05	5.11E-03	5.75E-08	1.46E-03	3.53E-06	0.00E+00	7.56E-07
2013	Annual	Mon-Sun	2270002063	Rubber Tired Doze	D	250	1.94E+00	1.62E+01	2.35E-04	6.60E-04	6.82E-01	2.01E-03	1.78E-01	2.00E-06	2.06E-03	8.51E-05	0.00E+00	2.12E-05
2013	Annual	Mon-Sun	2270002063	Rubber Tired Doze	D	500	2.98E+00	3.60E+01	4.78E-04	2.11E-03	1.42E+00	4.06E-03	3.94E-01	3.87E-06	2.60E-03	1.69E-04	0.00E+00	4.31E-05
2013	Annual	Mon-Sun	2270002063	Rubber Tired Doze	D	750	4.48E+00	8.15E+01	1.09E-03	4.79E-03	2.14E+00	9.35E-03	8.93E-01	8.98E-06	4.01E-03	3.85E-04	0.00E+00	9.80E-05
2013	Annual	Mon-Sun	2270002063	Rubber Tired Doze	D	1000	3.03E-01	8.18E+00	1.14E-04	5.21E-04	3.44E+00	1.13E-03	8.96E-02	9.01E-07	5.95E-03	3.93E-05	0.00E+00	1.03E-05
2013	Annual	Mon-Sun	2270002066	Tractors/Loaders/B	D	25	1.29E+00	9.31E-01	1.26E-05	4.23E-05	6.56E-02	7.97E-05	1.02E-02	1.30E-07	2.01E-04	3.64E-06	0.00E+00	1.13E-06
2013	Annual	Mon-Sun	2270002066	Tractors/Loaders/B	D	50	7.91E+00	1.11E+01	3.54E-04	1.26E-03	3.20E-01	1.14E-03	1.20E-01	1.55E-06	3.92E-04	9.43E-05	0.00E+00	3.19E-05
2013	Annual	Mon-Sun	2270002066	Tractors/Loaders/B	D	120	1.06E+02	2.50E+02	3.68E-03	1.86E-02	3.53E-01	2.41E-02	2.73E+00	3.21E-05	6.06E-04	2.03E-03	0.00E+00	3.32E-04
2013	Annual	Mon-Sun	2270002066	Tractors/Loaders/B	D	175	7.89E+00	3.65E+01	3.90E-04	2.31E-03	5.86E-01	3.04E-03	4.00E-01	4.50E-06	1.14E-03	1.69E-04	0.00E+00	3.52E-05
2013	Annual	Mon-Sun	2270002066	Tractors/Loaders/B	D	250	2.55E+00	1.98E+01	1.54E-04	4.67E-04	3.66E-01	1.49E-03	2.19E-01	2.46E-06	1.93E-03	4.72E-05	0.00E+00	1.39E-05
2013	Annual	Mon-Sun	2270002066	Tractors/Loaders/B	D	500	4.12E+00	6.43E+01	4.72E-04	1.53E-03	7.44E-01	4.26E-03	7.10E-01	7.99E-06	3.88E-03	1.44E-04	0.00E+00	4.25E-05
2013	Annual	Mon-Sun	2270002066	Tractors/Loaders/B	D	750	1.21E+01	2.83E+02	2.09E-03	6.75E-03	1.12E+00	1.93E-02	3.13E+00	3.52E-05	5.82E-03	6.47E-04	0.00E+00	1.89E-04
2013	Annual	Mon-Sun	2270002069	Crawler Tractors	D	50	7.12E-02	8.29E-02	4.18E-06	1.15E-05	3.24E-01	9.34E-06	8.84E-04	1.14E-08	3.21E-04	9.61E-07	0.00E+00	3.78E-07
2013	Annual	Mon-Sun	2270002069	Crawler Tractors	D	120	4.04E+01	1.22E+02	2.61E-03	9.80E-03	4.85E-01	1.55E-02	1.33E+00	1.56E-05	7.71E-04	1.37E-03	0.00E+00	2.36E-04
2013	Annual	Mon-Sun	2270002069	Crawler Tractors	D	175	1.37E+01	7.56E+01	1.14E-03	5.08E-03	7.44E-01	8.56E-03	8.27E-01	9.31E-06	1.36E-03	4.88E-04	0.00E+00	1.03E-04
2013	Annual	Mon-Sun	2270002069	Crawler Tractors	D	250	1.17E+01	8.86E+01	1.03E-03	2.93E-03	4.99E-01	9.36E-03	9.74E-01	1.10E-05	1.87E-03	3.60E-04	0.00E+00	9.33E-05
2013	Annual	Mon-Sun	2270002069	Crawler Tractors	D	500	8.05E+00	9.48E+01	1.02E-03	3.82E-03	9.48E-01	9.00E-03	1.04E+00	1.02E-05	2.54E-03	3.49E-04	0.00E+00	9.22E-05
2013	Annual	Mon-Sun	2270002069	Crawler Tractors	D	750	1.73E+00	3.66E+01	3.96E-04	1.47E-03	1.70E+00	3.55E-03	4.02E-01	4.05E-06	4.67E-03	1.36E-04	0.00E+00	3.58E-05
2013	Annual	Mon-Sun	2270002069	Crawler Tractors	D	1000	1.73E+00	5.18E+01	5.97E-04	2.34E-03	2.70E+00	6.38E-03	5.69E-01	5.72E-06	6.61E-03	2.04E-04	0.00E+00	5.39E-05
2013	Annual	Mon-Sun	2270002072	Skid Steer Loaders	D	25	7.77E+00	4.89E+00	7.83E-05	2.41E-04	6.20E-02	4.53E-04	5.36E-02	6.80E-07	1.75E-04	2.44E-05	0.00E+00	7.07E-06
2013	Annual	Mon-Sun	2270002072	Skid Steer Loaders	D	50	7.18E+01	8.42E+01	1.86E-03	8.11E-03	2.26E-01	8.17E-03	9.15E-01	1.18E-05	3.30E-04	5.63E-04	0.00E+00	1.68E-04
2013	Annual	Mon-Sun	2270002072	Skid Steer Loaders	D	120	3.76E+01	7.34E+01	8.06E-04	5.16E-03	2.75E-01	6.14E-03	8.03E-01	9.42E-06	5.01E-04	4.60E-04	0.00E+00	7.28E-05
2013	Annual	Mon-Sun	2270002075	Off-Highway Tracto	D	120	5.42E-03	2.33E-02	5.73E-07	1.95E-06	7.18E-01	3.35E-06	2.54E-04	2.98E-09	1.10E-03	2.92E-07	0.00E+00	5.17E-08
2013	Annual	Mon-Sun	2270002075	Off-Highway Tracto	D	175	6.63E+00	3.95E+01	6.78E-04	2.76E-03	8.33E-01	5.08E-03	4.32E-01	4.86E-06	1.47E-03	2.89E-04	0.00E+00	6.12E-05
2013	Annual	Mon-Sun	2270002075	Off-Highway Tracto	D	250	6.27E+00	3.72E+01	5.14E-04	1.47E-03	4.68E-01	4.53E-03	4.08E-01	4.59E-06	1.47E-03	1.88E-04	0.00E+00	4.63E-05
2013	Annual	Mon-Sun	2270002075	Off-Highway Tracto	D	750	1.16E+01	3.00E+02	3.79E-03	1.68E-02	2.89E+00	3.37E-02	3.29E+00	3.31E-05	5.71E-03	1.37E-03	0.00E+00	3.42E-04
2013	Annual	Mon-Sun	2270002075	Off-Highway Tracto	D	1000	1.22E+00	4.54E+01	6.01E-04	2.76E-03	4.51E+00	6.15E-03	4.98E-01	5.00E-06	8.18E-03	2.10E-04	0.00E+00	5.42E-05
2013	Annual	Mon-Sun	2270002078	Dumpers/Tenders	D	25	7.71E-02	2.68E-02	3.72E-07	1.23E-06	3.20E-02	2.31E-06	2.94E-04	3.73E-09	9.67E-05	1.12E-07	0.00E+00	3.36E-08
2013	Annual	Mon-Sun	2270002081	Other Construction	D	15	1.11E+00	5.11E-01	6.52E-06	3.42E-05	6.17E-02	4.08E-05	5.60E-03	8.71E-08	1.57E-04	1.58E-06	0.00E+00	5.88E-07
2013	Annual	Mon-Sun	2270002081	Other Construction	D	25	1.88E-01	1.13E-01	1.50E-06	5.10E-06	5.44E-02	9.50E-06	1.24E-03	1.57E-08	1.68E-04	3.80E-07	0.00E+00	1.35E-07
2013	Annual	Mon-Sun	2270002081	Other Construction	D	50	2.93E-01	3.79E-01	1.11E-05	3.89E-05	2.65E-01	3.79E-05	4.10E-03	5.30E-08	3.62E-04	3.01E-06	0.00E+00	9.97E-07
2013	Annual	Mon-Sun	2270002081	Other Construction	D	120	4.84E-01	1.79E+00	2.44E-05	1.28E-04	5.27E-01	1.70E-04	1.96E-02	2.29E-07	9.48E-04	1.37E-05	0.00E+00	2.20E-06
2013	Annual	Mon-Sun	2270002081	Other Construction	D	175	6.68E-01	3.24E+00	3.13E-05	1.96E-04	5.87E-01	2.68E-04	3.55E-02	4.00E-07	1.20E-03	1.40E-05	0.00E+00	2.82E-06
2013	Annual	Mon-Sun	2270002081	Other Construction	D	500	1.55E+00	1.78E+01	1.13E-04	4.05E-04	5.23E-01	1.18E-03	1.97E-01	1.93E-06	2.49E-03	3.81E-05	0.00E+00	1.02E-05

9. Tier 2 Emission Factors

Offroad Drill Rig Engine Emission Factors

Equipment	HP	Load Factor[a]	Tier 2 Emission Factors (g/bhp-hr)[b]				Tier 2 Emission Rates (lb/hr)			
			ROG	NOx	CO	PM	ROG	NOx	CO	PM
Drill Rig - Units No. 1 - 3	1,354	0.5025	0.240	4.560	2.6	0.150	0.360	6.840	3.900	0.225
Drill Rig - Unit No. 4	197	0.5025	0.150	2.850	2.6	0.150	0.033	0.622	0.567	0.033

Sources:

[a] CARB (California Air Resources Board), 2011. Offroad Emissions Inventory Update Access Database (http://www.arb.ca.gov/msprog/ordiesel/offroad_1085.htm), accessed October 18, 2011.

[b] SCAQMD (South Coast Air Quality Management District). 2011. Table II - Off-Road Engine Emission Rates and Comparison of Uncontrolled to Tiered Rates and Tiered to Tiered Rates (http://aqmd.gov/ceqa/handbook/mitigation/offroad/MM_offroad.html), accessed October 18, 2011.

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C.2 Greenhouse Gas Emission Estimates

1. GHG Emissions Summaries

Construction Emissions

Emissions Source	Construction Emissions (total metric tons)			
	CO2	N2O	CH4	CO2e
Power Plant - Off-road Equipment	284.8	0.0	0.0	287.3
Power Plant - On-road Vehicle	1,466.9	0.0	0.2	1,480.5
Power Plant - Water Use	0.3	0.0	0.0	0.3
Power Plant - Subtotal	1,751.9	0.0	0.3	1,768.2
Well Development - Off-road Equipment	2,688.2	0.1	0.2	2,712.6
Well Development - On-road Vehicle	3,131.0	0.0	0.1	3,137.0
Well Development - Water Use	0.3	0.0	0.0	0.3
Well Development - Flow Testing	21.2	---	---	21.2
Well Development - Subtotal	5,840.6	0.1	0.2	5,871.1
Pipeline - Off-road Equipment	136.2	0.0	0.0	137.4
Pipeline - On-road Vehicle	495.1	0.0	0.1	500.9
Pipeline - Water Use	0.8	0.0	0.0	0.8
Pipeline - Subtotal	632.0	0.0	0.1	639.1
Grand Total (metric tons)	**8,224.5**	**0.1**	**0.6**	**8,278.4**

Annual Operation and Maintenance Emissions

Emissions Source	CO2e
On-road Vehicles	20.9
Emergency Diesel Engines	13.2
Fugitive SF_6 Emissions	39.0
Well Venting - Non-Condensable Gases	75.6
Total (maximum metric tons/year)	**148.6**

*Obtained from Mono County, 2012.

Total Annual amortized GHG Emissions

Emission Source	CO2e	
	metric tons	tons
30-year Amortized Construction Emissions	275.9	304.2
Total Direct and Indirect Annual Operation Emissions	148.6	163.9
30-year Amortized Decommissioning Emissions	80.2	88.5
Amortized Construction + Annual Operation	504.8	556.5

2. Offroad Construction Equipment Inventory

Onsite Equipment Usage for Power Plant Constructio

Equipment (hp)	No.	hrs/ day	Each wks	days	annual hrs	P 1 and II total hrs*
Excavator (157 hp)	1	8	4	24	192	384
Grader (162 hp)	1	8	4	24	192	384
Loader (87 hp)	2	7	28	168	2,352	4704
Backhoe (75 hp)	1	8	4	24	192	384
Crane (208 hp)	1	7	28	168	1,176	2352
Concrete Mixer (9 hp)	2	6	28	168	2,016	4032
Drill Rig (82 hp)	1	8	4	24	192	384
Roller Compactor (84 hp)	1	8	4	24	192	384
Generator (84 hp)	1	8	28	168	1,344	2688

*It is assumed that the construction emissions for Phases I and II would be approximately the same.

Onsite Equipment Usage for Well Developmen

Equipment (hp)	No.	hrs/ day	Each Well Site wks	days	annual hrs	Total hrs*** hrs
Excavator (157 hp)	1	8	4	24	192	2,688
Grader (162 hp)	1	8	4	24	192	2,688
Loader (87 hp)	2	7	4	24	336	4,704
Backhoe (75 hp)	1	8	4	24	192	2,688
Drill Rig - Unit No. 1 (1,354 hp)	2	5	4	30	150	2,100
Drill Rig - Unit No. 2 (1,354 hp)	2	5	4	30	150	2,100
Drill Rig - Unit No. 3 (1,354 hp)	2	5	4	30	150	2,100
Drill Rig - Unit No. 4 (197 hp)	2	1	4	30	30	420

*The maximum day for well development assumes simultaneous drilling of two wells.

**The maximum annual emissions assume that 6 wells would be drilled per year.

***The total hours assume that 14 wells would be drilled.

Onsite Equipment Usage for Pipeline

Equipment (hp)	No.	hrs/ day	2013* wks	days	annual hrs	2014** weeks	days	annual hrs	2015*** weeks	days	annual hrs	Total hrs hrs
Crane (208 hp)	1	7	24	144	1,008	4	24	168	2	12	84	1,260
Backhoe Loader (87 hp)	2	8	24	144	2,304	4	24	384	2	12	192	2,880
Fork Lift (149 hp)	1	8	24	144	1,152	4	24	192	2	12	96	1,440
Excavator (157 hp)	1	8	2	12	96	0	0	0	0	0	0	96
Loader (87 hp)	1	7	2	12	84	0	0	0	0	0	0	84
Jack and Bore Rig (164 hp)	1	8	2	12	96	0	0	0	0	0	0	96

*It is assumed that the main pipelines, including the Highway 395 crossings, would be constructed in 2013.

**It is assumed that pipeline construction in 2014 would be limited to the pipeline segments associated with 6 well sites.

**It is assumed that pipeline construction in 2015 would be limited to the pipeline segments associated with 2 well sites.

Notes: Equipment types and weeks of use are based on the Project Description; equipment amounts, horsepower, hours per day, and total weeks of activity were obtained from SCAQMD, 2011, CalEEMond User's Manual Appendix D - Default Data Tables. It is assumed that the equipment would operate 5 days each week. Total hours for all well sites combined is estimated by multiplying the equipment total hours for each well site by six to represent the six well sites.

3. Off-road Construction Exhaust Emissions

GHG Emissions Factors for Diesel Equipment

Fuel	CO2 (kg/gal)	CO2 (g/gal)	N2O (g/gal)	CH4 (g/gal)
Diesel*	10.21	10,210.00	0.26	0.58

*Emission factors obtained from TCR, 2011, Tables 13.1 and 13.6.

Off-road Construction Fuel Consumption Factors

Equipment	Offroad HP Range	Fuel Consumption (l/hr)*	Fuel Consumption (gal/hr)
Excavator (157 hp)	120-175	10.927	2.883
Grader (162 hp)	120-175	12.109	3.195
Loader (87 hp)	50-120	6.050	1.596
Backhoe (75 hp)	50-120	6.050	1.596
Crane (208 hp)	175-250	12.269	3.237
Concrete Mixer (9 hp)	0-50	3.465	0.914
Drill Rig (82 hp)	50-120	7.823	2.064
Roller Compactor (84 hp)	50-120	6.413	1.692
Generator (84 hp)	50-120	6.614	1.745
Backhoe Loader (87 hp)	50-120	6.050	1.596
Fork Lift (149 hp)	120-175	10.191	2.689
Jack and Bore Rig (164 hp)	120-175	14.849	3.918
Drill Rig - Unit No. 1 (1,354 hp)	1,354**	140.105	36.967
Drill Rig - Unit No. 4 (197 hp)	175-250	20.387	5.379

*Fuel consumption factors were derived using Offroad2011.

**Based on ratio (1,354 hp / 875 hp) applied to 875 hp emissions (875 hp is the assumed average of 750 hp - 1,000 hp

Total On-site Power Plant Construction Exhaust Emissions

Equipment	Total Hours	Total Emissions (metric tons)			
		CO2	N2O	CH4	CO2e*
Excavator (157 hp)	384	11.30	0.00	0.00	11.41
Grader (162 hp)	384	12.53	0.00	0.00	12.64
Loader (87 hp)	4,704	76.67	0.00	0.00	77.37
Backhoe (75 hp)	384	6.26	0.00	0.00	6.32
Crane (208 hp)	2,352	77.74	0.00	0.00	78.44
Concrete Mixer (9 hp)	4,032	37.63	0.00	0.00	37.97
Drill Rig (82 hp)	384	8.09	0.00	0.00	8.17
Roller Compactor (84 hp)	384	6.63	0.00	0.00	6.69
Generator (84 hp)	2,688	47.89	0.00	0.00	48.33
Total (metric tons/project) =		**284.75**	**0.01**	**0.02**	**287.34**

Total On-site Well Development Construction Exhaust Emissions

Equipment	Total Hours	Total Emissions (metric tons)			
		CO2	N2O	CH4	CO2e*
Excavator (157 hp)	2,688	79.12	0.00	0.00	79.84
Grader (162 hp)	2,688	87.68	0.00	0.00	88.48
Loader (87 hp)	4,704	76.67	0.00	0.00	77.37
Backhoe (75 hp)	2,688	43.81	0.00	0.00	44.21
Drill Rig - Unit No. 1 (1,354 hp)	2,100	792.61	0.02	0.05	799.81
Drill Rig - Unit No. 2 (1,354 hp)	2,100	792.61	0.02	0.05	799.81
Drill Rig - Unit No. 3 (1,354 hp)	2,100	792.61	0.02	0.05	799.81
Drill Rig - Unit No. 4 (197 hp)	420	23.07	0.00	0.00	23.28
Total (metric tons/project) =		**2,688.19**	**0.07**	**0.15**	**2,712.62**

Total On-site Pipeline Construction Exhaust Emissions

Equipment	Total Hours	Total Emissions (metric tons)			
		CO2	N2O	CH4	CO2e*
Crane (208 hp)	1,260	41.64	0.00	0.00	42.02
Backhoe Loader (87 hp)	2,880	46.94	0.00	0.00	47.37
Fork Lift (149 hp)	1,440	39.53	0.00	0.00	39.89
Excavator (157 hp)	96	2.83	0.00	0.00	2.85
Loader (87 hp)	84	1.37	0.00	0.00	1.38
Jack and Bore Rig (164 hp)	96	3.84	0.00	0.00	3.88
Total (metric tons/project) =		**136.16**	**0.00**	**0.01**	**137.39**

**Global Warming Potential for CH4 = 21; GWP for N2O = 310.

Non-condensable GHG Emissions

Source	metric tons CO2/hr testing	hr/well	wells	metric tons CO2/ yr
Well Testing	0.378	4	14	21.17
Annual Emissions (metric ton/year)				**21.17**

Source: Based on data in MPLP, 2010

4. Construction Onroad Criteria Pollutant Emissions

Emission Factors

Vehicle Type	Units	Exhaust Emission Factors		
		CO2*	N20**	CH4**
Light duty truck (LDT1 gas)	g/mile	400.246	0.022	0.202
Light duty truck (LDT1 gas)	lb/mile	0.882	0.000	0.000
Heavy duty truck (T7 diesel)	g/mile	1746.100	0.005	0.005
Heavy duty truck (T7 diesel)	lb/mile	3.850	0.000	0.000

* Emission factors (g/mile) obtained online from EMFAC 2011, for Mono County, average model years, and average speed
**Emission factors (g/mile) obtained from TCR, 2011, Table 13-3.

Power Plant Construction - Worker and Material Delivery Trips

Vehicle Type	trips/day	days/proj	miles/trip	CO2	N20	CH4	CO2e*
Light duty truck	300	384	10	461.1	0.0	0.2	473.8
Heavy duty truck	30	384	50	1,005.8	0.0	0.0	1,006.7
			Emissions (metric tons/project)	**1,466.9**	**0.0**	**0.2**	**1,480.5**

Notes: It is assumed that there would be 384 work days (6 days a week, four weeks per month, for 8 months for each of the phase.

Well Development Construction - Worker and Material Delivery Trips

Vehicle Type	trips/day	days/proj	miles/trip	CO2	N20	CH4	CO2e*
Light duty truck	76	392	10	119.2	0.0	0.1	122.5
Heavy duty truck	88	392	50	3,011.7	0.0	0.0	3,014.5
			Emissions (metric tons/project)	**3,131.0**	**0.0**	**0.1**	**3,137.0**

Notes: It is assumed that there would be 392 work days (7 days a week, four weeks per month, for a total of 14 months.

Pipeline Construction - Worker and Material Delivery Trips

Vehicle Type	trips/day	days/proj	miles/trip	CO2	N20	CH4	CO2e*
Light duty truck	150	336	10	201.7	0.0	0.1	207.3
Heavy duty truck	10	336	50	293.3	0.0	0.0	293.6
			Emissions (metric tons/project)	**495.1**	**0.0**	**0.1**	**500.9**

Notes: It is assumed that there would be 336 work days (6 days a week, four weeks per month, for a total of 14 months.

All trips per day are one-way trips obtained from Table 4.16-1.
The light-duty truck trips represent construction worker commute trips. Heavy duty truck trips represent material and fill haul trips
*Global Warming Potential for CH4 = 21; GWP for N2O = 310.

5. Operation and Maintenance

Onroad Criteria Pollutant Emissions

On-road Emission Factors

Vehicle Type	Units	Exhaust Emission Factors		
		CO2*	N20**	CH4**
Light duty truck (LDT1 gas)	g/mile	400.246	0.022	0.202
Light duty truck (LDT1 gas)	lb/mile	0.882	0.000	0.000
Heavy duty truck (T7 diesel)	g/mile	1746.100	0.005	0.005
Heavy duty truck (T7 diesel)	lb/mile	3.850	0.000	0.000

* Emission factors (g/mile) obtained online from EMFAC 2011, for Mono County, average model years, and average speed.
**Emission factors (g/mile) obtained from TCR, 2011.

Operation Worker and Plow Trips Emissions

Vehicle Type	Trips/year	miles/trip	CO2	N2O	CH4	CO2e***
Light duty truck	4,380	10	19.32	0.00	0.01	19.86
Heavy duty truck	40	20	1.54	0.00	0.00	1.54
Annual Emissions (metric ton/year)			**20.86**	**0.00**	**0.01**	**21.40**

All trips per day are one-way trips.

*The light-duty truck trips represent employee commute trips. Heavy duty truck trips represent road plowing event (2 per week for 5 months)

**Global Warming Potential for CH4 = 21; GWP for N2O = 310.

Non-condensable GHG Emissions

Source	metric tons/unit-yr	plant units	metric tons CO2/ yr
Well Venting	38	2	75.60
Annual Emissions (metric ton/year)			**75.60**

GHG Emissions Factors for Diesel Equipment

Fuel	CO2 (kg/gal)	CO2 (g/gal)	N2O (g/gal)	CH4 (g/gal)
Diesel*	10.21	10,210.00	0.26	0.58

*Emission factors obtained from TCR, 2011, Tables 13.1 and 13.6.

Off-road Construction Fuel Consumption Factor

Equipment	Offroad HP Range	Fuel Consumption (l/hr)*	Fuel Consumption (gal/hr)
Firewater Pump Engine (376 hp)	250 - 500	29.361	7.747
Emeregency Standby Generator (760 hp)	750 - 1,000	67.430	17.792

derived using Offroad2011 for

Total On-site Emergency Diesel Equipment Exhaust Emissions

Equipment*	Total Hours	Total Emissions (metric tons)			
		CO2	N2O	CH4	CO2e
Firewater Pump Engine (376 hp)	50	3.95	0.00	0.00	3.99
Emeregency Standby Generator (760 hp)	50	9.08	0.00	0.00	9.16
Total (metric tons/project) =		**13.04**	**0.00**	**0.00**	**13.15**

Fugitive SF6 Emissions

Sources	Number	SF6 (lbs/ source)*	Lbs SF6 Leaked*	Metric Tons CO2e***
OEC - circuit breakers	2	60	1.2	13.0
Well Pad - switches	8	30	2.4	26.0
Total Emissions (metric tons/year)				**39.03**

*Pounds of SF6 based on SCE, 2010; for SF6 GWP: CCAR, 2009.

**Leak rate assumed to be 0.5 percent.

***Global Warming Potential for SF6 = 23,900 (CCAR, 2009).

References:

The Climate Registry (TCR), 2011. Table 13.1 US Default Co2 Emission Factors for Transport Fuels. [http://www.theclimateregistry.org/downloads/2009/05/2011-Emission-Factors.pdf]

6. Indirect GHG Emissions

Electricity use emission factors

Units	CO2	N2O	CH4
lbs/MW-hr	681.01	0.00623	0.02829

Source: TCR, 2011, Table 14.1

Offset Electrical Grid Emissions

	Annual	Metric tons			
Capacity (MW)	MWh	CO2	N2O	CH4	CO2e
33	288,288	89,053	1	4	89,380

Construction Indirect Emissions from Water Use

		Water Use		Assoc. Electricity Use		Indirect GHG Emissions (metric tons/proj)			
Source	days/proj*	gal/day**	million gals/proj	Kw-hrs***	MW-hrs	CO2	N2O	CH4	CO2e
Power Plant	384	10,000.0	3.8	960.0	1.0	0.3	0.0	0.0	0.3
Pipeline Construction	336	10,000.0	3.4	840.0	0.8	0.3	0.0	0.0	0.3
Well Development	420	25,000.0	10.5	2,625.0	2.6	0.8	0.0	0.0	0.8
					Emissions (lbs/yr)	**1.4**	**0.0**	**0.0**	**1.4**

*Power plant construction would occur over two 8-month periods, 6-days a week; pipeline construction would over a total of 14 months, 6-days a week; well drilling would occur for 30 days and each of the 14 locations.

**Obtained from Proposed Action and Alternatives Section 2.2.3.4

***Assumes 250 kw-hrs per million gallonswould be required to supply and treat the water.

7. Offroad2011 Output

Calendar Year	AirBasin	Equipment Class	Equipment Type ID	Equipment Type	Horse power Bin	BaseBSFC (pounds/yr)	FC (liter/hr)	Base Activity (hr/yr)	Scen Activity	Population
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	50	132.629384	4.455621725	15.8840722	15.8840722	0.05029321
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	120	799.8272254	7.822972277	54.5575432	54.5575432	0.15405605
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	175	944.5971749	14.84910471	33.9450761	33.9450761	0.12070371
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	250	1337.854689	20.38707155	35.0174495	35.0174495	0.12017431
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	500	1482.102716	33.60623457	23.5336268	23.5336268	0.08417495
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	750	2042.431669	61.20442071	17.8071804	17.8071804	0.04182278
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	1000	160.9377602	90.54059885	0.94851675	0.94851675	0.00158821
				average (750-1,000 hp)	875					
				hp and multiplier (1,354 / 875)	1354	1.547428571	140.1051095			
2013	GBV	Construction and Mining	11	Bore/Drill Rigs	9999	544.6253963	262.4226254	1.10745739	1.10745739	0.00158821
2013	GBV	Construction and Mining	12	Cranes	50	42.93382134	2.515894727	9.10620647	9.10620647	0.02329603
2013	GBV	Construction and Mining	12	Cranes	120	1024.062135	4.993552462	109.432698	109.432698	0.28088351
2013	GBV	Construction and Mining	12	Cranes	175	2703.507133	8.393163206	171.882739	171.882739	0.42132526
2013	GBV	Construction and Mining	12	Cranes	250	4565.36719	12.26886299	198.564593	198.564593	0.47324212
2013	GBV	Construction and Mining	12	Cranes	500	6991.709364	18.95928364	196.784939	196.784939	0.4539397
2013	GBV	Construction and Mining	12	Cranes	750	1843.516669	31.94557626	30.7940461	30.7940461	0.06656007
2013	GBV	Construction and Mining	12	Cranes	1000	431.4017274	52.58734771	4.3775491	4.3775491	0.00998401
2013	GBV	Construction and Mining	12	Cranes	9999	33.22718197	58.11349039	0.30510334	0.30510334	0.0006656
2013	GBV	Construction and Mining	13	Crawler Tractors	50	130.8178101	3.900419898	17.8972343	17.8972343	0.05907552
2013	GBV	Construction and Mining	13	Crawler Tractors	120	5798.695828	7.370706198	419.8089	419.8089	1.01668974
2013	GBV	Construction and Mining	13	Crawler Tractors	175	6306.967704	12.55200153	268.125449	268.125449	0.66519038
2013	GBV	Construction and Mining	13	Crawler Tractors	250	6363.790408	17.08212702	198.794486	198.794486	0.48619155
2013	GBV	Construction and Mining	13	Crawler Tractors	500	17068.97529	28.84378064	315.78077	315.78077	0.78156916
2013	GBV	Construction and Mining	13	Crawler Tractors	750	6639.771918	47.99621327	73.820435	73.820435	0.16009467
2013	GBV	Construction and Mining	13	Crawler Tractors	1000	878.3007434	69.98629996	6.6966967	6.6966967	0.01417813
2013	GBV	Construction and Mining	13	Crawler Tractors	9999	464.308325	123.1812091	2.0113721	2.0113721	0.00354453
2013	GBV	Construction and Mining	14	Excavators	50	5238.294598	2.976417842	939.131556	939.131556	1.44689745
2013	GBV	Construction and Mining	14	Excavators	120	6800.590899	6.051060106	599.715946	599.715946	1.04652796
2013	GBV	Construction and Mining	14	Excavators	175	14326.96174	10.92686733	699.662898	699.662898	1.32962947
2013	GBV	Construction and Mining	14	Excavators	250	18227.81536	16.36074429	594.513851	594.513851	1.14306676
2013	GBV	Construction and Mining	14	Excavators	500	30238.2962	24.50723236	658.405518	658.405518	1.16261142
2013	GBV	Construction and Mining	14	Excavators	750	2733.906528	42.80220812	34.0837916	34.0837916	0.05922626
2013	GBV	Construction and Mining	14	Excavators	1000	306.8518554	62.8145822	2.60674585	2.60674585	0.0047381
2013	GBV	Construction and Mining	14	Excavators	9999	598.3037185	116.234019	2.74674828	2.74674828	0.00414584
2013	GBV	Construction and Mining	15	Graders	50	34.59295252	3.270657966	5.64394684	5.64394684	0.01845368
2013	GBV	Construction and Mining	15	Graders	120	935.1167778	7.273411945	68.6053647	68.6053647	0.19644244
2013	GBV	Construction and Mining	15	Graders	175	8685.88924	12.10897464	382.769505	382.769505	0.91911251
2013	GBV	Construction and Mining	15	Graders	250	15071.42	16.53836916	486.286154	486.286154	0.72981343
2013	GBV	Construction and Mining	15	Graders	500	4297.760337	23.50084446	97.5863645	97.5863645	0.13631915
2013	GBV	Construction and Mining	15	Graders	1000	41.55242888	63.71096499	0.34802677	0.34802677	0.00059528
2013	GBV	Construction and Mining	15	Graders	9999	585.3526203	159.2113649	1.96188666	1.96188666	0.0029764
2013	GBV	Construction and Mining	16	Off-Highway Tractors	50	2164.193147	3.562259802	324.190915	324.190915	0.55422268
2013	GBV	Construction and Mining	16	Off-Highway Tractors	120	2770.472082	6.414184185	230.485052	230.485052	0.40296486
2013	GBV	Construction and Mining	16	Off-Highway Tractors	175	2359.996789	13.51709534	93.1662142	93.1662142	0.15300984
2013	GBV	Construction and Mining	16	Off-Highway Tractors	250	1977.538344	18.17854282	58.0492027	58.0492027	0.0998652
2013	GBV	Construction and Mining	16	Off-Highway Tractors	500	5586.198056	28.52191073	104.512474	104.512474	0.17169807
2013	GBV	Construction and Mining	16	Off-Highway Tractors	750	1407.317326	49.09373588	15.2966513	15.2966513	0.0251123
2013	GBV	Construction and Mining	16	Off-Highway Tractors	1000	39.76437363	85.28735326	0.24879401	0.24879401	0.00058401
2013	GBV	Construction and Mining	16	Off-Highway Tractors	9999	310.0759394	143.2340943	1.15518642	1.15518642	0.00233603
2013	GBV	Construction and Mining	17	Off-Highway Trucks	50	207.0882002	2.346321463	47.0975433	47.0975433	0.03298396
2013	GBV	Construction and Mining	17	Off-Highway Trucks	120	254.3123884	6.41977601	21.1386893	21.1386893	0.01851731
2013	GBV	Construction and Mining	17	Off-Highway Trucks	175	4920.252204	11.83193362	221.902428	221.902428	0.17707178
2013	GBV	Construction and Mining	17	Off-Highway Trucks	250	10092.80547	15.67990629	343.477943	343.477943	0.30322096
2013	GBV	Construction and Mining	17	Off-Highway Trucks	500	42890.2159	28.07981061	815.06918	815.06918	0.67356718
2013	GBV	Construction and Mining	17	Off-Highway Trucks	750	15411.14372	49.60659679	165.777601	165.777601	0.15392515
2013	GBV	Construction and Mining	17	Off-Highway Trucks	1000	10664.47859	67.27576451	84.5885146	84.5885146	0.07059725
2013	GBV	Construction and Mining	17	Off-Highway Trucks	9999	15357.19944	133.3633757	61.447732	61.447732	0.04571461
2013	GBV	Construction and Mining	18	Other Construction Equipment	50	1173.086403	3.464555449	180.681172	180.681172	0.42799367
2013	GBV	Construction and Mining	18	Other Construction Equipment	120	3664.407553	6.614087286	295.640727	295.640727	0.75518129
2013	GBV	Construction and Mining	18	Other Construction Equipment	175	1998.64688	12.35057801	86.353352	86.353352	0.23502209
2013	GBV	Construction and Mining	18	Other Construction Equipment	250	2567.645181	17.7914945	77.0110406	77.0110406	0.21082864
2013	GBV	Construction and Mining	18	Other Construction Equipment	500	8785.785618	29.36064138	159.678144	159.678144	0.40956056
2013	GBV	Construction and Mining	18	Other Construction Equipment	750	3411.674389	48.69529263	37.3861728	37.3861728	0.08467708
2013	GBV	Construction and Mining	18	Other Construction Equipment	1000	398.0540201	67.4298423	3.15007057	3.15007057	0.00748845
2013	GBV	Construction and Mining	18	Other Construction Equipment	9999	247.0913033	89.32839828	1.47604068	1.47604068	0.00345621
2013	GBV	Construction and Mining	19	Pavers	50	143.7391848	3.51100379	21.8461189	21.8461189	0.06937073
2013	GBV	Construction and Mining	19	Pavers	120	1389.567798	6.4410681	115.120393	115.120393	0.33702615
2013	GBV	Construction and Mining	19	Pavers	175	1888.466839	12.87513726	78.2686619	78.2686619	0.22776724
2013	GBV	Construction and Mining	19	Pavers	250	1275.243422	17.4208662	39.0619357	39.0619357	0.09827521
2013	GBV	Construction and Mining	19	Pavers	500	480.5729126	26.37485393	9.72298551	9.72298551	0.02427976
2013	GBV	Construction and Mining	19	Pavers	750	55.53356569	61.01326041	0.48569288	0.48569288	0.00115618
2013	GBV	Construction and Mining	20	Paving Equipment	50	178.6889625	2.669372622	35.7206159	35.7206159	0.08541965
2013	GBV	Construction and Mining	20	Paving Equipment	120	811.9145637	6.179960324	70.105979	70.105979	0.17430226
2013	GBV	Construction and Mining	20	Paving Equipment	175	764.8253942	10.28872802	39.6671525	39.6671525	0.09523137
2013	GBV	Construction and Mining	20	Paving Equipment	250	401.1810124	15.00455335	14.2674944	14.2674944	0.03462959
2013	GBV	Construction and Mining	20	Paving Equipment	500	565.7655702	23.40695605	12.8979886	12.8979886	0.03116663
2013	GBV	Construction and Mining	20	Paving Equipment	750	268.2811613	42.08682722	3.40153077	3.40153077	0.00750308
2013	GBV	Construction and Mining	20	Paving Equipment	1000	52.46423608	58.62525993	0.47753915	0.47753915	0.00115432
2013	GBV	Construction and Mining	21	Rollers	50	2949.020401	2.922402438	538.478253	538.478253	1.75259363
2013	GBV	Construction and Mining	21	Rollers	120	4609.147431	6.413097826	383.515701	383.515701	1.30701898
2013	GBV	Construction and Mining	21	Rollers	175	4760.898824	10.5607629	240.560365	240.560365	0.75569461
2013	GBV	Construction and Mining	21	Rollers	250	751.5427566	15.70390756	25.5373822	25.5373822	0.09267953
2013	GBV	Construction and Mining	21	Rollers	500	473.5739165	24.86693974	10.1623897	10.1623897	0.03802237
2013	GBV	Construction and Mining	21	Rollers	750	23.1359399	38.3028594	0.32231934	0.32231934	0.0011882
2013	GBV	Construction and Mining	22	Rough Terrain Forklifts	50	150.1665345	4.145494908	19.3297922	19.3297922	0.079602
2013	GBV	Construction and Mining	22	Rough Terrain Forklifts	120	12077.95277	7.593355959	848.769923	848.769923	3.41053389
2013	GBV	Construction and Mining	22	Rough Terrain Forklifts	175	2220.668003	10.19133174	116.274133	116.274133	0.45633904

Calendar Year	AirBasin	Equipment Class	Equipment Type ID	Equipment Type	Horse power Bin	BaseBSFC (pounds/yr)	FC (liter/hr)	Base Activity (hr/yr)	Scen Activity	Population
2013	GBV	Construction and Mining	22	Rough Terrain Forklifts	250	182.7754196	16.44614611	5.93040098	5.93040098	0.02676274
2013	GBV	Construction and Mining	22	Rough Terrain Forklifts	500	77.39902356	29.15285687	1.41672245	1.41672245	0.00617602
2013	GBV	Construction and Mining	22	Rough Terrain Forklifts	750	12.11033156	49.20424226	0.13133603	0.13133603	0.00068622
2013	GBV	Construction and Mining	23	Rubber Tired Dozers	50	129.2381393	3.527458463	19.55056	19.55056	0.02319536
2013	GBV	Construction and Mining	23	Rubber Tired Dozers	120	616.6826146	6.369598915	51.6630489	51.6630489	0.06902034
2013	GBV	Construction and Mining	23	Rubber Tired Dozers	175	516.5220501	11.62608878	23.7074937	23.7074937	0.03564165
2013	GBV	Construction and Mining	23	Rubber Tired Dozers	250	538.7949048	16.43940927	17.4891091	17.4891091	0.02772128
2013	GBV	Construction and Mining	23	Rubber Tired Dozers	500	6176.786188	27.86536544	118.284609	118.284609	0.18499714
2013	GBV	Construction and Mining	23	Rubber Tired Dozers	750	725.5740825	45.31949827	8.54332802	8.54332802	0.01131481
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	50	409.4992684	3.282929829	66.5613227	66.5613227	0.0872716
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	120	9988.314789	6.041658141	882.198849	882.198849	1.0849983
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	175	23658.52074	10.61021799	1189.85405	1189.85405	1.42170158
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	250	32609.97455	14.52499597	1198.02216	1198.02216	1.26366922
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	500	42590.83131	22.50463827	1009.89098	1009.89098	1.17403893
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	750	7510.197726	41.20243916	97.2655076	97.2655076	0.10378245
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	1000	2187.129943	59.14209548	19.7336896	19.7336896	0.01886954
2013	GBV	Construction and Mining	24	Rubber Tired Loaders	9999	869.6147444	107.0551141	4.33460861	4.33460861	0.00412771
2013	GBV	Construction and Mining	25	Scrapers	50	9.380063653	3.779840013	1.32422804	1.32422804	0.0040796
2013	GBV	Construction and Mining	25	Scrapers	120	428.1947304	8.168343969	27.9729143	27.9729143	0.05886287
2013	GBV	Construction and Mining	25	Scrapers	175	4523.255249	15.93542239	151.466967	151.466967	0.37823766
2013	GBV	Construction and Mining	25	Scrapers	250	5195.04797	21.11036614	131.317985	131.317985	0.36716444
2013	GBV	Construction and Mining	25	Scrapers	500	45502.48643	36.08123064	672.952174	672.952174	1.61377515
2013	GBV	Construction and Mining	25	Scrapers	750	20829.18393	53.45956739	207.910886	207.910886	0.45982975
2013	GBV	Construction and Mining	25	Scrapers	1000	325.6034684	89.74853789	1.93594072	1.93594072	0.00757641
2013	GBV	Construction and Mining	25	Scrapers	9999	1183.493287	185.6718966	3.40133994	3.40133994	0.00757641
2013	GBV	Construction and Mining	26	Skid Steer Loaders	50	2228.451548	3.504004716	339.366467	339.366467	1.21416335
2013	GBV	Construction and Mining	26	Skid Steer Loaders	120	11841.98248	5.094233387	1240.44065	1240.44065	3.91819001
2013	GBV	Construction and Mining	26	Skid Steer Loaders	175	80.08501494	10.96170167	3.89855527	3.89855527	0.01625305
2013	GBV	Construction and Mining	26	Skid Steer Loaders	250	61.52967696	14.24518582	2.30487262	2.30487262	0.00902947
2013	GBV	Construction and Mining	26	Skid Steer Loaders	500	16.89412705	19.44304444	0.46366242	0.46366242	0.00180589
2013	GBV	Construction and Mining	26	Skid Steer Loaders	750	17.82107753	38.24809765	0.24863057	0.24863057	0.00060196
2013	GBV	Construction and Mining	26	Skid Steer Loaders	1000	29.08079965	72.16622199	0.21503185	0.21503185	0.00120393
2013	GBV	Construction and Mining	27	Surfacing Equipment	50	20.52442196	2.375477954	4.6105246	4.6105246	0.02129816
2013	GBV	Construction and Mining	27	Surfacing Equipment	120	161.2429783	5.230957144	16.4486425	16.4486425	0.06826333
2013	GBV	Construction and Mining	27	Surfacing Equipment	175	83.55885326	8.899523406	5.01021237	5.01021237	0.02293648
2013	GBV	Construction and Mining	27	Surfacing Equipment	250	177.39144	12.88779391	7.34487637	7.34487637	0.03440472
2013	GBV	Construction and Mining	27	Surfacing Equipment	500	560.3817627	21.26713592	14.0606501	14.0606501	0.05679509
2013	GBV	Construction and Mining	27	Surfacing Equipment	750	518.4499429	36.25609729	7.63055612	7.63055612	0.02839755
2013	GBV	Construction and Mining	27	Surfacing Equipment	1000	84.5543101	48.25062538	0.93511111	0.93511111	0.00382275
2013	GBV	Construction and Mining	27	Surfacing Equipment	9999	29.63762759	66.31030171	0.23850245	0.23850245	0.00109221
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	50	4401.113552	3.012784229	779.515864	779.515864	1.69912977
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	120	71376.54941	6.050381911	6295.10783	6295.10783	11.5369135
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	175	12316.55683	10.33705821	635.803284	635.803284	1.29062819
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	250	7136.031996	14.70168306	259.012156	259.012156	0.51625127
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	500	9619.692153	23.17124981	221.534887	221.534887	0.46592862
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	750	1353.249842	40.87989952	17.6643873	17.6643873	0.03256172
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	1000	229.4037147	63.54434554	1.92643317	1.92643317	0.00296016
2013	GBV	Construction and Mining	28	Tractors/Loaders/Backhoes	9999	3217.413349	144.9548752	11.8441649	11.8441649	0.02190516
2013	GBV	Construction and Mining	29	Trenchers	50	1563.181121	4.378077469	190.526888	190.526888	0.55720309
2013	GBV	Construction and Mining	29	Trenchers	120	1132.571353	8.13985555	74.2470646	74.2470646	0.25833962
2013	GBV	Construction and Mining	29	Trenchers	175	230.9253287	14.02909666	8.78359446	8.78359446	0.03419201
2013	GBV	Construction and Mining	29	Trenchers	250	452.704995	21.54676325	11.2114984	11.2114984	0.04052386
2013	GBV	Construction and Mining	29	Trenchers	500	764.5289534	35.26639553	11.5681331	11.5681331	0.03672475
2013	GBV	Construction and Mining	29	Trenchers	750	344.757478	61.29361883	3.00143433	3.00143433	0.00759822
2013	GBV	Construction and Mining	29	Trenchers	1000	20.36235514	84.63129669	0.12838888	0.12838888	0.00063319
2013	GBV	Construction and Mining	36	Sweepers/Scrubbers	50	1358.842406	3.533426938	205.212301	205.212301	0.32706033
2013	GBV	Construction and Mining	36	Sweepers/Scrubbers	120	2100.136002	6.947367198	161.308621	161.308621	0.2662792
2013	GBV	Construction and Mining	36	Sweepers/Scrubbers	175	523.8578086	14.26083139	19.6019371	19.6019371	0.03068
2013	GBV	Construction and Mining	36	Sweepers/Scrubbers	250	279.1950976	18.16363483	8.20229604	8.20229604	0.01273509
2013	GBV	Construction and Mining	36	Sweepers/Scrubbers	500	77.89178064	26.99016702	1.53998494	1.53998494	0.00231547
2013	GBV	Construction and Mining	36	Sweepers/Scrubbers	1000	54.58861982	75.66169136	0.38499623	0.38499623	0.00057887

APPENDIX D

Geologic and Geothermal Resources Technical Report

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Technical Geologic Overview of Long Valley Caldera for the Casa Diablo IV Geothermal Development Project

Prepared for:

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October 29, 2012
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Table of Contents

List of Figures

List of Tables

Geologic Overview of Long Valley Caldera
Potential Environmental Impacts

1 Introduction

Long Valley Caldera in eastern California has been explored for geothermal resources since the 1960s. Early exploration wells less than 1000ft (<300m) were drilled around Casa Diablo near the most prominent hot springs and fumaroles on the southwest flank of the Resurgent Dome (Figure 1). Deeper exploration wells were drilled to evaluate early federal lease offerings in the central caldera and later a portion of the caldera west of the Resurgent Dome. Well data established that the principal geothermal reservoir in Long Valley was not located directly beneath the Casa Diablo Hot Springs and did not appear to be related to the Resurgent Dome. Instead, the current hydrothermal system is more complex with shallow production at Casa Diablo supplied by upflow and outflow from a geothermal source beneath the western caldera moat.

EGS has been retained by Geologica, Inc., to provide background data for ESA in preparing the environmental documentation required to assess the potential geologic and hydrogeologic impacts of the planned expansion of geothermal production. This report addresses geologic and hydrogeologic considerations in preparing an EIS/EIR including:

Geology, soils and minerals
Geologic hazards
Seismic hazards
Faulting/surface rupture
Ground shaking
Slope stability
Liquifaction
Volcanic hazards
Surface water and shallow groundwater
Hot springs and fumaroles
Geothermal resources
Geothermal system evolution
Geothermal development
Conceptual basis for numerical modeling

This review is based on relevant background geologic reports and geothermal exploration experience in Long Valley Caldera. Additional drilling and exploration inherently yields new knowledge or unanticipated results. All of the geologic issues that could result in significant impacts related to expanded geothermal production may not have been identified or may require additional analysis in the future.

2 Regulatory Framework

Agencies involved in project permitting in Long Valley include:

U.S. Forest Service

The Pacific Southwest Region (Region 5) of the U.S. Forest Service adopted a set of best management practices for the protection of water quality and the prevention of soil erosion (USDA, Forest Service 2000). Included is the requirement for the preparation of an erosion control plan to limit and mitigate erosion and sedimentation.

State of California

The Alquist-Priolo Earthquake Fault Zoning Act (CGS, 2012) prohibits the location of most structures for human occupancy across the traces of active faults. The State Geologist (Chief of the California Division of Mine and Geology) is required to identify "earthquake fault zones" along known active faults in California. Counties and cities must withhold development permits for human occupancy projects within these zones unless geologic studies demonstrate that there would be no problems.

Mono County

County administration has adopted the 2001 California Building Code (replacing the "Uniform Building Code"). Among other elements, this code dictates the design and construction standards applicable to resist seismic shaking.

3 Geology, soils and minerals

The Project Site is located in the Long Valley Caldera, a 17 X 32 kilometer (km) topographic depression created approximately (~) 760,000 years ago by the eruption of an estimated 600 km^3 of rock (Bishop Tuff) (Figure 2 after Bailey, 1976). The topographic floor of the caldera slopes from ~8,500 feet above sea level (asl) in the west across uplands and hills in the west and central part of the caldera to a relatively flat alluvial plain at approximately 6,700 feet at Lake Crowley on the east. The caldera's topographic walls reach elevations of 9,800 at Glass Mountains on the northeast to 11,500 feet in the Sierra Nevada on the south and west.

3.1 Geologic Background

Long Valley Caldera is the largest feature in the Mono-Long Valley volcanic field that includes Pleistocene-Recent eruptive centers of Mammoth Mountain and the Mono–Inyo volcanic chain. Complex volcanic, tectonic and glacial processes have controlled the caldera's formation and shaped the surface features of the caldera. Volcanism associated with Long Valley began ~ 4 million years ago with widespread eruptions of intermediate and basaltic lavas accompanying the onset of large-scale normal faulting that formed the eastern front of the Sierra Nevada and the Owens Valley graben (Figure 2). Discontinuous erosional remnants of these precaldera extrusive rocks are scattered over a 4000 km2 area around the caldera suggesting an extensive mantle source region (Bailey and others, 1989).

Rhyolitic eruptions began ~ 2 Ma ago from multiple vents of the Glass Mountain eruptive complex along the northeast rim of the present-day caldera (Metz and Mahood, 1985) (Figure 2). The caldera-forming Bishop Tuff eruption partially evacuated the underlying magma chamber and the floor of the caldera subsided along semicircular systems of ring fractures that define the structural margin of the caldera. Approximately 350-400 km^3 of the Bishop Tuff filled the caldera depression and is the deeper potential geothermal reservoir within the caldera.

Post-collapse eruptions have continued to fill the caldera over the last 600,000 years (Bailey and others. 1976; Bailey 2004; Hildreth 2004). A series of rhyolite flows and tuffs (Early Rhyolite) mark the onset of resurgence in the west-central part of the caldera approximately 600,000 years ago (Figure 2). Coarsely porphyritic Moat Rhyolites erupted later around the Resurgent Dome beginning in the north approximately 500,000 years ago progressing to the south around 300,000 years ago and approximately 100,000 years ago in the west (Bailey and others, 1976; Bailey and others, 1989). The western Moat Rhyolites erupted during a period of more voluminous basaltic and andesitic flows that began approximately 200,000 years ago in the western part of the caldera extending beyond the caldera margins to the south and west. These more mafic eruptions include basalts in the southwestern caldera moat (Casa Diablo flow of Bailey and others, 1976), eruptive events such as the 100,000 year-old Devil's Postpile basaltic andesite and more recently, the 8,000 year-old Red Cones south of the caldera. A series of rhyodacitic eruptions also occurred in the western caldera moat 110,000 – 50,000 years ago; the most prominent of these is Mammoth Mountain on the southwestern topographic rim of the caldera (Bailey 2004). The main bulk of the mountain was formed in less than 2,000 years (Mahood and others, 2010) and Hildreth (2004) suggested that the mixed mafic-rhyodacitic volcanism represented a separate magmatic system outside the caldera's ring-fracture system.

The most recent eruptions in the area occurred along the Mono-Inyo volcanic chain extending from the western caldera moat northward to Mono Lake (Figure 3). Eruptions along the chain began approximately 40,000 years ago and have continued to historic times. Bursik & Sieh (1989) identified 20 small eruptions (erupted volumes <0.1 km^3) within the chain over the past 5000 years. The most recent dome-forming eruptive events occurred at the north end of the Mono Craters about 600 years ago (Bursik & Sieh 1989) and along the south end of the Inyo Domes about 700 years ago (Sorey and others, 1998). The magma source for these eruptions is an 8–10-km-long dike that trends north out of the caldera. The progression of eruptions over the past 2 Ma from Glass Mountain on the eastern caldera margin to Mammoth Mountain on the west and the Mono–Inyo volcanic chain to the north suggests that the magmatic system that erupted to form Long Valley Caldera has declined with time and has been supplanted by mixed composition eruptions from the active Mammoth Mountain–Inyo Domes magmatic system (Hildreth, 2004).

The Project site is located in western caldera moat and within the ring fracture system that defines the southern and western boundary of the caldera. The Project site is located in the northern part of the Mammoth Creek drainage that flows through the southwestern caldera moat and includes the seasonal drainage of Basalt Canyon and Rhyolite Plateau upland north of the Town of Mammoth Lakes (Figure 5).

3.2 Structure

Long Valley Caldera lies within an east-west embayment or offset in the northwest trending Sierran escarpment (Mayo, 1934). The east-dipping normal faults that form the escarpment mark the western edge of crustal extension in the Basin and Range Province. The caldera is located at the northern end of the Owens Valley graben, part of the Eastern California Shear Zone, a region of transtensional deformation along the western edge of the Basin and Range that extends to the north along the Walker Lane in western Nevada (Figure 4) (Hill, 2006). Transtensional deformation and active magmatism within the Eastern California Shear Zone are attributed to distributed right-lateral slip that accounts for 15 - 25% of the relative motion between the Pacific and the North American plates (Dixon and others. 2000). The region remains tectonically active. The USGS Quaternary Fault Database and the California Geologic Survey mapping identifies numerous faults that have been active in recent times based on offset glacial till or alluvial units within and outside the caldera (Figure 5).

The structural floor of the caldera is composed of Paleozoic metasedimentary rocks and Mesozoic crystalline intrusive rocks segmented into a number of discrete blocks with varying offsets. Extensional strain is complexly resolved within the caldera because of the inherited older crustal faulting and fracturing that defined the pre-existing Sierran range front embayment and accommodated 1-2 km of subsidence as the caldera's floor foundered. The pre-existing tectonic framework controlled the configuration of the caldera floor and, through faults and fault intersections, controlled the location of postcollapse eruptive centers. The inherited deep basement structures of the western caldera provide the high fracture density and deep permeability for the source of the present geothermal system in Long Valley (Suemnicht and Varga, 1988).

3.3 Seismic Setting

Moderate to strong historical earthquakes occur regularly in the eastern Sierra Nevada and the Owens Valley south of Long Valley Caldera (Ellsworth, 1990). The northern end of the rupture zone of the M~7.6 Owens Valley earthquake of 1872 extended to within 60 km of Long Valley Caldera (Figure 4) and earthquakes M>5 occurred outside the caldera before 1970 (Cramer & Toppozada 1980; Ellsworth 1990). The Project site is located in a broad region of active and potentially active fault zones identified in the USGS Quaternary Fault Database (USGS, 2006) and in seismic hazard maps compiled by the California Division of Mines and Geology (CDMG, 2005) (now California Geologic Survey).

Beginning in the late 1970s, Long Valley Caldera began a period of unrest that included earthquake swarms, approximately 80 cm of inflation over approximately 4 km^2 within the resurgent dome, changes in the outflow from hot springs and fumaroles and increased carbon dioxide (CO_2) emissions around the flanks of Mammoth Mountain (Figure 6). The gas emissions on Mammoth Mountain have been accompanied by rising $^3He/^4He$ ratios interpreted as potential indicators of magma moving to shallower crustal levels. The largest magnitude earthquakes occurred within the Sierran block south of the caldera while caldera activity was marked by earthquake swarms, long-period (LP) and very-long period

(VLP) volcanic earthquakes. An intense earthquake sequence included four M>6 earthquakes within and around the caldera on May 25, 1980.

3.3.1 Seismic Hazards

Long Valley caldera remains a tectonically active area. The Hilton Creek fault that deforms the southeastern caldera margin and splays across the Resurgent Dome is a significant range-bounding normal fault along the eastern side of the Sierra Nevada and is one of the most studied faults within the Sierra Nevada-Basin and Range boundary zone (USGS, 2006). Exploratory indicates the fault is characterized by down-to-the-east normal displacement and it offsets late Tioga lateral moraines and outwash deposits that are ~10,000 years old. Surface-fault rupture along the Hilton Creek Fault was associated with four M 6+ earthquakes that occurred in May 1980 (Taylor and Bryant, 1980). Latest Pleistocene vertical slip rates range from 0.9 mm/yr to 4.2 mm/yr (USGS, 2006).

3.3.2 Faulting and Surface rupture

The Geologic Map of Long Valley (Bailey, 1989), Mt. Morrison Earthquake Fault Zoning Map (CDMG, 1982) and the USGS Quaternary Fault database identify several Quaternary-Recent-Historic north-northwest trending fault zones within the Project area (Figure 5). The CDMG evaluated the effects of the 1980 period of seismic unrest and identified ground cracks and minor fault offsets within the Resurgent Dome northeast of the project area and the north-northwest striking Taylor-Bryant fault zone crossing the junction of Route 203 and Highway 395 just west of the existing MP-I power plant (Sherburne, 1980). Additional north striking faults deform the Rhyolite Plateau north of the Project area in the vicinity of proposed well 55-31 (CDMG, 1982; EMA, 2005).

The principal damage risk of surface fault rupture (exclusive of induced slip or settling) is deformation or offset along the actual location of a fault break. To avoid those potential risks, California's Alquist-Priolo act was passed in 1972 and both State and Federal geologic surveys have worked to identify faults the represent the greatest risk of near-term movement and surface rupture. The fundamental design criteria for earthquake stability and seismic hazard avoidance were in place when the current G-1 plant was built in 1985. The existing G-1 plant at Casa Diablo has not had a significant seismicity related problem despite nearly three decades of continued seismic unrest and multiple locally felt earthquakes in and around Casa Diablo. Engineering studies completed in advance of a proposed M-1 replacement plant identified a <u>suspected</u> fault and "has no evidence of 1980 or even Holocene (*within the last 10,000 years*) movement," The trenching revealed "no direct evidence of faulting," based on the lack of deformation in Pleistocene (1.8 million to 10,000 year old) sediments (Black Eagle Consulting, 2011). While engineering work for the planned CD-IV facility has not been completed, the planned plant site is less than 0.5 mi (0.8km) northwest of the trenching locations for the M-1 replacement plant along the same fault trend that should have a similar movement history.

3.3.3 Ground shaking

Proximity and composition of subsurface materials affect the potential for ground shaking during an earthquake. California permitting agencies set suitable levels of protection for the peak ground acceleration anticipated at individual project sites. The closer the site is to an epicenter location, the more severe the impacts of ground shaking. Wells within and adjacent to the Project area penetrate a thin section of poorly consolidated poorly sorted coarse alluvial, colluvial or till units that have the potential for substantial seismic ground shaking related to soft soil/rock conditions. Quantitative analysis of in-situ liquefaction or earthquake induced slide potential requires site-specific assessment of ground shaking levels. There is a ten percent probability that the peak ground acceleration from an earthquake will be between 40 to 50 percent of gravity in the next 50 years (EMA, 2005).

Project Impacts

The planned Project will fully comply with all applicable building codes including planning and construction for seismic hazards. The completed engineering studies comply with the requirements of the Alquist-Priolo Act and document that no definitive active faults could be identified within the area of the planned facility. Trenching for foundation engineering is now a standard method for determining as conclusively as possible the presence of an active fault. Under the Alquist Priolo Act, "an active fault is one that has ruptured in the last 11,000 years" (CGS, http://www.conservation.ca.gov/cgs/rghm/ap/Pages/main.aspx). In accord with the general US Geological Survey definition: "Faults are commonly considered to be active if they have moved one or more times in the last 10,000 years" (USGS, http://earthquake.usgs.gov/learn/glossary/?term=active%20fault).

As noted (Section 3.3.2 *Faulting and Surface Rupture*), the project site is within a region of Quaternary-Recent faulting that the California Geologic Survey with the greatest risk of ground shaking resulting from a major earthquake (CDMG, 2005). The existing Casa Diablo plants have operated since 1985 through a peak period of earthquake swarms and three decades of sustained seismic unrest within the caldera without any significant ground shaking effects.

3.3.4 Liquefaction

Liquefaction, or the conversion of soils from a solid state to a more liquefied state, can occur in areas of a shallow groundwater table where unconsolidated sediments or poorly consolidated rock units are saturated at shallow (<10ft; <3m) levels. Neither condition occurs in the project area. Lithologic logs from groundwater wells within and adjacent to the Project area indicate the area is underlain by a thin section of poorly consolidated poorly sorted coarse alluvial, colluvial or till units that are unsaturated because water table depths are 50 -150 ft. (15-45 m) below the ground surface.

Project Impacts

Liquefaction from ground shaking during a seismic event is highly unlikely based on soil conditions within the project area. The existing Casa Diablo plants have operated since 1985 through a 20-year period of peak earthquake activity within the caldera and at Casa Diablo without any liquefaction events. Project plans specifically avoid potential areas of saturated soils such as wetlands or minor topographic lows that might accumulate seasonal runoff.

3.3.5 Induced Seismicity

Increased levels of seismic activity can occur around developed geothermal fields and is one form of induced seismicity (Majer and others, 2007). The induced events are typically small (M<3.0) and are not generally felt (Majer, 2011). Long Valley is a seismically active area and swarms of earthquakes have occurred within and outside of the caldera during the period of seismic unrest following a series of M6± earthquakes in 1980. Brief flurries of small (M<2.3) earthquakes beneath the north flank of Mammoth Mountain were triggered by the M=7.2 Hector Mine earthquake of 16 October 1999 (epicentral distance ~ 420 km). Surface wave propagation from the M=7.9 Denali Fault earthquake of November 3, 2002 (epicentral distance ~ 3 460 km) also triggered microearthquakes beneath the south flank of the mountain (Prejean and others, 2004). Remotely triggered earthquake swarms could be related to a variety of physical processes. Similarly timed remotely triggered events occurred in Yellowstone, The Geysers and Coso implying some relationship with changes in the existing hydrothermal systems and active transport of hydrous fluids in the crust (Hill & Prejean 2005).

Project Impacts
Given the high level of background seismicity in the region, induced seismicity directly related to geothermal activity has not been observed in the extensive records compiled from the regional and local seismic network established to monitor caldera unrest. Known induced seismicity within the caldera has been limited to remotely triggered swarms common to other hydrothermal systems. Seismic unrest within the caldera has declined since the 1990's. Few if any microearthquakes are currently detected on regional or local USGS monitoring networks (http://earthquake.usgs.gov/earthquakes/recenteqsus/Maps/special/Long_Valley.php) and none can be directly linked to geothermal development at Casa Diablo despite continued production and injection through and beyond the period of seismic unrest.

3.4 Slope stability

Slope instability could be related to shallow soil development, the presence of excess water, or a lack of shear strength at the soil/rock interface or in the soil itself. Seismicity, combined with these pre-existing instabilities, could trigger landslides, earthslip or mudflows.

Project Impacts
There are no known unstable slopes in the immediate vicinity of the project site.

3.5 Subsidence

Land subsidence is the loss of surface elevation as a result of the removal of subsurface support caused by a variety of natural mechanisms or human activity. One common cause of land subsidence is the removal subsurface fluids from underground reservoirs without replacing the extracted volume. Since geothermal production removes fluid from an underlying reservoir and can result in minor amounts of subsidence or inflation depending on the type of geothermal resource and the reservoir management strategy for a specific resource. One of the major factors in declaring a volcanic hazard alert for Long Valley was the ~80cm of measured uplift across the caldera's Resurgent Dome potentially related to magma intrusion. Subsidence of ~25 cm was also noted in the vicinity of Casa Diablo from the same monitoring surveys (Farrar and others, 1995; Howle and others, 2003). The subsidence was superimposed on the general pattern of uplift that began in 1980 so that actual land surface elevations at Casa Diablo remained relatively constant with subsidence nearly balanced by uplift. The U.S. Geological Survey related the subsidence to geothermal production from the comparatively shallow outflow reservoir at Casa Diablo (Howle and others, 2003). Increased production withdrawal for expanded production has the potential for inducing additional subsidence.

Project Impacts

Subsidence is not been considered an important environmental consequence for geothermal development in Long Valley because of the minimal amount of documented movement at Casa Diablo, the small affected area compared to the overall deformation across Long Valley and the known variability of deformation events during unrest in volcanic areas (Hill, 2006). Measured subsidence rates for Casa Diablo averaged 25 mm/year that is less than other developed geothermal systems (Mossop and Segall, 1997; Allis and others, 2009) and considerably less than subsidence rates in regions of extensive groundwater extraction (Poland and Lofgren, 1984). Notably, as with repeated inflation/deflation events of much greater magnitude in other well-studied active caldera complexes such as Yellowstone and Campi Flegri in Italy, calderas do experience complex inflation and subsidence during periods of unrest (Hill, 2006). Neither Yellowstone nor Campi Flegri or any one of many other volcanic centers experiencing complex deformation events are linked to geothermal production. The well-documented unrest in Long Valley caldera has been episodic and not necessarily uniform. Recent deformation within the resurgent dome in the west central part of Long Valley caldera has been punctuated by periods of abrupt rapid uplift, relative quiescence and even minor subsidence (Hill, 2006). The leveling data are not necessarily a uniform record and although early USGS short baseline leveling studies around Casa Diablo document the amount of subsidence in a noisy record was less that 25% of the total uplift noted across the resurgent dome.

The potential for subsidence is reduced by the differing reservoir conditions across the caldera and modern geothermal field management practices of developing the reservoirs in stages and complete return of all the produced fluid to the subsurface to avoid large-scale and irreversible effects on surface features and resource sustainability. Caldera deformation, particularly subsidence at Casa Diablo, has been discontinuous since 1988 and the record of deformation across the entire caldera including Casa

Diablo has not necessarily been constant or uniform (Langbein, 2003). The USGS observed that the apparent amount of subsidence was limited and spatially related to the producing area around Casa Diablo. Interpretations related the minor amount of subsidence to a combination of thermal contraction in the deeper 700m deep injection zone and slow pressure declines in the shallow 200m deep production zone (Farrar and others, 1995; Langbein, 2003). Later USGS publications on the Casa Diablo field also suggest alternative mechanisms for the subsidence such as comparatively shallow effects like changes in shallow unconfined aquifers and the slow dewatering of relatively compressible, porous sediments and hydrothermally altered volcanic tuffs or tuffaceous sediments that underlie the topographic low of the structural graben that contains most of the Casa Diablo development (Howle and others, 2003). The shallow effects are part of the changes limited to the early production history of the field and are not necessarily continuous or continuing. The USGS continues to monitor deformation with fixed global positioning system (GPS) stations and 2-color geodimeter instruments (http://earthquake.usgs.gov/monitoring/edm/longvalley/continuous.php). Records for the monitoring station nearest Casa Diablo indicate vertical displacement in the area has been relatively stable and within the last year has begun to rise in response to a more recent minor inflation event within the Resurgent Dome.

The planned development into Basalt Canyon will produce from a much deeper reservoir in indurated Early Rhyolite and Bishop Tuff which should reduce the effect of changes in shallow aquifer conditions and relatively compressible poorly consolidated altered alluvium/colluvium noted at Casa Diablo. Reservoir modeling (Section 5.5) of potential pressure declines related to the Basalt Canyon development are forecast to be in the range of 1.45 psi to 10 psi or approximately 20% of measured pressure declines from existing Casa Diablo facilities. Howle and others (2003) note that the Casa Diablo subsidence could be due to shallow effects like changes in shallow unconfined aquifers and the slow dewatering of relatively compressible, porous sediments and hydrothermally altered volcanic tuffs or tuffaceous sediments in the topographic low of the structural graben that contains most of the Casa Diablo development. Those shallow effects will be minimized because Basalt Canyon wells will be completed in and produce from zones two to three times deeper than the existing Casa Diablo production reservoir in competent welded Bishop Tuff separated from less competent overlying sediments.

3.6 Volcanic Hazards

Volcanic hazard concepts related to the continuing unrest within the caldera evolved rapidly as research progressed on the Mono-Long Valley magmatic system Hill (2006). The intense earthquake sequence on May 25, 1980 included four M>6 earthquakes within and around the Long Valley that occurred within days of the May 18, 1980 eruption of Mount St Helens and, in that context, raised strong concerns about the eruptive potential of a large active magma chamber beneath the caldera. Based on Long Valley data and a better understanding of restless calderas worldwide, large silicic calderas can go through sustained periods of episodic unrest, separated by years to decades of relative quiescence, all without producing an eruption (Newhall & Dzurisin 1988; Newhall, 2003). Caldera unrest can also be more intense and may extend beyond the comparatively short restless periods associated with central vent volcanoes. Volcanic earthquakes, increased magmatic gases and changes in geothermal manifestations have all occurred in Long Valley Caldera without an eruption.

3.6.1 Eruptive Potential

The USGS volcanic hazards response plan for Long Valley (Hill and other, 2002) reasoned that potential future eruptions in the region would be similar to the types and scales of eruptive events that have occurred within in the recent past. Eruptive events in the region within the last 50,000 years include explosive eruptions of silicic lavas like those occurred along the north striking Mono Craters and Inyo Domes 500 to 600 years ago (Miller, 1985). Volcanic unrest at single-vent volcanoes have been monitored much more closely after the 1980 eruption of Mt St. Helens and patterns of seismic activity, deformation and rapid changes in hydrothermal systems have given strong indications of the location of eruptions shortly before magma reaches the surface. Long Valley more complex than a single vent volcano and symptoms of volcanic unrest may persist for decades or even centuries at large calderas, such as Long Valley Caldera. Recent studies indicate that only about one in six such episodes of unrest at large calderas worldwide actually culminate in an eruption (Newhall & Dzurisin 1988; Newhall, 2003).

The USGS California Volcanic Observatory (CalVO) monitors volcanic activity through seismicity, emissions of volcanic gas and ground swelling. Long Valley remains on an active volcanic hazard alert status although the US Geological Survey states that earthquake activity within and adjacent to the caldera has remained at a comparatively low level since 1999. The caldera is probably not underlain by a laterally extensive, upper-crustal magma body capable of feeding a major eruption (Eichelberger, 2003), but none of the current data exclude the possibility of smaller (<1 km3) eruptions from smaller magma sources or a series of phreatic explosions similar to the historical eruptions that occurred along the Inyo-Mono dike (Miller, 1985). The 1978-2004 period of unrest most likely was associated with the addition of ~0.3 km^3 of magma and hydrous fluids at a depth of 6-7 km beneath the resurgent dome. Seismic tomography studies might resolve a 1–2 km diameter magma body but not the smaller melt volumes noted above (Hill and Prejean, 2005). The dacitic magma chamber beneath Mammoth Mountain has probably crystallized because the last eruption occurred 52,000 years ago (Hildreth, 2004). Hill & Prejean (2005) ascribed the 1989 earthquake swarm beneath Mammoth Mountain that included mid-crustal long-period earthquakes and increased CO_2 venting to a "mid-crustal plexus of basaltic magma (*that*) remains capable of feeding future mafic eruptions. This magma plexus presumably fed eruptions of the mafic field surrounding Mammoth Mountain, including the 8,000 year-old Red Cones vents, and it is the likely heat source for the 700 year-old phreatic explosion vents on the northeast flank of Mammoth Mountain." Some long period earthquakes have occurred west of the Mono Domes (Pitt & Hill 1994) but the area has remained comparatively quiet during the unrest in Long Valley.

Project Impacts

Based on a geologic history of 20 eruptions over the last 5000 years and the eruption at Pahoa Island approximately 200 years ago (Bailey 2004), the young silicic domes of the Mono–Inyo volcanic chain still have the potential to produce significant eruptive events (http://volcanoes.usgs.gov/observatories/calvo/). The USGS reasoned that "….the probability of such an eruption occurring in any given year is less than 1%. This is comparable to the annual chance of a magnitude 8 earthquake (like the Great 1906 San Francisco Earthquake) along the San Andreas Fault in coastal California or of an eruption from one of the more active Cascade Range volcanoes in the Pacific Northwest, such as Mount Rainier" (USGS Fact Sheet 073-07).

3.6.2 Eruption effects

If, as the USGS suggests, potential future eruptions are similar to the most recent eruptive events in the last 5000 years along the Mono-Inyo volcanic chain the eruptions are likely to be small and the overall impact will depend on the location, size and type of eruption and the wind direction. The well-documented eruptive progression along the Mono-Inyo chain is apparently controlled by magma type, the depth of penetration into the shallow crust, variations in country rock and groundwater. Dike intrusions, similar to the Mono-Inyo dike, would fragment and produce phreatic eruptions that discharge a mix of rocks, ash and steam around an explosion craters like the Inyo Craters (Figure 7) and phreatic craters on the north face of Mammoth Mountain but without surface extrusions. The initial phreatic explosions clear a path for later magma to make it to the surface and, if an eruption progressed, magma extrusion to the surface would eventually build a rhyolite dome in the center of a tephra ring that could be overridden by upwelling lava to produce lava domes like the Inyo Domes 550 years ago (Miller 1985). The recent domes along the Mono-Inyo chain are relatively small volcanic cones, less than 1,000 feet (300 m) in diameter, that produced hot, viscous lava flows that extended only a few miles.

The pumice and ash from an anticipated small eruption may be blown by the wind tens to hundreds of kilometers from the vent before falling to the ground. At the surface, the ash becomes finer grained and smaller in volume with distance from the vent (Figure 8). Based on other recent eruptive events, the USGS projects that a thin dusting of fine ash could disrupt social and economic activities for weeks or months and that modest ash accumulations would pose no immediate threat to life or property in part because most structures in the Mammoth Lakes region are built to withstand substantial snow loads. Larger volume explosive eruptions can produce turbulent hot pyroclastic flows that can be more devastating (Figure 9). Several sites over the past 5,000 years, along the Mono-Inyo chain have produced narrow, pyroclastic flows that extended more than 5 miles. The potential of snow melt and volcanic mud flows (lahars) persist if an eruption were larger scale occurred during the winter and was located at higher elevations such as Mammoth Mountain (Miller and others, 1982).

Project Impacts

The project area is more than 3 km from the potential future eruption sites like the phreatic explosion craters on Mammoth Mountain and more than 5 km from potential eruptive areas around the Inyo Craters. Early volcanic hazard evaluations (Miller and others, 1982) considered areas of earthquake swarms around the southern caldera moat (Figure 9) as a potential eruptive site. The area remains a potential vent area but seismicity has since declined and, as the USGS notes in its volcanic hazard assessment, “pinpointing the precise time and location of the next eruption in the Long valley area is not feasible,” and “Future eruptions in the region are most likely to consist of one or more of the types of volcanic activity that have occurred in the past few thousand years along the Mono-Inyo Craters volcanic chain”(http://volcanoes.usgs.gov/volcanoes/long_valley/long_valley_hazard_9.html). Project buildings and facilities would conform to accepted construction requirements to withstand heavy snow loads and should be able to accommodate light ash fall. Larger scale events and larger volumes of erupted materials are not projected for probable future eruptions.

3.6.3 Magmatic Gases

Increased gas emissions have been noted at the ground surface within the caldera since the 1990’s and have been interpreted as another manifestation of the pattern of volcanic and seismic unrest in the area (Hill and others, 2002). The increased gas emissions attributed to magmatic activity are distinguished from the natural releases of gas dissolved in geothermal fluids by the distinct helium and carbon isotope contents related to increased magma input at depth beneath at least the Mammoth Mountain section of the caldera (Sorey and others, 1998; Gerlach and others, 1998). The potential magma-related gas emissions vary from diffuse gas flow over broad areas and prominent surface steam vents such as a fumarole on the north slope of Mammoth Mountain 4 km from the project area and at less prominent surface manifestations in the western caldera moat. A broad zone of diffuse gas flow at Horseshoe Lake resulted in trees dying off in the early 1990's during a period of increased earthquake activity beneath Mammoth Mountain generally interpreted as new dike intrusions and magmatic gas input deep beneath Mammoth Mountain (Hill, 2005). The CO_2 gas flow at Horseshoe Lake was measured at 5800 g/d/m^2 of ground surface, a level usually associated with hot gases at the summit of active volcanoes. The high CO_2 gas flow was sufficient to interrupt root zone respiration killing trees in a 0.2 km^2 area (Sorey and others, 1998). Localized areas of potential gas flow within the project area occur at fumaroles north and east of Shady Rest Park and Basalt Canyon within the project area. The RDO-8 DOE exploration hole ~0.5 km north Shady Rest in the project area had elevated levels of CO_2 and H_2S in and around a containment structure over the wellhead and the hole was plugged and abandoned in 2007.

Gas dissolved in geothermal fluids at reservoir depths can be released when geothermal fluids are released to the atmosphere. Although such releases are not part of normal operations of the planned project, they will occur occasionally during flow testing, start-up or power plant outages. These geothermal gases represent a small (<1%) component of the geothermal fluids. The gases are primarily carbon dioxide with minor amounts of other gases such as hydrogen sulfide, methane, ammonia, nitrogen, and hydrogen.

Project Impacts

Gas emission hazards are not anticipated to be a problem within the project area. Gas emissions are currently monitored as part of the USGS volcanic hazards program to permit avoiding any areas of elevated gas concentrations or to note where confined spaces might create a hazard. Increased gas emissions from further magmatic or seismic unrest would most likely take place over an extended period of time. Project construction and drilling operations regularly monitor gases as part of geothermal workplace safety. Gas emissions from wells is a common air quality issue but should not be a problem with standard completion practices to maintain wellbore integrity.

3.7 Soil Resources

The Project area is situated in a variety of soil types in the southwestern caldera. Based on NRCS mapping (Figure 10), project soil distribution includes:

Vitrandic Haploxerolls soils in the vicinity of Shady Rest Park. These soils are composed of 0 to 60 inches of gravelly coarse sand derived from pumice and/or residuum weathered from obsidian and support Jeffrey Pine habitats (NRCS-1).

Haypress family soils around proposed wells to the northeast and southwest of Sawmill Road. These soils are gravelly loamy and coarse sand derived from till and granitic rocks (NRCS-1) on steep slopes in mountain foothills where water table depths are usually over 80 inches (NRCS-1). Haypress soils primarily support open Jeffrey Pine, Ponderosa Pine, Manzanita, black oak, and some grass and sagebrush (Great Basin scrub) habitats. Haypress family soils typically support livestock grazing and timber production (NRCS-2).

Both the Haypress family and Vitrandic Haploxerolls have low erosion hazard, low runoff potential, rapid permeability and low to moderate soil productivity (EMA, 2005).

Calpine family soils around proposed wells in the flatter lowland areas to the east and west of Highway 395 in the southeastern portion of the Project area. Calpine family soils are composed of gravelly sandy loam derived from alluvium in alluvial fans and stream terraces (NRCS-1; NRCS-2) primarily supporting Great Basin scrub, livestock grazing with some areas used for irrigated agriculture (NRCS-2). Calpine soils are well drained, have low surface runoff potential, moderately rapid permeability, and low to moderate erosion hazard (NRCS-2; EMA, 2005).

Biglake-Chesaw family soils in the hills immediately to the northeast of several proposed well locations. Biglake-Chesaw soils are composed of very gravelly, coarse sand with occasional rock outcrops and typically occur on moderately sloping terrain. These soils are well drained and have rapid permeability (NRCS-2).

Project Impacts

All of the soils in the Project area have a low to moderate erosion hazard and very low to moderate soil productivity. No substantial soil erosion or the topsoil loss is anticipated related to the Project.

3.8 Mineral Resources

Known mineral resources in the region include the current geothermal system (see Section 4), potential precious metal deposits and industrial minerals such as clay, aggregate, pumice and cinders). The Blue Chert mine or prospect is a drilled and identified epithermal gold deposit on the southeastern side of the Resurgent Dome with inferred gold reserves of 68 M tons @ 0.018 oz/ton (Jessey, 2009, Prenn and Dyer, 2008). Sources of pumice or cinders generally occur 2-3 km north of the Project area. Claims for kaolinite clay sources include the Hundley Clay Pit in the northern part of the Resurgent Dome and numerous small hydrothermally altered areas distributed within the central caldera. Magma Power Company completed annual claim work on these minor prospects during the 1970's to maintain grandfather mineral/geothermal rights prior to federal geothermal lease sales in the 1980's. The claims include alteration areas adjacent to the Project area but the potential deposits were never fully evaluated or developed. The Hundley Clay Pit has operated intermittently since 1952. Standard Industrial Minerals, the current owner, trucks kaolinite from the Hundley pit to the company mill north of Bishop. Uses include paint filler, plastic, rubber, paper processing, Portland cement, ceramics, insecticides, pharmaceuticals, and stucco (Wilkerson and others, 2007; Lipshie, 2001).

Project Impacts

Geothermal development is not anticipated to interfere with any future gold mining activity because the Blue Chert prospect is approximately 10 km northeast of the Project area and central part o the geothermal system is located in the western caldera. Geothermal development has not and is not anticipated to interfere with kaolinite mining activity because the Clay Pit is approximately 8 km northeast of the Project area and central part o the geothermal system is located in the western caldera.

4 Surface Water and Shallow Cold Groundwater

Surface water in the vicinity of the Project area consists of perennial streams, ephemeral streams, small lakes and dams. Snow melt from the surrounding Sierra Nevada is the principal source of surface water runoff that recharges both the shallow cold groundwater system and deep geothermal system in Long Valley Caldera. Surface and groundwater generally follow topography flowing from very high elevation Sierra peaks to the west and south toward the topographic low of Lake Crowley to the southeast or northeast through the Dry Creek Basin to Big Spring along the Owens River headwaters in the northeast. Sources of cold groundwater and geothermal recharge include a portion of the same snow melt infiltration from surface water features and underflow or subsurface flow in shallow poorly consolidated glacial till or alluvium or in penetrative faults and fractures (Sorey, 2005; Wildermuth, 2009). Some additional recharge comes from higher elevations of the Glass Mountains complex in the eastern part of the caldera but the influx is less than recharge from the western and southern topographic margins of the caldera because precipitation is limited east of the Sierran Range front.

4.1 Surface water

Surface water flow follows topography within the Project Area originating at higher elevations on the topographic margins of the caldera to the south and west flowing downgradient to the north and east towards Mammoth Creek and eventually towards the Owens River below Lake Crowley reservoir. The Town of Mammoth Lakes is the principal water demand within the caldera. The Mammoth Community Water District (MCWD) supplies the Town of Mammoth Lakes through a mix of surface water and groundwater from the Mammoth Groundwater Basin (Figure 11) and recycling or conservation. The Project Area is located in the central- western portion of the Mammoth Groundwater Basin. The current maximum surface water right for MCWD in a wet year totals 2760 acre-feet (ac-ft) (Wildermuth, 2009) but surface water supplies are often limited because the caldera is subject to climatic extremes and prolonged periods of drought. A five-year average of recent diversions within the Mammoth Groundwater Basin totals 1,440 ac-ft (MCWD, 2012). Groundwater pumping makes up the greatest portion of the difference between water demand and surface water supply. Groundwater use averages 1595 ac-ft for normal years but varies between a low of 1331 ac-ft during a wet year but increases to 1942 ac-ft during a dry year (Wildermuth, 2009).

4.1.1 Mammoth Creek/Hot Creek

The perennial stream of Mammoth Creek is the principal surface water feature in the Mammoth Groundwater Basin flowing from the Lake Mary Basin in the Sierra highlands eastward through the Town of Mammoth Lakes and immediately south of the Project area. Near Hot Creek Fish Hatchery, Mammoth Creek becomes Hot Creek because natural thermal discharge from springs in and near the creek contribute to the flow (EMA, 2005). The Federal Emergency Management Association (FEMA) designated a 0.1 mile buffer zone around Hot Creek west and east of Highway 395 and south of the Project Area as a Zone A Flood Hazard or High Risk Area with a 1% annual chance of flooding and a 26% chance of flooding over 30 years (FEMA, 2011). Additional areas along Mammoth Creek in the Town of Mammoth Lakes are also designated as Zone A by FEMA; however these zones lie well outside the Project area.

The USGS maintains six Mammoth Creek/Hot Creek gauging and/or sampling stations in the vicinity of the Project Area (Figure 12):

- Western edge of the Town of Mammoth Lakes (Mammoth C AB)
- Mammoth Creek Park (Mammoth C Sherwin Rd and Mammoth Creek Flume within 100 meters of each other) in the Town of Mammoth Lakes
- Mammoth Creek - Highway 395 crossing upgradient of Hot Creek
- Hot Creek approximately 100 m and 600 m downstream

Periodic monitoring results (Table 1) for the western (upstream) reaches of Mammoth Creek document low water temperatures (6.5 – 11.5^{o}C), variable discharge rates (17 – 34.8 cfs). Comparatively elevated levels of silica (20.9 mg/L) boron (14 µg/L) and arsenic (4 µg/L) were analyzed in samples collected periodically between 1983 and 2008 at the Mammoth Creek/Hwy 395 monitoring point (Table 1). East of Highway 395, monitoring established a baseline stream flow rate of approximately 40 cfs for the Hot Creek drainage between 1996 and 2010 (http://lvo.wr.usgs.gov/HydroStudies.html). Increased discharge above background conditions occurred in 1996 (280 cfs), 2006 (190 cfs) and 2007 (240 cfs) during periods of high precipitation and runoff (Wildermuth, 2009; Farrar and others, 2010). Temperatures and surface water chemistry from periodic surface water samples collected from 1982 to 1986 downstream of Casa Diablo near where Mammoth Creek joins Hot Creek were distinctly different from those collected upstream. Analytical results from the site also show a comparatively higher average temperature of, and elevated levels of sulfate (115 mg/L), silica (188 mg/L), chloride of 193 mg/L and total dissolved solids (866 mg/L) (USGS National Well Information System http://waterdata.usgs.gov/nwis).

4.1.2 Basalt Canyon drainage

The U.S. Forest Service designates the Basalt Canyon drainage as an ephemeral/intermittent riparian conservation area (RCA) under the Sierra Nevada Forest Plan Amended Record of Decision (SNFPA ROD), (USDA, Forest Service, 2004). The Basalt Canyon drainage originates in the hills to the north and west of the Project area and includes a small upper tributary drainage near Shady Rest Park (Figure 12). The Basalt Canyon drainage parallels Sawmill Cutoff Road from northwest to southeast through the project area. The drainage turns east parallel to Pole Line Road until it crosses Highway 395, joins another ephemeral drainage that extends through the existing spill containment basin at the previously developed Casa Diablo portion of the project area before entering Mammoth Creek (Figure 12) (EMA, 2005). The Basalt Canyon drainage is not considered in FEMA's flood hazard mapping.

4.1.3 Murphy Gulch drainage

Murphy Gulch drains from west to east parallel to the north side of State Route 203 and is another ephemeral riparian conservation area south of the Project area and north of Mammoth Creek (Figure 12)(USDA Forest Service, 2004; EMA, 2005). Two small dams and siltation basins less than one-quarter mile south of proposed well 55-31 collects and stores sediment from storm water and snow melt runoff from the Town of Mammoth Lakes. Approximately one-third of a mile downstream from the siltation basin, Murphy Gulch flows under State Route 203 and into Mammoth Creek (EMA, 2005). The Murphy Gulch drainage does not appear in FEMA's flood hazard mapping program (2011); however, an earlier

Environmental Assessment for the Basalt Canyon Geothermal Pipeline mentions that the Murphy Gulch RCA is within a 100-year flood hazard zone (EMA, 2005).

Project Impacts

One potential surface water effect of the Project could be changes to the thermal spring input in the Mammoth Creek/ Hot Creek drainage. The proposed project shifts production farther west decreasing the potential for detrimental effects on thermal discharge of springs. Reservoir pressure changes are forecast to be relatively small for the planned production increase and small reservoir changes are less likely to have a significant impact on the thermal discharge that contributes to the surface waters such as Hot Creek. Additional injection wells proposed for the southern part of the Casa Diablo field will follow the current injection scheme returning produced fluids to permeable zones at ~2000 feet (~600m) within the deeper underlying Bishop Tuff. Over the 27 year production and injection history of the field, deeper injection has had no affect on thermal springs.

Project plans include mitigation measures designed to reduce the potential for adverse impacts to surface water quality in compliance with CSWRCB Construction General Storm Water Permit. Ditches would channel off-site storm water around construction and well sites to minimize erosion. Site storm water would be collected and contained and a Project Spill or Discharge Contingency Plan would be followed to clean up any incidental material or geothermal fluid spills. USFS or State of California best management practices for storm water would be followed and the Project would also comply with best erosion management practices during flood periods.

Geothermal fluids would not be discharged under normal operating conditions. Accidental releases could occur; however, large discharges of geothermal fluids are extremely unlikely because of well planned management practices, frequent inspections, testing, flow and pressure monitoring and automatic well shutdown features. A large release of geothermal fluid might pose a threat to surface water quality because of higher dissolved solids content but the Project Spill or Discharge Contingency Plan or Well Blowout Contingency Plan would be followed to prevent, control, contain, clean up and mitigate the impacts of any large spills.

4.2 Shallow cold groundwater

Light stable isotopes of deuterium (D) and oxygen 18 (^{18}O) have been used to determine the origins and interactions of groundwater and surface water in many hydrologic settings and in Long Valley. These data indicate that the recharge source for cold groundwater is snowmelt around Mammoth Mountain or the upper part of Mammoth Creek and from and the southern caldera margin predominantly Sherwin Creek (Figure 13) (Sorey and others, 1991; Sorey, 2011; Evans, pers. comm.). The cold groundwater system is differentiated from the deeper hotter geothermal system by geologic units, depth, temperature, and fluid chemistry (see Section 5.1.2 *Geochemistry*). Shallow non-thermal groundwater in the Mammoth Groundwater Basin is generally are colder (7 – 9 °C), shallower (25-265m), lower in total dissolved solids (TDS) and constrained to shallow glacial till, moat basalt and/or alluvium/colluvium aquifers of the Mammoth Groundwater Basin. These cold groundwater aquifers are separated from the deeper hotter geothermal system by either intense alteration of thick ash-rich Early Rhyolite units in the western caldera or low permeability rocks of a landslide that slid into the south central part of the caldera at the end of the catastrophic collapse of the caldera 760,000 years ago (Figure 14). Impermeable Early Rhyolite units have been penetrated by temperature gradient holes MLGRAP-1 and 2 and Oh Well-1 in the western part of the Mammoth Groundwater Basin (Figure 11) and the MCWD generally considers these units as impermeable unproductive consolidated bedrock (Wildermuth, 2009). Mammoth Basin groundwater supply wells produce cold groundwater from the hydrologic region drained by the upper reaches of Mammoth Creek

(Figure 11). Total production averaged 1.3 cfs (37 L/s; 590 gpm) over the 1983-2001 period (Sorey, 2005). The MCWD uses 1460 ac ft of groundwater on average but groundwater use can increase to as much as 3360 ac ft in extremely dry years (Norby, 2012).

4.2.1 Shallow groundwater quality

Monitored shallow non-thermal groundwater wells in the Mammoth Groundwater Basin include well M-14 by the Mammoth Community Water District), Sherwin Creek 2 (SC-2) by the USGS, and Elementary School New well (ESN) by Mammoth Pacific (Figure 15). Hydrographs for these wells are compared in Figure 16. Well ESN is a relatively shallow, non-thermal domestic water supply source for the local Elementary School located near geothermal monitoring wells 28-34 and CW-3. Because topography within the caldera varies considerably, depth to water or pressure readings are commonly converted to values of pounds per square inch – absolute (less atmospheric pressure) (PSIA) at a common elevation of 2072m (6800 ft) asl for the caldera-wide hydrologic monitoring program (Sorey 2005, 2010). Shallow cold water monitoring points are close to pressures plotted for the thermal wells in Long Valley At the 6800 ft datum. Average computed pressures of ~132 PSIA in the ESN supply well are close to those in nearby thermal monitoring point CW-3 (Figure 15). Average computed pressures of ~ 240 PSIA in SC-2 are close to ~ 230 PSIA measured in thermal well RDO-8 in the western caldera (Figure 17). Computed pressures of 340 PSIA in cold supply well M14 (Figure 16) are the result of closer proximity to recharge sources from the southern topographic margin of the caldera and illustrate that non-thermal groundwater monitoring points in different parts of the caldera have pressure histories that reflect proximity to recharge sources and the hydrologic characteristics of varying geologic units. The range of multiyear pressure variations computed for well SC-2 (Figure 16) is ~ 12 psi (28 ft of cold water head), but computed pressures in ESN are only 3 psi (7 ft of cold-water head). Seasonal variations have less of an effect at groundwater well SC-2 because the well is completed below a shallow confining bed. Cold supply well ESN is completed in the shallow unconfined aquifer in Chance Meadow resulting in relatively large annual variations in pressure related to variations in recharge but more subdued record of longer (multiyear) pressure variations.

Production temperatures and chemistry are slightly different for MCWD wells along the northwestern side of the basin compared to wells located to the east and south of the western edge of the Mammoth Groundwater Basin (Figure 18). MCWD production wells 16, 17 and 20 drilled in the northern part of the basin (Figure 11) range in temperature from 15 – 21 °C, approximately 10°C warmer than production wells in other parts of the basin. Well No.18 produces water at temperatures of 19-20°C and is the only warm shallow groundwater well located to the south. Slightly elevated temperatures 42°C were also noted at ~200m during the drilling and completion of well No. 26 in the central part of the Basin (Figure 11) but no stable static surveys were run to confirm the temperatures. The slightly warm MCWD wells in the northwest basin border the Rhyolite Plateau and the central part of the deeper geothermal source reservoir in the western caldera (Figure 5). The MLGRAP 1 and 2 and Oh Well-1 temperature gradient holes in the western caldera (Figure 15) were drilled to 460-665 m, considerably deeper than the 216 m total depth for the MCWD wells, and encountered maximum temperatures of 75-85°C. No fluid analyses are available for the temperature gradient wells but MCWD water quality analyses detect a very low concentration of 2-5 mg/L Cl and gradually declining pH in well No. 17 from 1992-2001.

Analyses for soluble conservative constituents like Cl and trace elements like As, B, Fl and Li have been used to identify and track the geothermal source of fluids in several geothermal systems including Long Valley (Sorey and others, 1978). Elevated Cl concentration and ratios of conservative elements such as CL/B are often used to estimate the geothermal contribution to hot springs, identify sources and to track changes in hydrothermal systems over time (Sorey, 2000). Within Long Valley, Cl/B ratios generally fall in the range of 23 although absolute Cl concentrations vary (Figure 19). Analytical data for cold MCWD groundwater supply wells was not available until the USGS collected samples in 2011)(Sorey, 2011; Evans, pers. Comm.). The Cl/B ratios of 22.4 in samples from well No. 17 in the far northwestern part of the Mammoth Groundwater Basin (Figure 18) are within the range of Long Valley geothermal waters; however, very low Cl concentrations of 5.17 are considerably less than ~250 mg/L typical of high temperature deep geothermal water.

Project Impacts

Monitoring records document no changes the chemistry of groundwater wells in the Mammoth Groundwater Basin from 1996 to 2009 during continual production of the geothermal system at Casa Diablo. There is no apparent relationship between current-day groundwater and geothermal chemistry. Based on Cl concentrations of only 5 mg/L in well No. 17 analyses, the geochemistry suggests a tiny 1-2% thermal component in this one groundwater well. Based on geochemistry, slightly warmer temperatures in groundwater wells in the northwestern corner of the Mammoth Groundwater Basin are not likely the result of a strong upward flow of hot water into the basin.

Because the shallow cold groundwater system and the deeper geothermal system are physically separated from the principal supply aquifers of the western Mammoth Groundwater Basin, geothermal production from the project is not expected to adversely affect the water quality in MCWD wells through either depleting the aquifer or by drawing in lower quality waters because of pressure declines. Reservoir pressures monitored in well 65-32 declined 60 psi during the prior 27 years of production from the field with no detrimental effects on shallow cold groundwater quality in the Mammoth Groundwater Basin supply wells (Sorey, 2011). Numerical simulations of the planned Basalt Canyon development forecast reservoir pressure declines in the range of 1.45 psi to 10 psi, which would be at the maximum less than 20% of the maximum monitored pressure declines to date. Regular monitoring data reviews by the BLM and the LVHAC should assure there are no adverse affects on the quality of shallow cold groundwater and would give permitting agencies the ability to order corrective actions should any adverse effects be determined.

5 Geothermal resources

Geothermal energy is the natural heat of the earth that, depending on temperature, permeability and fluid circulation, can be used in a range of applications from space heating to generating electricity. Geothermal electrical generation from conventional hydrothermal systems requires a relatively shallow young active heat source (<1 my old), highly permeable rocks and convectively circulating water at temperatures above ~ 130°C at economically accessible depths (currently ≤ 3,000 m or 10,000 ft). These unique conditions occur primarily around current volcanic areas or tectonic regions at the active margins of the earth's crustal plates. In a conventional geothermal resource, cold water recharge penetrates through faults and fractures in the crust where relatively high heat flow in areas of active tectonism and/or recent volcanism heats the water at depth. Hot water is less dense and rises in permeable zones in the overlying rock units eventually cooling and descending to be heated again. Mineral deposition or overlying impermeable rocks can form a barrier or cap limiting the vertical circulation of hot water and maintaining convective fluid flow in a permeable geothermal reservoir at depth. Most permeability barriers are imperfect or can be broken by the active tectonic processes responsible for the development of a geothermal system. Comparatively small amounts of water and/or gas leak to the surface along fractures and faults and show up as hot springs or steam vents (fumaroles) at the surface.

A conventional geothermal resource is generally defined as a hydrothermal system capable of supporting electrical generation. Geothermal resources vary in size, temperature, permeability and chemistry depending primarily on the geologic setting and the rocks that make up a geothermal reservoir. Based on reservoir fluids, geothermal systems occur as either water-dominated or steam-dominated resources. Steam-dominated systems like The Geysers, north of San Francisco, are comparatively rare but have the advantage of using the steam to directly power a turbine generator. Water dominated systems like Long Valley are more common and require that a portion of the geothermal fluid be flashed to steam or that the geothermal fluid can be used to vaporize a low vapor pressure secondary working fluid. Either the flashed steam or the vaporized working fluid powers a turbine. The generation system at Casa Diablo uses isobutene as a secondary working fluid that is vaporized by heat exchanged with the produced geothermal fluid.

About 10,715 megawatts (MW) of geothermal power is generated in 24 countries (GEA, 2010). Geothermal resources in the US account for 3,817 MW of installed capacity from 77 power plants generally in active tectonic or volcanic areas in the western US (US EIA, 2012). There are 25 known geothermal resource areas and 46 operating geothermal plants in California and 14 of the geothermal resources have temperatures over 148°C (300°F) with a combined total installed electrical capacity of 2,516 MW (California Energy Commission, 2012). The largest producing system is the steam-dominated Geysers with 1,517 MW of active installed capacity. Water-dominated geothermal systems in the eastern Sierra include 270 MWe at Coso, 90 MWe from Steamboat Springs and 40 MWe from Casa Diablo within the planned project area. More efficient generating plants and gathering systems and improved resource management strategies, primarily through injecting the produced fluids or augmenting injection, have increased the life-span and electrical generating capacity of many geothermal resources.

5.1 Long Valley geothermal resource

The USGS designated the Mono-Long Valley region as a Known Geothermal Resource Area (KGRA) in the 1970's because the young voluminous 760,000 year old silicic volcanism that formed a 17 X 35km collapsed caldera depression provided ample evidence of a shallow active magmatic heat source and the welded Bishop Tuff ignimbrite ponded in the caldera depression forms an ideal fractured geothermal reservoir over a wide area and depth range. Later volumes of Early (post collapse) Rhyolite, moat eruptives and a bimodal assemblage of <200,000 years old intracaldera volcanics were evidences of continued magmatic input into a viable magmatic heat source required to sustain a hydrothermal system. Widespread hot springs and fumaroles over more than 120 km^2 (45 mi^2) inside and outside the caldera are direct evidences of a viable circulating geothermal system.

5.1.1 Hot Springs and Fumaroles

Surface hydrothermal manifestations in Long Valley vary from weak fumaroles or steam heated ground at higher elevations west of the Resurgent Dome to hot springs flowing at varying rates and temperatures at lower elevations in the central and western part of the caldera (Bailey, 1989; Sorey and others, 1978, 1991). Most of the prominent higher flow rate springs within the caldera occur in the southern caldera moat localized along faults within or around the southern edge or within the Resurgent Dome primarily at Casa Diablo, Hot Creek Gorge and Little Hot Creek (Figure 20).

Hydrothermal manifestations are notably absent in the western caldera moat (Bailey and others, 1976); however, detailed mapping (Suemnicht and Varga, 1988) and remote sensing studies of the western caldera (Martini, 2002) identify many areas of high-temperature minerals and hydrothermal alteration that are the result of hot geothermal fluids interacting with rocks. Age dating of the minerals indicates that vigorous hydrothermal outflow occurred along deeply penetrating faults in the western caldera <100,000 years ago.

Hydrothermal circulation in Long Valley has varied through time (Bailey and others, 1976, Sorey and others, 1978; 1991). Different alteration mineral assemblages in and around the Resurgent Dome and differing age dates indicate that hydrothermal activity occurred in two separate phases (Sorey and others, 1991). The caldera supported an intense hydrothermal system, from 300,000 to 130,000 years ago, producing widespread hydrothermal alteration in and around the Resurgent Dome. The current hydrothermal system has probably been active for only the last 40,000 years (Sorey and others, 1991), but prominent surface manifestations occur in many of the older system's established outflow zones at comparatively low elevations in the south central portion of the caldera (Suemnicht and others 2007). Alteration mineralogy for several relict outflow zones shows that significant surface manifestations occurred at higher elevations in the western caldera in the early phases of the current hydrothermal system. The current pattern of outflow to the southeast toward Casa Diablo may have resulted from active fracturing and faulting opening older hydrothermal flow zones, allowing outflow along permeable zones at lower elevations (Suemnicht and others, 2007).

The project area includes the active thermal zone at Casa Diablo Hot Springs on the southwestern side of the caldera's Resurgent Dome, fumaroles in the Basalt Canyon drainage west of Casa Diablo and weak fumaroles or thermal ground in and around Shady Rest on the east side of the Rhyolite Plateau in the western caldera moat (Figures 5, 20). Active and relict fumaroles, mudpots and hot springs at Casa Diablo are localized along a major northwest trending normal fault system that forms a graben within the Resurgent Dome. The discharge characteristics of some of the Casa Diablo features changed and some previously dormant fumaroles were reactivated during the initial phases of caldera unrest and Resurgent Dome uplift from 1980 to 1983.

Key geothermal features of concern within the caldera include:

Hot Creek Springs is localized along two north-striking faults that form a small graben that contains the Hot Creek Geologic Site. Numerous earthquakes that have occurred during caldera unrest that began in 1980 commonly affect the flow of the springs. Additional boiling springs developed or were reinvigorated in May 2006 expanding beyond the protective fencing on the north side of the gorge and forcing the USFS to close the area for swimming. Changes in spring discharge were accompanied by temperature increases in nearby monitoring wells and pressure increases in adjacent cold-water aquifers, in response to above-normal precipitation in the preceding winter (Farrar and others, 2007).

Hot Bubbling Pool, located approximately 5 km east of Casa Diablo, experienced a 1.2 m in water level decline with the onset of expanded production and deeper injection in 1991.

Hot Creek Fish Hatchery, operated by the California Department of Fish and Game, is located immediately to the east of Hot Bubbling pool (Figure 20) and accounts for 2-5% of the caldera's total thermal outflow. The thermal water contribution raises water temperatures of an average of 5°C (41°F) above background, which is ideal for spawning. Hatchery fish are planted in many surrounding Sierra lakes and streams and are an important part of regional recreation and the local tourist industry. The dominant influences on Fish Hatchery spring flow and thermal discharge are seasonal and annual fluctuations in snow melt and recharge (Sorey and Sullivan, 2006). The total discharge of the Fish Hatchery springs declined ~2.5 cubic feet per second (cfs) between 1984 and 1995 with the onset of geothermal production or as the production scheme was changed in 1991; however, the region also experienced a long-term drought that affected the entire hydrologic system during that same time period. Through 2012 the combined Fish Hatchery spring discharge rate matched or exceeded pre-drought levels of 12-24 cfs while geothermal production has continued (Howle and Bazar, 2012). Based on chloride flux estimates, the thermal water contribution to the total spring flow has declined ~0.15 cfs since 1988 but the average spring temperatures have only changed ~2 °C through 2012 because of the buffering effect of conductive heat loss within the flow system.

Thermal ground occurs in several locations in the southern caldera moat related to active or reactivated fumarolic areas or older broad altered zones of nutrient-poor clay-rich soils. Surface manifestations and areas of thermal ground have varied considerably during the period of caldera unrest and geothermal development. Several relict mudpots and fumaroles at Casa Diablo became active after the earthquake swarms of the 1980's and have since decline. In part, the increased in fumarolic activity is related to shallow reservoir pressure declines as production increased in 1990. Pressure declines resulted in two-phase conditions at very shallow levels. Two-phase steam heating effectively increased heat flow to the shallow heated groundwater system that, in turn, increased the steam fraction in local fumaroles (Sorey, 2000). Several liquid hot springs at Casa Diablo converted to steam vents accompanied by increases in ground temperature within the field during 1991-1993 (Sorey et al, 1995, Sorey, 2010); however, many reactivated springs or fumaroles also occur at considerable distances from Casa Diablo, or at higher elevations and further west in the caldera moat. Changes in fumaroles, high CO_2 gas flow and tree deaths at Horseshoe Lake and the flanks of Mammoth Mountain were not related to geothermal production from Casa Diablo but were an apparent response to potential magmatic input around Mammoth Mountain after 1990 (Sorey and others, 1999). The rapid onset of dying trees was apparently related to CO_2 interfering with nutrient uptake through the tree roots (Sorey and others, 1999; Bergfeld and Evans, 2011).

Little Hot Creek

A group of hot springs near the head of Little Hot Creek approximately 2 miles (3 km) north of Hot Creek have maximum temperatures are near 175 ^{o}F (80 ^{o}C). Spring flow has systematically been measured and chemical samples have been collected at Little Hot Creek as part of the LVHAC monitoring system. The average total spring flow from this area was about 0.35 cfs (10 L/s). During the 1980s, total spring discharge varied with earthquakes of M>4-5 in the Long Valley region, similar to other springs in the eastern caldera. Little Hot Creek and other thermal springs and observation wells located between Hot Creek and Lake Crowley indicate a continuation of the zone of thermal outflow originating at Casa Diablo, with ultimate discharge occurring as seepage into the lake. Because the thermal and non-thermal ground water aquifers tend to merge near the surface in this high-water table area, the thermal water is cooler and more dilute than that discharging in Hot Creek gorge.

5.1.2 Geochemistry

The chemistry of a hydrothermal system reflects the source of the thermal water and the path it takes through permeable rocks as the water is heated, cooled and eventually reheated in a viable convecting geothermal system. Water-rock interaction changes the chemistry of both depending temperature, water-rock ratio and the original chemistry in each part of the system. Hydrothermal circulation alters the rocks that water circulates through, resulting in a chemical signature for the water that allows an evaluation of thermal water source and the processes affecting it on its permeable pathway to the surface. Complete evaluation of fluid chemistry and reservoir interaction typically requires sampling the deep geothermal fluids, surface manifestations and local cold water recharge to determine all of the interactions that affect the system.

The chemistry of Long Valley surface manifestations has been studied for more than four decades, initially for geothermal exploration (Waring, 1965; Mariner and Wiley, 1976; Sorey and others, 1978) and later as part of volcanic hazards monitoring (Farrar and others, 1987, Sorey and others, 1999) or for cooperative hydrologic monitoring of geothermal development through the Long Valley Hydrologic Advisory Committee (LVHAC). More recent geochemical data includes analytical results from producing geothermal wells, isotopic studies to determine potential hydrologic interactions within the caldera and gas analyses to evaluate changes related to potential magma intrusion and caldera unrest.

Active and relict fumaroles, mudpots and hot springs are generally localized along faults that deform the caldera (Bailey, 1976, 1989; Mariner and Wiley, 1976; Sorey and others, 1978). For example, fumaroles at Casa Diablo are distributed along a major northwest trending normal fault system that forms a graben within the Resurgent Dome. Hydrothermal alteration marks the trace of a fault that cuts 600,000 year-old Early Rhyolite of the Resurgent Dome on the northeastern side of the field. Mafic lavas flood the southwestern caldera moat and lap against the Resurgent Dome. Active fumaroles on the western side of the geothermal field are aligned along a fault scarp that uplifts and exposes these younger (129,000-62,000 year-old) postcaldera moat basalts. Hot spring temperatures across the caldera generally range from 79-93°C with ≤ 1330 milligrams per liter (mg/L) total dissolved solids and chloride concentrations of 200-300 mg/L. More dilute warm springs occur between Hot Creek and Lake Crowley (Figure 20).

Long-term flow measurements and mass-flux estimates based on conservative element concentrations like B and Cl indicate that the total thermal throughput of the hydrothermal system remains relatively constant. Prior to the 1985 onset of geothermal production, the total estimated flow of the entire hydrothermal system was at 13 cfs (370 L/s, or 5,900 gpm) (Sorey and others, 1991; Sorey, 2005). Of this total flow, as much as 8.8 cfs (248 L/sec ; 3900 gpm) or roughly 70% of the hydrothermal outflow occurs at Hot Creek on the southeastern edge of the Resurgent Dome (Figure 20). The median flow of thermal springs in Hot Creek Gorge has remained at 8.75cfs (245 L/sec; 3930 gpm) during the entire period of geothermal production through 2012 (Howle and Bazar, 2012); https://137.227.239.76/lvo/activity/monitoring/hydrology/hotcreekgorge.php). Geochemical estimates of source reservoir temperatures range from 200°C – 280°C (Sorey and others, 1978; 1991; Mariner and Wiley, 1976) whereas initial published geochemical estimates of potential geothermal source reservoir temperatures range from 200°C – 240°C (Sorey and others, 1978; 1991; Mariner and Wiley, 1976).

Light stable isotopes and trace elements have been important in determining the general west-east flow of source waters across the caldera for both the thermal and non-thermal water (Figure 13). Analyses and comparisons of light stable isotopes deuterium (D) and oxygen 18 (^{18}O) from Long Valley show that cold groundwater recharge for the shallow glacial till, moat basalt and alluvium/colluvium aquifers of the Mammoth Groundwater Basin originates from snowmelt around Mammoth Mountain or the upper part of Mammoth Creek and from and the southern caldera margin predominantly Sherwin Creek (Sorey and others, 1991; Farrar and others, 2003). Based on deuterium values, deeper recharge for the hot geothermal water beneath the western caldera is recharged from snowmelt along the northern base of Mammoth Mountain and the upper reaches of Dry Creek. Changes in isotopic values trace geothermal flow from the west moat to the south and east to Casa Diablo and beyond (Figure 13). Some conservative trace elements like boron are unique in geothermal systems and trace element concentration ratios with chloride have been used in Long Valley (Sorey and others 1978, 1991; Sorey, 2011; Evans, pers. comm.) and other geothermal systems for decades (White, 1957). Nearly constant Cl/B ratio of 23 for geothermal waters east and west of Casa Diablo indicate a common hot water source reservoir at depth beneath the caldera's west moat.

Carbon dioxide (CO_2) is the principal non-condensible gas in geothermal systems including Long Valley. Trace amounts of other gases like helium and isotopic analyses of gas constituents can be important in evaluating the nature and extent of geothermal systems or monitoring volcanic hazards (Farar and others, 1987; Sorey and others, 1999; USGS, 1996). In a liquid-saturated system like Long Valley, non-condensible gases are dissolved in the geothermal fluid and are released (for example by fluid rising to the surface) as pressure declines forming a gas ± vapor phase. Non-condensible gas output in Long Valley is primarily CO_2 and occurs through diffuse soil discharge, dissolved in groundwater or from steam vents or fumaroles. Past changes in the outflow from hot springs and fumaroles and increased CO_2 emissions around the flanks of Mammoth Mountain have been interpreted as potential indicators of magma moving to shallower crustal levels fracturing and releasing gases during dike emplacement in 1989 (Sorey and others, 1999).The gas emissions on Mammoth Mountain have been accompanied by rising $^3He/^4He$ ratios (Figure 21) and ^{13}C carbon isotope ratios have been interpreted as potential indicators of magma moving to shallower crustal levels (Sorey and others, 1998) rather than changes in the produced geothermal system. Magma-related gas emissions include increased CO_2 output that has resulted in several areas of tree death around the flanks of Mammoth Mountain (Sorey and others, 1999; USGS, 1996) and around the Resurgent Dome (Bergfeld and Evans, 2011). Higher than normal CO_2 concentrations in the soil kills the trees by denying their roots oxygen (O_2) and by interfering with nutrient uptake.

Geochemical changes in geothermal production fluids, particularly declines in chloride concentrations from 1990 to 2003, suggest that the cooling trend in produced fluids from approximately 338 ^oF (170^oC) to between 302 to 329 ^oF (150 ^oC and 165 ^oC) over a similar time period is predominantly related to the intrusion of small amounts of cold meteoric water or cold groundwater into the shallow geothermal reservoir (Geologica, 2003). Declining chloride typically indicates mixing with cold meteoric water (or groundwater) because cold recharge water has virtually no chloride (less than 5 mg/L) while chloride levels in the Casa Diablo geothermal resource vary between 265 and 300 mg/L. Based on geothermometer calculations, temperatures of the Casa Diablo reservoir fluid declined between 8 to 32ºF (5 to 20ºC) shortly after production expanded to 40 MW but then stabilized and have remained relatively constant.

Fluid leaks are rare in binary generation systems like Casa Diablo because of the cost of the secondary working fluid and the efficiency of the system requires total integrity of the heat exchanger. Some short-term isobutane leaks have provided an inadvertent tracer test for the Long Valley geothermal system (Evans et al., 2004). Isobutane is a non-toxic low-solubility gas that strongly fractionates to the vapor phase (Wilhelm et al, 1977). Small leaks have introduced trace amounts of immiscible and unreactive isobutane to the spent geothermal brine that is injected deep into the Bishop Tuff injection zone.

Isobutane has been detected in Basalt Fumarole in Basalt Canyon, 2 km west of Casa Diablo, but not in steam vents in the Shady Rest thermal area closer to well RDO-8 (Figure 20). Data collected from 1993 through 2004 (Evans and others, 2004) identified trace isobutane concentrations in dissolved gas samples from wells, thermal springs, and steam vents. To date, trace amounts have been detected in:

Well 66-25 (5 km west)
Basalt Fumarole (2 km west)
Hot Bubbling Pool (5 km east)
Well 28-34 (3 km east)
Well CW-3 (5 km east)
Fumarole Valley (4 km east)
Hot Creek gorge springs (10 km east)
Well CH10B (10 km east)

Transport of dissolved isobutane away from Casa Diablo, both within the production and injection reservoirs is poorly understood, even though the initial timing and appearance can be detected in surface manifestations and wells. The combination of isobutane migration and reservoir pressure transmission in the production zone and injection zones signifies a high degree of lateral continuity within the relatively shallow geothermal source reservoir beneath the south moat.

Project Impacts

The potential effect of geothermal development on sensitive hot springs or other thermal features and the potential impacts on surface or groundwater quality were principal reasons for initiating detailed hydrologic monitoring in Long Valley. Each of the most sensitive thermal features have been closely monitored during the initial development and expansion at Casa Diablo:

Hot Creek Springs were a concern because of the site is a prime recreation area for the US Forest Service. Changes in geothermal production have not resulted in drastic variations in spring flow during the history of production from Casa Diablo. Many of the variations in spring flow have occurred during periods of caldera unrest that do not correlate with production changes at Casa Diablo. The 2006 boiling events and expansion of the hot spring area in the Hot Creek gorge that forced the closure of the swimming area are a notable example. The changes in spring discharge were accompanied by temperature increases in nearby monitoring wells and pressure increases in adjacent cold-water aquifers in response to above-normal precipitation in the preceding winter (Farrar and others, 2007) and do not correlate with the recent history of production from Casa Diablo.

Hot Bubbling Pool is potentially sensitive because it is one of the thermal springs closest to Casa Diablo and monitoring records show that water levels in the pool are particularly sensitive to aquifer pressure changes (https://137.227.239.76/lvo/activity/monitoring/hydrology/hbp_main.php). For example, pool levels increased by about 1.5 feet (0.46m) in July 1986 because of above average groundwater recharge related to winter precipitation 150% above the long-term average in Mammoth Lakes. The water level declined approximately 3.5 feet (1 m) with the onset of expanded production and deeper injection at

Casa Diablo in 1991. Water levels in Hot Bubbling Pool recovered approximately 4 feet (1.22m) within days after production has shifted west to Basalt Canyon and continue to rise.

Hot Creek Fish Hatchery springs are sensitive because of the small (2-5%) contribution of thermal water that improves spawning conditions at the Hatchery. Recent studies of spring flow, temperature and water chemistry at the Fish Hatchery (Sorey and Sullivan, 2006) have shown that no significant temperature changes have occurred in the mixed thermal and non-thermal warm springs in response to geothermal development at Casa Diablo. Total net changes in temperature at the two main Hot Creek Fish Hatchery springs during the most significant period of geothermal development at Casa Diablo (1988-2003) were less than 2°F, and while greater annual temperature declines have occurred during this time period (~4°F in 1995). The changes were related to high winter precipitation, greater snow melt runoff and high spring flow rates during the spring and summer. Consequently, it is difficult to identify the smaller effects of geothermal development on thermal-water components at the Hatchery springs because climatic variations and geothermal reservoir pressure changes have both occurred simultaneously. Sorey and Sullivan (2006) note that projected temperature changes computed from measured chemical flux values for boron and chloride show significant overestimates of spring temperature changes. Temperatures are maintained by heat derived from the surrounding rock and fluid in the flow zone carrying mixed water from the Casa Diablo area to the Hatchery effectively moderating the influence of cold water input (Sorey and Sullivan, 2006).

Thermal ground, CO_2 outflow and stressed vegetation are a natural consequence of the shallow outflow in the Long Valley geothermal system. Widespread hydrothermally altered areas related to outflow from the earlier (300,000 to 130,000 years old) geothermal system within the caldera are more extensive than the recently noted more limited tree kill areas. Hydrothermally altered soils are clay-rich, depleted in nutrients and relatively high in trace element concentrations that inhibit vegetation growth. Consequently, the lack of vegetation cannot exclusively be related to changes in geothermal production. Prominent altered areas like the clay-altered major fault zones that define the Casa Diablo graben or the Hundley Clay Pit in Antelope valley have no vegetation at all but are unrelated to currently active thermal ground or elevated CO_2 emissions. The relict fumarolic mounds around Shady Rest are similarly bare because of alteration not specifically because of increased thermal ground. In discussing the potential mechanisms for the lack of vegetation around Shady Rest Bergfeld and Evans (2011) noted that CO_2 fluxes at Shady Rest are lower than average fluxes at Basalt Canyon fumarole area to the east and that gas collected at Shady Rest contains no detectable isobutane to link emissions chemically to geothermal fluid production.

Fewer shallow thermal effects are anticipated as production is increasingly supplied from Basalt Canyon because the production wells will be 2-3 times deeper than the Casa Diablo wells, the wells will produce from a comparatively deeper reservoir section lessening pressure declines and the Basalt Canyon reservoir is physically separated from the overlying outflow effectively buffering changes in heat flow and limiting or preventing gas loss to shallower levels. Project plans also include additional injection wells in the southern part of the Casa Diablo field. Like the existing injectors, the planned wells will return produced fluids to permeable zones at ~2000 feet (~600m) within the deeper underlying Bishop

Tuff to prevent reservoir cooling noted when injection was placed at the same level as the production reservoir. Two-phase steam/water conditions are not anticipated in the deeper production reservoir in Basalt Canyon and it is unlikely that any steam would reach the surface through the thick section of altered Early Rhyolite and the low permeability landslide block underlying the Basalt Canyon area.

As noted by Sorey (2000), pressure declines around the shallow Casa Diablo production reservoir (<200m) resulted in two-phase conditions (water+steam) near the top of the reservoir that increased the heating of isolated overlying shallow groundwater aquifers. This increase in heat flow resulted in more steam output from local fumaroles. Unlike Casa Diablo, shallow aquifers in the Basalt Canyon area are physically separated by thick sections of impermeable to very low permeability rocks (landslide block and altered Early Rhyolites) overlying the production reservoir. Potential reservoir pressure declines are also more limited based on reservoir modeling forecasts (GSI, 2012, Garg, 2012). The Long Valley geothermal reservoir model (Section 5.4) was developed from detailed geologic and reservoir data and validated by matching pressure and temperature data from 27 years of production history at Casa Diablo. Model results indicate that shifting production to Basalt Canyon will result in smaller reservoir temperature and pressure declines than the earlier development at Casa Diablo (GSI, 2012, Garg, 2012). Reservoir simulations show that maximum reservoir pressure declines should range from 1.45 psi to 10 psi, at the maximum and that is only 20% of the pressure declines observed during the prior 27 years of production from Casa Diablo. Consequently, the physical separation, the depth of the production reservoir and the limited potential of marked changes in heat flow related to shallow two-phase conditions limit the potential for increasing areas of thermal ground.

5.1.3 Geothermal exploration

Early exploration drilling in Long Valley focused on the southern and central part of the caldera. Magma Power Co drilled the first geothermal exploration wells in Long Valley at Casa Diablo between 1959 and 1962. A series of nine wells were drilled to total depths ranging from 125 m to 324 m (410-1062 ft) adjacent to active fumaroles west of Old Highway 395 (Figure22). The first deep well (66-29) was drilled in 1976 to evaluate the resource potential in the southeast moat (Figure 23). Numerous shallow gradient holes evaluated the heat flow associated with the Resurgent Dome in the 1970s and geothermal lease sale opportunities in the late 70s and early 80s prompted shallow and intermediate drilling to assess lease blocks within the Resurgent Dome.

Clay Pit-1 and Mammoth-1 drilled in 1979 were the first deep wells drilled in the caldera's Resurgent Dome and the first deep wells to penetrate the entire section of the caldera fill (Figure 23). Mammoth-1 drilled through 390m of Early Rhyolite, 863 m of Bishop Tuff and 230m of metasedimentary rocks that correlate with the Mt. Morrison roof pendant to the south, bottoming at 1,605m. Mammoth-1 was also the first well within the caldera to encounter a block of chaotically mixed metapelite and granite at 466m in the upper section of Bishop Tuff that was interpreted as a landslide block based on cuttings alone (Suemnicht, 1987). Drilling to evaluate federal lease offerings during the 1980s and scientific drilling to evaluate various eruptive processes expanded the understanding of the western part of the caldera. Unocal's deep well IDFU 44-16 penetrated the caldera fill, Tertiary volcanic rocks and metamorphic rocks to a depth of 2000m near the Inyo Craters (Figure 23). The well encountered temperatures of 218°C at 1100m, the highest yet measured in Long Valley, but proved unproductive because of a limited thickness of reservoir rocks and the incursion of cold water beneath the production zone (Suemnicht, 1987).

Later scientific drilling by Sandia National Labs west of 44-16 (Figure 23) established that 1000 m of vertical offset on the caldera's western ring fracture system occurs within a kilometer distance between the two wells along the western structural margin of the caldera (Eichelberger and others, 1988). Additional scientific drilling in Long Valley included the RDO-8 core hole at Shady Rest (Wollenberg and others, 1989), and an ultra-deep (3 km) Long Valley Exploratory Well (LVEW) intended to test the presence of magma near the center of the Resurgent Dome (Finger and Jacobsen, 1999) (Figure 23).

5.1.4 Geothermics

Because accessible viable geothermal systems represent a major thermal disturbance in the shallow crust, mapping temperature gradients, heat flow and temperature distribution at depth are critical in understanding the nature and extent of a potential geothermal resource. All other phases of exploration are based on evaluating the effects of heat but heat flow and deeper temperatures can only be determined by drilling. Nearly all of the formerly proprietary temperature data from shallow and deep Long Valley wells are publically available through California Division of Oil, Gas and Geothermal Resources (CDOGGR) well records (http://geosteam.conservation.ca.gov/Well/WellListPage.aspx) or have been compiled by the USGS (http://lvo.wr.usgs.gov/HydroStudies.html). The available data provide a relatively detailed picture of the established upflow from a deeper hotter source reservoir in the western caldera and outflow that sustains a moderate to low temperature shallower hydrothermal system to the east (Figure 24). All of the drilling results within the caldera show that the strong head of cold recharging waters from the caldera rim has a significant effect on the hydrothermal system. Sharp temperature reversals of nearly 100°C are commonly found on the structural margins of the caldera where high temperature upflow is affected by cold recharge penetrating into the deeper fractured section of Bishop Tuff or underlying deep Paleozoic basement rocks (Suemnicht, 1987). Early proposals used the available temperature data to suggest that hotter outflow was separated from colder recharge water because of density (Blackwell, 1985) and while density separation might prevail for a time, it would be a transient condition.

The drilling results from early deep exploration wells 66-29, Clay Pit and Mammoth-1 forced a reevaluation of the Long Valley conceptual model of a geothermal system centered on the Resurgent dome. Low temperatures and sharp temperature reversals in deeper exploration wells proved that the central caldera is not the ultimate deep source of current Long Valley geothermal system and the source of the caldera's prominent hot springs is not directly beneath the Resurgent Dome. The 3 km deep LVEW well on the Resurgent Dome (Figure 23) indicate that heat flow within the Resurgent Dome is currently low relative to the southern and western parts of the caldera. The present-day thermal conditions in the central caldera are controlled in places by vertical flow of relatively cold water in steeply dipping faults that formerly provided channels for high-temperature fluid upflow (Sorey and others, 2000; Farrar and others, 2003). There is little drilling evidence of possible magmatic temperatures at depths of 5-7 km postulated on the basis of recent deformation, seismic interpretations and shear-wave attenuation of teleseismic waves.

Geothermal systems and hydrothermal outflow at the surface are neither constant nor continuous. Few last 100,000 yrs. without heat replenishment (Lachenbruch and others, 1976; Cathles and others, 1997). A central Bishop Tuff magma chamber provided heat for an intense hydrothermal system 300,000-130,000 years ago that produced widespread hydrothermal alteration in the central caldera around the Resurgent Dome. The principal magmatic input in the caldera within the last 200,000 yrs. has been in the western caldera. The current hydrothermal system has probably been active for only the last 40,000 years (Sorey and others, 1991; Suemnicht and others 2007), but prominent surface manifestations occur in many of the older system's established outflow zones at comparatively low elevations in the south central portion of the caldera.

5.2 Long Valley conceptual model

The currently active high temperature geothermal system in Long Valley is the result of upflow in an actively convecting fractured geothermal reservoir in the western caldera and outflow along faults and fractures to shallower levels in the east. Geochemistry and hydrologic data (Sections 5.1.2 and 5.5) indicate that a significant portion of the snow-melt recharge from the western rim of the caldera penetrates deeply into the fractured rocks within the caldera and, at depths of ~2 km, is heated to >220°C by young (Quaternary-Recent) shallow magma in the western caldera moat. Data on pre-development hot spring flow rates, Cl/B chemistry of natural thermal features and progressively higher (>200°C) temperatures encountered in western caldera exploration wells establish that hot upflow from a deeper source reservoir feeds lateral thermal water outflow zone that extends from Shady Rest in the western caldera to production wells at Casa Diablo and farther to the east (Figure 19). The thick section of intracaldera Bishop Tuff and the underlying fractured caldera floor have long been considered the potential deep geothermal reservoir within the caldera. Based on temperature data from exploration wells and geochemistry, the source reservoir for the present geothermal system lies within the Bishop Tuff or older (Paleozoic-Mesozoic) deeper fractured metamorphic basement rocks beneath the Bishop Tuff in the western caldera moat. The caldera inherited and modified many faults and fractures from the pre-existing tectonic framework that controlled the collapse and configuration of the caldera floor. Many of these faults and fault intersections control the high fracture density and deep permeability for convective upflow within the present geothermal system.

The moderate temperature (170°C) fluids produced at Casa Diablo and prominent hot springs and fumaroles in the central and eastern part of the caldera are directly related to hydrothermal outflow from the western geothermal system (Sorey and others, 1991; Farrar and others, 2003; Suemnicht and others, 2007). Fluid temperatures and dissolved solids content decrease progressively farther to the east because of dilution by cold recharge and heat loss. The Bishop Tuff magma chamber supported a vigorous geothermal system from 300,000 to 130,000 years ago that circulated in a similar system of faults and producing widespread hydrothermal alteration in and around the Resurgent Dome. The current hydrothermal system has probably been active for only the last 40,000 years, but prominent surface manifestations occur in many of the older system's established outflow zones at comparatively low elevations in the south central portion of the caldera around the Resurgent Dome (Figure 20). The estimated 75% of the current hydrothermal output at Hot Creek further west is outflow from the principal source of the geothermal system in the western caldera.

Existing Geothermal wells at Casa Diablo produce moderate temperature fluids from a shallower (<200m; 650 ft.) fractured Early Rhyolite reservoir. Basalt Canyon wells approximately 2 km west produce outflow from the deeper system into a mixed fractured reservoir of Bishop Tuff and deeper fractured sections of Early Rhyolite. Injection is currently limited to deeper wells (>600m) completed within the welded fractured permeable Bishop Tuff underlying the Early Rhyolite reservoir at Casa Diablo. The present-day outflow of the deeper hydrothermal system occurs along penetrative NW-SE faults related to the Resurgent Dome and E-W ring fracture faults that control the southern structural margin of the caldera. Upflow at these fracture intersections occurs at comparatively low elevations at the base of the Rhyolite Plateau west of Shady Rest (Figure 5).

The shallow Early Rhyolite reservoir at Casa Diablo and west up to Shady Rest is stratigraphically separated from the underlying Bishop Tuff reservoir by an impermeable landslide block that controls the vertical distribution of shallow hydrothermal circulation in the southern caldera allowing sustained production and injection at Casa Diablo by isolating warm shallow outflow from deeper cold natural recharge and injection fluids that might quench the system (Suemnicht and others, 2007). All of the drilling results within the caldera show that the strong head of cold recharging waters from the caldera rim has a significant effect on the viability of the hydrothermal system. Sharp temperature reversals of nearly 100^{o}C are commonly found on the structural caldera margins where high temperature upflow is affected by cold recharge penetrating into the deeper fractured Bishop Tuff (Suemnicht, 1987).

5.2.1 Long Valley geothermal development

Based on the productive wells drilled around Casa Diablo Hot Springs in the 1960's, Magma Power considered a 15 Mw generation facility but binary production technologies were still in early experimental stages in 1962 and the project was shelved. Several geothermal development companies completed detailed geological, geophysical and geochemical investigations in the 1970's and drilled deep (>1500m) full-scale exploration wells to evaluate the geothermal potential of the geothermal source reservoir in the deeper Bishop Tuff ponded within the caldera depression (Section 5.1.3).

The development of Casa Diablo began in the 1980's. Initial production wells (MBP-1, 2, 3 and 5) and injection wells (IW-2, IW-1) were drilled to total depths ranging from 125 m (410 ft) to 324m (410-1062ft) in the area around Casa Diablo for the MP-1 power plant (Figure 22). Initial production rates averaged 3200 gpm (~1600kph) from 1985 to 1990 (Sorey, 2005, 2010). Successful generation led to additional development drilling for expanded power generation from the MPII and PLES plants commissioned in 1990, including eight new production wells (24-32, 24A-32, 24C-32, 24D, 32, 24-32, 25A-32, 35-32 and 35A-32) and four injection wells (43-32, 43A-32, 44-32 and 44A-32). The average production rate ranged from 12,700 to 14,000 gpm (~6000) kph of geothermal fluid to generate 40MWe (gross)(Sorey 2005, 2010). Several research and exploration wells including RDO-8 at Shady Rest, Inyo Domes (44-16) and the Resurgent Dome (LVF 51-20 later LVEW) were also drilled in the 1980's to further define the geothermal and potential magmatic system within Long Valley Caldera (Figure 23).

The results from Mammoth-1 (Figure 25) illustrate the general production and injection reservoir sections at Casa Diablo. Shallow wells (<200m; 650 ft.) at produce 170°C (338°F) outflow shown by the shallow temperature-peak in Mammoth-1 (Figure 25) that is supplied by upflow from an active geothermal system to the west. Injection wells return the produced fluid to deeper (750m; 2460 ft.) permeable zones in the underlying Bishop Tuff shown by the second deeper temperature peak in the Mammoth-1 well (Figure 25). Casa Diablo Injection was initially placed at the same level as the producing reservoir in wells IW-1 and IW-2 causing progressive degradation in production temperatures. As a result, injection was deepened and shallow injection wells were sealed off in 1990. The impermeable landslide block in the southern caldera moat separates the Early Rhyolite reservoir from the underlying Bishop Tuff and limits the vertical distribution of shallow hydrothermal circulation in the southern caldera. The isolation of the shallow Early Rhyolite and deeper Bishop Tuff allows sustained production at Casa Diablo by isolating the shallow hotter outflow production from deeper cold injection fluids. From early 1993 to mid-1995, overall field production declined from 7,000 kph to 6,160 kph. To offset declines in flow rate and temperature, production was augmented in 2006 by completing production wells 57-25 and 66-25 to total depths of ~500m to the west of Casa Diablo in the area immediately east of Mammoth Lakes designated as Basalt Canyon by MPLP. The two wells produce higher temperature 180°C fluids that are sent to the existing Casa Diablo plants through a 3 mile pipeline bringing approximately 2000 kph (4,000 gpm) to commingle and sustain a current average of flow rate of 6,000 kph (12,000 gpm) to the Casa Diablo power plants.

5.3 Project plans

ORNI 50, LLC, plans to expand electric production by approximately 50% (3,000 kph or 6,000 gpm) by drilling additional wells in the Basalt Canyon area to produce a total of approximately 18,000 gpm (9,000 kph) to sustain generation of approximately 60 MWe (gross).

5.4 Long Valley hydrologic monitoring

The shallow hydrologic system in Mammoth Groundwater Basin has been monitored periodically by the Mammoth Community Water District and the hydrological system of the whole caldera has been investigated by the U.S. Geological Survey since the early 1980's as part of volcanic hazard studies, and by Mammoth Pacific Limited Partnership (MPLP), as part of the cooperative monitoring of geothermal development on behalf Long Valley Hydrological Advisory Committee (LVHAC). The shallow cold groundwater monitoring network includes a limited number of supply and idle wells in the groundwater basin in the southwestern caldera moat. The caldera-wide monitoring network includes geothermal monitoring wells, shallow groundwater monitoring wells and surface hydrological features such as cold and hot springs and streams. The USGS monitors reservoir pressure and depths to water at thermal well CH10B in the southeast moat and cold-water wells SC-2 and M14 in the southwest moat (Figure 15). From 2001-2007, the USGS also monitored water levels in cold-water well CD-2 on the northern side of the production well field (Figure 15) for the MPLP monitoring well database. MPLP currently monitors producing wells for flow rate, wellhead temperature, wellhead flowing pressure and downhole reservoir pressure and also collects pressure data from six idle geothermal test wells or exploration temperature gradient holes drilled in the southern caldera moat (Figure 15).

The detailed caldera-wide LVHAC monitoring program in Long Valley has collected high quality reliable data on shallow and deep geothermal reservoir variations for more than 20 years. The collective record shows that the monitoring network is sensitive enough to detect long-term changes in relatively stable production periods (1985-1990), the onset of additional production for expanded generation (1991) and the augmented production from higher temperature wells in the Basalt Canyon/Shady Rest area (2005). The monitoring system also detected the inadvertent diversion of Casa Diablo injection into a well open to the shallower Early Rhyolite reservoir in late 2000 resulting in a very short-term production pressure increase that serves as an excellent marker obvious in all of the MPLP thermal monitor wells operating at that time. Monitoring equipment problems have also been readily detected through extreme or unusual data quality variations in the monitoring records. Data quality is sufficient that detailed short-term hourly records correlate very well between two individual monitoring points and instrumentation is sensitive enough to record diurnal changes and earth tide variations (Sorey, 2010).

5.4.1 Early development monitoring

Shallow (150-200m) fractured permeable Early Rhyolite is the principal production reservoir at Casa Diablo. All of the produced fluid is injected into deeper (600-700m) wells completed in the underlying Bishop Tuff below the landslide block that separates the shallow moderate temperature Early Rhyolite reservoir from the lower permeable fractured Bishop reservoir at depth. Between 1985-1990 and 1992-2005 drawdown rates in production wells were proportional to the total rate of production and overall reservoir pressure variations were limited in range (Figure 26 and 27). Monitoring records document pressure variations that are proportional to seasonal change or episodic production changes at Casa Diablo (Figures 28 and 29). Total production volume was increased after 1991 to support 40 MWe (gross) generation. Injection wells were deepened to avoid detrimental temperature declines in the shallow production reservoir. The result was a short-term period of more significant reservoir drawdown and a ~25 psi total reservoir pressure decline in nearby monitoring wells. Temperatures have declined from 175°C (347°F) to 150-165°C (302-327°F) in Casa Diablo production wells from 1990-2003.

5.4.2 Recent development monitoring

The production scheme for Casa Diablo was altered again in 2005 when wells 57-25 and 66-25 in Basalt Canyon (Figure 23) began to contribute ~ 4,000 gpm of higher temperature brine to the brine flow through the power plants and several cooler producing wells at Casa Diablo were either shut in or their flow rates reduced. Consequently, reservoir pressures within the Basalt Canyon area declined ~ 13 psi while pressures increased on the order of 15-20 psi in monitoring well 65-32 near Casa Diablo nearly recovering the ~25 psi total reservoir pressure decline that occurred during 14 years of expanded production (Figure 29) (Sorey, 2010).

Recent monitoring records for wells east of Casa Diablo generally correlate with pressure changes in the production reservoir at Casa Diablo prior to the onset of production from Basalt Canyon (Figures 27 and 29). Monitoring equipment problems affected the data recorded in well CW-3 (Figure 30) but reliable downhole pressure records for wells 65-32, 28-34, ESN, CW-3, and CH10B (Figures 27-32) illustrate the hydrologic continuity of the geothermal production zone to the east of Casa Diablo and the sensitivity of the hydrologic system to short-term induced pressure changes and long-term natural seasonal variations. Subtle pressure changes occurred through 2006 in USGS monitoring point CH10B at Hot Creek gorge ~ 10 km east of Casa Diablo (Figure 31) and while these changes were not as definitive as pressure variations in wells closer to Casa Diablo, changes in the CH-10B records are consistent with short-term pressure increases in late 2006 associated with the change to production from Basalt Canyon. Pressure variations in CH-10B farther east are significantly attenuated both in magnitude and amplitude compared with measured pressures close to Casa Diablo (for example well 28-34 in Figure 30) as would be expected with increasing distance in an aquifer.

Pressure records document declines from west to east for monitoring wells west of Casa Diablo from 1995 through 2006 (Figures 32-34). Pressure changes in monitoring wells 66-31 and 12-31 are consistent with the lateral continuity of the fractured Early Rhyolite geothermal production zone west of Casa Diablo. Wellbore problems in 66-31 after 2006 caused extreme variations in the recorded pressures unrelated to reservoir conditions and the monitoring well is no longer considered a reliable monitoring point (Sorey, 2010). Pressure records for monitoring well 48-29 completed within the Bishop Tuff are consistent with the lateral continuity of the fractured Bishop Tuff west of Casa Diablo. Reservoir pressures declined ~5 psi in monitoring well RDO-8 near Shady Rest and ~ 10 psi in BC12-31 with the onset of production from Basalt Canyon in 2006 (Figures 33, 34). The RDO-8 corehole completion allows communication with both the Early Rhyolite section and the underlying Bishop Tuff. The low-permeability landslide block that separates the shallower Early Rhyolite from the deeper Bishop Tuff in the southern caldera moat is absent west of corehole BC 12-31 apparently allowing hydrologic connectivity between thermal flow zones in the Early Rhyolite and Bishop Tuff, at least in the outflow region around Shady Rest. To the west, shallow cold groundwater aquifers are separated from the deeper geothermal reservoir by thick ash-rich Early Rhyolite units (Figure 14). Temperature gradient holes MLGRAP-1 and 2 and Oh Well-1 drilled into impermeable Early Rhyolite units in the western part of the Mammoth Groundwater Basin (Figure 11) and the MCWD generally considers these units as impermeable unproductive consolidated bedrock (Wildermuth, 2009).

Like many geothermal systems, fluid circulation in the Long Valley geothermal reservoir is controlled by permeable faults and fractures. Fluid upflow occurs along penetrative faults that controlled the caldera's collapse or more recent faults that deformed the caldera after collapse. Laterally fluid flow from west to east occurs in the fractured Bishop Tuff that is the primary geothermal reservoir within the caldera. The caldera collapsed along a series of penetrative E-W ring fractures that are the structural margin of the southern caldera. Later post-collapse faulting is predominantly NW-SE. In combination, these deep controlling faults connect the laterally extensive fracture permeability within the Bishop Tuff to channel upflow and outflow in the Shady Rest area.

Head data from shallow cold groundwater water wells distributed around the caldera's west and south moats and pressure data from monitoring wells correlate in time with seasonal patterns but, depending on proximity to recharge sources, differ in magnitude (Figure 28). Thermal monitoring wells show that geothermal reservoir pressures also vary seasonally. From 2007 to present, production reservoir pressures at Casa Diablo have been relatively constant with a superimposed seasonal variability similar to the magnitude and phase of seasonal variations noted prior to 2006 (Sorey, 2010). The shallow groundwater system can be affected locally by changes in heat flow from the deeper geothermal system as illustrated by the poor correlation between thermal monitoring well 65-32 and the nearby non-thermal monitor well CD-2 (Figure 28). The effects on the local shallow aquifer supplying CD-2 are related to local changes in heat flow above the production reservoir at Casa Diablo rather than regional changes in recharge or outflow. Pressure declines around the shallow Casa Diablo production reservoir (<200m) resulted in two-phase conditions (water+steam) near the top of the reservoir that increased the heating of isolated overlying shallow groundwater aquifers. This increase in heat flow resulted in more steam output from local fumaroles (Sorey, 2000).

5.5 Thermal/non-thermal hydrogeology in Long Valley

All of the monitoring results, geochemical and geologic data in Long Valley substantiate a separation between the shallow cold groundwater system and the underlying high temperature geothermal system in the western caldera moat. Drilling results establish that the shallow cold groundwater system is separated from potential geothermal influence by thick impermeable altered sections of Early Rhyolite underlying shallow groundwater aquifers in shallow moat basalt units, glacial outwash or poorly consolidated alluvium/colluvium in the western caldera. Slightly elevated temperatures occur in the northwest part of the Mammoth Groundwater Basin. MCWD wells 16, 17, 18 and 20 (Figure 11) produce water at 15.5 - 21°C slightly above production temperatures of 7.5 – 10.5°C in other parts of the basin (Sorey, 2011). Gradient holes MLGRAP-1 and Oh Well – 1 (Figure 11) also have temperature gradients slightly higher than background values in the caldera. There is no geochemical evidence that deeper geothermal fluid is leaking out into the groundwater basin (Section 4.2.1) (Sorey. 2011; Evans pers. comm.). Instead, all of these holes are located immediately south of the Rhyolite Plateau (Figure 5), the projected source reservoir for the Long Valley geothermal system. The slightly elevated temperatures are related to the increased conductive heat loss around the major thermal disturbance of the of the deeper high temperature geothermal system.

Drilling results and monitoring records also verify that a low to impermeable landslide block underlies much of the central part of the southern caldera moat separating the comparatively shallow Early Rhyolite geothermal reservoir east of Shady Rest and the deeper Bishop Tuff reservoir section where produced fluids are injected at Casa Diablo (Figure 35) (Suemnicht and others, 2007). Differences in geology, chemistry and temperature in Basalt Canyon wells 57-25 and 66-25 illustrate the complexity of interactions within the principal geothermal outflow reservoir in the western caldera. The connection between the thermal water-bearing zones in the Early Rhyolite and those in the Bishop Tuff are related to E-W and NW-SE faults in the southern caldera moat that provide discontinuous and variable vertical permeability channeling upward fluid flow between the Bishop Tuff and the Early Rhyolite. The moderate temperature thermal outflow into the shallow permeable Early Rhyolite rocks east of Shady Rest is effectively separated from the underlying Bishop Tuff and the pervasive influence of cold recharge waters around the edges of the caldera.

Highly permeable and laterally continuous hydrogeologic units over lateral distances of >10km underlie the southeastern part of the caldera. The hydrogeology is poorly defined east of Casa Diablo because fewer wells have been drilled and most do not penetrate as deep as underlying Bishop Tuff reservoir section. The available well data indicates that warm water outflow in the southern and eastern caldera is predominantly shallow (<200m; 650 ft.) occurring in permeable Early Rhyolites immediately east of Casa Diablo (monitoring well CW-3) and is entirely within shallower alluvial or lacustrine units farther east toward Lake Crowley (deep well 66-29). Pressure variations in wells 5-10 km east of Casa Diablo correlate in time and sign with those in the production reservoir (Figure 36) with only minor delays (days to weeks) in the arrivals of the pressure changes induced by changes in the production at Casa Diablo. Geochemical and thermal data from wells and springs in the southeastern caldera between Casa Diablo and Hot Creek gorge corroborate the continuity of thermal fluid flow from Casa Diablo through Hot Creek eastward to Lake Crowley (Sorey and others, 1991) and the comingling of shallow geothermal outflow and groundwater systems in the southeastern caldera. The combination of isobutane migration and reservoir pressure transmission in the production zone and injection zones signifies a high degree of lateral continuity within the relatively shallow geothermal system in the south moat.

Project Impacts

Variations in precipitation, recharge, geothermal production, non-thermal groundwater withdrawals, earthquakes, magmatic activity and crustal deformation all affect the Long Valley hydrologic system (Sorey 2000, 2010). Seasonal snowmelt is the predominant influence on the hydrology of the caldera. Deep recharge from the west supplies thermal water to the deep hot geothermal source reservoir in the western caldera moat and the eventual outflow at lower elevations to the east. Based on drilling results and pressure monitoring data, the shallow cold groundwater system appears to be isolated from the deeper geothermal system and is recharged from both the western and southern topographic margins of the caldera (Sorey, 2011; Evans pers. comm.).

Detailed hydrologic monitoring was initiated in Long Valley to address concerns that geothermal development effects would predominate resulting in detrimental changes in surface and groundwater quality and thermal features. A large part of the concern was related to short and long-term pressure declines that would alter the established hydrologic conditions supporting sensitive thermal springs. After 27 years of geothermal production, monitoring data show that pressure changes associated with the current level of production from Casa Diablo and Basalt Canyon are within sustainable levels (Sorey, 2010). The total reservoir pressure decline from geothermal production has been about 55 psi, with 35 psi of the decline occurring in 1991, when production was increased to supply the MP II and PLES I power plants and changes in injection to return spent fluid to the deeper Bishop Tuff reservoir (Sorey, 2005, 2010).

Less pronounced pressure declines have occurred in the shallow outflow zone around Casa Diablo. Monitored pressures in well CW-3, ~5km east of Casa Diablo, declined ~2-3 psi as production increased in 1991. The limited 165 acre production area at Casa Diablo continued to sustain 40 MWe generation without drilling make-up wells and with comparatively small ~ 2 psi pressure decline from 1991-2003 (Sorey 2005, 2010). Production has since shifted west since 2006 toward the outflow source to produce deeper hotter fluid from the Basalt Canyon ~2 km west of Casa Diablo. Pressures in Basalt Canyon have declined ~ 13 psi while Casa Diablo reservoir pressures have increased 15-20 psi partially recovering the 1991-2003 reservoir pressure declines. As planned, the Project will continue to shift production toward the ultimate source of reservoir of the Long Valley hydrothermal system. Assuming continued reservoir pressure increases from the westward shift in production, the potential impact of reservoir pressure declines are expected to lessen downgradient of Casa Diablo in the shallower thermal outflow that sustains thermal springs farther east.

Drilling results and hydrologic monitoring data establish that the shallow groundwater system and comparatively shallow geothermal outflow interact in portions of the southeastern caldera moat. Extensive geochemical monitoring within the caldera has not detected detrimental changes in water quality during geothermal development based on analyses of cations, anions and trace elements in the hot spring waters derived from geothermal outflow. The concentration of conservative elements such a Cl,B, F that have been used for decades by the USGS to track the origin, evolution and circulation of geothermal fluids have remained stable and unchanged in both the exploited geothermal reservoir and the active hot springs within the caldera (Sorey, 2011; Evans pers. comm.). Rates of flow of thermal water in springs at Hot Creek Gorge and the Hot Creek Fish Hatchery have been estimated from the concentrations of chloride and boron measured in the water. The estimated rate of thermal water discharge at Hot Creek Gorge has varied little since 1988 during a time of several changes in geothermal production and increased crustal unrest. Rapid increases in the discharge rate and temperatures that led to the closing of Hot Creek swimming area in 2006 were more in response to above normal precipitation in the preceding winter (Farrar and others, 2007) and cannot be related to changes in geothermal production from Casa Diablo. Distinct pressure variations are noted close to Casa Diablo but effect attenuates with distance and the magnitude of measured pressure variations are significantly less farther east at sensitive sites like Hot Creek. Water level measurements in well CH10B, located near Hot Creek Gorge (Figure 31), do not appear to show reservoir pressure changes related to geothermal development.

Producing the deeper Basalt Canyon geothermal reservoir has less potential for adverse effects on shallow cold groundwater in the MCWD well field or the expansion of thermal ground in the western caldera. Project production will be from the deeper fractured Early Rhyolite units and the Bishop Tuff the west. Separations between the deeper geothermal reservoir and shallow cold groundwater aquifers in the central Mammoth Groundwater Basin limit the potential for impacts to groundwater quality and quantity of supply.

Updated numerical models of the Long Valley geothermal reservoir indicate that Project development should have minimal impact on surface manifestations to the east around the Resurgent Dome (GSI, 2012; Garg, 2012). As a tool to help forecast future behavior of the geothermal reservoir, the model creates a three-dimensional simulation of pressure and temperature distributions within the reservoir over time. Model validity depends on the assumptions and inputs. The numerical model for Long Valley is based on the well-constrained geologic conceptual model (Section 5.2) and is validated by calibrating and matching the calculated temperature and pressure behavior against the extensive historical temperature and pressure monitoring data from the caldera. Model forecasts indicate that reservoir temperatures should decline by ~10°C and reservoir pressure declines should range from 1.45 psi to 10 psi, at the maximum only 20% of the pressure declines monitored during the prior 27 years of production from Casa Diablo. Project wells will produce deeper hotter reservoir section than the existing shallow Casa Diablo production reservoir consequently potential effects on cold groundwater, subsidence and more distant surface manifestations related to declining reservoir pressures would be minimized. Simulation results do not forecast declines in thermal output to the most prominent hot springs from either existing production or the expanded Project (GSI, 2012; Garg, 2012). The potential impact at the Fish Hatchery Springs would be an estimated 17 percent decline in thermal water input. The thermal water fraction of the Hatchery springs is a very small part of the total flow and spring temperatures have previously been shown to be primarily dependent on seasonal fluctuations in precipitation and not the thermal component of flow (Sorey and Sullivan, 2006).

6 Conclusions

Long Valley caldera has been an important geothermal exploration target since the 1960s. A large active young relatively shallow magmatic heat source is evident from the massive eruption of the Bishop Tuff 760,000 years ago. Still younger eruptions 600 years ago along the Mono-Inyo volcanic chain are obvious evidence of continued magmatic input supplying heat to the geothermal system in Long Valley. At least 60% of the Bishop Tuff filled the caldera depression providing a significant volume of fractured reservoir rock. Numerous hot springs and fumaroles across the caldera are ample evidence of an actively circulating hydrothermal system within the caldera. Early exploration wells (<300m) around Casa Diablo were drilled near the most prominent hot springs and fumaroles on the west flank of the Resurgent Dome. Deeper wells explored the southeastern caldera moat (Rep 66-29) and evaluated lease offerings in the northern Resurgent Dome (Clay Pit-1) and at Casa Diablo (Mammoth-1). The results revealed that the principal geothermal reservoir in Long Valley was not located directly beneath the Casa Diablo Hot Springs and did not appear to be related to the Resurgent Dome. Instead, the hydrothermal system appeared to be more complex and the shallow production at Casa Diablo appeared to be supplied by upflow and outflow from a deeper western source reservoir.

Prior to 2006, geothermal development within Long Valley Caldera had been limited to limited to ~165 acres around Casa Diablo on the southwestern edge of the caldera's Resurgent Dome. Production has been from a shallow (<200m) moderate temperature (170 ^{o}C) outflow in a permeable Early Rhyolite reservoir. Deeper (600 m) injection wells return all of the spent fluid to the underlying permeable Bishop Tuff. Production sustained 40 MWe (gross) until 2006 without drilling any makeup wells. The proposed Project will further develop the Basalt Canyon area in the western caldera closer to the higher temperature outflow from the ultimate deep source reservoir in the west. ORNI 50, LLC, the project operator, plans to expand generation by approximately 50% (3,000 kph or 6,000 gpm) by drilling additional wells in the Basalt Canyon area to produce a total of approximately 18,000 gpm (9,000 kph) to sustain generation of approximately 73MWe (net) from four power plants.

Well monitoring data show that pressure changes associated with the current level of production from Casa Diablo and Basalt Canyon are within sustainable levels (Sorey, 2011). The pressure records and geochemical data establish that fluid injected deep into the Bishop Tuff beneath the shallower Early Rhyolite production reservoir at Casa Diablo flows both east and west within the Bishop Tuff. The shallow cold groundwater aquifers farther west in the Mammoth Groundwater Basin are separated from the underlying geothermal system by thick altered and impermeable sections of ash-rich Early Rhyolite. To the east of Shady Rest, a landside block of indurated Paleozoic rocks surrounded by intensely altered ash that slid into caldera during the last stages of Bishop Tuff eruption underlies approximately 3 km^2 of the southern moat and separates the deeper Bishop Tuff geothermal reservoir and controls the shallower outflow of hydrothermal fluids southeast around the Resurgent Dome. At some distance east of Shady Rest, the geothermal production and injection zones merge into a single zone of laterally flowing hot water sourced by a deeper upflow region in the west caldera.

Geochemistry, isobutane migration and reservoir pressure transmission in production zone and injection zones signifies a high degree of lateral continuity within the relatively shallow geothermal system beneath the southern caldera moat. The Bishop Tuff injection reservoir is laterally continuous into the western caldera moat based on detailed pressure data collected as part of hydrologic monitoring of geothermal development. Transport of dissolved isobutane away from Casa Diablo, both within the production and injection reservoirs is poorly understood, even though the initial timing and appearance can be detected in surface manifestations and wells. The geology of the Basalt Canyon area is still being evaluated but the difference in geochemistry between in wells 57-25 and 66-25 may be related to the degree of penetration and the complexity of E-W and NW-SE faults in the southern caldera moat that provide discontinuous and variable vertical permeability channeling upward fluid flow between the Bishop Tuff and the Early Rhyolite. Reservoir pressures and geochemical data are consistent with the west to east flow of thermal water across the caldera.

Factors other than pressure reductions in a geothermal reservoir that influence temperature and flow rate of surface thermal features include variations in precipitation, snow melt, groundwater recharge, pumping of groundwater aquifers, and crustal unrest (Sorey, 2000). With increased production from Basalt Canyon wells 57-25 and 66-25 and curtailed production from Casa Diablo, monitored reservoir pressures in Basalt Canyon declined ~10 psi while pressures at Casa Diablo increased on the order of 15-20 psi. Shifting production to produce deeper geothermal outflow closer to the ultimate source reservoir in the west has had a positive effect on reservoir pressures at Casa Diablo and mitigates effects on surface manifestations to the east. Shifting production away from the comingled thermal and non-thermal hydrology around the southern Resurgent Dome should result in less stress on thermal features sourced by shallow outflow. The planned production and injection scheme for Long Valley has been evaluated with an updated numerical model of the geothermal reservoir. The Long Valley reservoir simulation is based on the well-constrained geologic conceptual model and is validated by calibrating and matching temperature and pressure behavior against the extensive historical temperature and pressure monitoring data from the caldera. Modeled development scenarios included production from Basalt Canyon and Casa Diablo with injection in part of Basalt Canyon and east of Casa Diablo. Based on modeling forecasts, reservoir pressure declines related to the Basalt Canyon development are forecast to be in the range of 1.45 psi to 10 psi, which would be equivalent to approximately 20% of measured pressure declines at Casa Diablo previously measured declines over 27 years of production from Casa Diablo. Basalt Canyon wells will be completed and produce from zones two to three times deeper than the existing Casa Diablo production reservoir, consequently potential effects on shallower cold groundwater aquifers are expected to be minimized.

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Figures

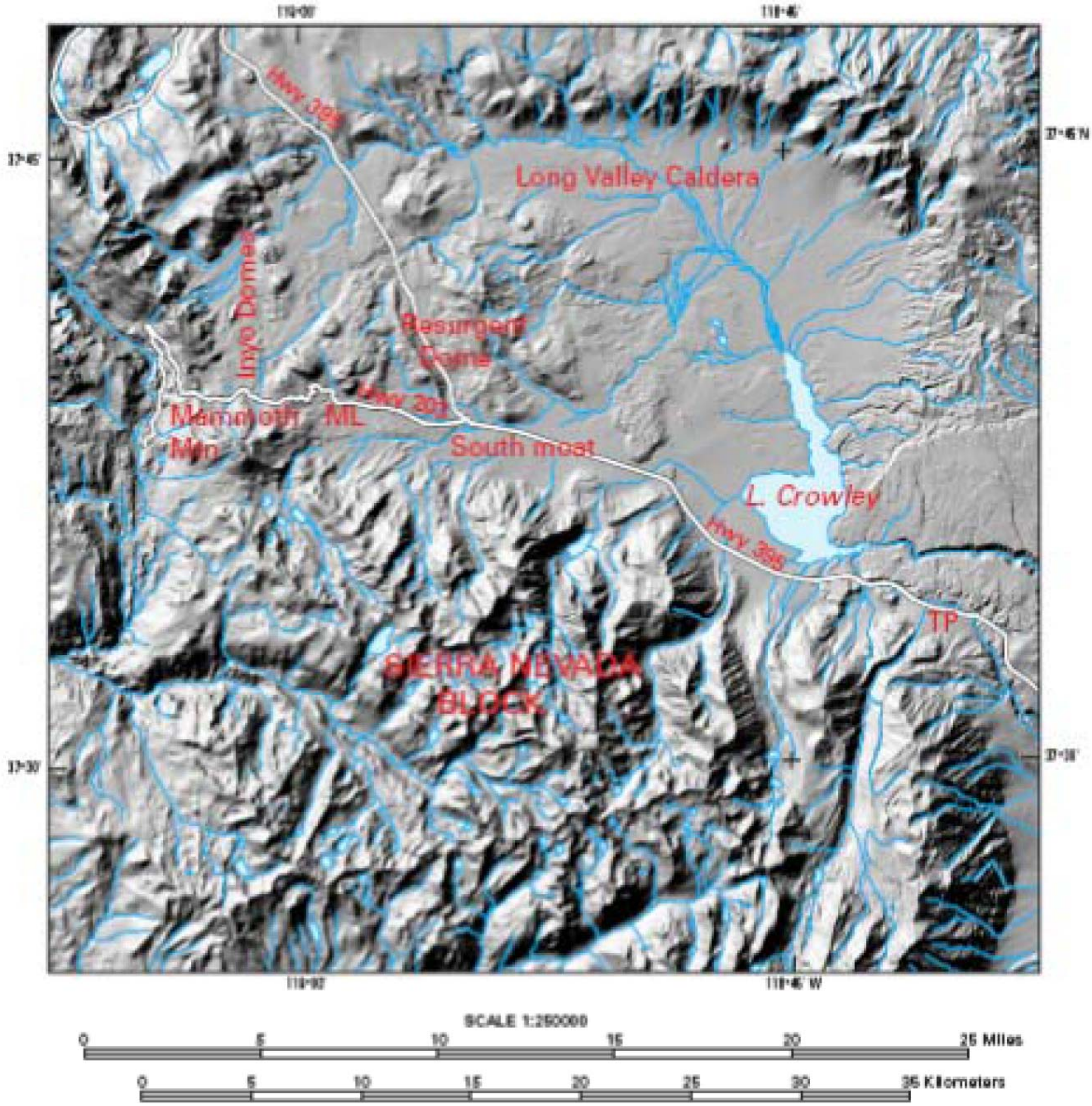

Figure 1 - Location map of Long Valley Caldera and the CD-IV Project area

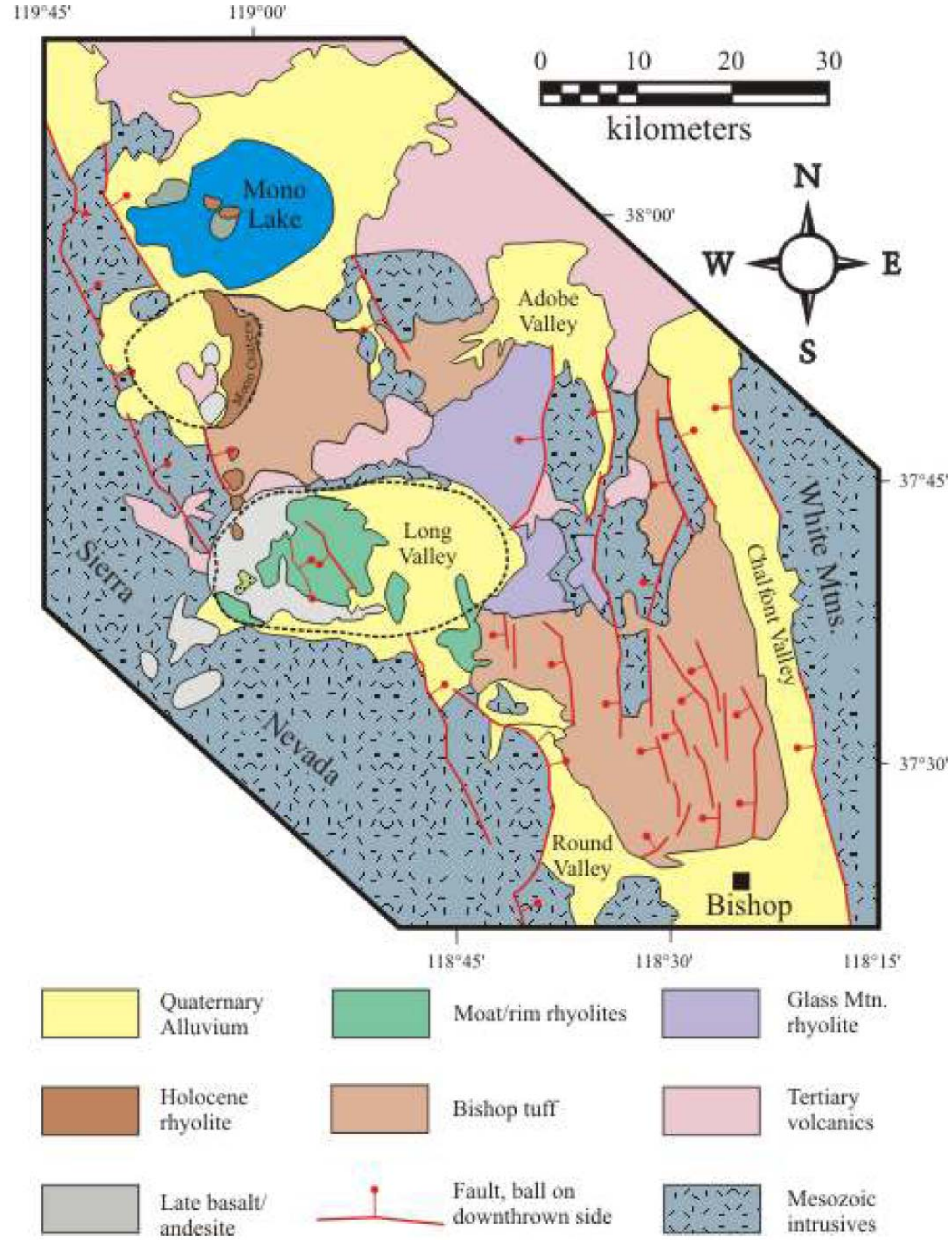

Figure 2 - Generalized geology of Long Valley Caldera (after Bailey, 1989)

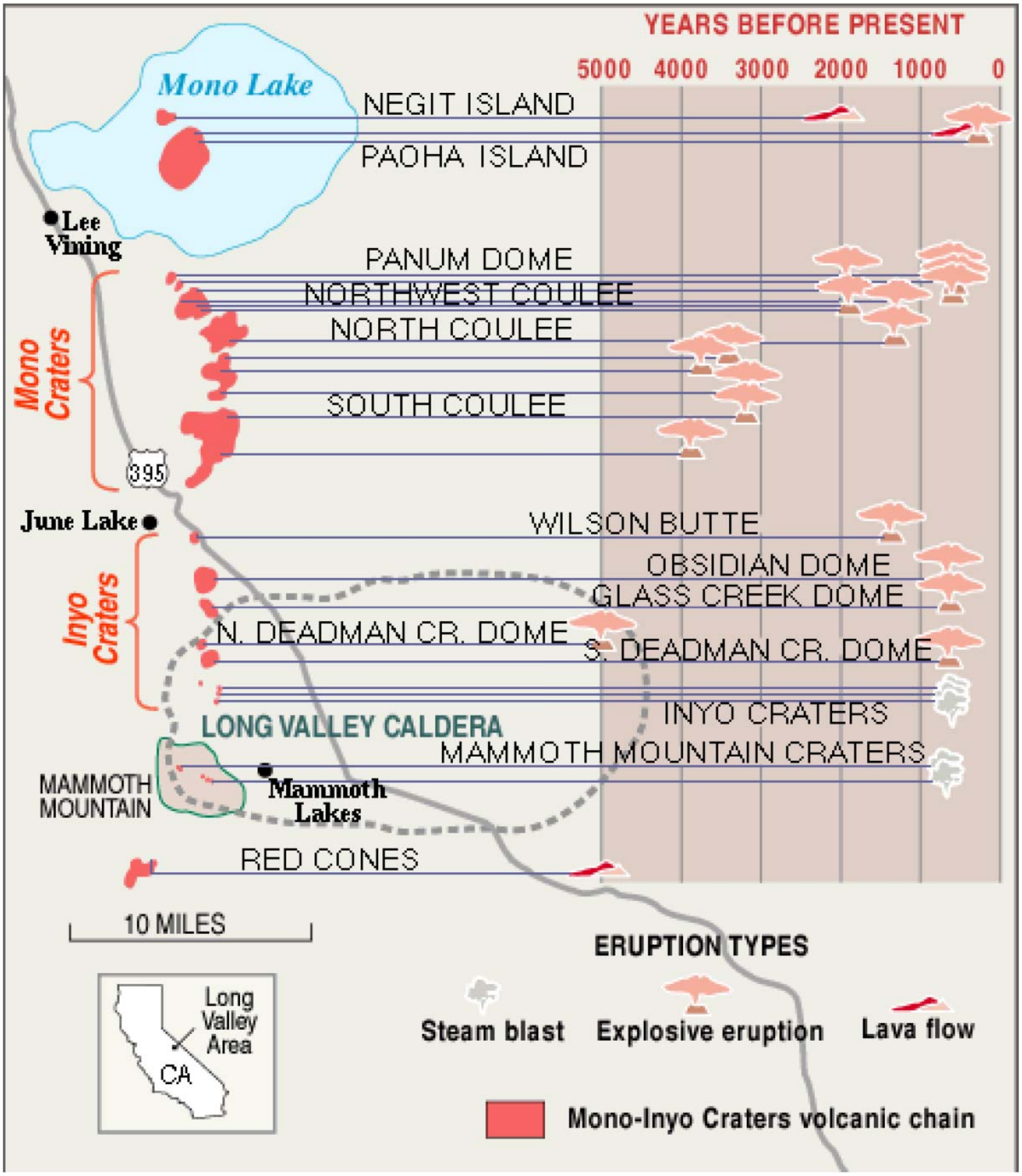

Figure 3 - Locations ages and types of eruptive events in the Mono-Inyo volcanic zone (from USGS)

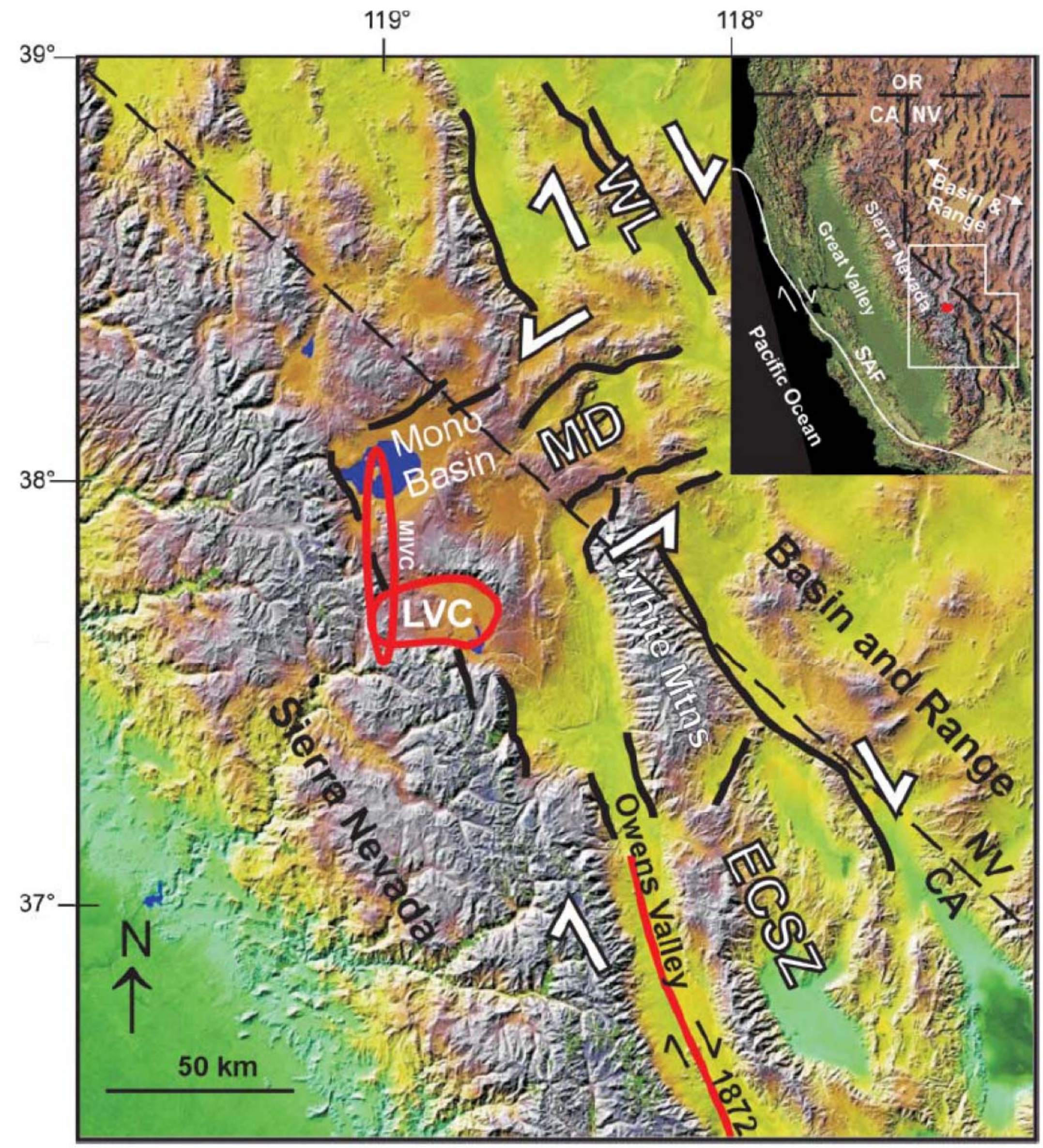

Figure 4 - Shaded relief map of east-central California and western Nevada, showing the location of Long Valley Caldera (LVC) and the Mono–Inyo volcanic chain (MIVC) and predominant regional tectonic features.

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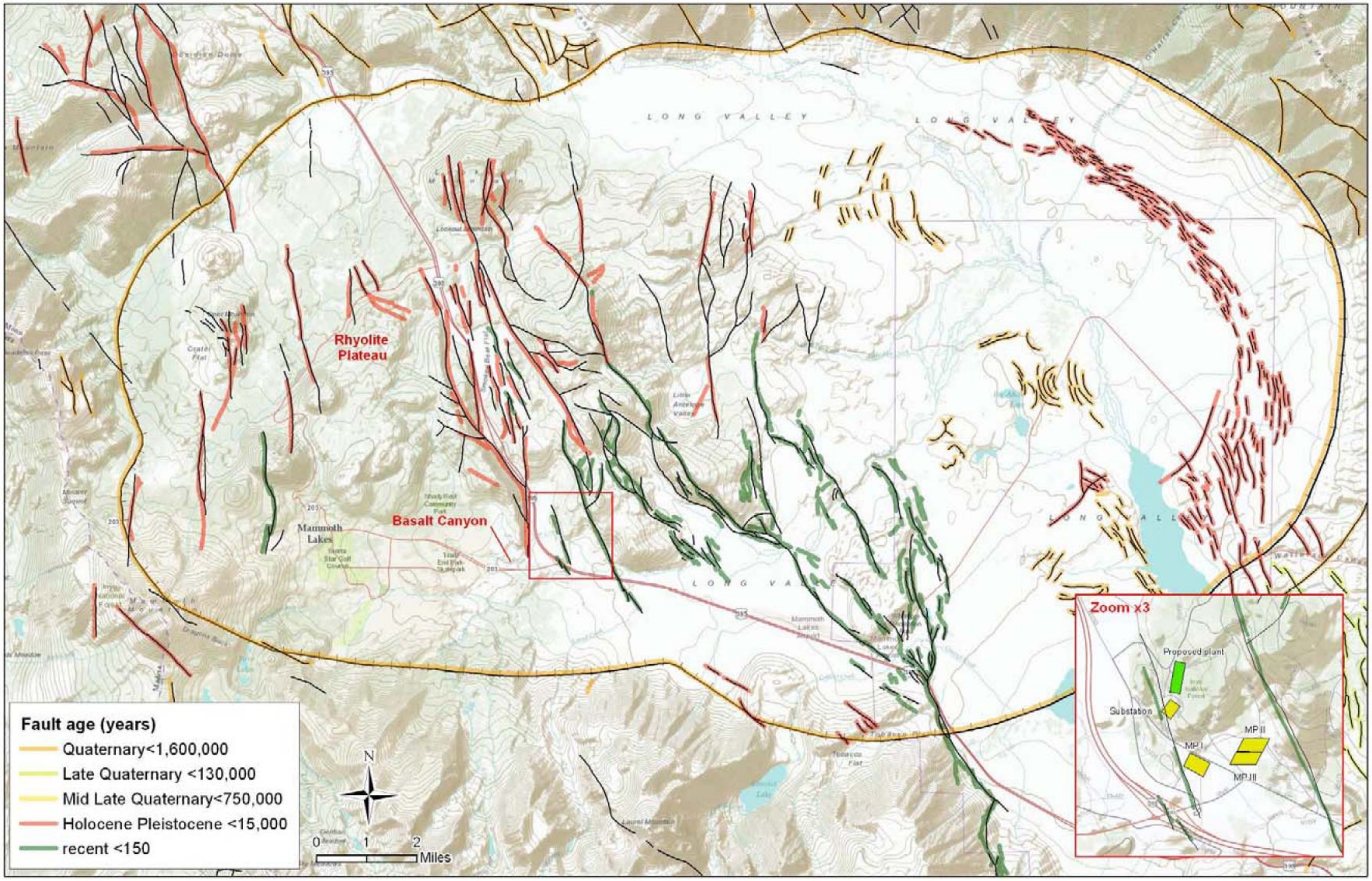


Figure 5 - Quaternary and Recent faults in the Long Valley region from USGS (http://earthquake.usgs.gov/hazards/qfaults/)

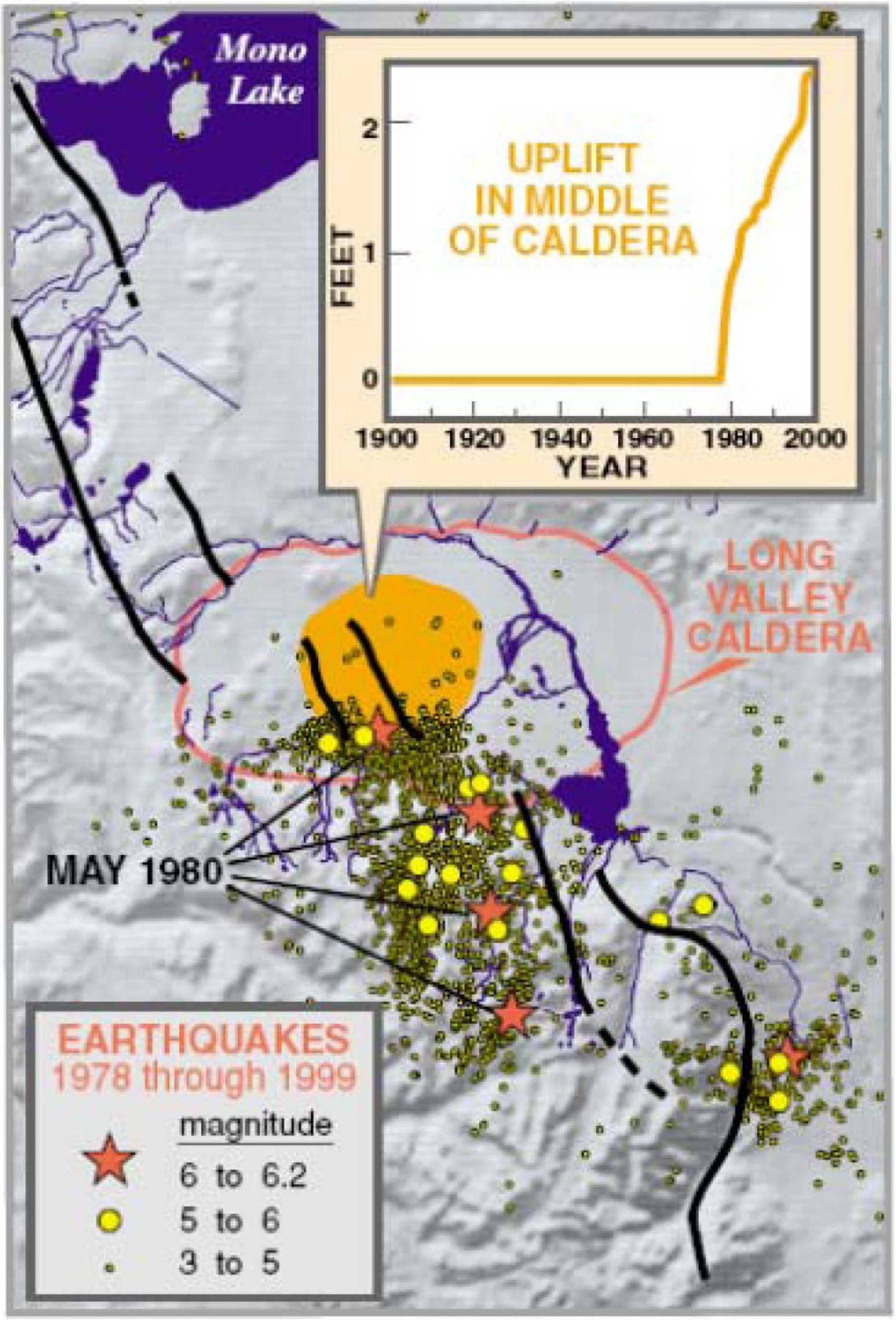


Figure 6 - Long Valley seismicity and uplift.

Figure 7 - Inyo Craters, part of the Mono-Inyo Craters volcanic chain, stretch northward across the floor of long Valley Caldera approximately 7 km north of the CD-IV project area.

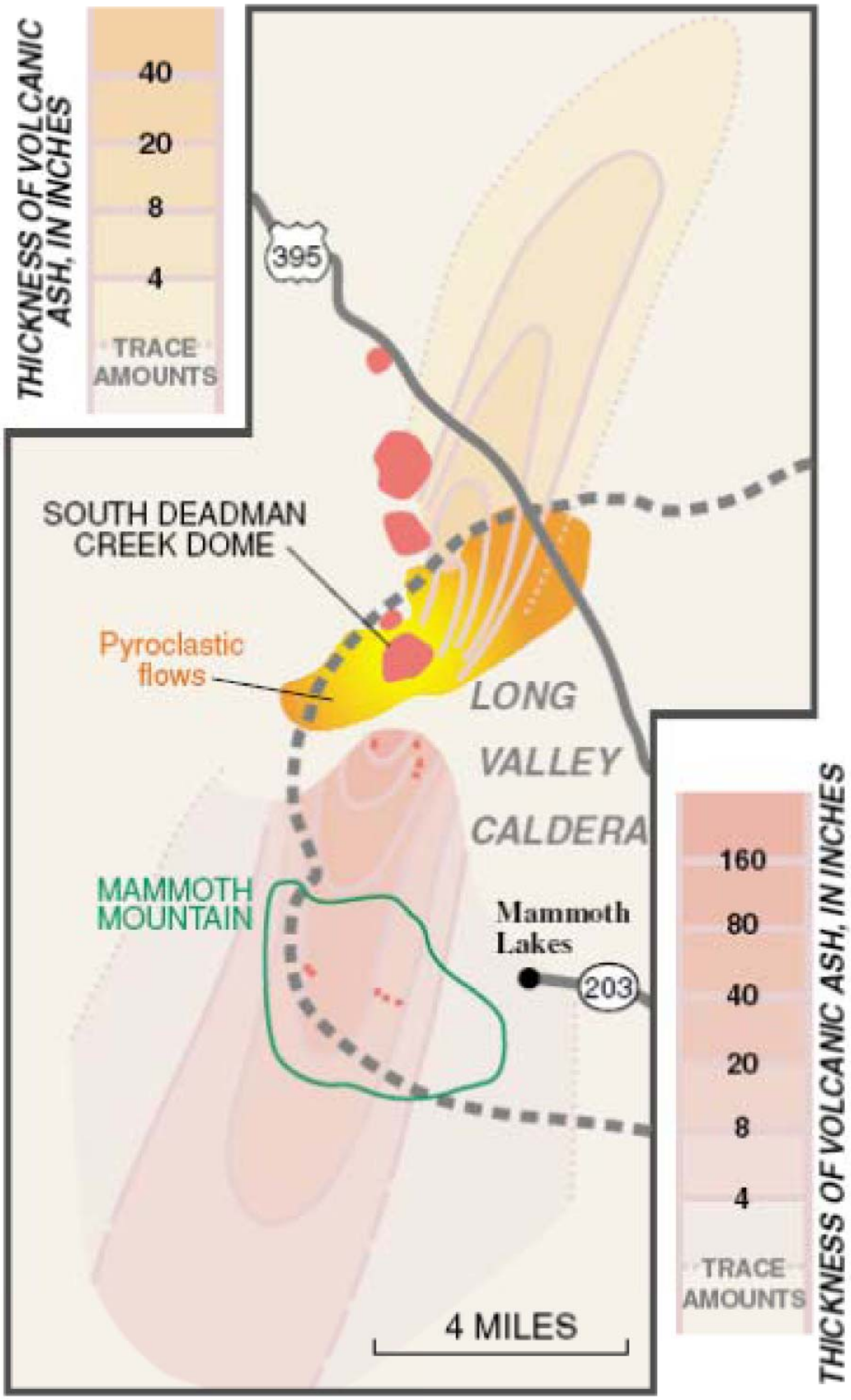


Figure 8 - Thickness of volcanic ash from eruptions <500 yrs. old along he Inyo volcanic chain.

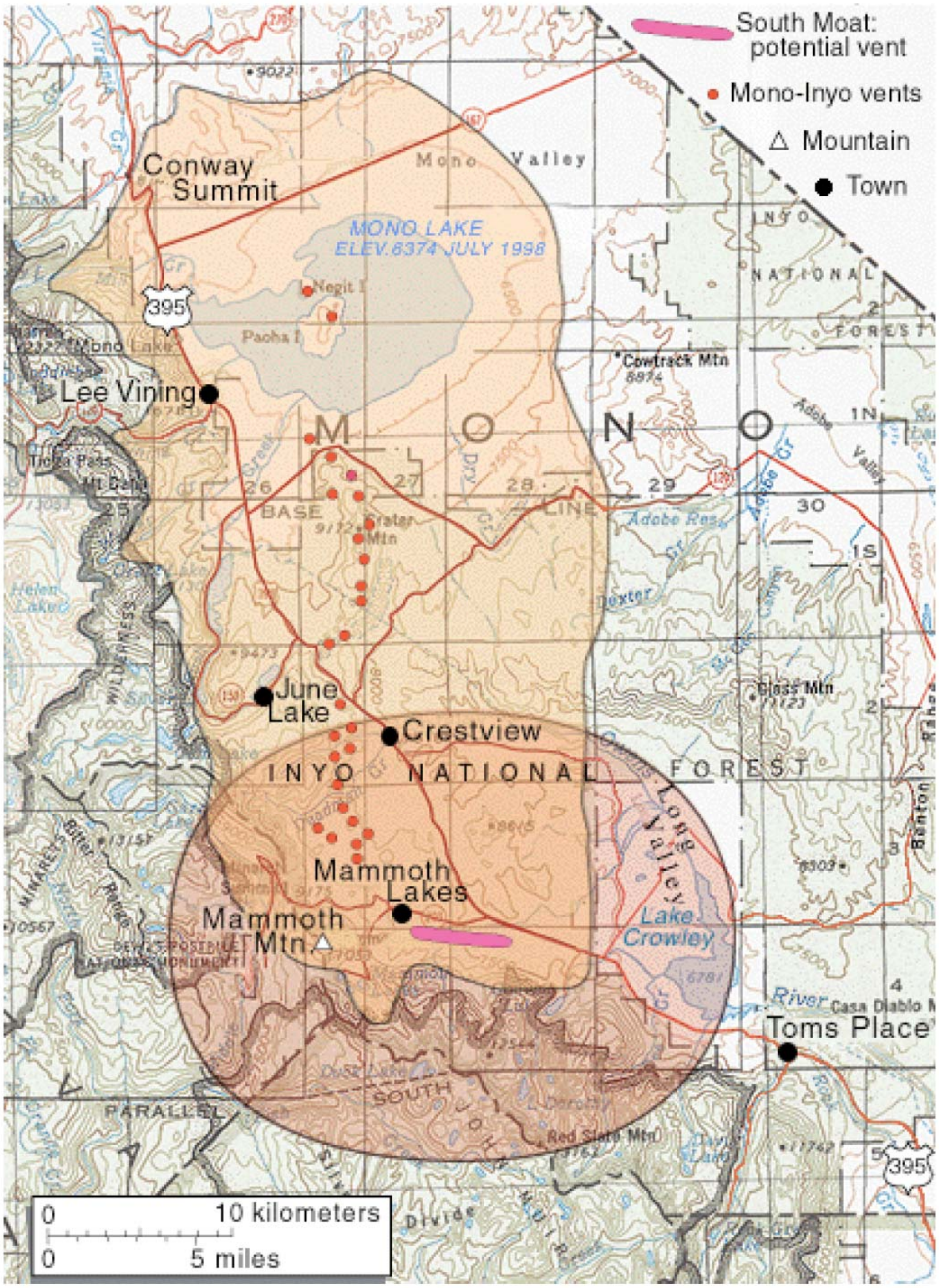


Figure 9 - Areas potentially affected by pyroclastic flows from vents in the LVC and vicinity: Potentially impacted area South Moat vent is pink, from Inyo crater potential vents, is orange. Map from USGS website: http://volcanoes.usgs.gov/lvo/hazards/pfzone_bot

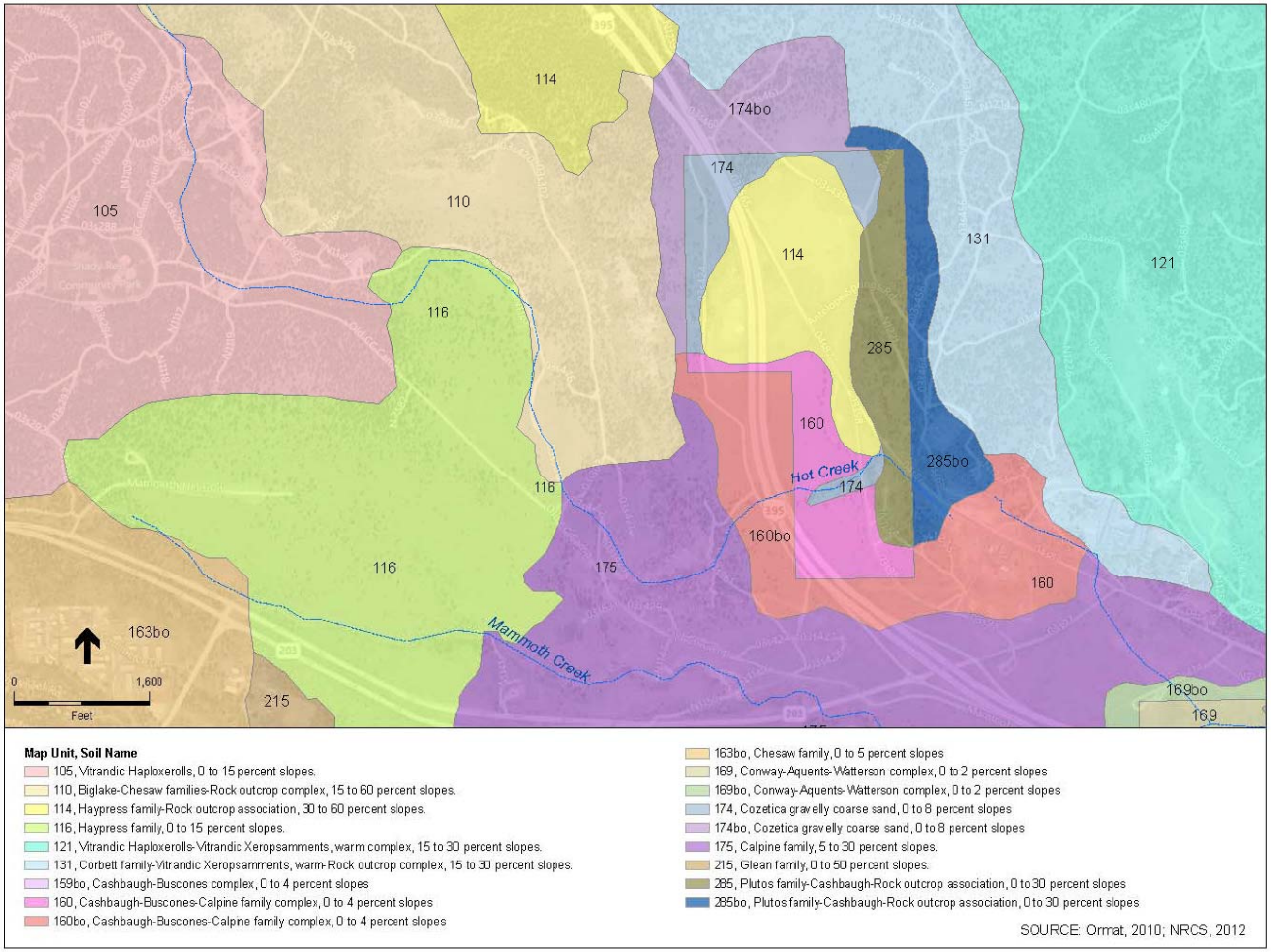


Figure 10 - NRCS soil classifications for Long Valley

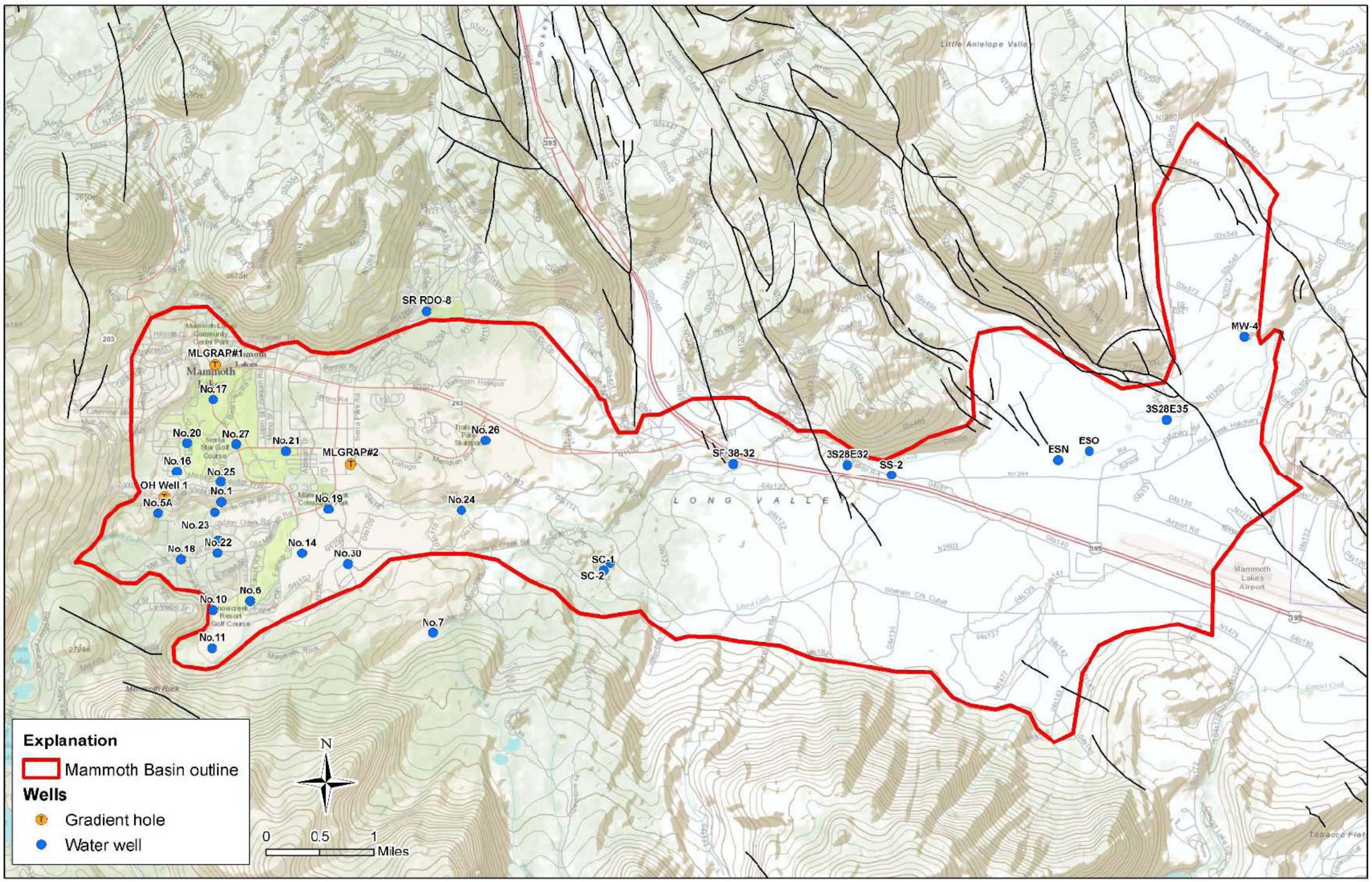


Figure 11 - Mammoth Groundwater basin from Wildermuth (2009). Water production wells are located close to the Town of Mammoth Lakes. All of the existing geothermal wells are drilled east of well RDO-8.

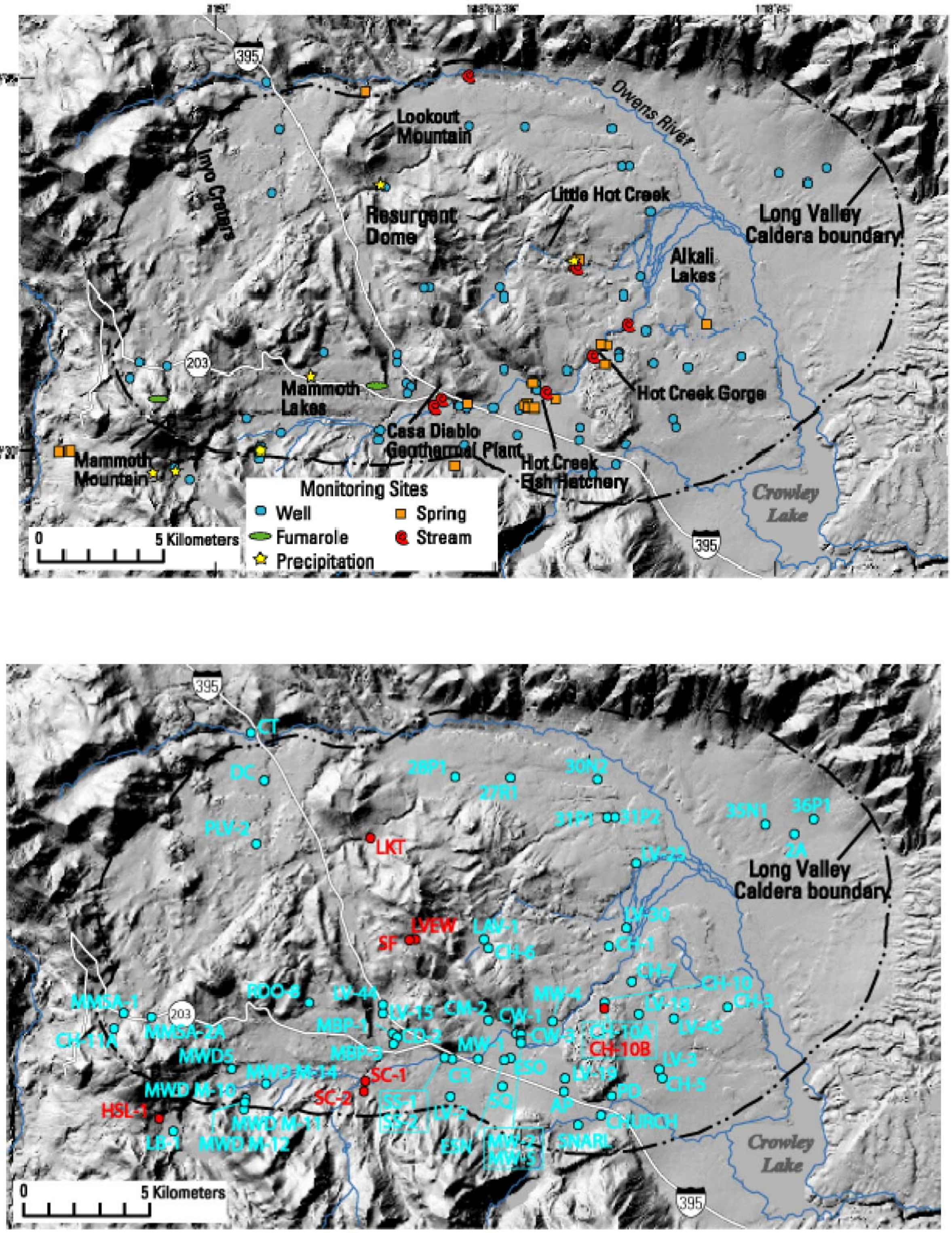


Figure 12 - USGS Hydrologic monitoring points in Long Valley

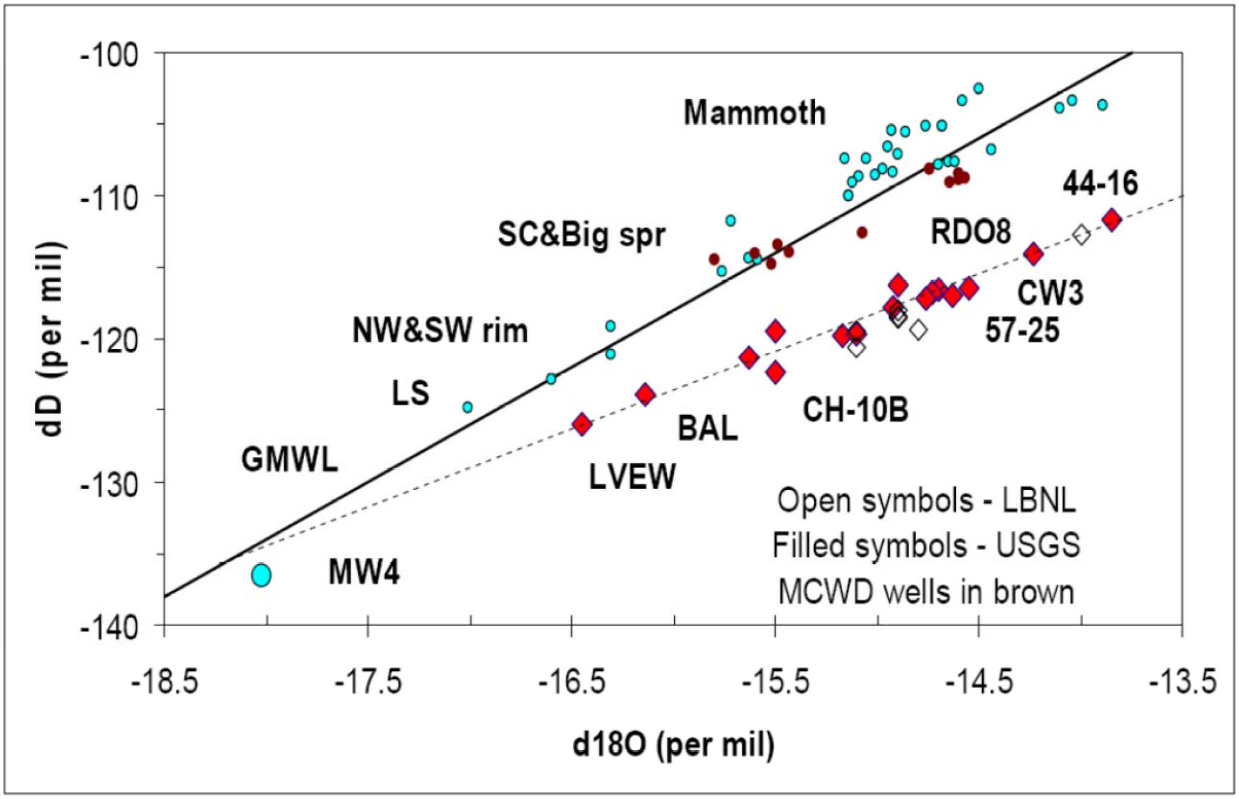


Figure 13 - Light stable isotope data for groundwater and thermal water in Long Valley Caldera

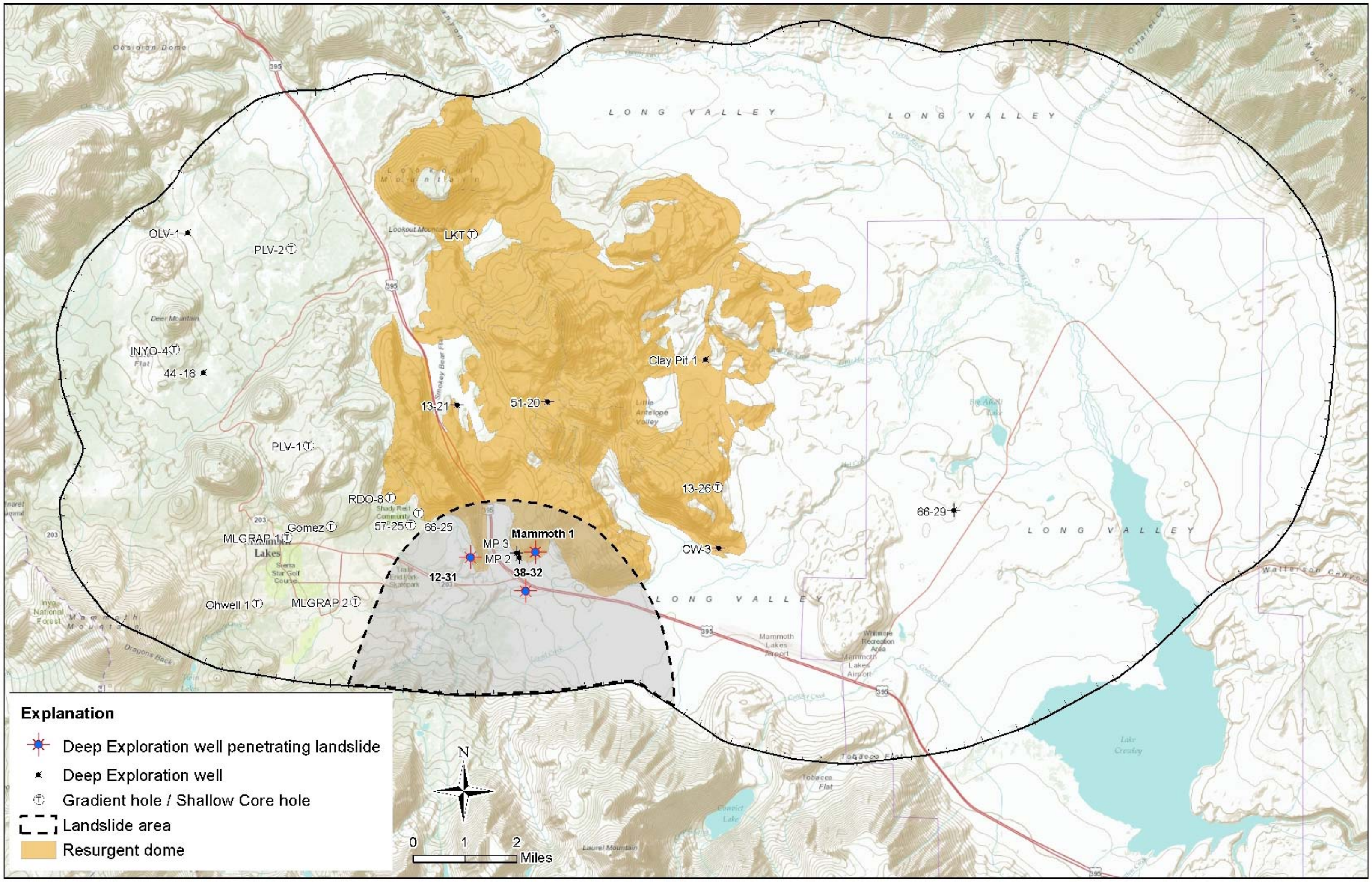


Figure 14 - Distribution of the landslide block of Paleozoic metasedimentary rocks from the southern rim of Long Valley caldera.

D-72

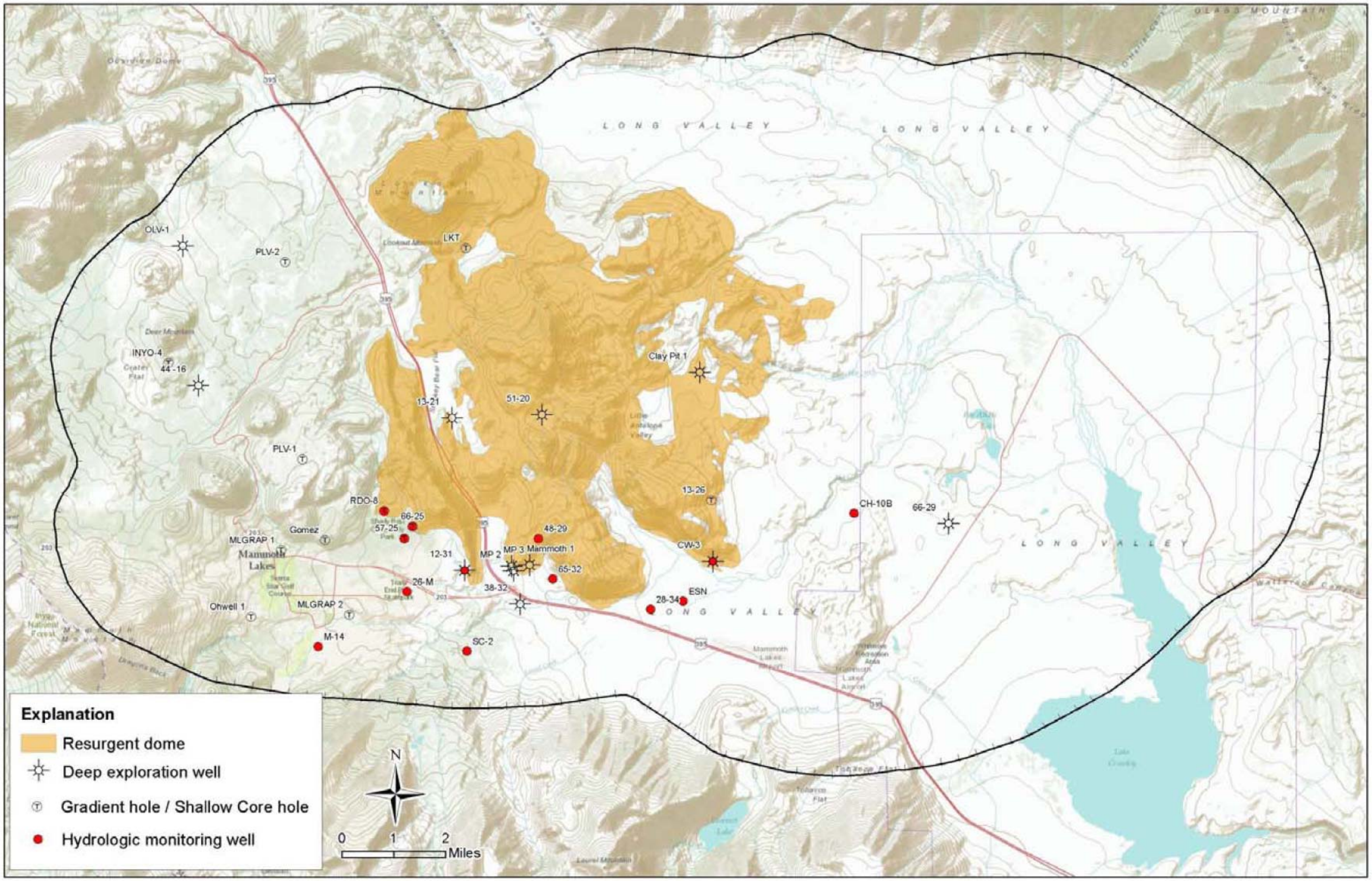


Figure 15- Monitoring well locations in Long Valley (after Sorey, 2010).

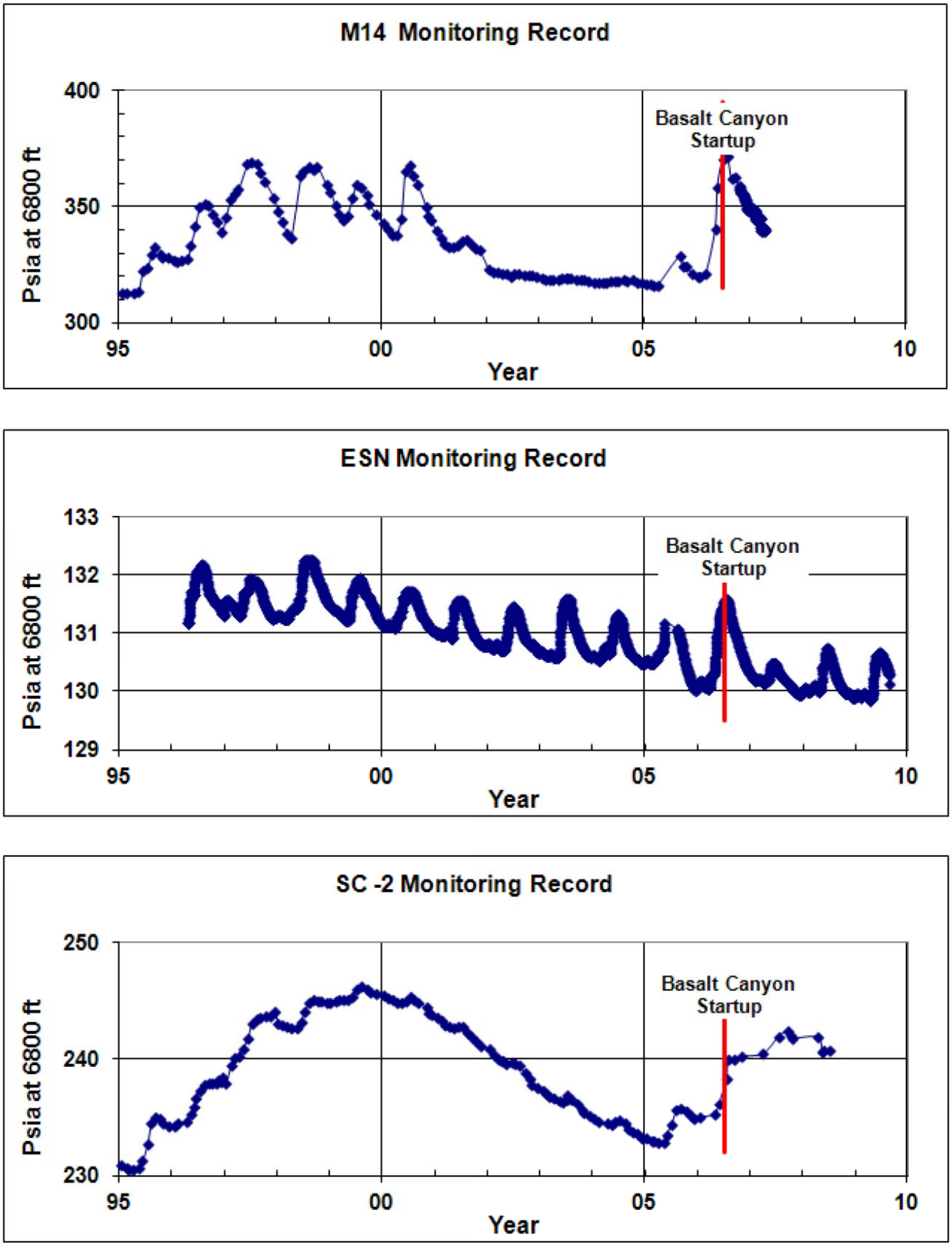


Figure 16 - Comparative hydrographs for shallow non-thermal groundwater monitoring wells M-14, ESN, SC-2, 1995-2010.

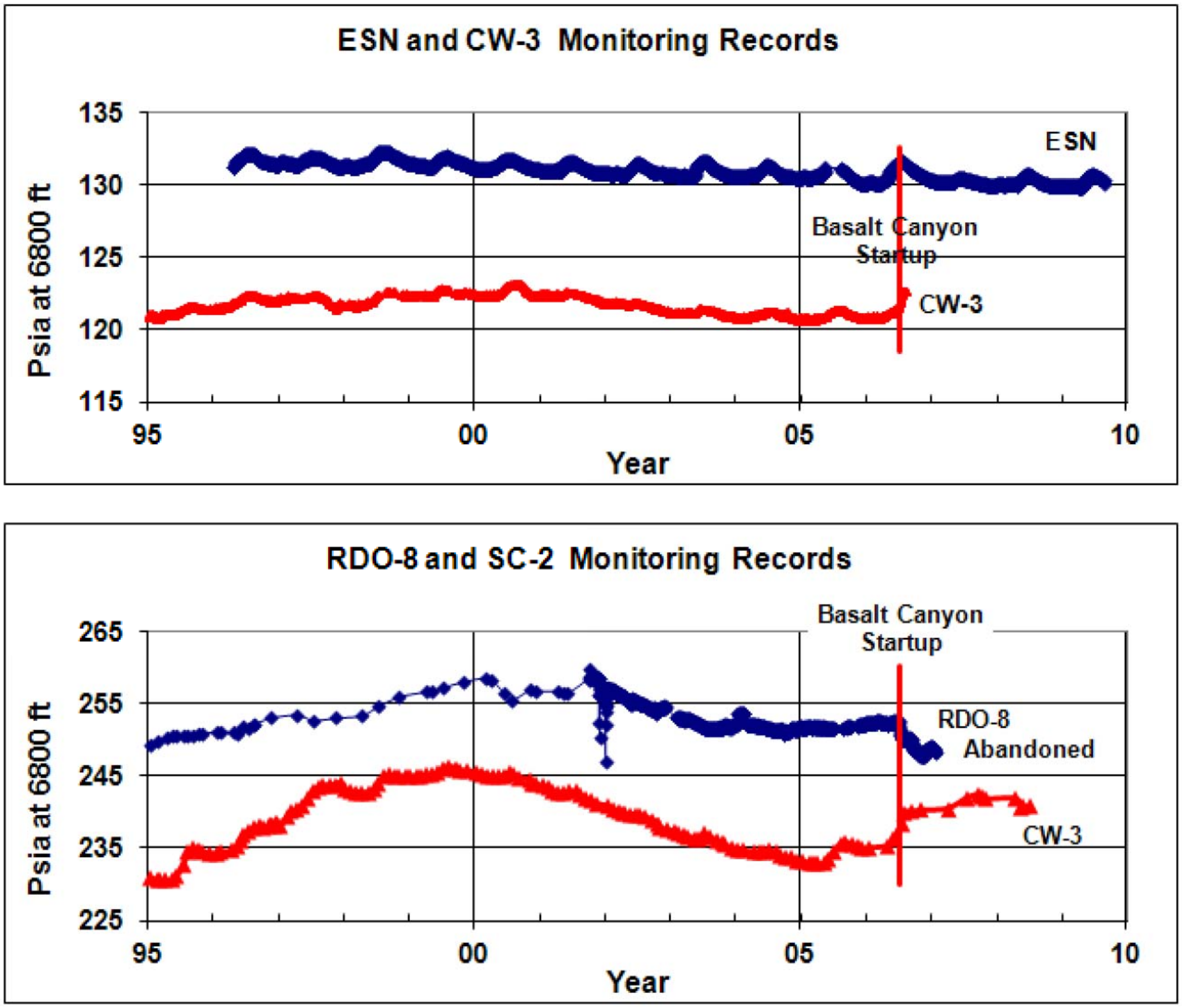


Figure 17 - Comparative hydrographs for groundwater monitoring wells ESN and SC-2 and thermal monitoring wells CW-3 and RDO-8, 1995-2010.

D-75

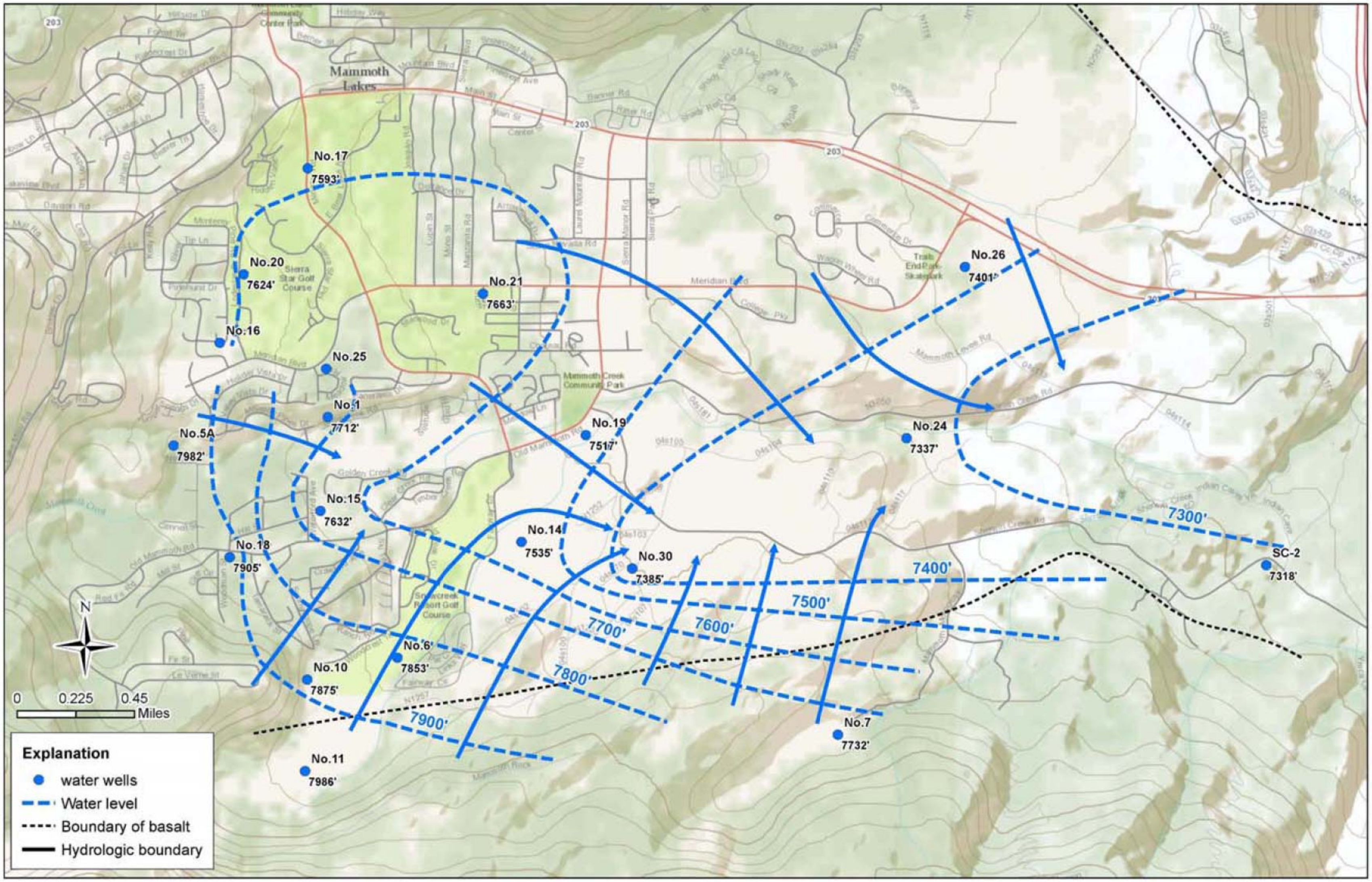
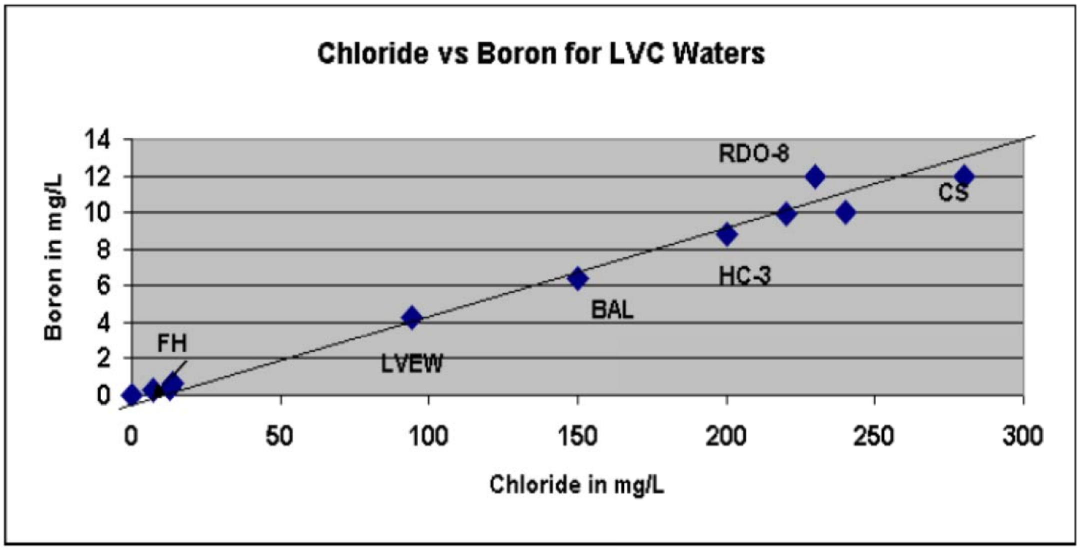


Figure 18 - Contours of water level elevations in MCWD wells of the Mammoth Basin.



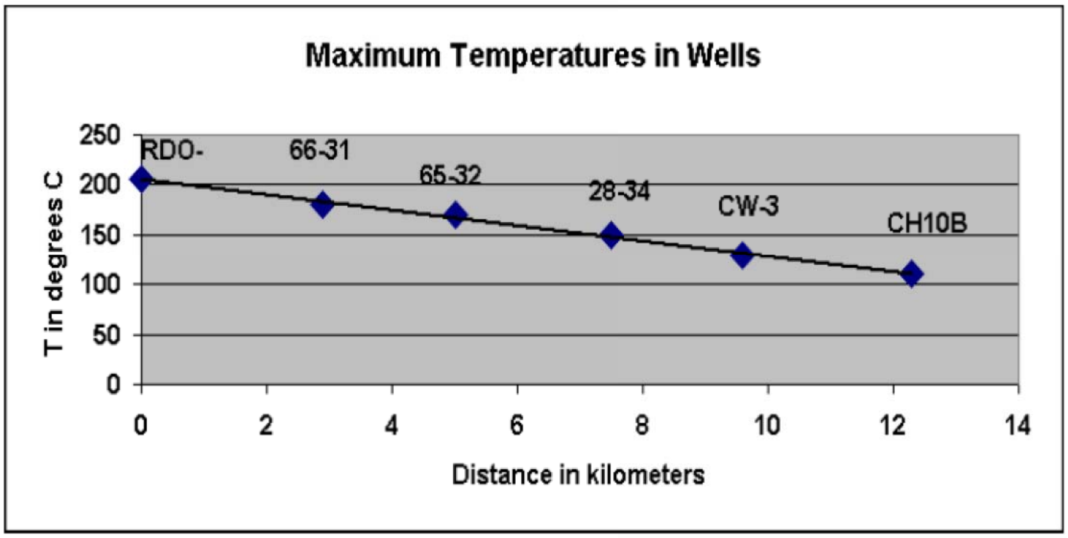


Figure 19- Cl/B ratios and temperatures for various types of cold and hot waters sampled in the Long Valley caldera.

D-77

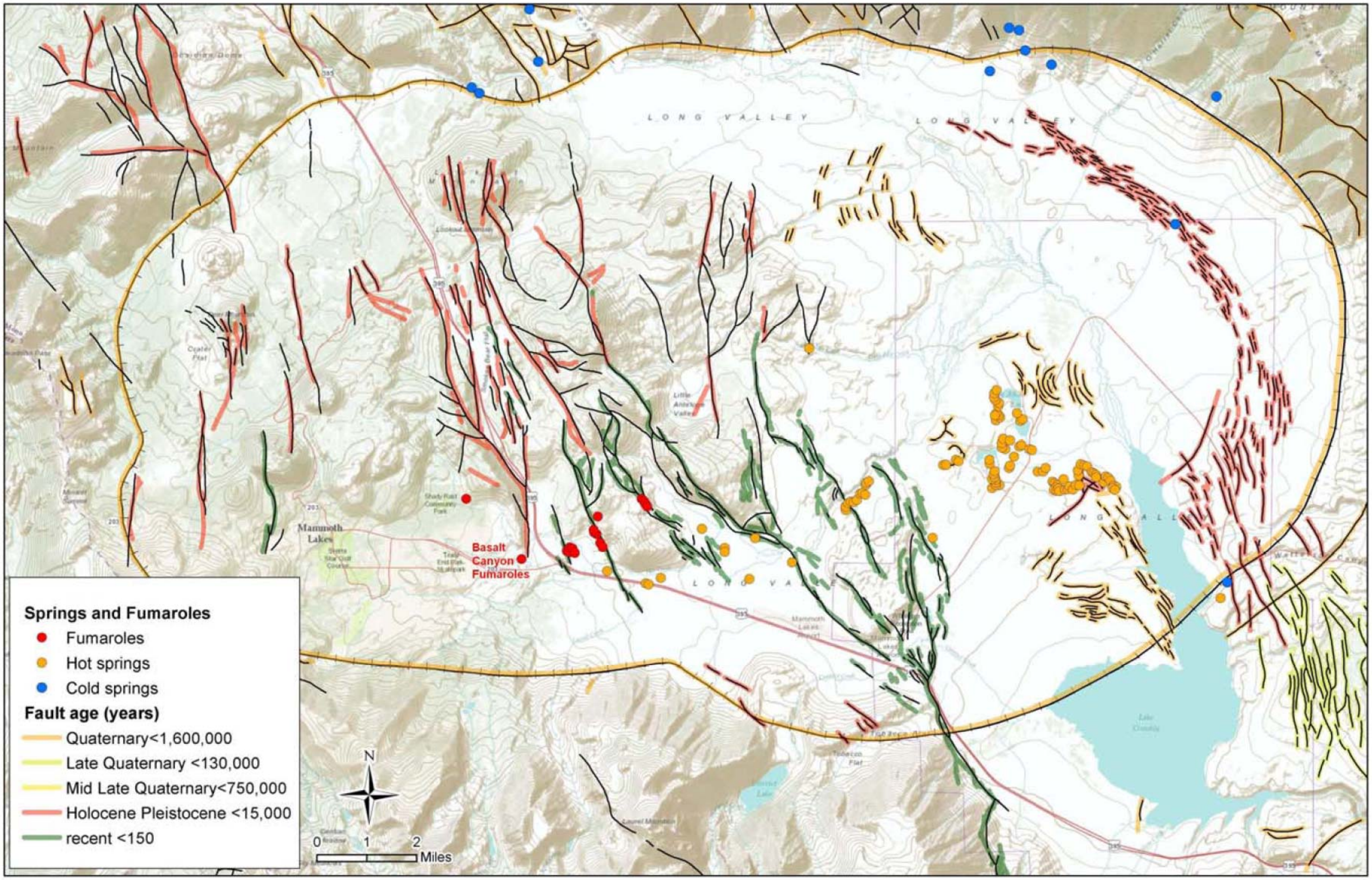


Figure 20 - Hydrothermal manifestations in Long Valley caldera.

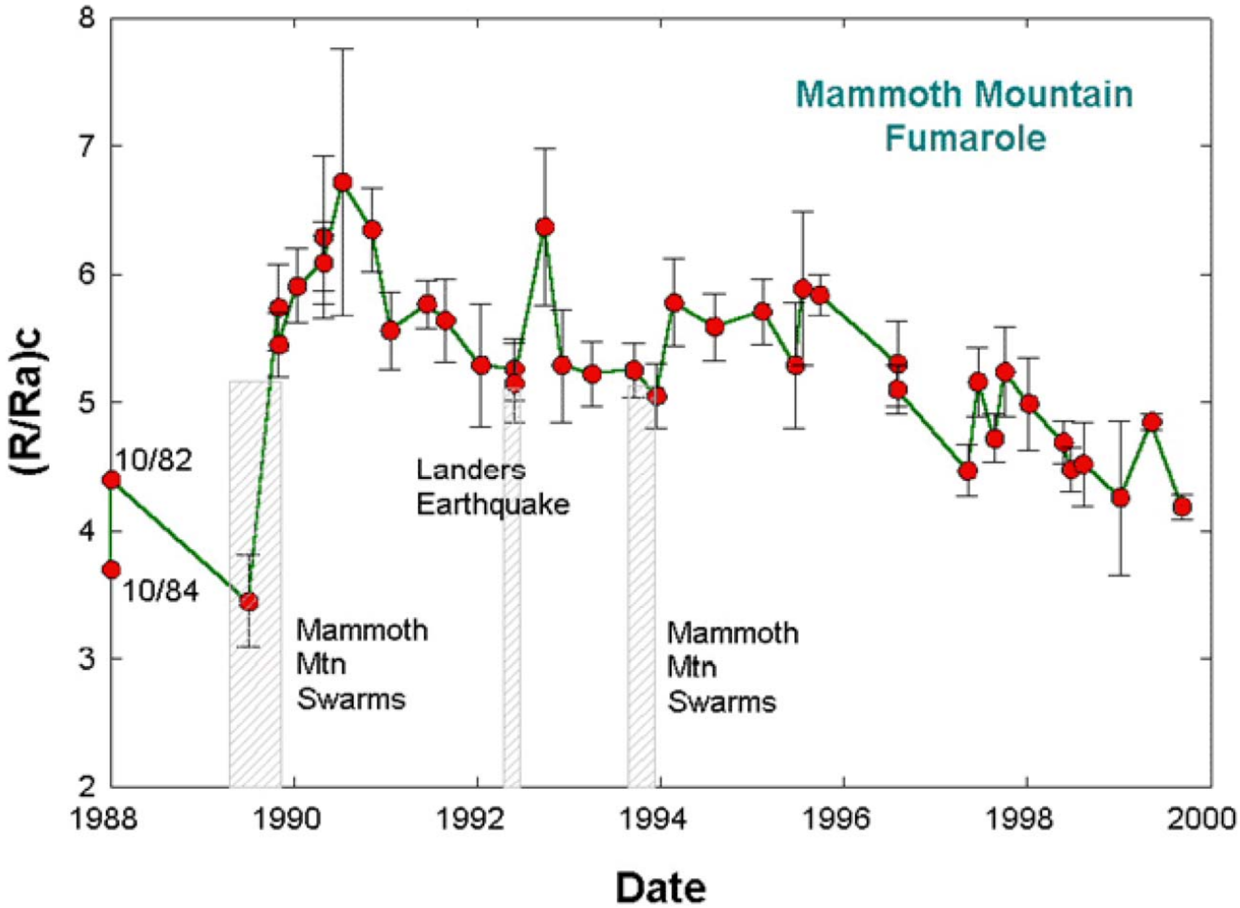


Figure 21 - Helium isotope variations in Mammoth Mountain fumaroles after earthquake swarms and potential dike injection at depth.

D-79

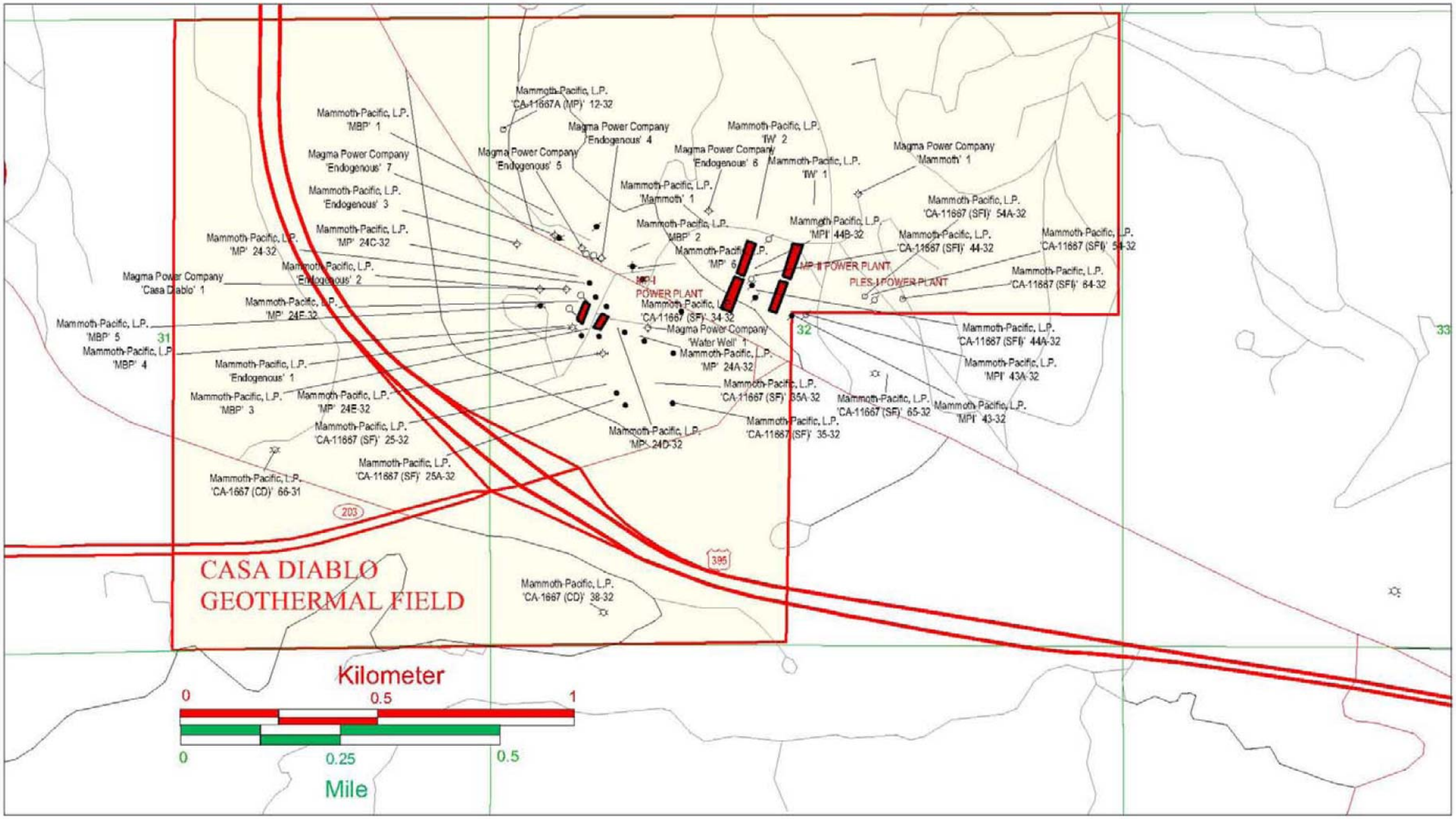


Figure 22 - Geothermal wells at Casa Diablo (after CDOGGR, 2012; ftp://ftp.consrv.ca.gov/pub/oil/maps/Geothermal/G1-1.pdf).

D-80

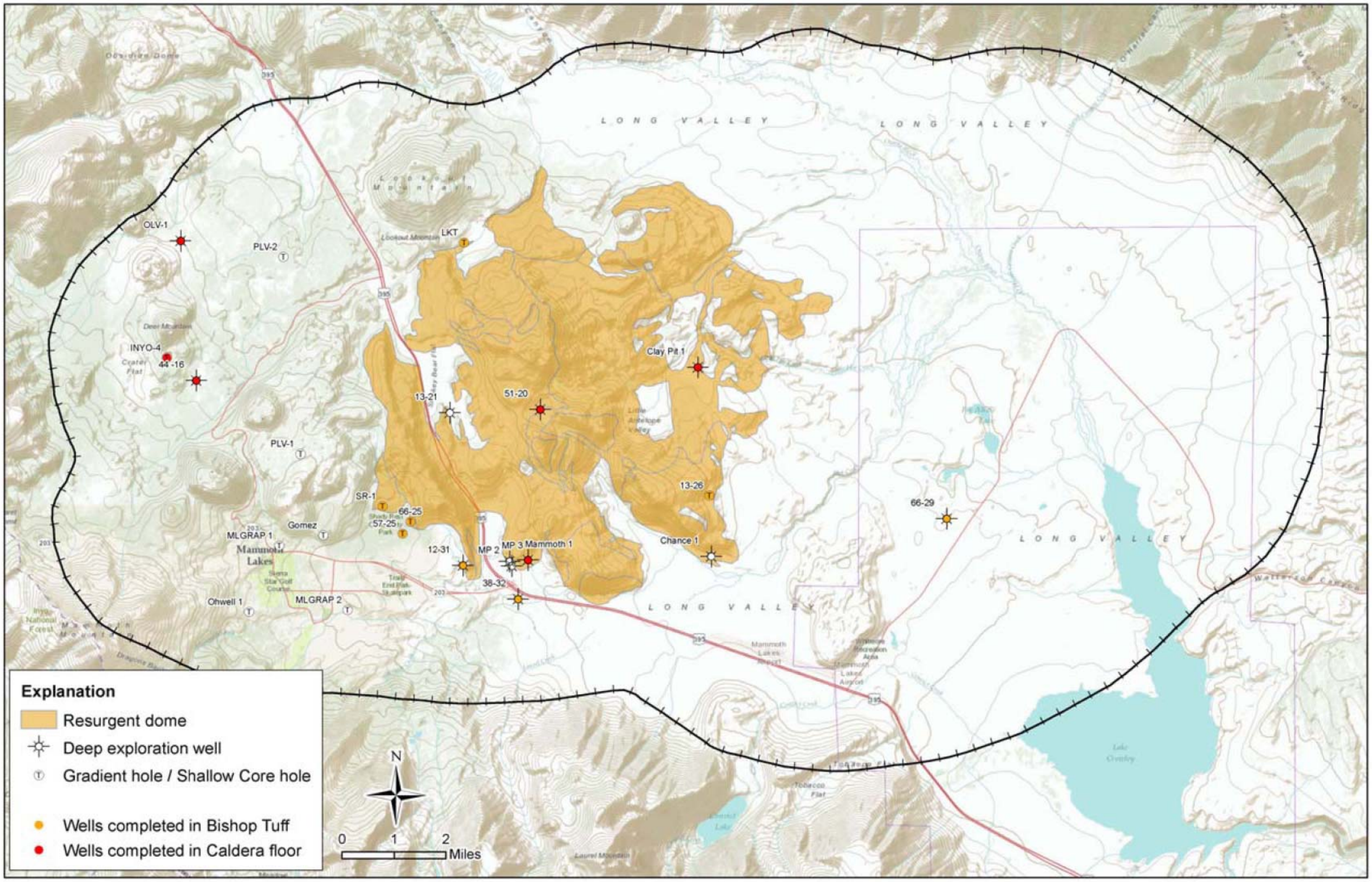
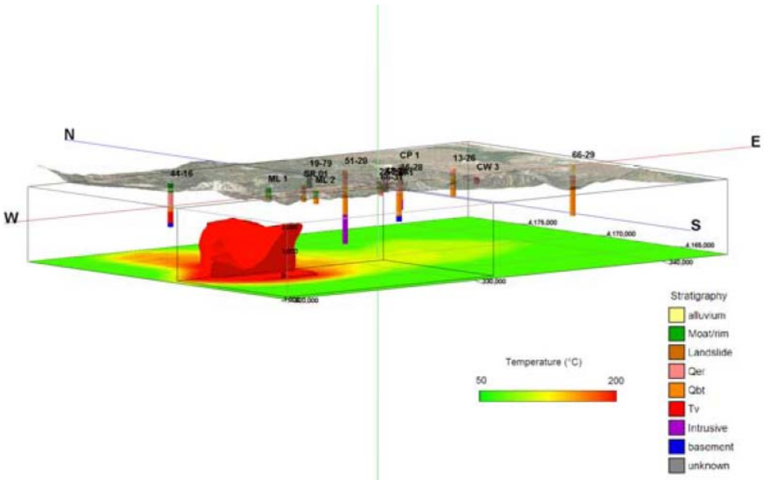
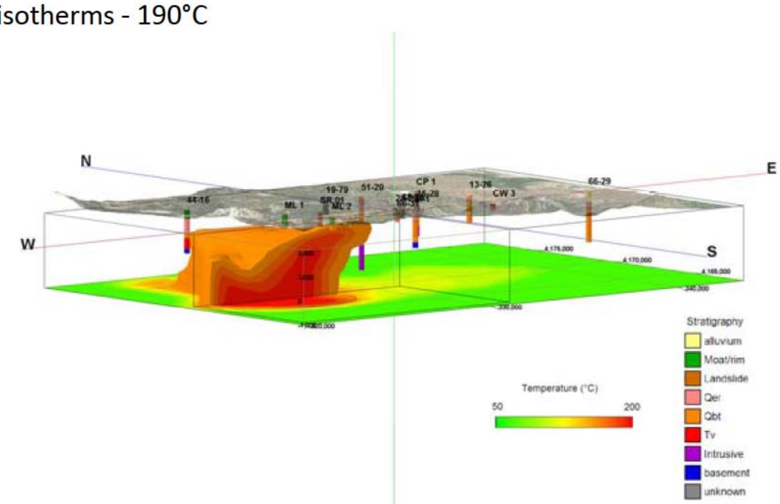


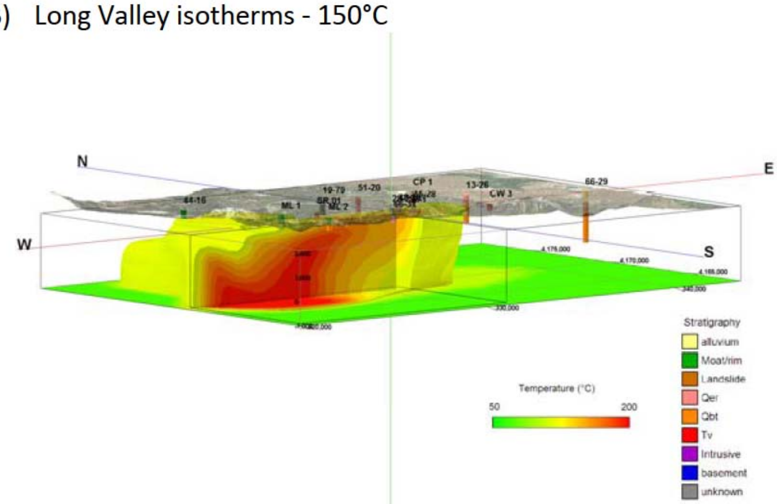
Figure 23 - Long Valley wells penetrating the Bishop Tuff (orange) or the caldera floor (red).



A) Long Valley isotherms - 190°C



B) Long Valley isotherms - 150°C



C) Long Valley isotherms - 100°C

Figure 24 - Temperature distribution in Long Valley Caldera from geothermal well records (CDOGGR) or published temperature data (Farrar and others, 2010).

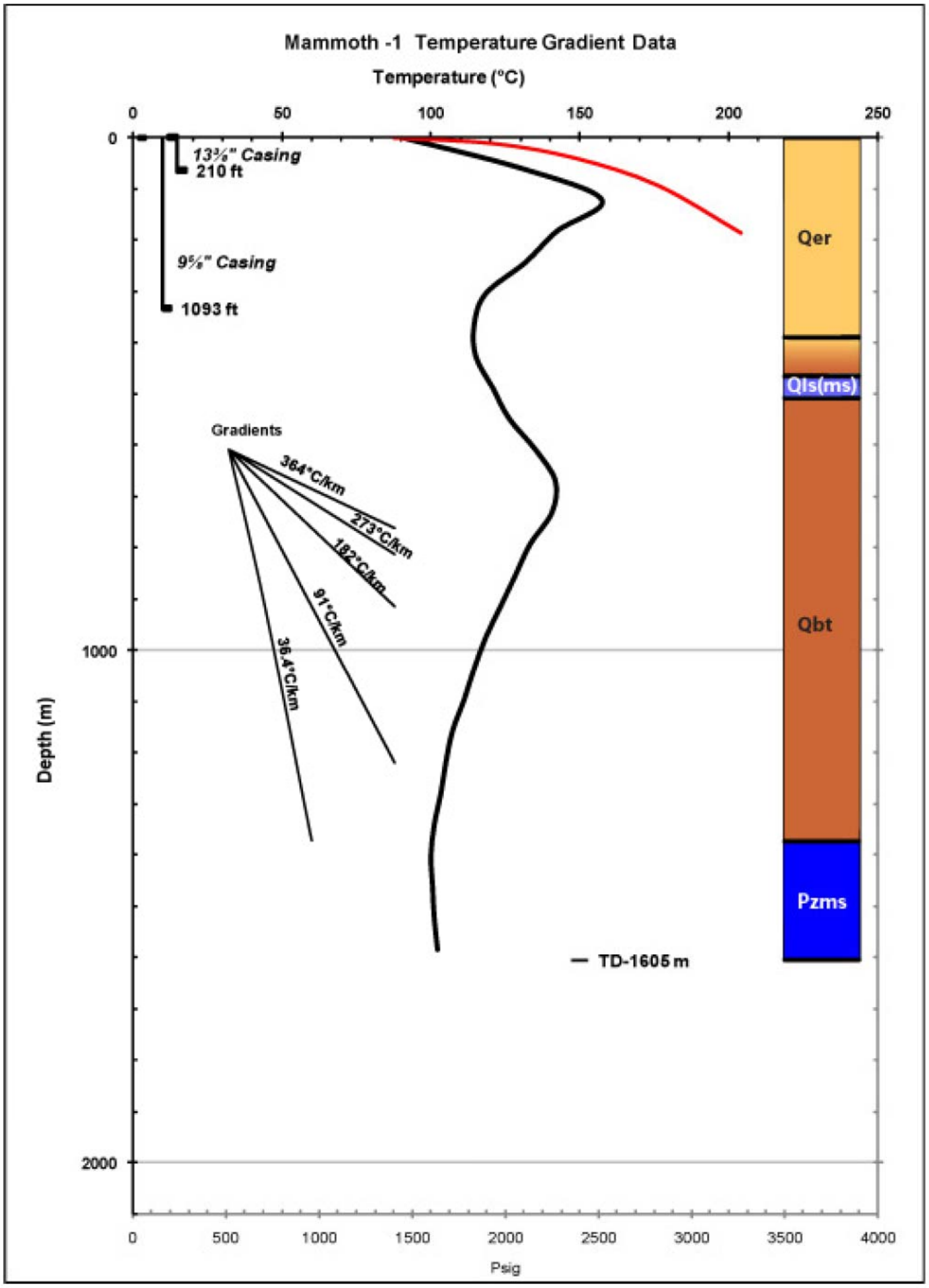
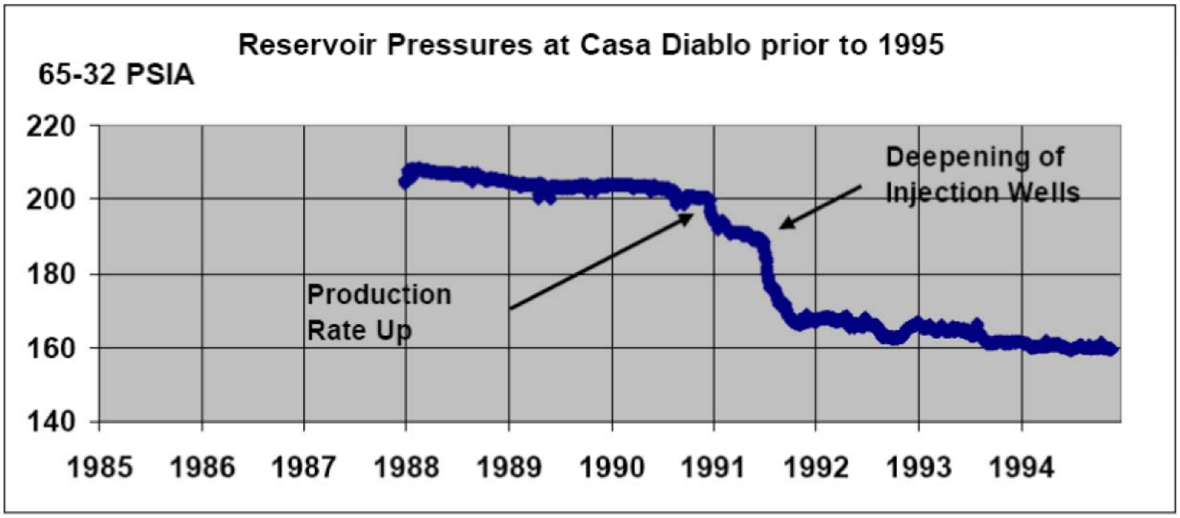


Figure 25 - Wellbore schematic for Unocal Mammoth -1 at Casa Diablo.



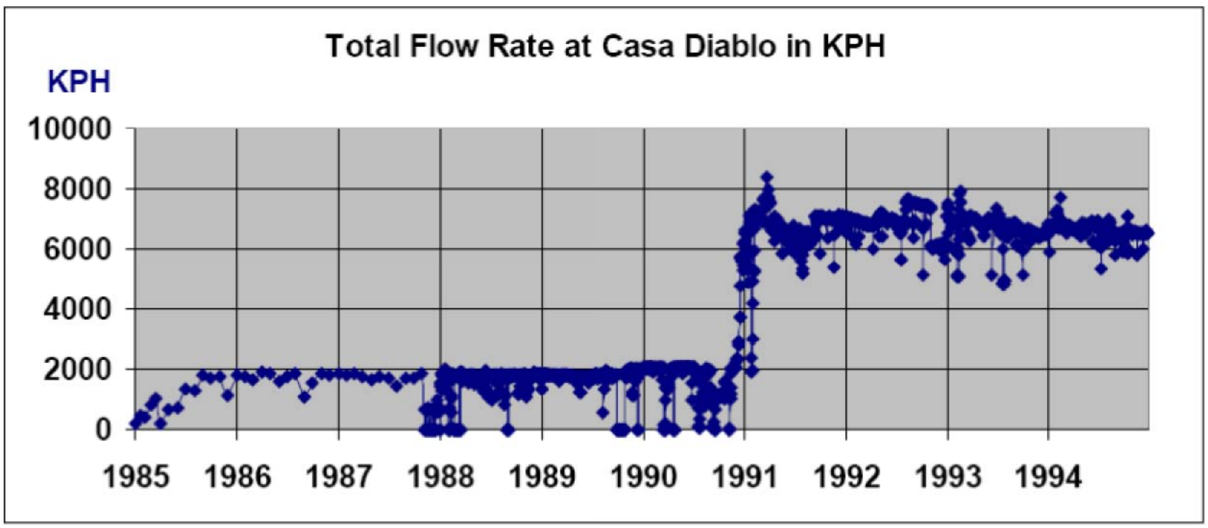


Figure 26 - Total flow rate and production reservoir pressure at Casa Diablo from 1985 to 1995.

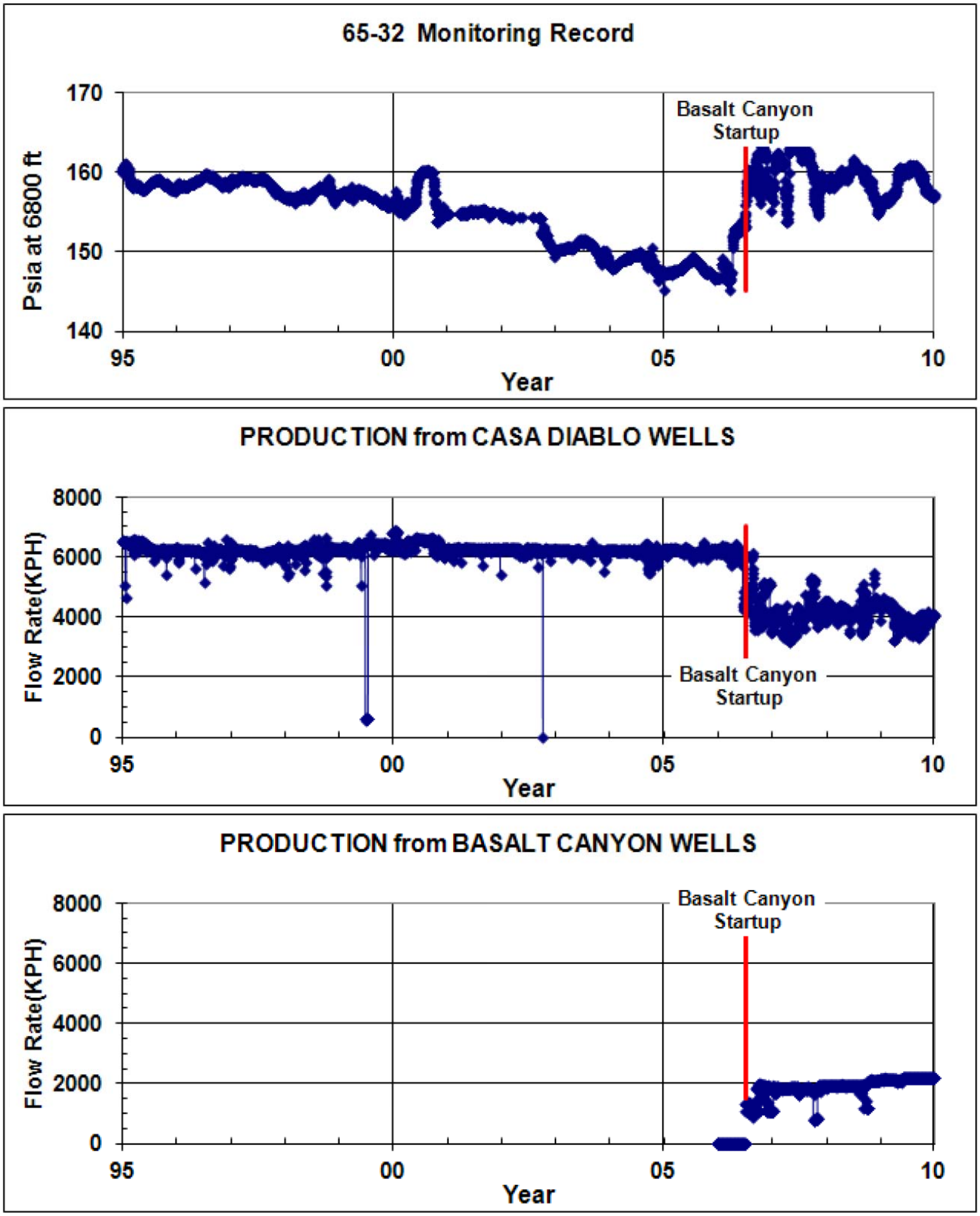


Figure 27 - Mass flow from Casa Diablo wells versus pressures in well 65-32 from 1995 to 2010.

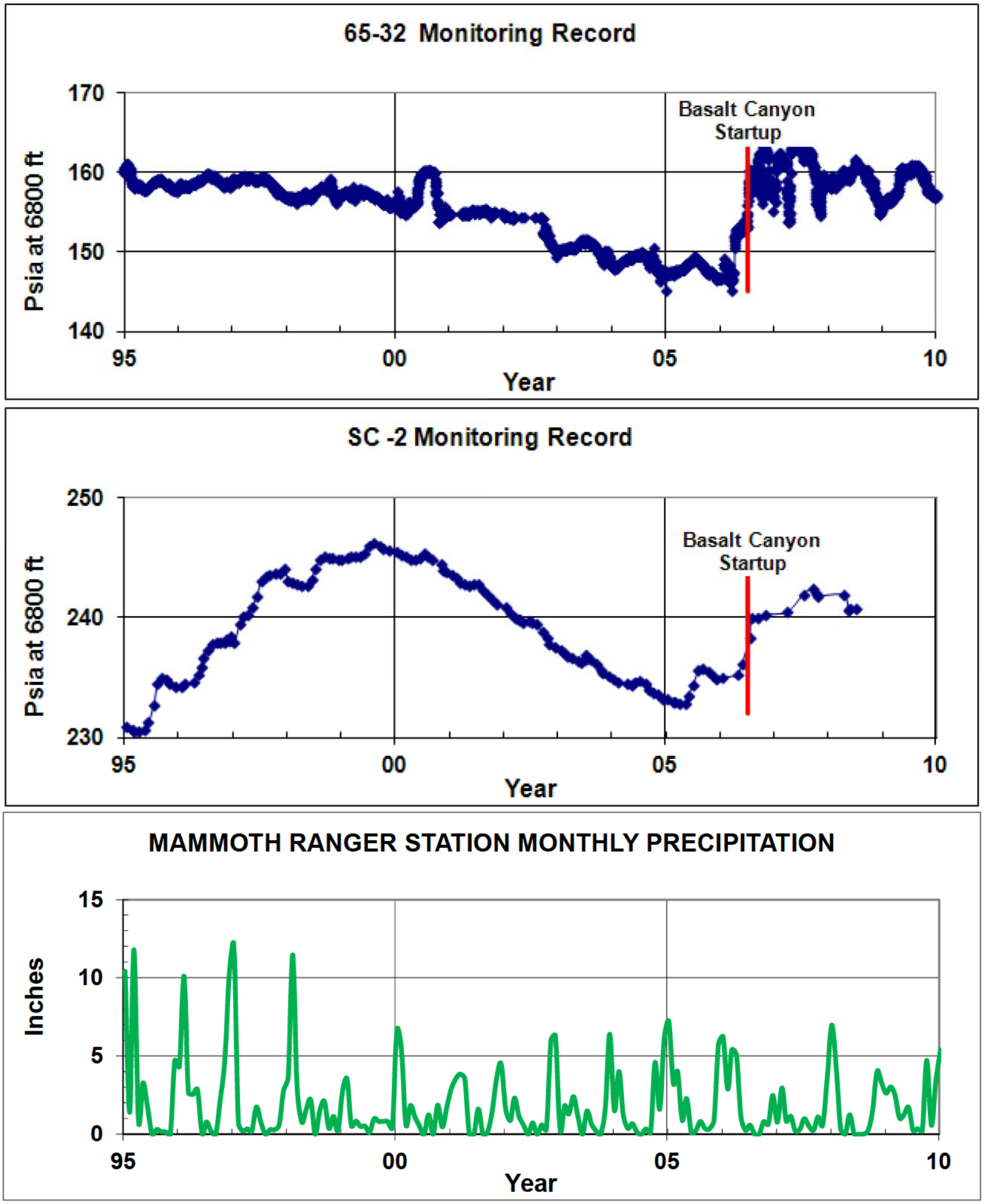


Figure 28 - Comparisons of seasonal variations in pressure and water level in thermal monitor wells 65-32 at Casa Diablo, non-thermal wells SC-2 in the Mammoth Groundwater Basin and monthly precipitation, 1995-2010.

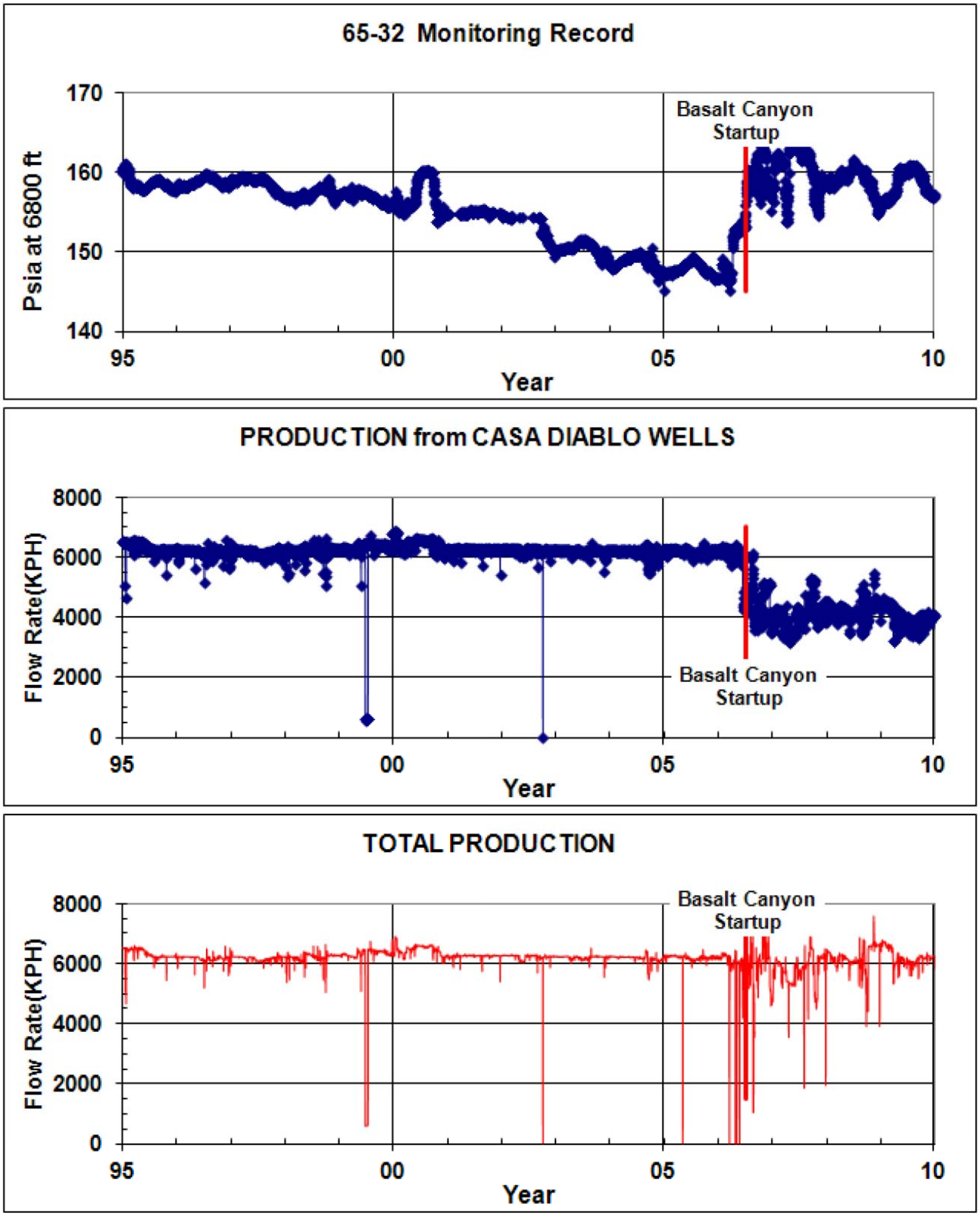
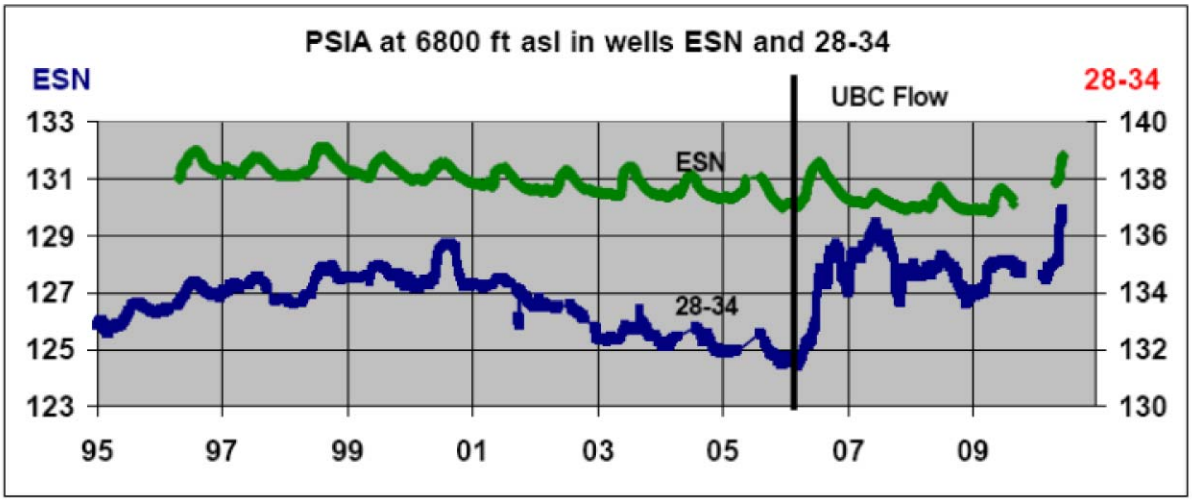


Figure 29 – Total mass flow to the Casa Diablo power plants versus pressures in well 65-32 from 1995 until 2010.



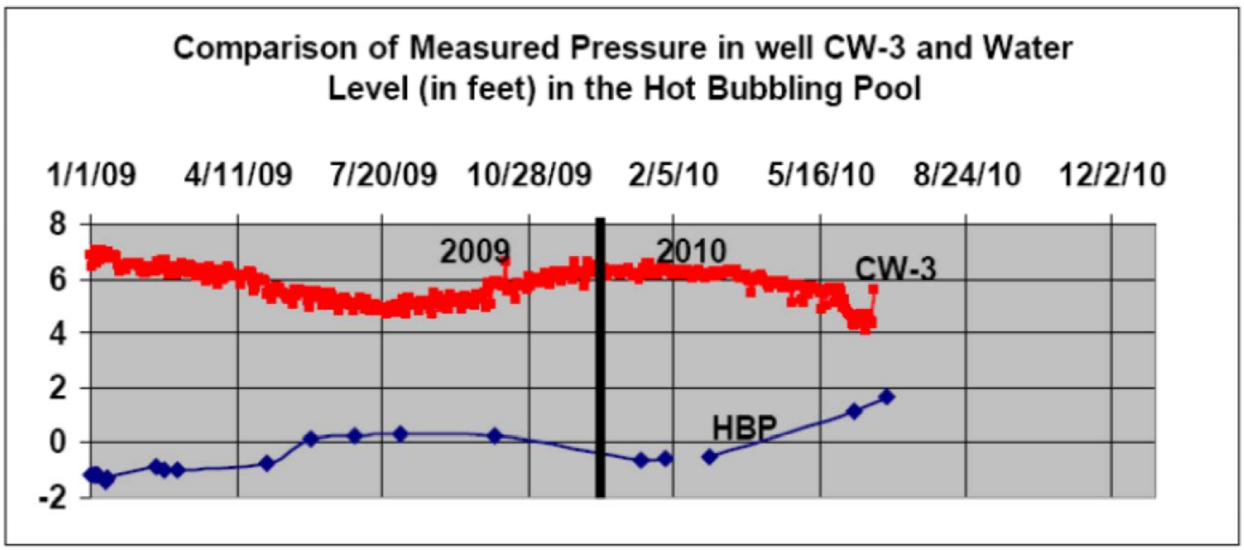
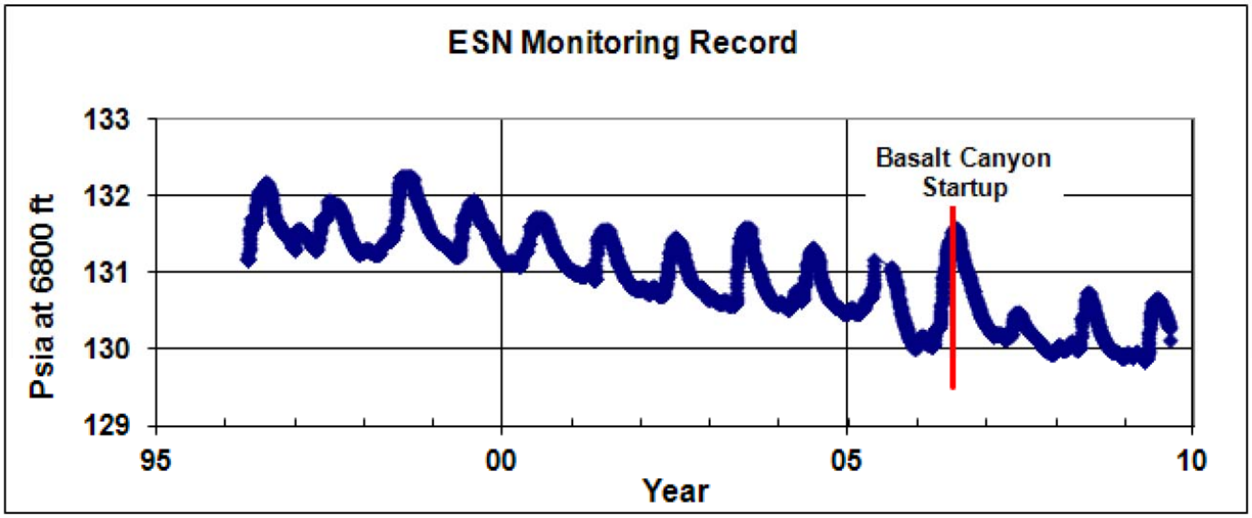
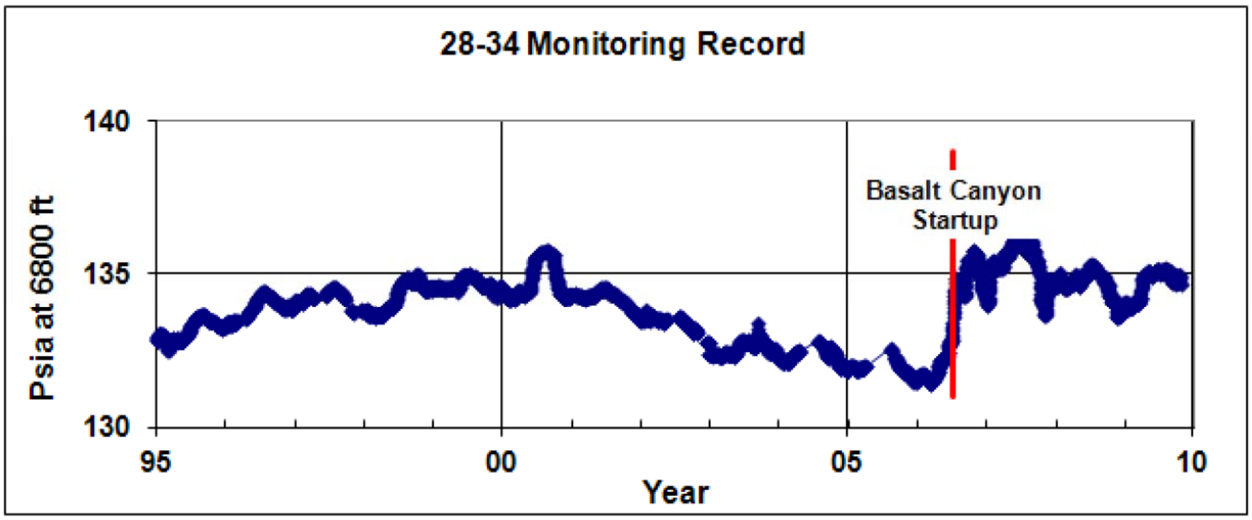


Figure 30 - Long-term plots of pressures in wells ESN (Elementary School New) and 28-34 and CW-3 and Hot Bubbling Pool from 1995-2010 relative to the onset of production from Basalt Canyon (2006)





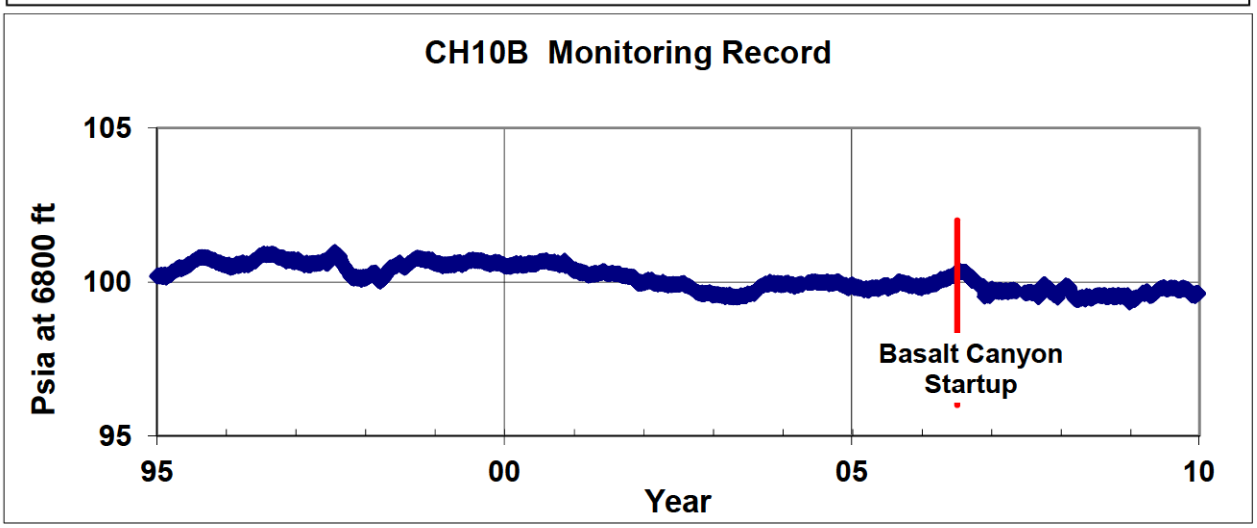
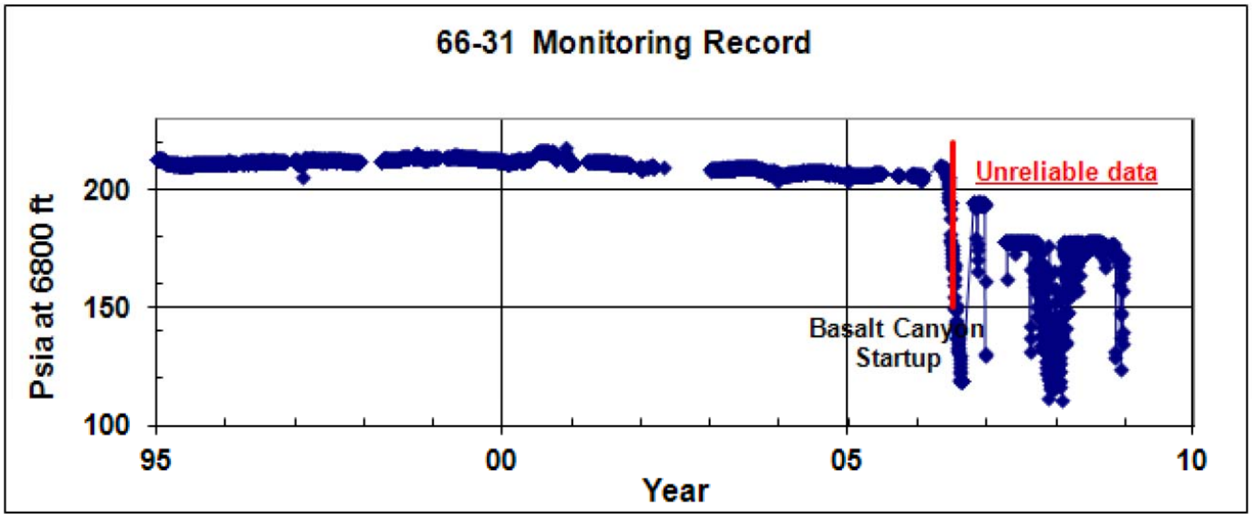


Figure 31 - Pressure histories of ESN, 28-34 and CH 10B 10 km east of Casa Diablo 1995-2010.



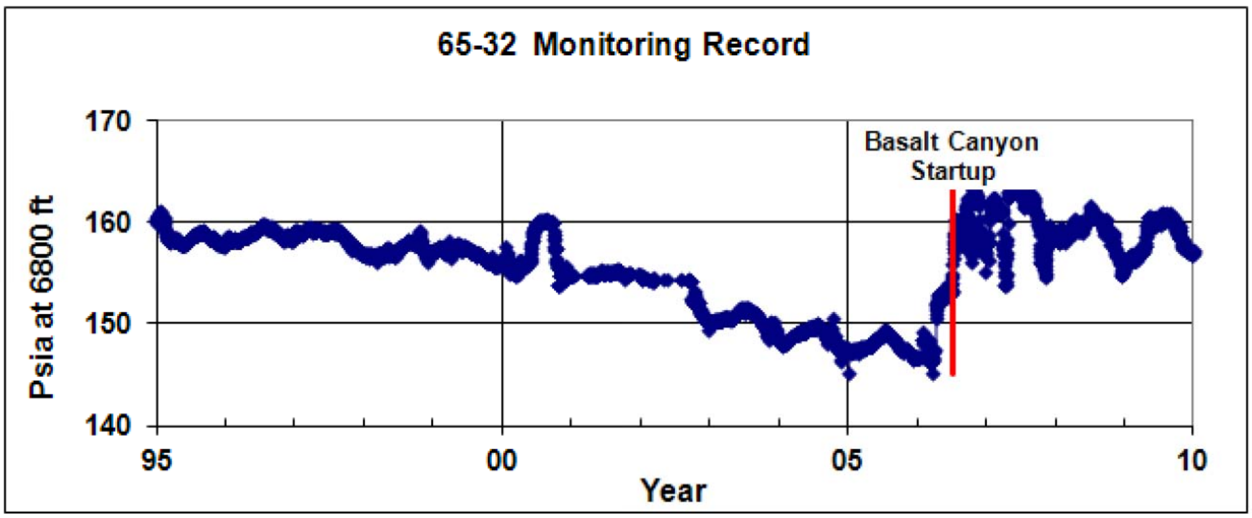


Figure 32- - Long-term pressure histories in geothermal monitoring wells 66-31 and 65-32, 1995-2010 (unreliable data noted).

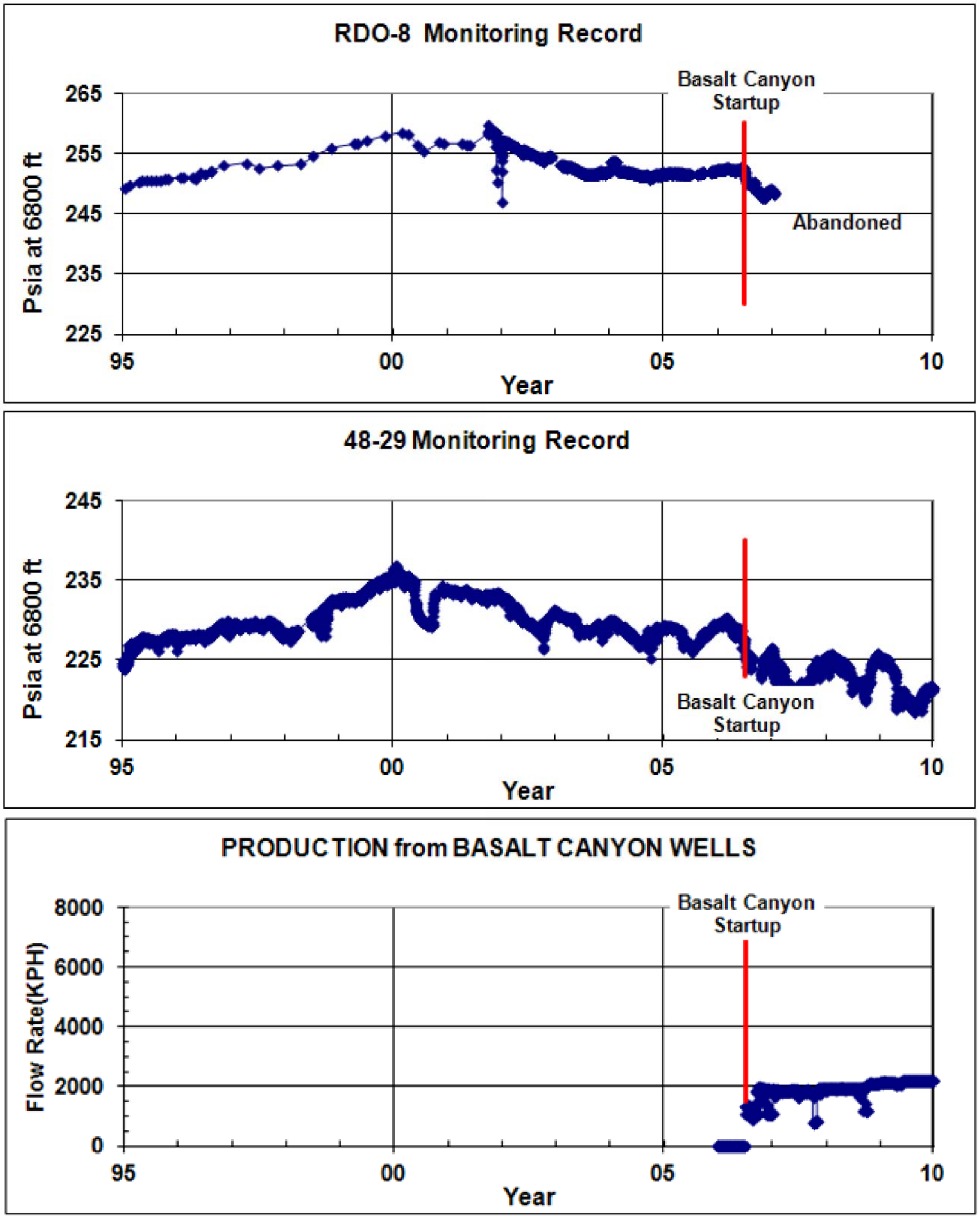


Figure 33 - long-term pressure histories of geothermal monitoring wells RDO-8 and 48-29 completed in the deeper Bishop Tuff injection reservoir in Long Valley, 1995-2010.

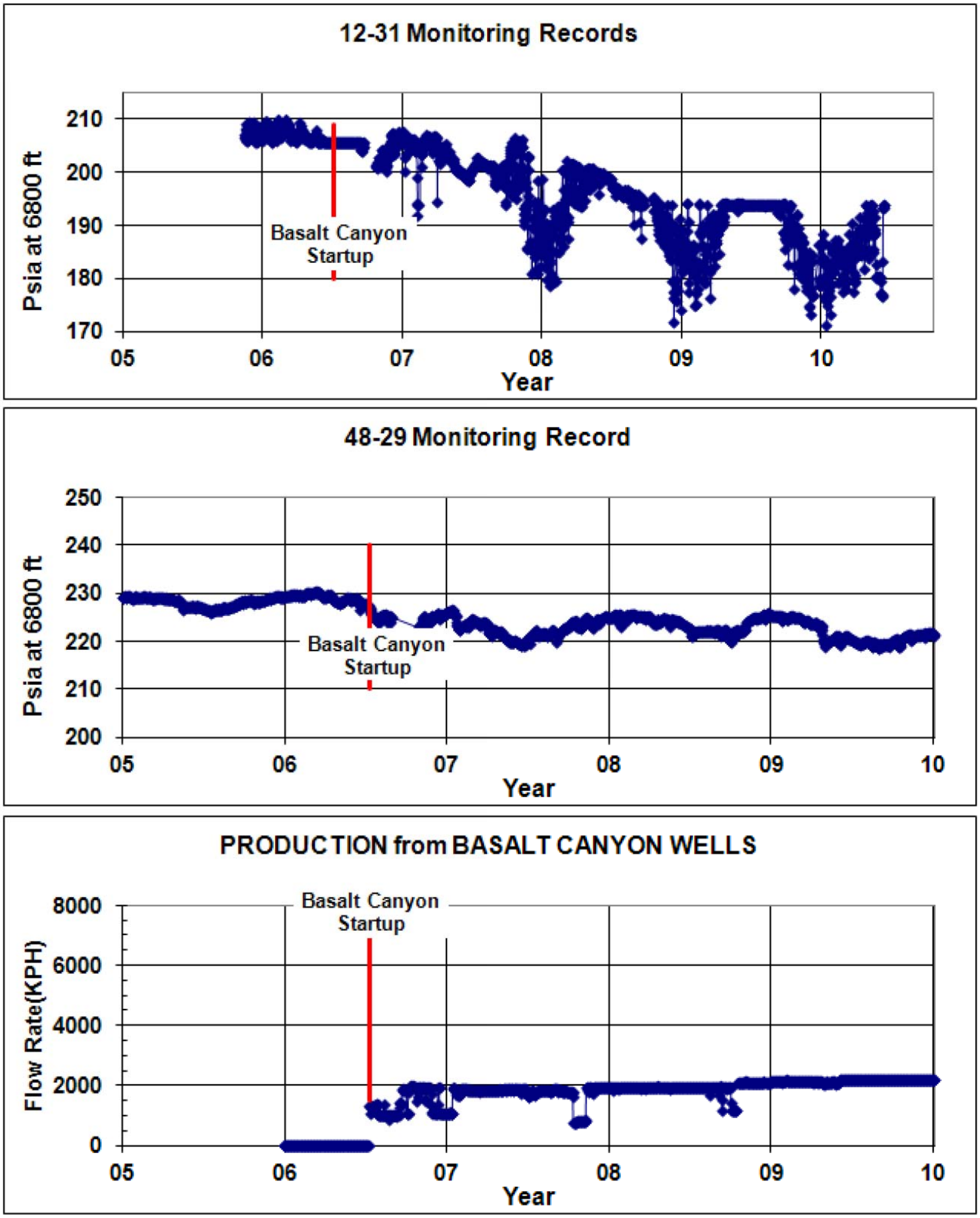


Figure 34 - Pressure monitoring data 2005-2010 for geothermal monitoring wells12-31 completed in western Bishop Tuff production reservoir in the Basalt Canyon area and 48-29 completed in the eastern Bishop Tuff injection reservoir north of Casa Diablo.

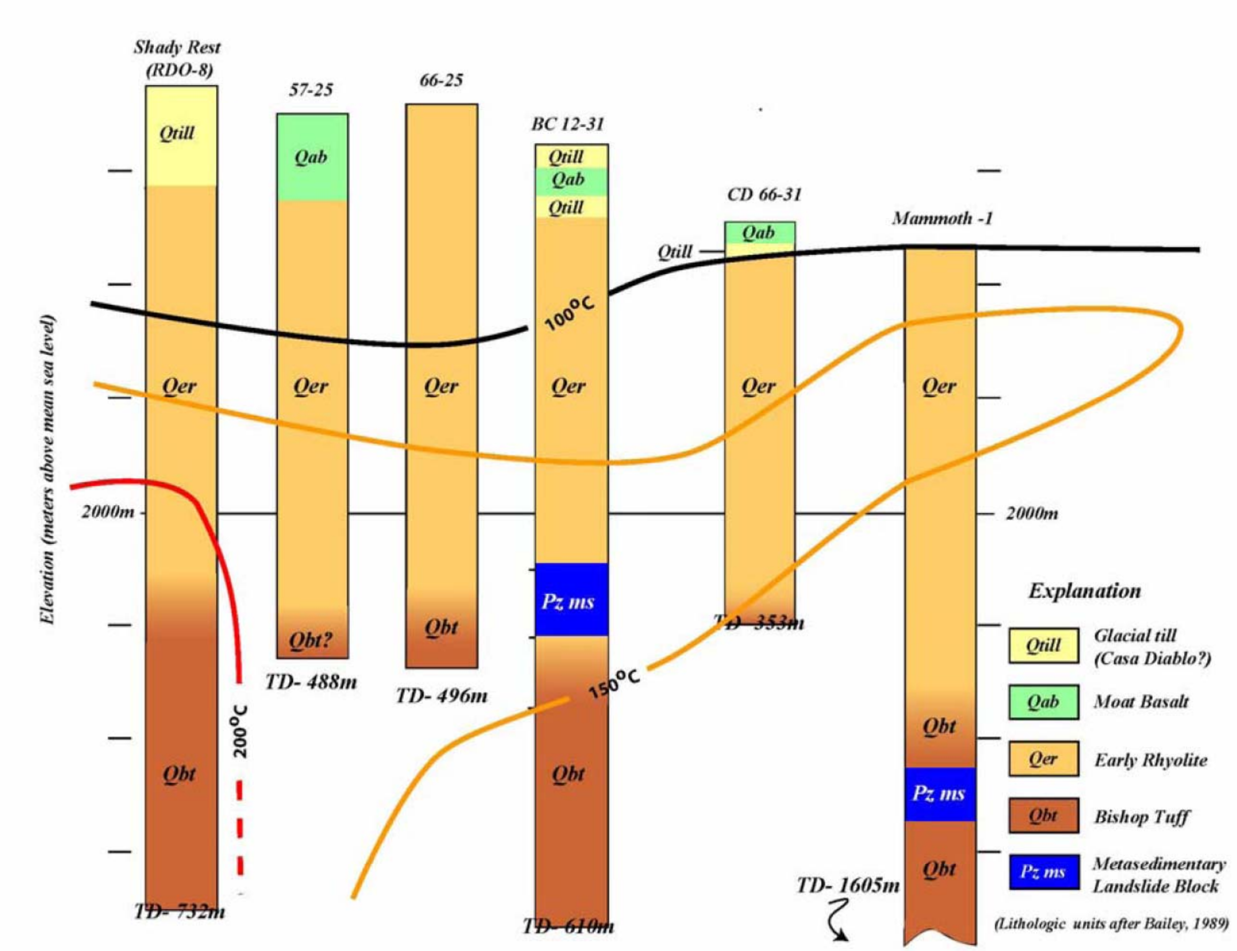


Figure 35 - Lithologic columns of western caldera wells showing a landslide block of impermeable Paleozoic rocks in wells 12-31 and Mammoth-1 but absent in corehole RDO-8 father west.

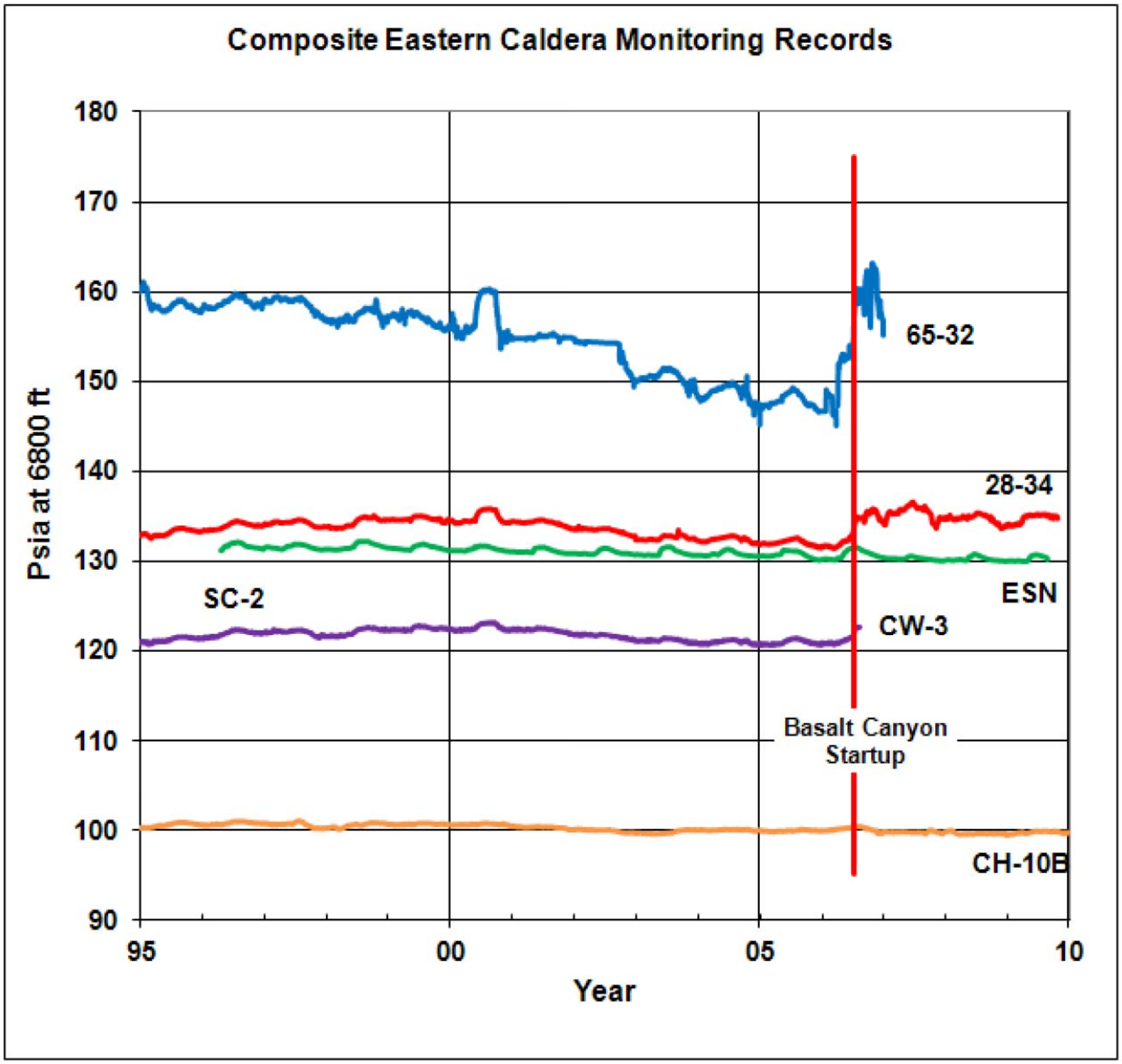


Figure 36 - Composite pressure monitoring records for eastern caldera monitoring wells.

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Tables

Table 1 –Summary of Long Valley hydrologic monitoring data for Mammoth Creek/Hot Creek

	sample date	T	flow rate	Conductivity	pH	N	PO4	Si	Cl	Na	As	B	SO4	TDS	Northing	Easting
		°C	cfs	µS/cm		mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	mg/L	mg/L		
Mammoth Creek																
Mammoth C AB	1982	6.5		58	7	<0.7	0.06								37°37'49"	118°59'18"
Mammoth C Sherwin Rd	1982-1996	11.5		58				10	0.3		2	<10		<10	37°38'06"	118°57'57"
Mammoth Creek Flume	1983-1990	8.7	34.8	127.98				23	4.8		21	246			37°38'26"	118°53'58"
Mammoth Creek 395	1983-2008	6.5	17	122				20.9	0.48		4	14			37°38'16"	118°54'10"
Hot Creek	1996-2010		40-190												37°38'25"	118°54'02"
Hot Creek - Mammoth Creek	1982-1986	61		1301	6.3			188	193	208	2090		115	866		
Colton Spring area																
Colton Spring	1987-1991															
Fish Hatchery area																
AB		15-18	2-16													
CD		13.5-16.8	5.5-12													
H1																
H2,3		10.8-11.5	2-5													
Hot Bubbling Pool																
HBP	2008-2010	49-90		1730-1830	7.7											
Hot Creek Gorge Springs																
HCG			8.5													

APPENDIX E

Noise Report

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NOISE REPORT

CASA DIABLO 4 (CD-4) GEOTHERMAL DEVELOPMENT PROJECT

June 29, 2011

Ormat Nevada Inc.
6225 Neil Road
Reno, NV 89511

CONTENTS

TABLE

APPENDIX

1.0 INTRODUCTION

1.1 Purpose of Report

ORNI 50, LLC, a wholly owned subsidiary of Ormat Nevada Inc. (Ormat), proposes to build the Casa Diablo 4 Geothermal Development Project (CD-4) in the vicinity of the existing MPLP geothermal project. The project area is east of the town of Mammoth Lakes in Mono County, California. The proposed CD-4 power plant would be located east of U.S. Highway 395 and north of the existing plants at Casa Diablo. The power plant and the well field would be located on public lands managed by the United States Forest Service (USFS), U.S. Department of Agriculture. While the USFS manages the surface lands of the project area, the US Bureau of Land Management (BLM), U.S. Department of the Interior, manages the geothermal resource.

This application is for the construction of a new 33 net megawatt (MW) binary power plant composed of two (2) Ormat Energy Converters (OEC), a geothermal well field, pipelines to bring the geothermal brine to the power plant, pipelines to take the cooled brine to injection wells, an electric transmission line to interconnect to the Southern California Edison (SCE) Substation at Substation Road. The additional power will be sold to a utility company. The project is described in detail in the Application Package dated February 17, 2010 that was submitted to the BLM and USFS.

The primary purpose of this report is to provide information on existing noise and estimated new noise levels from the proposed project. Some information is provided on anticipated impacts from these noise levels, but a full impact evaluation is not included, as this will be performed by the NEPA/CEQA consultant.

1.2 Basic Noise Terminology and Fundamentals

Noise is customarily measured in decibels (dB), units related to the apparent loudness of sound. A-weighted decibels (dBA) represent sound frequencies that are normally heard by the human ear. On this scale, the normal range of human hearing extends from about 3 dBA to 140 dBA. Speech normally occurs between 60 and 65 dBA. Table 1 shows the noise levels of different activities and the response criteria of various noise levels.

A logarithmic decibel scale is used to measure sound, because hearing sensation increases with the logarithm of the stimulus intensity. Each 10-dBA increase in the level of a continuous noise is a ten-fold increase in sound energy, but is judged by a listener as only a doubling of loudness. For example, 60 dBA is judged to be about twice as loud as 50 dBA and four times as loud as 40 dBA. Each 3 dBA increase in sound is a doubling of sound energy, such as doubling the amount of traffic on a street, but is judged as only about a 20 percent increase in loudness, and is a just-noticeable difference to most people. Increases in average noise of about 5 dBA or are more noticeable to most people, and is the level required before any noticeable change in community response would be expected. A 10 dBA change would almost certainly cause an adverse change in community response (*EPA, 1981*).

Because environmental noise levels fluctuate over time, a time-averaged noise level in dBA is often used to characterize the acoustic environment at a given location. The average noise intensity over a given time is the energy equivalent noise level (Leq).

Table 1

Weighted Sound Levels and Human Response

Sound Source	dB(A)[1]	Response Criteria
Carrier Deck Jet Operation	140	
		Painfully Loud
	130	Limit Amplified Speech
Jet Takeoff (200 feet)	120	
Discotheque		Maximum Vocal Effort
Auto Horn (3 feet)		
Riveting Machine	110	
Jet Takeoff (2,000 feet)		
Shout (0.5 feet)	100	
New York Subway Station		Very Annoying
Heavy Truck (50 feet)	90	Hearing Damage (8 hours)
Pneumatic Drill (50 feet)		
	80	Annoying
Freight Train (50 feet)		
Freeway Traffic (50 feet)	70	Telephone Use Difficult
		Intrusive
Air Conditioning Unit (20 feet)	60	
Light Auto Traffic (50 feet)		
	50	Quiet
Living Room		
Bedroom	40	
Library		
Soft Whisper (15 feet)	30	Very Quiet
Broadcasting Studio	20	
	10	Just Audible
	0	Threshold of Hearing

[1] Weighted sound levels taken with a sound-level meter and expressed as decibels on the scale.

Source: U.S. Environmental Protection Agency, 1981. *Noise Effects Handbook*. Office of Noise Abatement and Control, Fort Walton, FL. EPA 550-9-82-106.

1.3 Applicable Noise Policies and Regulations

Bureau of Land Management: All federal geothermal lessees must comply with the BLM Geothermal Resources Operational (GRO) Orders. GRO Order No. 4 (General Environmental Protection Requirements) requires that geothermal operations shall not exceed a noise level of 65 dBA, as measured at 0.5-mile from the source or at the lease boundary line, if closer.

Mono County: Mono County is the local agency responsible for adopting and implementing policies as they relate to noise levels and their affect on land uses within its jurisdiction. The Noise Element of the Mono County General Plan identifies goals and policies to attain and maintain acceptable noise levels within the county (County of Mono Planning Department 2010). Chapter 10.16 (Noise Regulation) of the Mono County Code sets noise standards for different types of land uses and also prohibits noise that would exceed these standards on other property within the County. Both acceptable and unacceptable noise levels associated with construction activities and exterior noise levels at various land use zones have been defined and quantified.

The State guidelines indicate that residential uses are normally acceptable in exterior noise environments up to 60 dBA CNEL and conditionally acceptable in exterior noise environments up to 70 dBA CNEL. For planning purposes, the 65 dBA CNEL (at receptors) is considered by many local jurisdictions as the exterior noise standard for transportation related noise impacts.

Town of Mammoth Lakes: For properties or receptors within the Town of Mammoth Lakes, the Town of Mammoth Lakes noise ordinances. Town of Mammoth Lakes Municipal Code Chapter 8.16 of the Town of Mammoth Lakes Municipal Code limits excessive noise. Section 8.16.090 (Prohibited Acts) sets noise limits for construction work. As discussed in the Basalt Canyon EA/EIR (EMA, 2005), the USFS campgrounds within the Town of Mammoth Lakes boundary could be considered within the "Type II Areas - Multifamily Residential" land use category. In these areas noise from mobile construction equipment is limited to 80 dBA during the day (from 7:00 a.m. to 8:00 p.m.) except on Sundays and legal holidays. At night (from 8:00 p.m. to 7:00 a.m.) and all day on Sundays and legal holidays the maximum permitted noise level from mobile construction equipment is 65 dBA. In these same areas noise from stationary equipment is limited to 65 dBA during the day (from 7:00 a.m. to 8:00 p.m.) except on Sundays and legal holidays. At night (from 8:00 p.m. to 7:00 a.m.) and all day on Sundays and legal holidays the maximum permitted noise level from stationary equipment is 55 dBA.

Per the Basalt Canyon EA/EIR, Shady Rest Park could be considered within the "Type III Areas – Semi-Residential Commercial" land use category. In these areas noise from mobile construction equipment is limited to 85 dBA during the day (from 7:00 a.m. to 8:00 p.m.) except on Sundays and legal holidays. At night (from 8:00 p.m. to 7:00 a.m.) and all day on Sundays and legal holidays the maximum permitted noise level from mobile construction equipment is 70 dBA. In these same areas noise from stationary equipment is limited to 70 dBA during the day (from 7:00 a.m. to 8:00 p.m.) except on Sundays and legal holidays. At night (from 8:00 p.m. to 7:00 a.m.) and all day on Sundays and legal holidays the maximum permitted noise level from stationary equipment is 60 dBA at the receptor area.

2.0 EXISTING NOISE CONDITIONS

2.1 Noise-Sensitive Land Uses in the Project Area

Occupants in such land uses as schools, hospitals, housing, religious, educational, convalescent, and medical facilities are more sensitive to noise than commercial, agricultural, and industrial uses. Sensitive receptors include, but are not limited to, residences, schools, hospitals, parks and office buildings.

The potential noise-sensitive receptors within or next to the Project area consist of concentrated public use areas (parks and campgrounds). There are no other noise-sensitive receptors (residences, schools, hospitals, daycare centers, long-term care facilities) located within or immediately next to the Project area.

The only area of concentrated public use within the Project area is Shady Rest Park, a Town of Mammoth Lakes-developed sports and recreation park located on USFS land. Outside of the project area are three USFS campgrounds, located to the southwest of the Project area: Pine Glen Group Campground; New Shady Rest Campground and Old Shady Rest Campground. Pine Glen Group Campground is the campground located closest to the pipeline corridor area and any well site.

There are no sensitive receptors in the immediate vicinity of the proposed power plant. The closest noise-sensitive concentrated land use to the CD4 Project is Sherwin Creek Campground, located approximately 1.5 miles to the southwest. Chance Ranch is the closest residence, approximately 1.5 miles to the east. Hot Creek Hatchery residences are located about three miles to the east-southeast. The John Muir Wilderness Area is located about 2.5 miles to the south of the project site. Mono County office buildings are located approximately 1.25 miles to the east.

2.2 Existing Sources of Noise in Project Area

In Basalt Canyon, existing sources of noise consists of recreational activities at Shady Rest Park, and dispersed motorized vehicle recreation use of the area such as off-road vehicles, all terrain vehicles, motorcycles, and snowmobiles in the winter. These vehicles can create fairly high noise levels in their vicinities. Pedestrian uses such as dog walking and snowshoeing along the public roadways in the vicinity of the site (primarily Substation Road/Old Highway) are also a common occurrence. There is also localized noise adjacent to the two existing production wells in Basalt Canyon.

Dispersed recreation use occurs within one mile of the project site on lands in the Inyo National Forest, though some of this recreation is itself noise-generating such as the use of off-road vehicles, all terrain vehicles, motorcycles, and target shooting. Pedestrian uses such as dog walking and snowshoeing along the public roadways in the vicinity of the site (primarily Substation Road/Old Highway) are also a common occurrence.

On the east side of the highway, noise sources include the three existing geothermal power plants, MP-1, MP-2 and PLES-1; traffic from Highway 395; off-road vehicles (as described for Basalt Canyon above); and a target shooting range northeast of the proposed CD-4 plant site as well as other recreational (and illegal) target shooting in the area, which generate loud and intermittent noise levels. Wood-cutting activities also are loud sources of noise in the area. Aircraft noise is audible intermittently from aircraft approaching and departing the Mammoth Yosemite Airport, located about three miles southeast of the project site.

In January 2011, Ormat measured noise levels in the Casa Diablo area on the east side of Highway 395. The most applicable noise monitoring locations were

At the intersection of Route 203 and Old Highway (about 460 feet south of PLES-1), measured at 65.3 dBA (primarily noise from the existing power plants)

By the entrance to the kiosk area off Route 203, measured at 60.3. The noise at this location was primarily traffic noise from Highway 395 and Route 203; the existing geothermal plants were not audible.

3.0 NOISE EVALUATION OF PROPOSED PROJECT

3.1 Noise from Well Pad Construction and Drilling

Site construction and drilling activities would introduce new but temporary noise sources to the Project area which would result in noise levels above the ambient noise levels in the immediate vicinity of each well site during construction and drilling. The principal noise sources would likely be the diesel engines on the construction equipment and drilling rig and the movement of pipe and casing. This would be temporary and only occur during the actual construction and drilling operations.

No receptors especially sensitive to noise (schools, hospitals, etc.) would be affected by the project. The nearest human noise receptors would be the temporary and dispersed recreation in the area (see discussion above).

Pipeline and well site construction and decommissioning activities would be conducted only during daylight hours. Pipeline construction also would appear from any given point to be intermittent as each construction task moved by.

The Basalt Canyon EA/Draft EIR provided estimates of construction noise levels, and concluded that the adverse effects of these short-term, temporary construction noise impacts are below the level of significance because they do not expose persons to or generate noise levels in excess of the applicable standards or result in a substantial temporary or periodic increase in ambient noise levels. Information below was obtained from the Basalt Canyon EA/Draft EIR.

As shown in the Basalt Canyon document, there is considerable distance between the well sites and nearest sensitive receptors. Sound levels from the Project at the nearest sensitive receptors are projected to range from 39-49 dBA within the normally acceptable range. As such, the Project would not be in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies to residents within the Project area.

Ormat measured noise from a drill rig on October 21, 2010. This rig was drilling a geothermal well on a geothermal lease located in rural Mineral County, Nevada. The drill site was near the bottom of a flat, wide valley, with high desert brush. The weather was cloudy with little to no wind, and there were no other background noise sources other than the rig. The rig was GeoDrill Rig #2. Noise measurements were taken at 7 locations, ranging from about 50 feet to a half mile from the drill rig. The calculated average noise level from these seven locations was 60.6 dBA at 400 feet from the rig.

The forest surrounding the drill sites for the CD-4 project would be expected to give some sound attenuation that would decrease the projected noise levels.

Again, the drilling activities are both short-term and infrequent.

The louder noises produced from Project construction and decommissioning activities in the immediate vicinity would be audible at Shady Rest Park. However, these noises are not expected to be intrusive, considering the infrequent nature of the noises and the relatively intense recreational activities typically conducted at the park. The louder noises may occasionally be audible at the campgrounds, but at much lower levels and only during daylight hours when construction is occurring. The total construction period for the drilling of wells would be 20 days per well. Construction noise would continue on and off for the expected two to three month construction period of the pipeline area.

Dispersed recreational users of the Project area may be able to hear the occasional louder construction and drilling activities when within one-quarter to one-half mile of any active construction site. Most construction activities would be quieter. The number of persons exposed to Project construction noise would be small, and comparable areas for dispersed recreation are available in the vicinity of the Project during the short construction period. The construction activities would be short-term and temporary. The proposed well construction will not expose persons to or generate noise levels in excess of the applicable standards or result in a substantial temporary or periodic increase in ambient noise levels. As such, the adverse effects of Project construction noise on dispersed recreational users are considered to be less than significant.

Groundborne vibrations generated by the Project drill rig would be low-level, short-term and would dampen naturally a short distance from the sources. The adverse impacts of any groundborne noise and vibrations generated by the Project drill rig are considered to be below the level of significance.

3.2 Noise from Plant Construction

Construction of the proposed power plant would involve the short-term use of heavy equipment such as backhoes, cranes, loaders, dozers, graders, excavators, compressors, generators, and various trucks for mobilizing crew, transporting construction material and debris, line work, and site watering. The principal noise sources during construction would be the diesel engines on the construction equipment. This would be temporary and only occur during the actual construction..

Construction noise is usually made up of intermittent peaks and continuous lower levels of noise from equipment cycling through use. Noise levels associated with individual pieces of equipment can generally range between 70 and 90 dBA (U.S. DOT, 2006). Short-term increases in noise levels within the immediate project vicinity would result from construction activities.

As described above, the nearest noise-sensitive receptors to the power plant would be at least two miles away. At this distance and with topographic barriers, the noise level from power plant construction would not be audible at sensitive receptors. Thus, the noise levels generated by plant construction would not result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

Some plant construction activities will take place on a 24 hour basis, seven days per week, to take advantage of the short summer construction season. However, due to the distance to the nearest receptors and the resulting noise levels, the noise impacts will be less than the applicable significance criteria.

Construction activities would comply with the applicable requirements of the Mono County Noise Regulations (Mono County Code §10.16). Construction noise impacts would be less than significant due to the short-term nature of this noise, the distance to applicable land uses, and due to compliance with all requirements of the Mono County Noise Regulations (Mono County Code §10.16).

3.3 Projected Noise Levels from Proposed CD-4 Power Plant

The ongoing normal binary power plant operations are less noisy than construction activities. The principal noise sources would be turbine operations and noise generated from the fans in the air condensers. For this report, noise levels measured at various distances from the Galena-3 geothermal power plant located near Reno, Nevada are used to be representative for CD-4. The Galena-3 plant is relatively new with similar technology and equipment as the CD-4 plant. Average measured and calculated noise levels at Galena-3 that can be used to be representative for CD-4 are were 71.5 dBA at 150 feet, 64.5 dBA at 400 feet, 54 dBA at ¼ mile (1,320 feet), and 48 dBA at ½ mile from the center of the plant. These can be considered representative for CD-4. The farther distances above assume flat terrain, so given that the proposed power plant site is tucked within some hills, the distance that noise from the plant travels would be less than above.

Groundborne vibrations generated by the power plant equipment would be low-level and would dampen naturally a short distance from the sources. The adverse impacts of any groundborne noise and vibrations generated by the Project are considered to be below the level of significance.

There are no sensitive receptors within a ½ mile from the plant, and are actually well more than a mile. With the distances and topographic barriers to sensitive receptors, the noise level from power plant operations would not be audible.

After construction, there would be no additional employees for long-term operations. Inspections of the two existing Basalt Canyon well sites and pipeline are performed approximately once each 12-hour work shift, and this will continue, so the same vehicle will be traveling in Basalt Canyon once each shift, but to additional well sites than currently done. There would therefore be no impact from traffic noise.

3.4 Projected Noise Levels from Wells

There are two types of wells, production and injection. Injection wells do not have any pumps and are therefore silent. Production wells have electric-powered pumps and generate a steady “hum” in the immediate area around the well. Ormat took noise measurements of the existing Basalt Canyon well, 57-25, to obtain noise levels that would be representative of proposed wells. The existing wells are surrounded by slatted chain link fences. Based on the noise measurements, the slats seem to reduce noise by 2.5 dB. The representative noise level is therefore outside of the fence and is 58.3 dB at 100 feet or 35.6 dB at ¼ mile from the well pump.

Typical pipeline operations would produce almost no noise, only a very slight rumble as the geothermal fluid moves down the pipeline and a rare "creak" as the pipe flexed. However, with the insulation around these pipes, there is no audible noise at all while standing next to the pipe.

Well pumps would require regular maintenance and/or replacement every two to five years. When necessary, well pumps would be removed and re-installed in the well bore in the same manner as the initial installation. The resulting noise levels would be the same as well site construction activities for the one to two days required to change out the pump. It may be necessary to re-drill, work-over or stimulate the two wells, and/or drill one or more replacement wells over the life of the Project. The noise impacts from any well re-drilling, work-overs or stimulation, and/or replacement well drilling would be consistent with that described above, with no resulting significant adverse impact.

APPENDIX

QUALIFICATIONS OF PREPARER

Noise Analysis Prepared by:
Ron Leiken, QEP, CEM

EDUCATION

1987 B.S., magna cum laude, Natural Resources Management, California Polytechnic State University, CA.

EXPERIENCE

Mr. Leiken has 25 years of environmental experience, summarized below.

NEPA and CEQA Experience: Mr. Leiken has extensive experience with and understanding of the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). He has managed completed documents and prepared almost all technical sections. His expertise has been with preparing air quality, noise, and odor sections of these documents. He has analyzed noise and air quality impacts from industrial projects (power plants, vehicle manufacturing), transportation projects (new highways and roads, roadway widening projects, bus stations), new residential developments, new commercial and industrial development, recreation (ski resorts, boating, and campgrounds), ships, rail, and helicopters.

Noise Experience: Mr. Leiken's noise experience includes an extensive amount of noise monitoring and modeling, noise and air impact analysis, transportation noise modeling, background noise monitoring, noise predictions, impact assessment, compliance monitoring, and noise mitigation plans. He has experience with both stationary, industrial noise sources and with traffic noise. He is experienced with Caltrans' *Traffic Noise Analysis Protocol* and *Technical Noise Supplement,* experienced with FHWA's *STAMINA/OPTIMA* highway noise models and with the new *Transportation Noise Model* (*TNM*), experienced with Caltran's *Sound 32* and *Sound 2000*, the Caltrans versions of the FHWA highway noise prediction programs. He is also experienced with noise monitoring, using Type 1 sound level meters to measure noise and various statistical measures of noise (i.e., Lav, L90, L50). He also performs noise compliance monitoring, to determine if noise levels from certain activities exceed county or city noise limits, as well as OSHA occupational exposure compliance monitoring.

SAMPLE PROJECTS - NOISE IMPACT AND MITIGATION ASSESSMENT PROJECTS

Mr. Leiken has prepared many noise impact analyses and/or evaluation of mitigation measures. Many of these were for CEQA Environmental Impact Reports and NEPA Environmental Impact Statements, and many were stand-alone technical noise documents. A sampling of these projects includes the following:

- Noise Impact Assessment, East Brawley Geothermal Development Project, Brawley, California
- Noise impact analyses, Beacon Street (proposed 11-story office building with helipad), San Pedro, California
- Noise and Diesel Air Toxic Analysis, Proposed Marin Airporter Bus Terminal, Novato, California
- Noise and air impact analysis, Polo Ranch (large residential project), Santa Cruz County, California

- Noise and air impact analysis, Auburn Business Center (proposed industrial park), Placer County, California
- Noise and air impact analysis, Campground and Resort (included woodsmoke), Mendocino County, California
- Noise and air impact analysis, Los Banos Bypass, Merced County, California
- Noise and air impact analysis, Clements Quarry (sand and gravel), San Joaquin County, California
- Noise and air impact analysis, Buena Vista Landfill (landfill expansion), Santa Cruz County, California
- Noise assessment, Solid Waste Transfer Station, Salinas, California
- Noise monitoring and complaint evaluation, Vashon Island Landfill, King County, Washington
- Noise impact analyses, Proposed Dam, Sonoma County, California
- Noise monitoring, various roadways (for landfill siting study), Whatcom County, Washington
- Noise monitoring, Waste Fibre Recovery Plant, Hayward, California
- Noise analysis, Panamint Valley Supersonic Operations, Inyo County, California
- Noise monitoring, Kings Beach community, California
- Noise monitoring, Safeway, South Lake Tahoe, California
- Noise monitoring, industrial facility, Fallon, Nevada
- Traffic noise analysis and sound wall evaluation, proposed new toll road (highway), Houston, Texas
- Ox Mountain Landfill, San Mateo County, California
- Noise monitoring, Chemical Manufacturing Site, San Jose, California
- NEPA EA's, ANR Gas Facilities (including 10 gas compressor stations), Eastern United States
- NEPA noise impact analysis, Pelican Butte Ski Area, Bend, Oregon
- EIR, Mobil Tank Farm (Marine Terminal lease renewal), Los Angeles Harbor, California
- EIR, Shell Oil Marine Terminal (lease renewal), Los Angeles Harbor, California
- EIR/EIS, Port of Oakland dredging project, San Francisco Bay Area, California
- EIR, Cold Storage and Shipping Facility, Monterey County, California
- EIR, Granite Regional Park (conversion of mining site to multi-use site), Sacramento, California
- Environmental assessment (EA), Tire-Derived Fuel Project, RMC Lonestar cement plant, Davenport, California
- EIR, Children's Hospital Incinerator, Los Angeles County, California
- EIR, Soledad Energy Plant (biomass plant), Soledad, California
- EIR, University of California at Davis Landfill (landfill expansion), Davis, California
- NEPA Environmental Impact Statement (EIS), Tungsten Mine and Processing Plant, Inyo County, California
- EA/Initial Study, Highway 89, Placer County, California
- Air quality and noise impact analyses, San Mateo-Hayward Bridge, San Mateo and Alameda Counties, California
- EIR, Decontamination and Waste Treatment Facility, Livermore, California
- Air quality and noise impact analyses, South Shore Club at Lake Don Pedro, Tuolumne/Mariposa Counties, California
- EIR, Vie Del Cogeneration Plants (coal-fired), Fresno County, California
- EIR, University of California, San Francisco, California
- EIR, GWF Power Plant Site 1A, Pittsburg, California
- Noise training, Shipyard, South San Francisco, California
- EA, Base Master Plan, Beale AFB
- EA, Los Angeles Air Force Base (two new hazardous waste/materials storage buildings)
- EA, Mail sorting facility, Beale AFB
- EA, New fire station, Beale AFB
- EA, Radio control tower, Beale AFB

REGISTRATIONS & AFFILIATIONS

- Certified Environmental Manager (CEM) – Nevada, since 2001
- Registered Environmental Assessor (REA) - California (No. 03414, since 1990)
- Qualified Environmental Professional (QEP) - Institute of Professional Environmental Practice (No. 12960268, since 1996); Nevada Regional Coordinator
- Air and Waste Management Association
- Certified Air Permit Professional, San Joaquin Valley Unified Air Pollution Control District – since 1998

APPENDIX F

Impervious Surface and Ground Disturbance

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Impervious Surface Calculations for the Casa Diablo Geothermal Development Project

Alternative 1

	Temporary	Impervious
Powerplant	6.5	6.5
Substation	0.25	0.25
Trans Line	0.75	0.0003
Well Pad	40	6.4
New Road	1.4	1.4
Existing Road	1.8	1.8
pipeline	27.6	0.97
Total (acres)	**78.3**	**17.3203**

Alternative 2

Powerplant	7.3	7.3
Substation	0.25	0.25
Trans Line	5.6	0.0007
Well Pad	40	6.4
New Road	1.4	1.4
Existing Road	1.8	1.8
pipeline	26.8	0.94
Total (acres)	**83.15**	**18.0907**

Alternative 3

Powerplant	6.5	6.5
Substation	0.25	0.25
Trans Line	0.75	0.0003
Well Pad	40	6.4
New Road	1.58	1.58
Existing Road	1.8	1.8
pipeline	26.2	0.92
Total (acres)	**77.08**	**17.4503**