FINAL

MAMMOTH PACIFIC GEOTHERMAL DEVELOPMENT PROJECT: UNITS II AND III

ENVIRONMENTAL IMPACT REPORT
ENVIRONMENTAL ASSESSMENT

SCH #86112408

PREPARED FOR:

COUNTY OF MONO
ENERGY MANAGEMENT DEPARTMENT AND

BUREAU OF LAND MANAGEMENT

OCTOBER 1987

ESA
PLANNING AND ENVIRONMENTAL SERVICES

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I. INTRODUCTION

This document contains summaries of the public comments received on the Draft Environmental Impact Report (DEIR), prepared for the proposed Mammoth Pacific II and III Geothermal project, and responses to those comments.

All substantive comments made at the Draft EIR public hearing before the Planning Commission, September 14, 1987, and all written comments received during the Draft EIR public review period from July 20, 1987, through September 14, 1987, are presented herein by direct quotation, edited to delete repetitive and nonsubstantive material only.

Comments and responses are grouped by subject matter and are arranged by topics corresponding to the Table of Contents in the DEIR. Each group of comments is followed by its response. As the subject matter of one topic may overlap that of other topics, the reader must occasionally refer to more than one group of Comments and Responses to review all information on a given subject. Where this occurs, cross references are provided.

Some comments do not pertain to physical environmental issues, but responses are included to provide additional information for use by decision-makers.

These comments and responses will be incorporated into the Final EIR as a separate document. Text changes resulting from comments and responses will also be incorporated into the Final EIR, as indicated in the responses.

II. LIST OF PERSONS COMMENTING

The set of initials given after each commentor is used to identify who made the comment in Section III, the Comments and Responses. The commentors are listed chronologically.

Frank Stewart and Lisa Jaeger, Private Citizens. Letter to Dan Lyster, Mono County Energy Management Department. August 18, 1987. (FS and LJ)

Dennis J. O'Bryant, Environmental Program Coordinator, Division of Oil and Gas, Geothermal Section, Department of Conservation. Memo to Dr. Gordon F. Snow and Mr. Daniel Lyster. August 24, 1987. (CDOG)

Mike Sorey, Research Hydrologist, U.S. Geological Survey. Letter to Dan Lyster. August 24, 1987. (USGS)

Pete Bontadelli, Acting Director, Department of Fish and Game, The Resources Agency. Memo to Project Coordinator, Resources Agency and to Mono County Energy Management Department. August 26, 1987. (CDFG)

Ellen Hardebeck, Air Pollution Control Officer, Great Basin Unified APCD. Letter to Mr. Dan Lyster, Mono County, Energy Management Department. August 31, 1987. (GBUAPCD)

Robert L. Therkelson, Chief, Siting and Environmental Division, California Energy Commission. Letter to Daniel Lyster, Mono County Energy Management Department. September 3, 1987. (CEC)

Hamilton Hess, Geothermal Coordinator, Sierra Club. Letter to Daniel Lyster, Mono County Energy Management Department. September 6, 1987. (SC)

Donald C. Liddell, Mammoth Pacific. Letter to Daniel Lyster, Mono County Energy Management Department. September 10, 1987. (MP) Enclosures included reports and comments from Cascadia-Pacific, GeoThermex, and Mesquite Group.

Frank Stewart speaking for Hamilton Hess, Sierra Club. Mono County Planning Commission, DEIR public hearing comments. September 14, 1986.

Robert Brown, CDFG, Bishop, Mono County Planning Commission. DEIR public hearing comments, September 14, 1986. (CDFG)

Lisa Jaeger, private citizen, Mono County Planning Commission. DEIR public hearing comments, September 14, 1986. (LJ)

Bureau of Land Management and U.S. Forest Service submitted an annotated copy of the DEIR at the DEIR public hearing, September 14, 1986. (BLM/USFS)

Dan Dawson, Commissioner, Mono County Planning Commission. DEIR public hearing comments. September 14, 1986. (DD)

Bob Kimball, Commissioner, Mono County Planning Commission. DEIR public hearing comments. September 14, 1986. (BK)

Sydney Quinn, Commissioner, Mono County Planning Commission. DEIR public hearing comments. September 14, 1986. (SQ)

George Lucas, Chief, Long Valley Fire Protection District. September 14, 1987. Memo to Mono County Planning Department. (LVFPD)

Bureau of Land Management and U.S. Forest Service comments were provided in an annotated copy of the DEIR submitted at the public hearing September 14, 1987. It is not reproduced in this document, but the substantive comments appear in Section III, Comments and Responses. (BLM/USFS)

GENERAL COMMENTS

COMMENT:

Six identical geothermal electrical generation units--Mammoth/Chance I & II, Mammoth Pacific I, II & III and Pacific Lighting Energy Systems I--will be developed in close proximity to each other and that each unit will produce 12 megawatts (MW) of electricity with a total power output of 72 MW. The CEC has exclusive permitting authority for all thermal power plants 50 MW or greater in capacity (Public Resources Code 25000 et seq.). As a multi-unit project, these units may fall within CEC jurisdiction. We are currently in the process of contacting the developers and gathering information which will assist us in making a determination on jurisdiction. We are currently in the process of contacting the developers and gathering information which will assist us in making a determination on jurisdiction. We should be able to resolve this issue within 45 days. (CEC)

RESPONSE: The six geothermal plants would not be identical in size or design. Otherwise, the comment is noted.

COMMENT:

The California Environmental Quality Act guidelines (Sect. 15126) require that an EIR identify and discuss the significant effects of a project. The draft EIR/EA does not consistently specify the significance of adverse impacts identified. In addition, while the document does suggest possible mitigation measures, it should also assess the residual impact level after mitigation, and which measures are actually proposed. (CEC)

RESPONSE: Section 5.1 of the DEIR lists significant adverse impacts. The anticipated effect of each mitigation, where it can be determined, is given in Chapter 4. It is up to Mono County to choose conditions and required mitigations for the project.

COMMENT:

EIR should include summary of unmitigable significant impacts. (DD)

RESPONSE: An edited version of the summary table appearing in Chapter 1 of the DEIR and included here indicates whether or not an impact is significant.

Environmental Category	Major Impacts	Mitigation Measures (Keyed to Specific Impacts)	Expected Result of Mitigation	Significant After Mitigation
Geology, Geologic Hazards and Soils	The proposed project is located in an area of hydrothermally altered rock and the well sites may be affected by unstable ground.	A geotechnical report for the drill sites will be required by CDOG prior to the issuance of a permit.	The potential impacts of drilling and production can be reduced by proper well siting and well construction determined by the geothechnical report.	No
	The proposed project is in a geologically active area and may be affected by fault rupture.	Site major facilities away from known fault traces. Design facilities to withstand fault offset without failure. Develop an emergency spill containment plan prior to operation.	Effects of fault rupture would be reduced or eliminated.	No
	The proposed project area may be affected by seismic groundshaking.	Design all project facilities to withstand the predicted levels of groundshaking (horizontal acceleration of 0.4 to 0.6g) without structural failure.	Effects of groundshaking would be reduced or eliminated.	No
	The proposed project may be exposed to volcanic activity.	Establish emergency shutdown procedures. Inspect and maintain shutdown controls regularly.	Impacts of a large eruption are essentially unmitigable. Emergency shutdown would prevent hazardous conditions during periods when operators cannot reach the power plants.	No
	Degradation of water quality in Mammoth Creek and Hot Creek is likely to occur due to erosion and sedimentation impacts during construction.	Adhere strictly to the Lahontan Regional Water Quality Control Board (RWQCB) guidelines for the Mammoth Creek watershed. Disturb no more than one-quarter acre of soil before implementing temporary erosion control measures. Construct all roads to U.S. Forest Service (USFS) standards. Build new access roads following hillside contours. Stockpile soil for use in revegetation. Revegetate using native grasses, shrubs, and trees.	Erosion and sedimentation impacts would be substantially reduced.	No
Water Quality and Hydrology	Accidental spills of geothermal fluid temporarily could raise the temperature of Mammoth Creek and Hot Creek. This could be caused by a well blowout or by a pipeline rupture during operation.	Have detailed blowout contingency plan. Regularly test and maintain automatic pump shutdown system. Adequately maintain containment dikes and catchment basins. Install valves or sluice gates at culverts under Hot Spring Road and State Route 203 to prevent hot water reaching Mammoth Creek.	Temperature effects would be minimized.	No

Environmental Category	Major Impacts	Mitigation Measures (Keyed to Specific Impacts)	Expected Result of Mitigation	Significant After Mitigation
Water Quality and Hydrology (cont.)	Surface water could be contaminated by runoff from soils that are contaminated by leakage or spills of fuels and other chemical compounds used on the site.	Maintain site and vehicles regularly. Store and handle potentially hazardous materials properly, following RWQCB requirements. Have a detailed spill contingency plan which should include: 1) immediate removal of spilled fluid by pump trucks for proper disposal; 2) construction of containment dikes with heavy equipment; 3) removal of contaminated soils; 4) immediate cleanup; and 5) notification of appropriate public agencies.	Significant contamination of soils or surface runoff would be prevented.	No
	Impacts on surface thermal features resulting from production/injection operations at the proposed project are difficult to predict. Experts studying the geothermal reservoir do not agree on how fluids move within the reservoir. One model (Upwelling/ Fracture Flow) postulates that deep upwelling from separate sources feeds multiple reservoirs, so that pumping at Casa Diablo would have no effect on the reservoir(s) at Hot Creek. The second model (Lateral Flow) proposes a source of geothermal fluid in the southwestern part of the caldera, with fluid movement toward the east. Calculations done using this model indicate that, using the information currently available about reservoir characteristics, there would probably be no effect on reservoir pressure or temperature beneath Hot Creek; however, there is the possibility that due to the lack of information about reservoir characteristics, the numerical modeling predictions are inaccurate and there could be an effect on the geothermal resource at Hot Creek Hatchery or Hot Creek Gorge.	Establish a program of fluid monitoring (see Table 4-3) including observation well just east of MP II & III well fields. Use reservoir management techniques (changes in production/injection) in response to observations mitigate impacts before effects reach Hot Creek.	Monitoring may supply early warning of effects on reservoir and may help distinguish impacts due to natural causes (such as tectonic strain and seasonal precipitation amounts) from impacts attributable to power plant operations.	Potentially
		If spring flows or temperatures were reduced at Hot Creek Hatchery or Hot Creek Gorge due to MP II & MP III power plant operations, Mammoth Pacific could: 1) supply hot water by pumping geothermal fluid and delivering it to the hatchery; and 2) supply lost flow of hot water to the bathing area.	If geothermal fluid is delivered to Hot Creek Hatchery, impacts at the hatchery would be mitigated but either pumping would increase or injection would decrease. If a well would were constructed at Hot Creek Gorge, lost flow would be replaced, but scenic value and visitor appeal as it currently exists would not be restored.	
Noise: Construction	Temporary noise from construction-related activities may affect nearby wildlife and occasional recreational users of adjacent forest areas.	Use muffling devices on construction equipment.	Noise level would be reduced on diesel-powered equipment by up to 10 dBA.	No

Environmental Category	Major Impacts	Mitigation Measures (Keyed to Specific Impacts)	Expected Result of Mitigation	Significant After Mitigation
Noise: Construction (cont.)	A temporary increase in traffic noise along State Route 203 and Hot Springs Road could affect wildlife and passers-by.	Establish vanpools or carpools and limit construction activities (except drilling) to 7:00 a.m. to 4:00 p.m.	This would reduce the total number of trips and would also reduce the noise levels at night.	No
Noise: Drilling	Noise levels of 77 dBA, L_{eq} are estimated for drilling. A total of 16 wells are planned, each requiring at least 12 days (24 hours per day) of drilling time.	Drill no more than one well at a a time. Follow OSHA and GRO 4 regulations.	Noise levels would not exceed 65 dBA at the lease boundary or 0.5 mile from the source, whichever is further.	No
Noise: Operation	The combined noise level if MP I, MP II and MP III were operating would be 4 to 5 dBA louder than MP I alone, an increase noticeable to people and wildlife in the vicinity.	Noise-muffling devices should be installed at all three power plants.	Noise levels would be reduced by 10 to 12 dBA, Leq, at each plant.	No
		Apply GRO 4 standards to all three power plants.	Noise levels would not exceed 65 dBA at the lease boundary or 0.5 mile from the source, whichever is greater.	
Air Quality: Construction	Earthmoving and construction activities would generate large amounts of dust and small amounts of CO, NO_2, SO_2, and hydrocarbons. This may create a temporary health hazard or degrade visibility in nearby areas.	Wet down construction sites during development at least twice a day.	The amount of dust would be reduced by up to 50%.	No
		Cover stockpiled materials and loaded trucks and do not overfill trucks. Minimize the area disturbed and revegetate promptly.	Dust would be further reduced.	
		Minimize traffic and speeds at construction sites.	Both dust and engine exhaust would be reduced.	
		Clean up off-site spills promptly. Use water-based paints and architectural coatings where feasible.	Evaporation of pollutants would be limited.	
Air Quality: Drilling and Testing	Required cleanout and testing would result in the release of up to 0.9 kg/hr of H_2S for a two- to four-hour period at each well. A blowout during well drilling could last longer.	Limit drilling,cleanout and testing activities to one well at a time.	No more than one well would contribute to the H_2S emissions.	No
	A slight potential for road icing and induced fog clouds would exist during flow testing.	Conduct flow tests under atmospheric conditions that would minimize induced icing and fog clouds.	The potential for hazardous conditions would be reduced.	No
Air Quality: Operational Phase	A five-minute spill of geothermal fluid supplying one power plant (5,000 gpm) would result in emission rates of H_2S of approximately 9 kg/hr. This would exceed the Air Pollution Control District (APCD) and state one-hour standards and would cause irritation to eyes and respiratory tract.	Maintain emergency shutdown equipment so that flow would be stopped promptly.	Hazardous levels of H_2S would be produced for a brief period.	No

Environmental Category	Major Impacts	Mitigation Measures (Keyed to Specific Impacts)	Expected Result of Mitigation	Significant After Mitigation
Air Quality (cont.)	Isobutane working fluid would be released from each plant at a rate similar to the loss at MP I of 4.6 cubic feet per minute or 1000 pounds per day.	Great Basin Unified APCD would require remedial control action with regard to the release of isobutane to the atmosphere.	No more than 250 pounds per day of isobutane would be released.	No
	A major rupture of the isobutane system could cause release of 200,000 cubic feet of working fluid to the atmosphere.	Add an an appropriate level of odorant to the isobutane. Install hydrocarbon sensors and alarms to alert personnel.	Plant personnel would be informed of the leak immediately.	No
		Use air-cooled condenser fan to dilute and disperse leaked vapors. Use vacuum trucks to collect the liquid working fluid.	Vapors would be dissipated or removed.	
		If the cloud of vapor were to ignite, relief values and discharge valves should be opened to reduce the quantity of material available for combustion and the material should be burned off.		
Vegetation	Development of the proposed power plants would remove up to 26 acres of available natural habitat from the area.	Avoid damaging existing vegetation whenever possible. Utilize areas which are already disturbed.	The loss of natural habitat would be lessened.	No
		Revegetate all disturbed areas with native trees, shrubs, and grasses. Newly planted seedlings should be drip irrigated to promote growth and fenced for protection. Their survival should be monitored.	Without irrigation, seedlings of Jeffrey pine could be expected to reach between five and eight feet in height with a diameter at breast height of 0.6 to 2.2 inches after ten years.	
	Botanically sensitive rhyolite buckwheat scrub communities are located near proposed facilities and may be affected by pipeline construction.	Adjust the locations of wells to avoid botanically sensitive areas, all of which are located on private property. Rhyolite buckwheat scrub communities should be fenced for protection.	Damage to sensitive plant communities would be minimized.	No
Terrestrial Wildlife	Noise and human activity may reduce songbird density near the power plants and may cause migratory deer to avoid the area.	Follow the recommended mitigation measures for noise.	Noise levels would be reduced to 65dBA at the lease boundary or 0.5 miles, whichever is further. This may lessen impacts to songbird and deer populations, but the effect is not certain.	No
	Deer pass through the area on their twice yearly migrations between summer and winter ranges. Human activity in the Mammoth Lakes area is putting increasing pressure on their traditional migratory routes.	Construct crossing ramps over pipelines or bury short segments. Design fencing and pipelines to avoid a funneling effect.	Physical barriers to deer migration would be minimal.	No

Environmental Category	Major Impacts	Mitigation Measures (Keyed to Specific Impacts)	Expected Result of Mitigation	Significant After Mitigation
Terrestrial Wildlife (cont.)		Require the project sponsor to contribute toward protection of migration routes or winter range.	Deer habitat would be protected.	
Aquatic Resources	Increased sedimentation in Mammoth and Hot Creeks may result from grading new roads and building surfaces. Elevated turbidity levels would clog and irritate gill structures and interfere with respiration, feeding, and swimming capabilities of resident fish and aquatic invertebrates.	Implement the erosion and sedimentation control measures described under Soils and Hydrology.	Turbidity effects would be reduced.	No
	Accidental spills or leakages of organic compounds used during drilling and construction could cause adverse effects on aquatic resources.	All compounds potentially harmful to aquatic organisms should be stored in secure containers within the bermed areas so that leaks would be contained. Follow requirements of the RWQCB.	The potential for accidental spills or leakages to affect aquatic resources would be greatly reduced.	No
	Thermal shock from a large spill of geothermal fluid could cause some mortality of aquatic organisms in Mammoth Creek.	See mitigation under Hydrology.	The Mammoth/Hot Creek fishery would not be adversely affected.	No
	There is a possibility that the production of geothermal fluid at this project may eventually decrease the temperature or amount of thermal water reaching Hot Creek Hatchery. This would adversely affect hatchery operations.	Supply thermal water.	This mitigation measure will supply the necessary thermal water, but either the production reservoir or the injection reservoir would be further depleted. An investment in equipment to achieve the appropriate mix of pumped and spring water would be required.	No
		Stop or reduce production at the geothermal plants.	Results would not be felt immediately because of the slow response time within the geothermal reservoir.	
Visual Resources	The proposed power plants would be visible from scenic highways and would conflict with the Visual Management Objectives of the USFS for federal land surrounding the project.	Use existing vegetation to screen facilities. Lay out well pads and roads so that mature trees are preserved. Revegetate disturbed soil areas promtly. Plant native trees and shrubs to screen equipment yards and accessory structures, and the lower parts of major structures. Use rough textures and neutral earth-tone colors for exterior surfaces. Minimize exterior structural light.	The power plants would be less conspicuous; however, they would still be noticed by casual observers and would be inconsistent with the USFS Visual Management Objectives for the vicinity.	No

Environmental Category	Major Impacts	Mitigation Measures (Keyed to Specific Impacts)	Expected Result of Mitigation	Significant After Mitigation
Visual Resources (cont.)		Insert redwood laths in chain link fencing.		
		Apply the above mitigation measures to the MP I plant.		
		Locate the plant 400 to 500 feet east of the proposed plant site.	Existing mature trees would partially screen the power plants.	
Land Use and Planning	The addition of two power plants and their appurtenant features would increase the industrial nature of the area, increase erosion, and remove some range and timber land.	See Section 4.1.1.1, Soils and Erosion; Section 4.1.2.1, Vegetation; Section 4.1.3.1, Visual Resources; Section 4.1.3.3, Range; and Section 4.1.3.4, Timber.	The use is compatible with County plans in effect when the application was filed and present USFS plans with the exception of the Visual Management policies discussed above.	See Visual Resou
Employment, Population and Housing	Temporary construction activities are expected to average 48 workers over a nine-month construction period for each power plant. During operation, six new operators would be required for each power plant.	Schedule construction during the summer.	More housing would be available.	
		Hire workers who already live in the area.	Demands for housing would be minimized.	
Economics	In the unlikely event of depletion of geothermal water at Hot Creek Gorge and Hot Creek Hatchery, there would be a reduction in employment, retail sales, and rentals, increasing the severity of the unbalanced winter/summer tourist economy.	See mitigation recommended in Section 4.1.1.2, Water Quality and Hydrology.	Although these mitigtions could eliminate impacts at Hot Creek, there is still the possibility due to the uncertain knowledge about the geothermal reservoir, that impacts could occur.	Potentially
	Demand for general county fiscal expenditures would increase due to the need for more community services by the increased residential population.	Increase local hiring. Adjust application fees, charge fees for services, assess impact fees and user fees, and make maintenance agreements to cover costs.	Expenses to the County would be reduced.	No
	For both MP II and III, property tax revenues would increase by approximately $470,000 per year.	None is necessary.		
Community Services: School	Increased employment during construction and operation may result in an increase in overcrowding at elementary schools.	Assess an impact fee on power plant construction.	Additional funding for schools would be available.	No
		Use local labor.	There would be fewer new students.	
Community Services: Sheriff	There would be potential for vandalism at the facility.	Power plant facilities and each well site should be enclosed with a chain-link fence to keep casual visitors away from equipment and operations.	Opportunities for vandalism would be reduced.	No

Environmental Category	Major Impacts	Mitigation Measures (Keyed to Specific Impacts)	Expected Result of Mitigation	Significant After Mitigation
Community Services: (cont.)				
Community Services: Health Care	The health care services of Mono County are not expected to be significantly impacted during construction or operation of the facilities. However, local facilities are not equipped to handle victims of severe scalding or burns.	Follow the safety regulations as administered by OSHA. Drill wells in conformance with CDOG requirements.	The risk of accidental injury or death would be reduced.	No
		Provide standard first aid supplies and instruct personnel on emergency procedures and locations of emergency supplies and services.	First aid would be immediately available.	
		Insulate surface pipelines.	Risk of burn would be reduced.	
		Incorporate geothermal development emergency needs into County emergency response plan.	County agencies would be prepared for prompt response.	
		Develop evacuation procedures for burn victims.	Burn victims would be properly treated.	
Community Services: Fire	Construction activities would pose the danger of shrub or forest fires. During plant operations, the possibility that the isobutane working fluid might be released to the atmosphere poses a serious fire hazard.	Implement the fire control measures proposed as part of the project. See Section 4.1.3.2.4, Community Services.	The fire hazard would be reduced.	No
		Mammoth Pacific should submit a detailed fire protection plan to the Long Valley Fire Protection District and the Mammoth Lakes Fire Department.	Response would be coordinated, prompt, and appropriate.	
		Contribute to construction of a fire station closer to the project.	Emergency response time would be shortened.	
Community Services: Roads	County and USFS roads may be damaged by heavy construction traffic.	Establish agreements for the repair of damage to the County and USFS road systems caused by project activities.	The costs of road repair would be paid by the project sponsor.	No
Recreational Resources	There is a possibility that the thermal springs at Hot Creek Gorge could be depleted as a result of operating the MP II & III plants.	See mitigations in Hydrology, Section 4.1.1.2.	Although the mitigations are likely to prevent adverse impacts, there remains the possibility that, due to uncertainties about the nature of the geothermal reservoir, adverse impacts could occur.	Potentially
	The California trout stocking program would be adversely affected if the temperature of water used at Hot Creek Hatchery were lowered by more than 2°F.	See Aquatic Resources, Section 4.1.2.3, and Economics, Section 4.1.3.2, for discussions of hatchery operations. See Hydrology, Section 4.1.1.2 for discussion of effects on geothermal resource.	The mitigations suggested could restore the trout stocking program.	No

Environmental Category	Major Impacts	Mitigation Measures (Keyed to Specific Impacts)	Expected Result of Mitigation	Significant After Mitigation
Recreational Resources (cont.)	A spill of geothermal fluid may temporarily, adversely affect fishing in Hot Creek.	See mitigation in Section 4.1.1.2.3, Hydrothermal Resources, to confine the spill. Restock affected portions of stream.	Confining the spill would minimize the impact.	No
	Recreationists driving, cycling, or jogging past the project area may be adversely affected by the noise and industrial appearance of the facility.	See Section 4.1.1.3, Noise, and Section 4.1.3.1, Visual, for suggested mitigations.	Impacts would be reduced.	No
	The power plants would attract attention.	Install an informational display.	The public would learn about geothermal resources and how they are used in Mono County.	No
Timber Resources	Merchantable-size Jeffrey pine would be harvested during the clearing of about 15 acres for the project.	Site well pads and pipelines in natural openings and clearings. Orient clearings which result from project development so that clustering of small non-merchantable trees is avoided.	The minimum amount of timber would be harvested.	No
		The operator should purchase all merchantable timber when harvested at prevailing market rate.	The timber owner would be compensated for harvested timber.	
		Replant with natural vegetation wherever possible and fence revegetated areas.	The timber resource would be replaced.	
Range Resources	Construction of the proposed MP II & III project would remove approximately 23 acres of range land from active use.	Revegetate all non-occupied cleared range lands. Fence revegetated areas to protect vulnerable plants.	Some of the range land would eventually be recovered.	No
Cultural Resources	Historic and prehistoric cultural resources could be adversely impacted by the proposed development.	Perform an archaeological assessment of the area to determine the exact areas that would be impacted.	Cultural resources would be protected or only slightly affected.	No
		Locate wells in areas where they would have no impact or a low impact. If the assessment indicates significant cultural resources in the area and no practical mitigation alternative exists, expansive data recovery investigations would be recommended.		
	The Bishop Elders have voiced concerns over resources important to Native Americans.	The project sponsor has agreed that Native Americans would have continued access to resources important to their culture.	Native American interests would be protected.	No
Transportation and Access	Heavy equipment used during construction could worsen traffic congestion at the Highway 395/State Route 203 interchange during busy periods.	Direct project traffic off Highway 395 to Hot Springs Road at the intersection south of State Route 203.	The potentially busy intersection would be avoided by project construction traffic.	No

COMMENT:

In terms of scientific analysis and professional quality, this Draft EIR is considerably superior to other environmental documents that have been prepared for Mono County for geothermal project proposals. While it generally reflects a pro-project bias (which an EIR should not reflect) it does draw a number of cautionary conclusions from the evidence and data upon which it is based. It concludes that too little is known about the hydrothermal reservoir, or reservoirs, in the Casa Diablo-Hot Creek region to be able to predict the consequences for Hot Creek and the state fish hatchery if the proposed Mammoth Pacific project is to go forward (pages 2-4; 3-17, 19, 20; 4-12, 15; and 5-2). It acknowledges that if the thermal springs at Hot Creek were to be degraded as a result of project operations no mitigations are available for the loss of this "unique recreational resource" (pages 4-50 and 61). It states that the Forest Service policy and standards for visual quality retention and of the Mono County Scenic Element will be violated in the Casa Diablo area if Mammoth Pacific II and III are built (pages 3-42, 49; 4-44, 46; and 5-1). In its brief review of the cumulative impacts to be anticipated from the one presently operating and the five proposed geothermal power plants in the region, the report concludes that the overall and long-term impacts from their construction and operation could be significant with respect to water quality (page 5-6), pressure changes in the geothermal reservoir(s) (page 5-7), degradation of hot springs in the Hot Creek Gorge with the consequent loss of its recreational value (page 5-15), the disturbance of deer migration (page 5-11), and in the creation of an industrialized atmosphere in the region (page 5-14).

These basic findings reached in the DEIR raise serious questions about the justifiability of the proposed project. In exchange for a meagre 24 MW of electricity produced for the relatively short period of thirty years, it would contribute to at least moderate -- and perhaps disastrous -- degradation of one of the nation's two or three most heavily used, appreciated and needed mountain recreational playgrounds and, together with the other presently proposed geothermal project in Long Valley, would turn the energy producing area into an industrial park. Unfortunately, the DEIR ignores these fairly obvious conclusions to be drawn from its own findings and it justifies the project with gratuitous claims that all of the problems, except for the possible degradation of the [illegible] Hot Creek and loss of visual quality, can be mitigated. The overly facile [illegible] problems of the stream pollution and noise, especially, should be remedied in the EIR. (SC)

RESPONSE: Noted.

COMMENT:

Pages 5-2 and 5-16. The discussion of cumulative impacts from the several geothermal projects presently operating or proposed for the area is much needed and is a good beginning. A more comprehensive study of cumulative impacts from all geothermal projects together with others, such as the airport expansion project is urgently needed. The study needs to be free of a pro-development bias, under which the present brief discussion suffers, and should be undertaken by a consultant employed jointly by the County and the federal government and paid for by all project applicants in the Long Valley region proportionate to the costs of their projects. (SC)

The Department recommends the "No Project" alternative until a cumulative impact analysis of all geothermal projects in the Long Valley KGRA is completed. We can no longer concur with the piecemeal consideration of similar projects or project phases that may result in cumulative long-term adverse impacts to the important biological, hydrological, and recreational resources of the area. (CDFG)

A comprehensive cumulative analysis is needed. (LJ)

RESPONSE: Noted.

COMMENT:

Pages 2-5 to 2-8. Further details are needed with regard to proposed well sites: terrain, cut slopes, quantities of soil to be removed, slope stability, proximity to faults. (SC)

RESPONSE: The wells are permitted by California Division of Oil and Gas (CDOG) and would be sited after completion of the geotechnical report required by CDOG. The locations shown in Figures 2-2 and 2-7 are approximate. Additional details are unknown at present.

PROJECT DESCRIPTION

COMMENT:

Pages 2-4 and 2-5. What about Chevron tank farm, county junk yard, power lines, gravel pits, airport?... The statement that "Development at the site has the potential to disrupt the traditional migration routes of many of these deer", is misleading. (BLM/USFS)

RESPONSE: This section refers to issue raised by respondents to the NOP. It is not a description of the existing conditions.

COMMENT:

Page 2-5. What is surface infrastructure? (BLM/USFS)

RESPONSE: Mainly access roads and surface drainage features.

COMMENT:

Page 2-6. Table 2-1 should include all pipeline, transmission lines, roads and facilities and federal land as being under the jurisdiction of the BLM. (BLM/USFS)

RESPONSE: Acknowledged.

COMMENT:

Page 2-9 and 2-12. The short-term flow test isn't described in enough detail. (BLM/USFS)

RESPONSE: The well would flow without being pumped (up to 500 gpm) into an open 21,000 gallon tank for two to four hours.

COMMENT:

Page 2-7, Figure 2-2. Well MP 12-32 is incorrectly identified in the figure as MP 12-52. (MP)

RESPONSE: Agreed.

COMMENT:

Page 2-8. What are the locations of the additional wells that may be required? What permitting process will be followed when and if these wells are proposed? (SC)

RESPONSE: Additional well locations are unknown. See page 2-6 of the Draft EIR for necessary permits and approvals.

COMMENT:

Page 2-17. How big would the reverse osmosis unit be? The size of a shed or a house? (BLM/USFS)

RESPONSE: It would be small compared to other features of the power plant.

COMMENT:

Page 2-17. The 50,000 to 500,000 gallon range for the water tank is very wide and could be important for assessing resource impacts (i.e., visual). (BLM/USFS)

RESPONSE: Noted.

COMMENT:

Page 2-20, third paragraph. "The sumps would be drained of liquids and these liquids would be trucked to a reinjection well or, if toxic, disposed of at the Class II waste site." Clarification is needed on this statement. The geothermal injection wells are permitted by the Division of Oil and Gas. However, the injection wells are only permitted to inject produced geothermal fluids. If the sump liquids are to be injected into the geothermal injection wells, waste discharge requirements may be required by the Regional Water Quality Control Board; this operation is not covered by the Division of Oil and Gas permit. (CDOG)

RESPONSE: Sump muds would not be injected. The sentence should read: "The sumps would be drained of liquids and these liquids would be disposed of consistent with RWQCB regulations. If toxic, they would be disposed of at a Class II waste site."

COMMENT:

Page 2-20. Sump muds should not be left in the sumps but should be disposed of at a Class II waste site if toxic. (FS & LJ)

RESPONSE: Noted.

ALTERNATIVES

COMMENT:

Alternatives are not well developed. Should discuss other alternatives and alternative mitigation measures. (DD)

The Alternatives section of the report fails to meet the requirements of the California Environmental Quality Act, whereby a full discussion of reasonable alternatives must be provided (CEQA Guidelines, Section 15126(d)). The DEIR confines itself to a discussion of the "no project" alternative, and this only from the standpoint of financial loss if the project is not implemented. (SC)

RESPONSE: Two alternatives are discussed in the document: The Alternative Location (and its slightly different power plant design) and the No-Project Alternative. Alternatives could have included different geothermal power plant design (water-cooled), power plants using a different energy source, a larger geothermal project, or a smaller geothermal project. The water cooled plant was not considered because of its consumptive use of water. A power plant using another source of energy would be infeasible in the location. Larger geothermal plants would require larger well fields and would likely require acquisition of additional leases which may not be available. The only alternative which is truly feasible is a smaller project, and that analysis can be obtained easily from the existing DEIR. MP II and MP III would be identical plants - each would account for about half the impact of the total project, so it is not necessary to analyze a smaller project as a separate alternative.

There would be no environmental impacts if there were no project. The only impacts would be socioeconomic, so those are the impacts specified for the No-Project Alternative.

COMMENT:

Page 2-22. Why is a different power plant location proposed for the Ormat alternative? (SC)

Page 2-22. It is confusing to combine the alternate plant design with the alternate location. The design is not linked with the location, is it? (BLM/USFS)

RESPONSE: The Ormat units are larger than the radial flow turbo-expander units and the would not fit on the proposed site. Only the alternate site could be used if the Ormat design were selected.

COMMENT:

Page 2-23, Figure 2-7. Well MP 12-32 is incorrectly identified in the figure as MP 12-52. The production pipeline extending from the proposed site to the alternative site is not shown on the figure; however, it would parallel the existing plant injection pipeline route to the MP II & III alternate sites. (MP)

RESPONSE: Acknowledged.

COMMENT:

No-Project Alternative should be pursued.

RESPONSE: Noted.

PHYSICAL ENVIRONMENT

GEOLOGY, GEOLOGIC HAZARDS AND SOILS

COMMENT:

Page 4-5. There is some current evidence (USGS) that slight amount of subsidence may be occurring - I suggest you make requirements consistent with our GRO 4 #8 which we will be requiring on adjacent land. It is not burdensome and good early warning. (BLM/USFS)

RESPONSE: Noted. For information, GRO Order 4 #8 reads as follows:

"8. Subsidence and Seismicity. Surveying of the land surface prior to and during geothermal resources production will be required for determining any changes in elevation of the leased lands. Lessees shall make such surveys as required by the Supervisor to ascertain if subsidence is occurring. Production data, pressure, reinjection rates, and volumes shall be accurately recorded and filed monthly with the Supervisor as provided in 30 CFR 270.337. In the event subsidence activity results from the production of geothermal resources, as determined by surveys by the lessee or a governmental body, the lessee shall take such mitigating actions as are required by the lease terms and by the Supervisor."

"If subsidence is determined by the Supervisor to present a significant hazard to operations or adjoining land use, the the Supervisor may require remedial action, including but no limited to, reduced production rates, increased injection of waste or other fluids, or a suspension of production."

COMMENT:

Page 4-1, (summarized on page 1-3), Environmental Category, Geology, Geologic Hazards, and Soils.

The following statements about the hydrothermally altered rock at, and near the proposed drill sites should be included. The area of concern has a history of impacts from previous drilling activity.

Major Impacts. The proposed project is located in an area of hydrothermally altered rock and the well sites may be affected by unstable ground.

Mitigation Measures. A geotechnical report for the drill sites will be required by the Department of Conservation, Division of Oil and Gas, prior to the issuance of a permit. This report should be included in the Final EIR.

Expected Results of Mitigation. The potential impacts of drilling and production can be reduced by proper well siting and well construction determined by the geotechnical report. (CDOG)

RESPONSE: The comment is correct and should be inserted immediately after the heading 4.1.1.1.1 Geology and Geologic Hazards, except for the condition that the geotechnical report be included with Final EIR. It is likely that the FEIR will be published before the geotechnical study is complete.

COMMENT:

Page 4-4, top of page. It is also necessary to design and build all facilities in such a way as to protect the natural environment. (SC)

RESPONSE: Agreed. Add the phrase "and to protect the natural environment" at the end of the last sentence in the paragraph.

COMMENT:

Page 4-8, second bullet. All disturbed areas should be stabilized at the latest by October 1st. (SC)

Page 4-8, third bullet. All work performed between October 15th and May 1st should be conducted in such a manner as to be stabilized in four hours. A winter storm can have come and gone in 48 hours. (SC)

RESPONSE: The listed mitigations are requirements of the Lahontan Regional Water Quality and Control Board developed for construction sites in the Mammoth Lakes area.

HYDROLOGY AND WATER QUALITY - GENERAL COMMENTS AND MONITORING PROGRAM

COMMENT:

A definitive description of hydrology should be given. (SQ)

RESPONSE: Experts do not agree about the hydrology. The description given in the Draft EIR is a summary of the two basic models which have been used to describe how the subsurface fluids behave.

COMMENT:

A Long Valley Technical Advisory (Hydrological) Committee is being formed under the auspices of the Mono County Energy Department to provide a monitoring plan to assure

the protection of all environmental concerns resulting from geothermal development. By means of this letter, the Department requests that effective enforceable safeguards be built into the monitoring plan to protect the jeopardized natural resources. (CDFG)

The probable relationship between surface flow, shallow groundwater, constant temperature springs, and the geothermal fluid must be assessed to the present "state of knowledge" or "state of the art" and/or state of risk or uncertainty. (CDFG)

Page 4-21: The proponent should participate in a hydrologic monitoring program at the outset, rather than at a later time when decreased spring flows or temperatures at either the fish hatchery or Hot Creek area were noticed.

The irreplaceable value of the Hot Creek Gorge is illustrated by the feeble attempt to propose an adequate mitigation. Once the Gorge is affected in a negative manner, a valuable recreational resource is lost for the forseeable future. This fact reinforces the need for all geothermal proponents to participate in a detailed hydrologic monitoring program. (FS & LJ)

If the geothermal component of water at the hatchery or Hot Creek Gorge decreases, it should not be the County's responsibility to prove that use of the resource for power generation has caused the loss. The burden of proof should rest with the power plant owners and operators to prove that the power plants are not responsible. (LJ; BK)

Page 5-20: Should add limitation on pumping rates, relocation of injection or ultimately plant shut down. Also potential effects on Hot Creek Hatchery could be detected by the implacement and maintenance of a hydrologic monitoring network. (BLM/USFS)

Page 3-17, paragraph 4: Reference is made to our considering a proposal to greatly improve the quality of such data. Mammoth-Pacific is currently putting complete a comprehensive program to enhance and upgrade the geothermal resource monitoring instrumentation of the operating Mammoth-Pacific geothermal power plant in order to provide highly accurate and continuous reservoir data, including capillary tubes which are being installed to provide downhole pressure measurement with an accuracy of ±0.1 psi. Additional instrumentation will provide the following data: Produced fluid temperature at each well (±0.2 F); injected fluid temperature at each well (±1.0 psi); and injection fluid pressure at each well (±1.0 psi). All data will be transmitted to an onsite computer for processing. The upgraded reservoir monitoring and data acquisition system should be completely operational by October 1, 1987. It is our intention to provide similar instrumentation for MP II, MP III, and the Long Valley Hydrological Advisory Committee ("LVHAC," formerly Long Valley Technical Advisory Committee) monitoring well which will greatly improve the degree of accuracy and overall quality of reservoir data obtained from power plant operations at Casa Diablo. (MP)

Page 4-19, Table 4-3: Mammoth-Pacific is actively participating in the LVHAC and has attended all organizational meetings, including the meeting of August 6, 1987, at which Mammoth-Pacific agreed to participate in the drilling of a monitoring well on the adjoining property. The location was acceptable to all the experts present. By being on the far edge of the established Casa Diablo geothermal reservoir, the monitoring well will provide very early warning of any significant changes taking place within the reservoir. At the same meeting, we supported the general area-wide monitoring program which was

proposed by the members. We believe that such monitoring will provide important baseline data which will help greatly in the development of an area-wide model of geothermal resources and will enable permitting agencies to quickly identify changes that are taking place within the Long Valley Caldera. (MP)

RESPONSE: These comments, all addressing aspects of data acquisition, monitoring, and potential mitigation measures, are grouped for response because of recent related developments which should be fully explained in the Final EIR.

During recent meetings of the LVHAC, with Mammoth-Pacific as a participant, general agreement has been reached on the description of an appropriate monitoring program. A key feature of the program will be a monitoring well about 1000 feet east of the wellfield for MP II & III. (On-going monitoring conducted largely by the USGS will be continued as part of the LVHAC program.) The new monitoring well will be monitored for evidence of pressure or temperature changes. Because the well is much closer to the project well field than Hot Creek, changes would be detected there years before the changes could propagate to the areas underlying the hatchery or Hot Creek Gorge. If changes were observed in this monitoring well, the County could direct that reservoir management techniques be used to mitigate the impacts.

Such techniques could include changes in the pumping rates of production wells to change the pattern of drawdown in the reservoir, a decrease in the total pumping rate, or changes in the kind of injection support provided. If reservoir management techniques were not adequate to mitigate the impact at the monitoring well, then production could be stopped entirely as a final mitigation measure.

The appropriate mitigation actions would be required by the County, with LHVAC serving as a review body which would discuss and interpret the results of the monitoring program and the likely effectiveness of mitigation measures.

The combination of monitoring to provide an early warning system and mitigation measures designed in response to specific observations noted in the monitoring program should prevent any damage to the reservoir(s) underlying Hot Creek Hatchery and Hot Creek Gorge. However, because experts do not agree how fluids move within the geothermal reservoir(s) in the Long Valley caldera, it is not absolutely certain that the early warning and mitigation measures will prevent all impacts at the hatchery or at Hot Creek Gorge.

COMMENT:

Pressure decline within the hot producing zone due to power plant operation can affect flow patterns to other areas within the Long Valley Known Geothermal Resource Area (KGRA). Thus far wells MBP-3 and MBP-5 have shown some decline in productivity index, indicating pressure loss. However, direct pressure changes are still undetermined due to changes in monitoring equipment. Accurate measurements of pressure changes are necessary and should be documented prior to construction of additional power producing plants. Also, additional monitoring wells, as mentioned in Section 2.3.4 (page 42-45) should operate without the influence of further development for several years to establish baseline data, and if possible, to determine whether these wells provide an accurate assessment of pressure changes due to plant operations.

We are concerned over the cumulative effects of overall geothermal development in the Long Valley KGRA on the temperature gradient throughout the basin. Although one project by itself might seem to exert no theoretical impact, we are concerned over the impact of several such projects. It must be recognized that the recreational demand on the area will increase annually, and it will be substantial over the 30-year life of the project. (CDFG)

RESPONSE: It should be noted that the pressure declines are "apparent" and this opinion is not shared by all investigators. We believe the data for these wells indicate a decline, but that the decline is slight and even if larger declines are seen (as we believe will be the case with additional fluid withdrawal) it will not necessarily result in propagation of pressure drawdowns outside the Casa Diablo area.

We agree that as much background data as possible would be desirable once the improved pressure monitoring system is installed.

HYDROLOGY AND WATER QUALITY - SURFACE RESOURCES - CREEKS AND SPRINGS

COMMENT:

Page 3-11: A chemical analysis of Mammoth Lake tributary stream waters should be undertaken by the applicant so that baseline data can be provided. (SC)

RESPONSE: This is an idea worth presenting to Long Valley Hydrologic Advisory Committee (LVHAC). However, we believe that even weekly sampling would fail to establish a baseline, as thermal spring contribution and local precipitation varied with season as well as from year to year, even prior to MP I startup. Hence, water sample analysis for a specific period need not be directly comparable to previous or subsequent year.

COMMENT:

Page 3-11: "A portion of the flow is lost to shallow groundwater in the meadow between Highway 395 and Hot Creek Hatchery." This is not true year round. (BLM/USFS)

RESPONSE: Noted.

COMMENT:

Page 3-13: Of the three thermal springs in the Colton Spring area noted on p. 3-13, only Colton Spring itself is continuously monitored. (USGS)

RESPONSE: Noted.

COMMENT:

Page 3-15: States "Temperatures vary from 73 to 96 degrees C." Is this over time or different springs at the same time? (BLM/USFS)

RESPONSE: These temperatures were measured at different vents at approximately the same time. The tables in Technical Appendix to the DEIR show the temperatures to vary somewhat, but there is no specific trend. The variation in temperature

between sampling data is more likely due to equipment, method, creek flow and creek temperature at the time of sampling.

COMMENT:

Page 3-15: States "No changes in temperature, flowrate or chemistry have been seen in Hot Creek Gorge springs as a result of current MP I power plant operations." It is possible that changes may take up to 100 years to be observable at Hot Creek Gorge. (BLM/USFS)

RESPONSE: Acknowledged.

COMMENT:

Spring discharge at the Fish Hatchery appears to be relatively constant only during the late fall and winter. Continuous measurements in 1985 and 1986 show that the peak flows in July of each year were 32% and 75% greater than the wintertime flows at the AB spring group. (USGS)

RESPONSE: Noted.

COMMENT:

The maximum natural fluctuations of spring temperatures at the Fish Hatchery springs is ±1.8 degrees F. (CDFG)

RESPONSE: Noted. [See data supplied by DFG biologist R. Brown included with complete comments in Section IV of this document]

COMMENT:

Supply of water, geothermal fluid, etc. to compensate or restore an "existing or present" condition (i.e., temperature?, water chemistry at Hot Creek Hatchery Springs) is not a realistic or acceptable mitigation measure. If the project proponent believes this to be "acceptable mitigation" further analysis and discussion must be presented in the final EIR and demonstration of capability to deliver acceptable "supply" water must be done. (CDFG)

RESPONSE: We agree that more investigation is necessary to prove deliverability.

COMMENT:

Page 3-31. The operation of the existing MP I plant has apparently disturbed the natural discharge rate of the Casa Diablo Geyser to such an extent the since April of 1987 this geyser spring has ceased to flow. Obviously any plant or animal life which at one time relied upon this spring source has been adversely affected. Our concern over the loss of other hot springs, artesian springs, and surface waters in the area of influence of the proposed project extends to all aquatic resources present, including endemic plants and animals. An extensive basin-wide survey on all known hot springs, artesian springs, and surface waters should include all associated habitat types and provide complete lists of all plants and animals present. This is necessary, for without even listing their names and the quantity of habitat potentially to be lost as a result of temporary or permanent disruption of flows, it will be impossible to develop measures capable of preventing their loss. (CDFG)

RESPONSE: Though we believe Casa Diablo Spring flow and MP I well production are related, the relationship is not clear and the spring flow has been reported as variable (and at times dry) before the start of MP I. Disruption of spring flow at Casa Diablo does not necessarily infer disruption of other springs and the likelihood and potential magnitude of such disruption decreases exponentially with distance from Casa Diablo.

HYDROLOGY AND WATER QUALITY - SURFACE RESOURCES - SPILLS OF GEOTHERMAL FLUIDS

COMMENT:

Page 2-21: Will the power plant site be paved as well as bermed to ensure retention of spilled fluids for proper disposal. (Sierra Club)

RESPONSE: At this time there is no plan to pave the power plant site.

COMMENT:

More discussion of past disposal (spill) of geothermal fluid into Mammoth Creek is necessary in the final EIR including sediment transport and impact on biota. (CDFG)

RESPONSE: Because of a shortage of CDFG personnel available, the information referred to could not be acquired until after the due date of these responses. However, a senior CDFG official was reached by phone, though he had limited time to discuss the issue as he was preparing for a trip out of town. He, in effect, reiterated Mr. Brown's reference to a significant temperature increase and sediment plume at the point of entry at Mammoth Creek. He also noted a survey of aquatic biota above and below the point of entry which showed a decrease in insect life downstream. He offered to look for and send any available written information the week of September 28, 1987.

COMMENT:

Page 28, Technical Appendix: The Department documented a decrease of natural biota as the result of excessive silt from Casa Diablo thermal well discharge into Mammoth Creek in 1960. The 1962 incident further exacerbated an already existing water chemistry problem.

The document fails to discuss the provision of containment facilities in areas where pipe ruptures could release several thousand gallons of hot geothermal fluids into creeks. The temperature effects of such a slug of hot fluid would be catastrophic to trout and invertebrate populations in Mammoth Creek, and perhaps, Hot Creek, a recognized blue-ribbon trout stream. Full recovery of the fish and invertebrate populations would require several months to a year and may never completely achieve the ecological balance present before the spill if more than temperature effects are involved.

The water quality characteristics of the fluids contained in the geothermal wells (Table 1-3) are such that they would significantly impact aquatic resources should a pipeline rupture or spill of these fluids occur. Specifically, the concentrations of arsenic (0.1 to 2.5 mg/L) and mercury (1.2 to 2.6 mg/L) pose the greatest threat. EPA's 1986

Quality Criteria for Water specifies concentrations for various water quality parameters. Arsenic concentrations should not exceed 0.19 mg/L and mercury should not exceed 0.00014 mg/L once every three years. Should an accident occur in the project area, concentrations of both these metals in existing waters could be exceeded in a relatively short period of time. The long-term impact to the downstream resources as well as to the use of these resources by sportsmen could devastating. The proposed mitigation does not identify how the developer proposes to keep hot geothermal fluid from entering Mammoth Creek in the even of pipe rupture. Therefore, mitigation for this potential occurrence has not been identified. (CDFG)

The description of mitigation measures to curtail the amount of geothermal fluid that could spill is too vague. (CDFG)

Page 4-40: Once again - the proposed mitigation is much too vague. How will the proponent reduce the maximum flow of geothermal fluid that may reach Mammoth Creek in the event of a major spill of geothermal fluid (as during an earthquake. (FS and LJ)

Page 4-40, last paragraph: How is it proposed that the maximum flow of geothermal fluid to reach Mammoth Creek could be reduced? (SC)

RESPONSE: Mitigation measures for potential spills on the power plant site include berms surrounding the plant.

An additional mitigation measure has been proposed by the project proponent in order to contain spills outside the power plant sites. This involves manually and/or automatically operated valves for closing the pipes which direct drainage under State Route 203 and Old Highway 395 should a spill occur. This would prevent hot fluid from reaching Mammoth Creek. The fluid could be released or pumped into trucks after it had cooled. No doubt significant infiltration into the soil would occur in the area, but the measure should prevent catastrophic degradation of creek waters.

The design would be subject to approval of appropriate road maintenance authorities and the USFS.

COMMENT:

Reference was made at the public hearing to the spills and mitigation measures taken in the Geysers Geothermal Area of northern California, to be used as models for potential consequences and mitigation measures to be used in the case of MP II and III. (CDFG; DD)

RESPONSE: Due to schedule constraints these changes could not be reviewed nor could copies be mailed out to us for review before the due date of these responses. However, in at least one Geysers power plant site it is required that full-time automated stream water quality monitoring be installed up and downstream of potential entry points of spills. These monitors activate alarms (by phone) to various agencies and individuals and initiate periodic sampling.

We agree that the Geysers area information on spills may suggest appropriate mitigation measures. However, the recently proposed spill mitigation measure of sluice gates or valves on culverts is likely to be the best available given the favorable topography and drainage at Casa Diablo. Such measures are not feasible in the Geysers area.

Spills at the Geysers have been primarily geothermal steam condensate and chemicals being transported to the plant sites. Condensate spills accounted for 82% of the spills from 1974 to 1984. About 2% of the spills were materials used for H_2S abatement and the treatment of condensate (Warner et al., 1986). At MP II & III, the geothermal fluid would be circulated in a closed system and the working fluid would be air cooled, so there would be no condensate nor would treatment be necessary.

COMMENT:

Page 5-6: As the EIR correctly points out, the probability of contamination from spills to surface water increases with each additional power plant installed or under construction. (FS and LJ)

RESPONSE: Noted.

HYDROLOGY AND WATER QUALITY - SUBSURFACE RESOURCES

COMMENT:

Page 3-17: What is a "similar warm zone?" This appears to be building a case for inferring that the reader should choose the lateral flow model. This should be a factual and unbiased report. (BLM/USFS)

RESPONSE: All readers cannot be expected to be able to interpret the data. As with most other geothermal resources there is more than one interpretation for a given set of data. Here a comparison is being made between two prominent views.

COMMENT:

Page 4-15: Define units of kh = 500,000 md-ft and 150,000 md-ft. (BLM/USFS)

RESPONSE: The definitions are on page 4-22 in the DEIR.

COMMENT:

Page 3-7 and 4-12: The claim is made that the Upwelling/Fracture Flow Model implies that there is no hydraulic communication between the Casa Diablo area and thermal springs at the Fish Hatchery and Hot Creek Gorge. This claim would not be valid if hydraulic communication existed between these areas via deeper, hotter reservoirs and the faults which provide conduits for upflow of thermal water. I don't feel either model precludes the potential for adverse impacts on thermal springs. (USGS)

RESPONSE: The statement on page 3-7 implies that a greatly reduced risk of potential effects on springs is suggested by this model based on other geothermal reservoirs.

On page 4-12 it states "no communication" between the various areas is likely under the Upwelling/Fracture Flow model. We agree that the latter is stated too firmly given the present lack of evidence and that potential adverse effects are not entirely precluded under either model. However, we will believe that the risk of significant adverse effects are greatly reduced should the Upwelling/Fracture flow model prove to be the correct one.

COMMENT:

Page 4-17, third line, third paragraph. Mispring of "winter" for "water".(SC)

RESPONSE: Acknowledged.

COMMENT:

Page 4-21. Since a pressure rise east of Casa Diablo shown in the model, the mitigation should include actions to mitigate temperature increases as well temperature decreases. (BLM/USFS)

Page 4-13 to 4-15: Some discussion is needed in this section of the basis for assuming complete hydraulic communication between injection and production zones because the effects of injection dominate these simulations. The GeotherEx (1986) report, in fact states that it is unlikely that recharge (i.e., pressure support) is provided by reinjection because production and injection zones are separated by 500 to 700 feet of relatively impermeable rhyolite. The model results show pressure rises east of Casa Diablo - what effects would that have on spring flows? (USGS)

RESPONSE: As stated several times in the main body of the EIR and in the Technical Appendix on hydrology, the model in which the calculations are based is simplistic. But as yet there is little reliable or convincing data on which to base a detailed numerical simulation including complex geologic data or pressure responses data in wells for matching. There was neither the time nor funding available for numerous trails to be run for each consultant who has ever proposed a model for the system. We still believe injection does support production zone reservoir pressure in the Casa Diablo area to some degree. However, it would be more difficult to defend choosing 0, 10, 50, 70% etc. injection support and there is no data on which to select a best case based on the results of each iteration. We believe it would be valuable for detailed numerical models to be analyzed, but that is a long-term project and must be continuously updated.

Pressure rises to the east again reveal the limitations of the model. The results simply an increase in pressure and potential for increase in spring flow. Given the distance from Casa Diablo and that the geology is far from homogeneous, we believe neither is likely.

COMMENT:

Page 4-16: Actual injection temperatures at MP I are between 160°F and 180°F. (BLM/USFS)

RESPONSE: The temperature of 300°F applies to reheating of the injected fluid at the thermodynamic front (interface) in the injection zone. The following note should be added to explain the use of 300°F in the model:

"Actual injection temperatures at MP I are between 160°F and 180°F. The injected fluid from the power plant would be rapidly heated by the surrounding rocks to the temperature of the injection reservoir (approximately 300°F). Since the viscosity of fluid at 300°F is much lower than fluid at 175°F, performing the Bulk-Model calculation with fluid at 300°F actually results in a more conservative (i.e., rapid) estimate of the advance of the thermal front than if the 175°F temperature were used."

COMMENT:

Calculations of the rate of propagation of a cold temperature front (1,400 ft in 30 years - p. 4-16) suggest that the front could reach the vicinity of the nearest production well (650 ft) at Casa Diablo in less than ten years. Some discussion is needed of the possibility that premature breakthrough of cold water could limit the productive life of the field. The value used in these calculations for the reservoir width should be stated. (USGS)

RESPONSE: Again, we realize all of the assumptions used to construct the simple models are unlikely to reflect actual reservoir conditions. This calculation is given for comparison. It assumes a homogenous radial aquifer. In both models discussed (Lateral Flow and Upwelling/Fracture Flow) a cold water front would be prevented from moving west.

A radially unbounded reservoir was assumed in the Bulk Model calculations. It would be useful to compare results from calculations assuming a number of reservoir widths, but this could not be done given the constraints discussed above. However, it would be interesting to see if any investigators in the region could agree on a suitable width value for use in these calculations.

COMMENT:

Please see letter report in Section IV entitled Comments Regarding the Draft EIR by Mesquite Group Inc.

RESPONSE: We thank the Mesquite Group for its expanded discussion of the Upwelling/Fracture Flow Model, which could not be described exhaustively in Appendix 1 on Hydrology. Description of the Lateral Flow Model was also subject to similar constraints.

An expanded description of the Lateral Flow Model from its supporters would also be welcomed. The Mesquite Group opinions concerning the risk to Fish Hatchery and Hot Creek Gorge springs presented by further geothermal development at Casa Diablo and information on the proposed monitoring plant are noted.

COMMENT:

Please see attached Cascadia Pacific Corporation discussion on the hydrology section of the MP II & III EA/EIR opinions concerning probable risk to thermal springs.

RESPONSE: Noted.

COMMENT:

Please see attached GeothermEx letter report on the hydrology section of the MP II & III EIR/EA.

RESPONSE: Noted.

NOISE

COMMENT:

Page 3-21, paragraph 3. Silencers have been re-installed on the expander exhausts of the operating plant, resulting in a greatly reduced overall noise level from the plant. The current noise level recorded at 0.5 mile distance is approximately 40 dBA. The noise level adjacent to the plant along Hot Springs Road (old Highway 395) has been reduced from an average of approximately 80 dBA without the silencers to 69 dBA with silencers and other noise reduction equipment installed on both units. (MP)

RESPONSE: Acknowledged.

COMMENT:

Page 3-21. Reduced noise levels at MP II, III should be a design priority. A duplication of noise complaints associated with plant MP I is unacceptable. (FS and LJ)

RESPONSE: Noted.

COMMENT:

From information in the draft EIR/EA it is unclear what project-related noise levels will occur off-site, or if such levels will conflict with proposed land uses around the proposed facility. An analysis of noise levels at the property lines of the proposed facility should be provided, and noise levels that are acceptable for the proposed use of the surrounding lands should be identified and discussed. (CEC)

RESPONSE: Section 4.1.3 discusses anticipated noise levels at all off-site noise-sensitive receptors in the vicinity of the project area. In all cases, outdoor noise levels at these receptors were found to be less than 50 dBA, L_{eq}, which would not present noticeable noise impacts. Section 5.3.1.3, p. 5 to 9, indicated that "no noise sensitive development is currently planned for areas within 0.5 mile of the project site," and that noise levels beyond that distance would not be intrusive.

COMMENT:

Page 4-23. A night-time concern or impact is not identified, why mitigate. (BLM/USFS)

RESPONSE: Acknowledged.

AIR QUALITY

COMMENT:

Page 3-30. GBUAPCD has no permit program for wood-burning devices. (GBUPACD)

RESPONSE: Acknowledged.

COMMENT:

Page 4-25. (Re: Worst-case 24-hr. PM_{10} levels): How is this arrived? Needs support. (BLM/USFS)

RESPONSE: The PM_{10} particulate portion is generated at varying rates depending on weather conditions and other factors, but a useful worst-case value is 1.2 tons per acre per month of activity (BAAQMD, 1985). This figure includes emissions from excavation and earthmoving, traffic on unpaved surfaces, wind erosion, and construction.

COMMENT:

Page 4-25. Although the air quality within the boundaries of the John Muir Wilderness area may not be affected, air pollution emissions may be viewed by visitors within the wilderness area. (LJ)

RESPONSE: Acknowledged.

COMMENT:

Page 4-26. Add the following mitigation to those indicated: Surface permanent roads and pads with at least four inches of road base material. (BLM/USFS)

RESPONSE: Acknowledged.

COMMENT:

Page 4-26. Fourth mitigation. Build a wall? Not practical or effective. (BLM/USFS)

RESPONSE: Noted.

COMMENT:

Page to 4-26. Fifth mitigation. A 15 mph speed limit is unacceptable. (BLM/USFS)

RESPONSE: Noted.

COMMENT:

Page 4-26. What will be the source of fresh-water needed to reduce construction dust. Perhaps reclaimed water from MCWD could be utilized. (LJ)

RESPONSE: The source of water to reduce construction dust has not been determined. Reclaimed MCWD water should be considered.

COMMENT:

Page 4-27. Mitigation. Drilling has not been identified as causing an impact and long-term testing would not reach the atmosphere. Change first sentence of mitigation to read: "Limit cleanout and short-term testing activities to one well at a time." (BLM/USFS)

RESPONSE: Acknowledged.

COMMENT:

Page 4-27, paragraph 2. The assessment of hydrogen sulfide emissions during well testing operations assumes the well will be pumped during the short-term (two to four hour) well cleanout period. This assumption is incorrect and the 2,000 gpm pumped well flow rate overestimates the expected hydrogen sulfide emissions. The proposed operations would allow the wells to flow naturally without pumping (flow rate estimated not to exceed 500 gpm) to on-site tanks. This rate of flow would not result in emissions in excess of those allowable under GBUAPCD emission standards (2.5 kg. per hour per well), as conservatively calculated below:

500 gpm x 3.785 1/gal x 8 mg/1 x kg/10^6 mg x 60 min/hr = 0.9 kg/hr

The 2,000 gpm flow rate refers to the estimated pumped flow rate of the wells during long-term flow testing. The long-term flow tests would be conducted in a closed system and would, therefore, not release any hydrogen sulfide to the atmosphere. (MP)

Page 4-27. GBUAPCD will require mitigations on flow tests of wells so that H_2S emissions will not exceed emissions limits and ambient standards. The long-term test flows should be run through the existing MP-1 plant and reinjected as will be done for the PLES-1 flow tests. (GBUAPCD)

RESPONSE: Acknowledged.

COMMENT:

Page 4-28 (re: amount of isobutane emitted) The PLES EA shows possibly to be less than the hydrocarbons emitted from the forested area to the east. How does this compare to a typical Mammoth gas station? (BLM/USFS)

RESPONSE: A California Air Resources Board (1987) inventory of isobutane emissions in Mono County for the year 1985 indicates that gasoline dispensing accounts for about 53 lbs per day of emissions. Total isobutane emissions for the county were estimated at about 91 lbs per day. Estimates of early 1987 losses from the MPI plant represent 175% to 1000% increases over estimated 1985 levels. Operating emissions of MP I, II, and II would be no more than 750 lbs per day. Isobutane is considered a slightly photo-reactive hydrocarbon. In contrast, hydrocarbon contained in by-products of gasoline combustion and that produced by some varieties of trees is considered reactive.

COMMENT:

Page 4-29. No more than 250 lbs/per day of isobutane should be allowed to escape into the atmosphere. (LJ)

RESPONSE: See page 4-29. The GBUAPCD will not allow emissions to exceed 250 pounds per day.

COMMENT:

Pages 4-30 to 4-32. The draft EIR/EA states that substantial emissions of both H_2S and isobutane could result during upsets of the facility. Ambient concentrations that would result from such events should be compared to levels that are considered acceptable for public exposure. Criteria used to gage such exposures should consider the effects on sensitive members of the general public. (CEC)

RESPONSE: Federal Occupational Safety and Health Administration guidelines have set the maximum acceptable H_2S concentration at 50 ppm for no longer than ten minutes during any eight-hour period. The acceptable ceiling concentration of 20 ppm should be considered the upper limit for acceptable exposure to sensitive members of the public. The concentration shown in Table 4-9 for severe upsets may exceed these levels. OSHA guidelines for isobutane have not been established, although as stated on page 3-28 isobutane is flammable at concentrations between 1.8% and 8.4% in air. Model results for catastrophic release of isobutane, as shown in Table 4-11, indicate that this hazardous level could be reached.

COMMENT:

The geothermal fluid released during upsets can contain trace amounts of arsenic, lead, and mercury. The resultant public exposure to these pollutants should also be evaluated. (CEC)

RESPONSE: The use permit application for MP II & III (Mono County application No. OIE-86-02) indicates that lead is not likely to be present in any of the planned production wells at the site. Arsenic has been measured in fluids from nearby wells, but would form compounds which would precipitate from the hot geothermal fluids and would not become air quality hazards. A small fraction of mercury was detected in one of the eight wells tested. Prolonged inhalation of the geothermal fluids from this well could expose an individual to toxic levels of mercury. Under normal operating conditions such exposure would not occur.

COMMENT:

Page 4-31, paragraph 4. States isobutane is normally stored as a colorless, odorless, ... gas. However, for the MP II & III project, it is proposed that an odorant would be added to the hydrocarbon working fluid, prior to storage and use. (MP)

RESPONSE: Acknowledged.

COMMENT:

Page 4-33, paragraph 1. States vacuum truck would collect hydrocarbon vapor for potential reuse. Should state vacuum trucks would be used to collect non-vaporized hydrocarbon liquid for potential reuse or disposal. (MP)

RESPONSE: Acknowledged.

COMMENT:

Page 4-34, paragraph 1. States relief valves and discharge valves would be opened to reduce the quantity of material available for combustion. Should state these valves would be closed to reduce ... (MP)

RESPONSE: Acknowledged.

COMMENT:

Page 4-34, paragraph 2. States a mercaptan should be added to the isobutane as an odorizer. However, it has been demonstrated that mercaptans are not stable at the temperatures expected in the geothermal heat exchanger. As such, should state a temperature-stable odorizer, such as tetrahydrothiophene should be maintained in the system. (MP)

RESPONSE: Acknowledged.

COMMENT:

Page 5-9. The cumulative amount of construction time for constructing all proposed geothermal plants of four years is considerable. The impact on regional air quality when viewed in this light is considerable. Perhaps tighter constraints on air quality during the construction phases is necessary. (FS and LJ)

RESPONSE: A four-year construction period is the worst-case estimate based on a sequential timing of construction periods. In reality, it is anticipated that PLES I and MP II would be built, to the extent possible, simultaneously, thus reducing the net air quality impact.

COMMENT:

The document states, on page 5-10, that the facility may emit. 1,500 to 6,000 lbs/day of non-methane hydrocarbons. This may also be considered to be a significant impact. It is

unclear that this impact will be mitigated to the extent feasible. (CEC)

RESPONSE: The cumulative case considers six separate geothermal plants, not one facility. With mitigation measures required by GBUAPCD, total emissions of working fluids for six plants would not exceed 1,500 lbs/day. This is not considered a significant impact.

COMMENT:

Pages 5-9 to 5-10. The document, states that construction activities could cause new or continued violations of the state's ambient PM10 standard. This is unlikely to be considered a significant impact, yet there is no indication that impacts will be mitigated to the extent feasible.

RESPONSE: If Mono County is reclassified as "non-attainment" for PM_{10} as anticipated by the GBUAPCD, then a PM_{10} attainment plan would impose specific measures for reduction of PM_{10}. Until then, the mitigation measures proposed on page 4-26 would control fugitive emissions of particulate matter from construction activities at the site.

COMMENT:

Page 5-10, paragraph 3. The analysis for cumulative impacts from fugitive emissions of hydrocarbons (see Table 4-7) is overstated in that two of the six proposed power plants (Mammoth/Chance Units I and II) would be located at least two miles east of the Casa Diablo area and would not perceptibly influence the maximum ground-level concentration of hydrocarbon resulting from fugitive emissions in the Casa Diablo area. As such, they should not be considered in the single source, PTPLU model, analysis. (MP)

RESPONSE: The purpose of the cumulative analysis was to identify maximum concentrations of isobutane caused by continual leakage from joints and fittings under worst-case meteorological conditions. To that end, emissions from the six plants were modeled as a single point source. The ground-level concentrations shown in Table 4-7 for emissions rates of 1,500 and 6,000 lbs/day are less than 0.2% in air and do not present a safety risk. If the results of that modeling effort had indicated that ignitable concentrations could be reached, then it would have been necessary to separate out the sources for a more realistic representation.

BIOLOGICAL ENVIRONMENT

VEGETATION

COMMENT:

The draft EIR/EA fails to provide adequate information on the existing biotic conditions or possible impacts on rare or endangered species or natural communities. The draft EIR/EA cites a "biotic assessment" by Dean Taylor and Richard Buckberg (1987) as the basis for the discussion on vegetation. However, this study was conducted at an inappropriate time of year (winter), without an appropriate level of study for impact analysis (D. Taylor, personal communication, 8/27/87). According to Dr. Taylor, these limitations are stated in his report, which was intended to be only a general scoping study. Although other supporting data were attached as appendices, the "biotic assessment" was not attached.

A detailed rare plant survey report which follows guidelines provided by the California Department of Fish and Game should be prepared to serve as a data base for assessing potential impacts to rare plants. (CEC)

RESPONSE: The following is quoted from Taylor and Buckberg (1987):

"Based on the array of species and habitats of rare plants known for the eastern region (Table 2), we can offer two lines of evidence why we feel occurrence of specific species on the Casa Diablo Hot Springs study site would not be expected given current information."

"History of Botanical Collecting – the site, located adjacent to highway, has often been visited by botanists passing through the eastern Sierra region. The first collecting of which we are aware (through personal communications and herbarium research) was in the 1930's, when John Thomas Howell and Alice Eastwood, and Frank Peirson collected along Highway 395 and in the Mammoth Area. Eastwood and Howell visited Casa Diablo Hot Springs, but found no rare species there. The Eastwood and Howell collecting trips were effective explorations, as several previously unknown species were discovered (including Lupinus duranii, Astragalus monoensis, and A. joahnnis-howellii). Peirson's collecting in the Long Valley region was also thorough, for example, he discovered Pedicularis crenulata var. candida growing at Convict Creek."

"Other botanists, including Dean Taylor and Mary Dedecker, have also collected at the site in the past, without noting rare plants."

"Array of Habitats and Geography – the availability of habitats for rare plants on the site are seemingly such that potential habitat for several candidate species ... is absent. The Mono milkvetch (Astragalus monoensis) is known to occur about one mile to the north of the Casa Diablo area, but we did not observe this species on the study. At the time of our survey, A. Monoensis plants, although dormant, were evident and easily recognized as observed at nearby populations, indicating that we would have detected any populations on the site. The habitat for this plant, the pumice soils with moderate to low sagebrush cover, occurs on the northern portion of the site, but A. monoensis is apparently absent there."

"Others of the species .... (which could occur in the area) are typical of hot springs or alkaline meadow areas in the Eastern Sierra. Occurrence of these species on the Casa Diablo Hot Springs site was not documented in this survey, nor have there been historical reports of these taxa from the site."

"Two species occurring in the Mammoth region for which detailed habitat information is lacking, Mammoth Lupine (Lupinus sublanatus), last seen in 1935 and known only from the type collection, and Pine City stonecrop (Sedum pinetorum), last seen in 1913 and also known only from the type collection, are unlikely to occur on the site. The Mammoth Lupine is known from a single collection near the "Earthquake fault" along Highway 203, while the sedum was collected in the montane forests west of Old Mammoth (the sedum was once thought to occur only in Mexico, but this supposition is erroneous)."

COMMENT:

Page 4-34, last paragraph. What is the name of rhyolite buckwheat? Is it state listed? Who determines if a plant is botanically sensitive? (BLM/USFS)

RESPONSE: Rhyolite buckwheat, Erigonum kennedyi var. purpursii, is not listed by the state or federal agencies. The rhyolite buckwheat scrub community includes many herbs, the most important being pussy-paws (Calyptriduim Umbellatum), locoweed (Astralagus purshii), and cheatgrass. This plant community is restricted to present or formerly thermally affected soils and is essentially limited to such areas in the eastern Sierra region (Taylor and Buckberg, 1987). It can be considered a botanically sensitive area using California Department of Fish and Game, Data Base Criteria (see Holland, 1986).

COMMENT:

Information should also be provided regarding disturbance to areas identified as "thermal marsh" and mountain meadow communities, as these may be wetlands and thus subject to state and federal policy.

All wetland areas should be completely avoided. Wetlands areas that have been degraded without federal permits should be rehabilitated. (CEC)

RESPONSE: No impacts to these communities are expected.

COMMENT:

Page 4-35, paragraph 2. We have worked closely with a Subcommittee of the Owens Valley Interagency Council ("OVIAC") and representatives of Mono County on landscaping of the operating plant. We have always agreed with and continue to completely agree with, the need for landscaping, but believe that the following points should be acknowledged:

A) The soil in the area is infertile with low moisture holding capacity which inhibits rapid plant growth in the relatively short growing season available.

B) There are natural open areas where vegetation currently does not grow. These areas are especially hard to revegetate.

C) The project area is geothermal in character and there are considerable portions of the area where the surface or sub-surface ground temperature is high enough to kill vegetation. It will not likely be possibly to establish vegetation to grow in these already denuded areas.

D) Fencing can be used in some, but not all, locations for effective screening of pipelines because of terrain. There are certain number of plants and trees that will necessarily have to be removed by reason of selection of the proposed alternate plant site. We propose, wherever feasible, to transplant existing trees to other locations including the existing plant site so as to improve the overall landscape. However, it should be noted that Jeffrey pines are difficult to transplant successfully, and it may be more practical to plant seedlings. (MP)

RESPONSE: Comments noted. Growing conditions would limit good plant growth.

COMMENT:

Page 4-36. Seedling survival should be monitored and if less than 75% of seedlings have survived, then replacement planting should be conducted. Three years is much too long. (FS and LJ)

RESPONSE: A 75% survival rate seems high and optimistic for the region and the species to be used for revegetation. A more realistic percentage should be about the 50% survival level -- this is a typical percent for revegetation work in the western United States, especially in nutrient poor soils of the Great Basin.

It is agreed that a three year long monitoring period to determine seedling survival is long. Two growing seasons, should be used to determine seedling production and survival.

COMMENT:

Page 4-37, paragraph 1. States the pipeline from wells MP 12-32 and MP 12A-32 should be moved approximately 50 feet north to avoid the botanically sensitive area to the west of the proposed power plant site. However, the pipeline route proposed would actually follow the operating plant pipeline along an existing access road and would not impact the botanically sensitive area identified in the Draft EIR/EA. Further, moving the pipeline 50 feet north would increase the visibility of the pipeline along the Bluff north of the existing MP Unit I power plant. (MP)

RESPONSE: According to the vegetation map provided by Taylor and Buckberg (1987), the pipeline would pass through an area of rhyolite buckwheat scrub (see Figures 2-2 and 3-5 in the DEIR). However, the scale of mapping makes it unlikely that areas are precisely delineated. The general mitigation (p. 4-[illegible]) that a biologist should groundtruth the locations of wells and pipelines to ensure that they would not impinge on botanically sensitive areas applies, regardless of how the details of vegetation are shown on the maps.

COMMENT:

Page 4-34. It seems to be implied in the last paragraph that the previous disturbance of three acres of the power plant site somehow softens the impact of further vegetation loss. Furthermore, the case is editorially put in a minimizing fashion. Could it not also be put that "more than 12 acres of Jeffrey pine, more than six acres of sagebrush scrub ... would be directly affected?" This instance is characteristic of the recurrent pro-project tone of the entire document. (SC)

RESPONSE: The acreage of the disturbed area is included for completeness. The phrase "up to 13 acres ..." is used to provide an upper limit; "... more than 12 acres" is meaningless, since it could be 13 acres or any larger number. The logical question which follows would be "how much more than 12 acres?"

COMMENT:

Page 3-34. Complete botanical (and faunal) knowledge should have been obtained for the leasehold and included within this DEIR. (SC)

RESPONSE: A biotic survey of the site was conducted in 1986 by Taylor and Buckberg. That document is available at the BLM office in Bishop and at the Mono County Energy Management Department in Mammoth Lakes.

TERRESTRIAL WILDLIFE

COMMENT:

The draft EIR/EA should identify wildlife species that occur on or near the project site. Specific information on the occurrence of Sage Grouse on the project site (as opposed to a general discussion about the regional occurrence) should be provided. (CEC)

RESPONSE: See Section 4.1.2.2, page 4-37. Discussions with USFS grouse experts indicated that the project site receives little sage grouse use.

COMMENT:

Page 3-37: A more accurate picture of deer migration over the Sierra Crest would include mention of Deadman Pass and San Joaquin Ridge as key migration routes.

Additional discussion of the importance of spring migration habitat to herd viability is required. The fact that does are carrying fawns in the spring and therefore are particularly vulnerable to stresses and disturbances, such as new developments on or near migration pathways, should be stressed in the discussion. (CDFG)

RESPONSE: Deer probably migrate over both Deadman Pass and San Joaquin Ridge. Neither area would be directly impacted by the project. Acknowledged. Does carrying fawns may be more vulnerable to stress during migration than other deer.

COMMENT:

Page 4-38. I have personally observed over 250 mule deer during spring migration/staging in the riparian area along Mammoth Creek just below the bridge over 395. The mule-deer study makes no reference to the impacts on these animals due to noise during construction and operation. Its focus is too site specific when it only considers the dozens of deer that may pass directly thru the project site. (FS and LJ)

RESPONSE: The riparian area below the 395 bridge is over 0.5 mile from the project site. Construction noise is not expected to significantly affect deer migration. Deer currently migrate past the existing MP I during operation.

COMMENT:

Page 4-38, second paragraph, third and fourth lines. The use of "directly" connotes prevention, not slowing. What are the areas impassible by deer? (BLM/USFS)

RESPONSE: By blocking passage of the deer, the power plants and associated pipelines could directly prevent deer from crossing the project site. Impassible areas may be created by the plants and other facilities.

COMMENT:

Page 4-38, fourth paragraph. Is there any data (sic) to indicate this is an effective mitigation? Where did the numbers come from? (BLM/USFS)

RESPONSE: Distance between crossings and crossing width were developed during mitigation work done for PG&E's Crane Valley hydroelectric facilities in Madera County, California. Mitigations were developed in cooperation with PG&E and CDFG personnel.

COMMENT:

Page 4-38, paragraph 4. The Draft EIR/EA suggests the applicant adopt costly mitigation measures for impacts on deer migration which are characterized in Appendix C to the document to be "trivial" even under a "worst case" scenario. Therefore, the mitigation measures appear unjustifiable. (MP)

RESPONSE: The mitigation measures are designed to offset both direct on-site impacts and regional cumulative impacts. CDFG, the responsible agency, considers potential impacts to deer an important issue.

COMMENT:

Page 4-38, paragraph 5. The Draft EIR/EA suggest the applicant consider acquisition of mule deer winter range habitat as a mitigation measure. This appears unjustifiable because: (1) the project does not specifically impact mule deer winter range habitat; and (2) the project is not expected to significantly impact mule deer. (MP)

RESPONSE: Acquisition and protection of threatened winter range deer habitat would help maintain the viability of local deer herds by protecting key elements needed for their life history. Swall Meadow is used for migration in addition to wintering.

Alternatively, for in-kind mitigation, private lands in Little Round Valley south of Lake Crowley could be purchased and protected. Consultation with CDFG and USFS would be required to determine key parcels used by deer during migration.

COMMENT:

Page 4-38, last paragraph. There is no federal land for sale on this area. The purchase of federal land would not create additional habitat. Probably not legal to require a private land owner to buy land in order to develop his own land. Please omit mitigation. (BLM/USFS)

RESPONSE: The wording of the mitigation should read: "If necessary, consider the appropriation of funds toward the purchase for transfer to federal ownership of land in the Swall Meadow area for winter range habitat, which is presently privately owned."

The goal would be to protect existing habitat which is in danger of development. The mechanism for implementation would likely require all project sponsors to make contributions to a mitigation fund which could be used to finance appropriate mitigations. This would be an appropriate mitigation to maintain the viability of the deer herds wintering at Swall Meadow and migrating through the Mammoth Lakes area.

COMMENT:

Page 4-38. Though some negative impact from pipelines and fencing is unavoidable, we concur with the stated mitigation to design these obstacles so as to minimize the impact. Even so, some migratory deer impacts will still occur through unavoidable increase in noise, visual obstructions, and physical barriers. A detailed map of pipeline routes should be included to enable specific evaluation of these problems and this measure's ability to mitigate them. Burial of 100-feet segments of pipeline also recommended to better provide for deer passage.

RESPONSE: A detailed map of pipelines, fences, and facilities would be developed in the siting and engineering phase of development. These plans would include mitigation measures required by the County.

COMMENT:

Appendix C Page C-14. We concur with the methods and findings of the deer migration study. However, the interpretation that deer show preference for the less developed portions of the area is substantiated by prior collection of information by the Department of deer migration. Considering historic deer migration use, a more accurate interpretation would be that deer actively avoid the existing MP I power plant due to noise and visual impacts and the presence of substantial physical barriers in the form of fences and pipelines. This avoidance response effectively results in project impacts to deer use area beyond that physically occupied by project features.

Appendix C, Page 7, C-19. The apparent avoidance of existing development by deer demonstrates the importance of fully considering cumulative impacts of additional projects such as MP II and MP III. As projects multiply, habitat options for various wildlife species decrease, unavoidably causing stress and direct losses to wildlife populations. To quantify such losses, we recommend that all geothermal development project approvals in the area be kept in abeyance until an areawide study of cumulative impacts to all natural resources, including deer, can be completed by the permitting authority. Such a study would allow decision makers to recognize those projects which provide for retention of aesthetically and economically important natural resources and those that do not. (CDFG)

RESPONSE: We acknowledge and concur with CDFG's interpretation of the deer migration study. We agree that cumulative impacts from geothermal and other developments in the Mammoth Lakes areas could be significant, and that a thorough study of potential cumulative affects is needed; however, it is beyond the scope of this project.

COMMENT:

Page 4-67. Due to its greater unavoidable impacts, we oppose the alternative location proposal. (CDFG)

RESPONSE: Noted.

COMMENT:

Page A-3 (Appendix): We concur with the environmental checklist, item 5-C, that the project will result in a barrier to animal movements. This impact is not mitigable to a level of non-significance. (CDGF)

RESPONSE: Noted. Based on the deer migration study, we believe the mitigations could reduce potential impacts on animal movements from this project to a non-significant level.

AQUATIC RESOURCES

COMMENT:

Appendix A-3, (Initial Study), #5 Animal Life. This project has the potential to change the diversity and/or number of species of animals present throughout the Long Valley KGRA, not only within the project area as stated in the document. However, it has not yet been determined if there exist within this potentially affected area any unique, rare, or endangered invertebrate species. Therefore, it is necessary to survey all hot springs, artesian springs, and surface waters in the Long Valley KGRA in order to inventory all aquatic oriented animals including fish, reptiles, amphibians, and invertebrates. (CDFG)

RESPONSE: The suggested study is beyond the scope of this document.

COMMENT:

Page 3-40, paragraph 2. A report titled Biological Assessment of Proposed Geothermal Energy Development in Casa Diablo Hot Springs Area on the Owens Tui Club (Gila bicolor snyderi) and Hot Creek Headsprings Refugia, August 1987, has been submitted for review by the U.S. Fish and Wildlife Service in conformance with Section 7 of the Endangered Species Act. The submitted report can be fairly and succinctly summarized by stating that the proposed development will have no significant impact on the Tui Chub. (MP)

RESPONSE: Acknowledged.

COMMENT:

Page 3-40 and 3-41. Delete all references to "hot" springs at the Hatchery. (BLM/USFS)

RESPONSE: Comment acknowledged. The springs at the Hot Creek Hatchery may not be considered hot but are warm relative to above-ground surface waters in the area.

COMMENT:

Page 4-39. Replace mitigation listed in paragraph four with the mitigation in paragraph two referencing Section 4.1.1.1. in the DEIR.

RESPONSE: Comment noted. The erosion and sedimentation control procedures, however, do not adequately answer to the problem of hazardous material spills; therefore, the presently stated mitigation measures should remain in place.

COMMENT:

Page 4-40. Require applicant to restock trout in the sections affected by a spill. (BLM/USFS)

Page 4-40. The detrimental effect (of a spill reaching Mammoth Lake) on the catch and release section due to trout mortality from high water temperatures would be severe. In that event, a census of number and size of destroyed trout should be taken, and the same size and species of fish replaced by the proponent responsible. A similar mitigation should apply to impacts that may occur at the hatchery.

Page 4-61. A significant mortality of trout in Hot Creek is not a temporary effect. (FS & LJ)

RESPONSE: The following mitigation should be added on page 4-40:

- Require the project sponsor to restock trout in the sections affected by a spill.

COMMENT:

Page 4-42. Could pipe water from injection lines to hatchery and not increase withdrawal of fluids. (BLM/USFS)

RESPONSE: Noted. This would reduce the level of injection support to the injection reservoir. Supplying geothermal water to the hatchery would require use of geothermal fluid, whether it resulted from increased production or decreased injection.

COMMENT:

Cumulative biological impacts of geothermal development in the Long Valley Geothermal Resource Area are not adequately addressed. A study of the cumulative biological impacts of this and other developments in this area should be completed prior to the approval of any additional power plants, and should be included in the data used to determine the cumulative impacts related to the proposed project. (CEC)

RESPONSE: Cumulative impacts relating to proposed projects near Mammoth Lakes are discussed in the DEIR (see pages 5-11 and 5-12). Cumulative biological impacts of geothermal development in the entire Long Valley Geothermal Resource Area is beyond the scope of this document.

COMMENT:

Cite experience at the Geysers to discuss changes in aquatic fauna (CDFG).

RESPONSE: Siltation of salmonid spawning gravels and decreased food production in the form of benthic invertebrates are of particular concern at the Geysers. The steep slopes characteristic of the area are susceptible to erosion and landsliding and spills travel rapidly on the steep slopes. This impact is less severe at Casa Diablo because the topography is gently sloping and there are fewer perennial streams to be affected. In particular, the spill control measures suggested by the project sponsor for MP II & III should be sufficient to stop fluids from reaching Mammoth Creek.

Spills at the Geysers have been primarily geothermal steam condensate and chemicals being transported to the plant sites. Condensate spills accounted for 82% of the spills from 1974 to 1984. About 2% of the spills were materials used for H_2S abatement and in the treatment of condensate (Warner et al., 1986). At MP II & III, the geothermal fluid would be circulated in a closed system and the working fluid would be air cooled, so there would be no condensate nor would treatment of it be necessary.

Baseline studies of aquatic fauna at the Geysers are available; but, in the time available since receiving the comment, we have not been able to obtain studies which document the effects of spills on aquatic fauna.

SOCIAL ENVIRONMENT

VISUAL RESOURCES

COMMENT:

Page 3-46. MP II, III will contribute to the continued degradation of the Highway 395 scenic corridor. (FS & LJ)

RESPONSE: Noted.

COMMENT:

Page 3-42, paragraph 2. Replace paraphase of GRO Order 4 with a direct quote. GRO Order 4 states that "The lessee shall reduce visual impact, where feasible, by the careful selection of sites for operations and facilities on leased lands. The design and construction of facilities shall be conducted in a manner such that the facilities will blend into the natural environmental setting of the area by the appropriate use of landscaping, vegetation, compatible color schemes, and minimum profiles. Native plants or other compatible vegetation shall be used, where possible, for landscaping and revegetation." (BLM/USFS)

RESPONSE: Noted.

COMMENT:

Page 3-42, paragraph 3. Delete the existing paragraph under Forest Service Plans and Policies. Add the following to the preceding BLM discussion. "The BLM's Lease Block I

Environmental Analysis and subsequent geothermal lease stipulations designate the proposed project site, and most adjacent areas along Highway 395, as Visual Resource Constraint Level 2. This constraint level requires that surface occupancy for high impact geothermal activities should be "...excluded unless surface management concerns can be mitigated." (BLM/USFS)

RESPONSE: Acknowledged. Make the appropriate changes to the text of the DEIR.

COMMENT:

Page 4-43. Change mitigations to read: "Paint long-term equipment to blend with the surroundings." (BLM/USFS)

RESPONSE: Agreed.

COMMENT:

Page 2-28. New electrical transmission lines should be buried adjacent to road easements. (FS & LJ)

Page 4-43. All new power transmission lines should be underground to reduce visual impacts with revegetation of disturbed soil. (FS & LJ)

RESPONSE: Noted. Burial of power transmission lines would reduce their visual impacts. The lines could also be carried in conduits along pipelines, which also would remove them from the overhead visual environment without additional disturbance of soil and subsequent need for revegetation which burial would require. An additional mitigation should read: "Electrical transmission lines should be buried or should be conveyed in conduits along pipelines."

COMMENT:

Put all fluid transmission lines below grade. (PC)

All pipelines should be below grade. (PC)

Fluid conveyance lines should be concealed behind berms along adjacent road easements. (FS & LJ)

RESPONSE: Berms or trenches could be used to screen pipelines from view, but this was not suggested as a mitigation for the following reasons:

- Excavation to build the berms and or trenches would disturb the soil and change the topography over an area approximately 20 to 30 feet wide along the pipeline. If all project pipelines (including those traveling along existing pipelines) were bermed, this would result in a disturbance of up to five acres. The slope of the disturbed area would be relatively steep, causing an increase in erosion rates. The slopes could be revegetated, but it is possible that to maintain the berm height, maintenance grading would be required. In that case, the soil would be disturbed in the long term.

- Natural drainage patterns would be disrupted and water channeled along pipeline routes.
- The pipelines would be less accessible for maintenance and inspection.
- If pipelines were near berm walls, the pipelines could be damaged by contact with the berms during an earthquake.
- Shallow bedrock in parts of the project area could substantially increase the difficulty of berm construction.

COMMENT:

Page 4-44, first mitigation. Add "pipelines" to list. Also add sentence : "Utilize existing vegetation to screen intrusions from critical viewshed points." (BLM/USFS)

COMMENT:

Page 4-43, first paragraph. Grading for pads and access roads can alter the landscape form more than "slightly," depending on slope and layout. (SC)

RESPONSE: The site is one of relatively low relief and should not require significant topographic changes.

COMMENT:

Page 4-44, sixth bullet. Not beneficial visually or practically as snow tends to destroy fences. (BLM/USFS)

RESPONSE: Noted.

COMMENT:

Page 4-44, last bullet. Exterior light should be directed inward and downward toward work areas, should be shielded so that no light shines outward nor upward, and should be equipped with operational switches so that light may be turned off when not needed. (SC)

RESPONSE: Noted.

COMMENT:

Page 4-46, fourth line. What other mitigations? (BLM/USFS)

RESPONSE: The sentence should read: "These mitigations..."

COMMENT:

Page 4-46. The draft EIR/EA states that even with mitigations the plant would be noticed by casual observers and the project would therefore be inconsistent with the Visual Management Objective of "retention." However, the text does not state whether this inconsistency would constitute a significant environmental impact. The document should make a determination on this issue.

Page 5-14. The document described the cumulative visual effect of the project in combination with the existing Mammoth Pacific I project and the proposed PLES I project. However, it does not assess whether this impact would constitute a significant environmental impact, either before or after mitigation. (CEC)

RESPONSE: See page 5-1. The impact would be significant, even after mitigation.

COMMENT:

Page 3-46. In general, MP I is a very poor example of the proponents' sensitivity to the high visual quality associated with the Eastern Sierra region. I feel it is audacious on their part to include "the existing geothermal development" as part of their justification of the other visual pollution in the area.

In light of Mammoth Pacific's track record in this area, a full and detailed visual impact analysis, including revegetation and the use of berming, etc. should be submitted prior to the issuance of the CUP. (FS & LJ)

RESPONSE: Noted.

COMMENT:

Page 2-22. The alternative plant location seems to be less visually sensitive as it can be partially screened by existing Jeffery pines. This would be a preferred location. (FS & LJ)

Page 4-44. The alternate site for MP II, III should be used to reduce its visibility. (FS & LJ)

Page 4-46, paragraph 2. Based on further review, we agree with the recommendation of others to relocate the proposed plants about 400 feet east (alternate power plant site) of the initially proposed site in order to take advantage of the screening effect which would be provided by existing mature trees. We have also decided to reduce the visual impact of the existing plant by putting redwood slats in all of the chain link fence around the plant as well as all existing and proposed well sites that would be visible from public roads in the area. (MP)

RESPONSE: Noted.

COMMENT:

Page 5-1. As the MP II, III geothermal power plants are in direct conflict with the USFS VMO of "retention," I urge that the no-project alternative be adopted.

RESPONSE: Noted.

COMMENT:

Pages 5-12 and 5-14. Is the appearance of an "industrial park" type of viewscape appropriate for Eastern Sierra visitors just as they are exiting 395? Since recreation is certainly the emphasis of our regional economy, and further geothermal development and the continued industrialization of the Long Valley area is in direct contract with these economic and aesthetic values, we strongly recommend a no-project alternative for Mammoth Pacific II and III. (FS & LJ)

Pages 5-14 to 5-15. The document should assess whether the cumulative land use effect of "transforming several undeveloped areas to industrial uses" would be a significant environmental impact, even though it would be consistent with Mono County and Inyo Forest Plans except for the Visual Management Objectives for the area. (CEC)

The document should discuss the effect of industialization of Long Valley. (DD)

RESPONSE: Recommendation noted. The degradation of visual quality at Casa Diablo due to the construction of the project is not likely to have any adverse impact on the regional economy (see discussion under Economics on page 52 of this document). The industrialization would not be any more or less significant in terms of visual impact than other forms of development in the Long Valley area. Agricultural development or urbanization or resort development, for example, would not be prefereable to industrialization from the perspective of retaining a high quality, natural visual environment characteristic of the Eastern Sierra. Therefore, the issue confronting decision-makers is how to balance changes in the visual environment in the Long Valley area, whether they are caused by cooling towers, control towers, multi-story buildings, or large areas of unnatural vegetation, against economic effects of proposed projects.

The impact is significant because it is inconsistent with the VRM [illegible]. It is not important that the structure [illegible] be considered "industrial".

SOCIOECONOMICS - LAND USE

COMMENT:

Page 3-48, Figure 3-8. Delete USFS designated range from map because grazing allotments cover almost all the map. Change USFS Lease Block 1 to BLM Lease Block 1. (BLM/USFS)

RESPONSE: Noted.

COMMENT:

Page 3-49. Add gasoline storage tanks owned by Chevron to list of land uses. (BLM/USFS)

RESPONSE: Noted.

COMMENT:

Page 4-46. The draft EIR/EA states that the project is compatible with current County and United States Forest Service plans, with the exception of the applicable visual resource management policies. However, the text does not discuss whether the project would conflict with existing and planned land uses in the area. Conflicts with recreational uses are of particular concern and should be addressed.

RESPONSE: No land uses are planned nearby other than the PLES I Geothermal Project proposed for immediately south of the MP II & III site. No recreational uses are planned for the area.

SOCIOECONOMICS - HOUSING

COMMENT:

Page 4-47. The number of temporary and permanent housing units in the area as well as the vacancy rate for each category should be specified. Given the lack of data on how many workers will be from the local area, the population figures used to determine the additional housing required should be calculated on the minimum local employment scenario. Alternatively, an analysis of workers needed by trade compared to locally available workers in those trades could provide a more specific estimate of nonlocal employment and thus housing needed. (CEC)

RESPONSE: The large local construction sector and the high percentage of entry level jobs indicate a strong likelihood of local area employment (see 3.3.2.3 and Table 3-10). The minimum local employment scenario (page 4-47) is presented as a worst case; it is unlikely to occur.

The immediate housing market is about 11,000 housing units. About 4,500 are used as permanent housing and 6,500, mainly condominium units, as temporary housing. The vacancy rate for permanent housing is around 2-3%. The vacancy rate for temporary housing varies greatly with the seasons and day of the week. The lowest vacancy rates occur during the weekends of the winter skiing season and the highest during the weekdays in the spring and fall.

COMMENT:

Page 4-48, paragraph after Table 4-14. This infers that a demand for housing is a negative impact, however this may not be the case during certain seasons and bad snow years. (BLM/USFS)

RESPONSE: Noted.

COMMENT:

Page 4-48, bullet at bottom of page. In the interests of the reduction of housing needs, construction activity should also be timed so as not to coincide with Mammoth/Chance construction nor PLES construction if these projects are implemented. (Sierra Club)

RESPONSE: Were the period of construction activity to be significantly lengthened, with the construction workers moving on from one geothermal project to the next over several years, the character of the construction workforce's housing demands would change from the abundant, temporary nonwinter housing to less abundant permanent housing causing a greater demand for housing construction.

COMMENT:

Page 4-48. The EIR/EA states that construction of some additional housing can be expected due to the project. However, the text does not state whether this additional housing would constitute a significant environmental impact. The document should make a determination on this issue. (CEC)

RESPONSE: See page 5-1. The impact on housing is not significant.

COMMENT:

Page 5-14. The document states that "simultaneous construction of two plants could tighten the housing market." The document should quantify the effect on the housing market and assess whether this effect would constitute a significant environmental impact. The EIR/EA should also provide the specific reasons(s) for including only Mammoth Pacific II & III and PLES-I from among the proposed projects in the Mammoth Lakes area in the assessment of cumulative housing impacts. (CEC)

RESPONSE: The cumulative demand for housing from all five proposed geothermal plants would be about 30 units, less than 0.7% of the permanent housing market and less than 0.3% of the overall housing market. The overall impact on housing would not be significant.

Simultaneous construction of two geothermal plants could temporarily tighten the market for nonpermanent housing with a worst case of an average of 96 workers seeking temporary housing, peaking with 164 workers (see Section 4.1.3.2.2), while this demand could prevent rents from falling to their usual off-season lows, its temporary nature would not provide an incentive for developing additional housing. The increased demand would not result in a significant environmental impact.

SOCIOECONOMICS - ECONOMICS

COMMENT:

There should be much more economic detail, especially about the direct costs and benefits of the project to the County. (Planning Commission)

Page 4-52. It is suggested that the proposed plants, MP-II and MP-III, will generate costs that are greater than the funds that will be received by the county and special fees should be charged to cover costs for services provided. On page 3-54, section 3.3.2.4. County Fiscal Considerations, it is noted that the County receives 20% of the geothermal lease and royalty revenues from federal lands within its borders. In the economic impact section (page 4-51), no mention is made of funds the county will receive from the geothermal wellfield located on Federal Lease Number CA-1667A which will supply

MP-III. It is estimated that MP-III would generate about $100,000 in Federal County of Origin funds during the first full year of operation for the County. The adjoining PLES-I development on Federal Lease Number CA11667 would also generate about $95,000 for the County in County of Origin funds. Annual property taxes on the MP-II and MP-III are estimated at $300,000 per plant, plus taxes from MP-I and PLES-I are estimated at $500,000. Therefore, the proposed plants at Casa Diablo would provide over $1.3 million annually in revenue to the County. Given these funds, the total development at Casa Diablo could generate approximately 10% of the County's operating income. Using the County labor force figure of 5,559 as shown on page 3-52, less than 1% of the County's labor force (i.e., less than 56 people) would be employed at Casa Diablo. On this basis, it appears that the proposed projects would be paying ten time its proportional share based on employment. On an income-revenue basis, these proposed plants appear to be very advantageous to the County. (MP)

RESPONSE: Geothermal lease and royalty revenues to the county are mentioned on page 4-51 and explained on pages 3-53,54. With information now available from the project sponsor, the estimated annual geothermal lease revenues to the county for one plant in full operation could range from $80,000 to $160,000, with $100,000 as a likely figure. With both plants in operation, the revenues could range from $160,000 to $320,000 with $200,000 as a likely figure. The revenues from other geothermal plants (MP I and PLES I) are not relevant in addressing the revenues expected from MP II and MP III (see Table 1).

The community service providers have indicated that, except for firefighting equipment for the fire district and an Environmental Compliance Office and equipment for the County's Energy Management Department, they have the capacity to handle the increase in services required without and increase in staff or significant equipment needs. Thus the actual increase in county costs as a result of just MP II and MP III would be very low (see Table 2).

An alternative method of estimating community service costs is to use the per capita cost of the general budget. This method would overstate the actual cost of the Mammoth Pacific project by itself, but may be justified in a more cumulative perspective (see Table 3). Based on the 1985-86 General Budget, the county expenditures were about $13,500,000 and the county population was about 9,200. Therefore, the per capita expense was approximately $1,500. The worst case scenario, with no local hiring, has the population increasing by an average of 108 persons for 9 months during the construction phase of each plant, and by 14 persons during the permanent operating phase. Based on a per capita expense of $1,500 per person, the annual county expenditures would be about $122,000 ($1,500 per person per year x 108 persons x 3/4 of a year) during construction of MP II; $143,000 ($1,500 per person per year x 108 persons x 3/4 of a year + $1,500 per person per year x 14 persons x one year) during MP II operation and construction of MP III phase; and $42,000 ($1,500 per person per year x 28 persons x one year) during the operational phase. See Table 4-14 for population estimates.

In addition, based on property tax per student, the local cost of each student is $2,400 per year. The greatest concentration of construction workers would occur in the summer when school is out, however, the worst case costs would be $86,400 ($2,400 x 36 students) during construction of MP II, $96,000 ($2,400 x 40 students) during operation of MP II and construction of MP III, and $19,000 ($2,400 x 8 students) during the operational phase. See Table 4-15 for student population estimates.

Annual general expenditures and school expenditures would be about $239,000 during operation of MP II and construction of MP III, and $61,000 during the operation phase. Annual lease and tax revenues during the operation phase would be about $670,000 (see Table next page).

It should be noted that the geothermal lease revenue is restricted in how it can be spent, and that the tax revenue is divided between the county, the school district and special districts. Of the $470,000 in property tax revenue, about $211,000 would go to the county, about $155,000 to the school district and about 131,000 to special districts. The greatest costs to the county would occur during the construction phase and the greatest revenues during the operational phase. Whether the project is financially advantageous to the county is dependent upon the loss, if any, of geothermal heat/water to Hot Creek Gorge and the Hot Creek Fish Hatchery

TABLE 1: ECONOMIC BENEFITS

MONEY PAID DIRECTLY TO COUNTY

Annually

Geothermal lease	$200,000
Property Tax	$470,000
TOTAL ANNUAL LEASE AND TAX REVENUE	$670,000

One Time

Fees are unknown but expected to cover costs
Contribution to Special Mitigation Fund unknown. It may cover one-time fire mitigation payment, cost of supporting LVHAC and monitoring program, cost of an Environmental Compliance Officer and equipment, and other mitigation measures may be be jointly funded by project sponsors in the area.

MONEY SPENT IN LOCAL AREA

Direct Spending	$300,000
Local Employee Payroll	$1,100,000
Spending by Non-local Employees	$1,000,000

TABLE 2: POTENTIAL COSTS

	Annual/a/	One-time
Police	Nil	Nil
Medical	Nil	Nil
Fire	Nil	$30,000
School	$500-2,400 per student	Nil
Water	Nil	Nil
Waste	Nil	Nil
Administration	$34,000	$3,000
Hatchery/b/	0 to $19,000,000	Nil
Recreation at Hot Creek/c/	0 to $1,000,000	Nil
Visual Degradation	Nil	Nil
Permit Processing	Covered by Fees	

/a/ Nil does not indicate Zero Cost, but a cost that is not considered significant by the service providers.
/b/ $19,000,000 is loss associated with complete loss of hatchery.
/c/ The $1,000,000 assumes complete loss of usage of Hot Creek, fishing, swimming, guided tours and sight seeing, and does not include the loss of about $2,000,000 in angler days already incorporated into potential loss from the Hot Creek Hatchery. It is expected that the monitoring plan and mitigation measures would not allow this to occur, but it remains a potential impact.

TABLE 3: WORST CASE PER CAPITA COSTS

	Construction	MP II operation operating Per Capita Costs of MP II	MP III construction phase
County	$122,000	$143,000	$42,000
School	86,000	96,000	19,000
TOTAL	$208,000	$239,000	$61,000

COMMENT:

Page 4-52. This is abit hard to swallow considering we're talking about a short-term influx of a max 200 employees and a probable long-term influx of 12 employees in a town that caters to over 20,000 skiers a day in the winter (which equals approximately 30,000 people). (BLM/USFS)

RESPONSE: Noted.

COMMENT:

EIR should more fully discuss economic value of hatchery to the County. (CDFG,LJ)

RESPONSE: See pages 3-51, 3-52, 3-53, 4-49, and 4-50 in the Draft EIR.

COMMENT:

Mammoth Pacific should post bond to cover abandonment or any damage to aquatic resources. (LJ)

EIR should provide a full discussion of a bond or other mechanism being posted to cover any loss in hatchery production or aquatic fauna. CDFG recommends the posting of such a bond. (CDFG)

RESPONSE: Comment noted. The posting of phased bonds to cover costs in case of abandonment is a fairly common construction practice and should be considered as a possible fiscal mitigation. The posting of a full bond for all possible damages to aquatic resources would not be economically feasible. Such a bond might be in excess of $200 million.

COMMENT:

Page 4-49, third paragraph. There are very few trout at the gorge hot springs per se. (BLM/USFS)

RESPONSE: Noted.

COMMENT:

EIR should discuss economic loss due to degradation of visual environment.(LJ)

RESPONSE: Because the site is not a tourist destination, is not visible from the nearby tourist destinations (e.g.,Hot Creek Gorge, Shady Rest Campground, Sherwin Creek Campground, and Little Antelope Valley) and the view from near the site also encompasses numerous other man-made visual features (e.g., Mammoth Pacific I, electricity transmission lines, gas and propane storage tanks, county impound yard, and the Southern California Edison Substation, see 3.3.1.4, p. 3-46), there is unlikely to be an economic loss due to changes in the visual environment.

COMMENT:

EIR should give cost to administer and monitor geothermal projects. (LJ)

RESPONSE: As stated in 4.1.3.2.3, p. 4-52, the county's experience with geothermal projects has not been extensive enough to estimate all costs. However, a $2,000 application fee is paid for processing the use permit and a 2 1/2% of total EIR cost for processing the EIR, about $2,000. The actual cost of processing the EIR, however, may be closer to 5% of total cost. A noise meter costing $2,000 to $3,000, and an Environmental Compliance Officer (full-time for the first year, part time for following four years) with an annual full-time cost of about $24,000 in wages and $10,000 in fringe benefits annually for full-time work, would be required if the MP II & III project is approved. No additional personnel or equipment is believed to be required if PLES I and the Mammoth/Chance geothermal projects are developed, although if these other projects are also built, their sponsors would contribute funds to support the Compliance Officer. The Mono County Energy Management Department and the geothermal developers are currently discussing a mitigation payment by developers for these costs, the division of which between producers would be based on Megawatt production. The Geothermal Lease Fund provides 40% of the funding for the County's Energy Management Department.

SOCIOECOMONICS - PUBLIC SERVICES

COMMENT:

Page 5-3. The EIR/EA should provide the specific reason(s) for including only Mammoth Pacific II & III PLES-I from among the proposed projects in the Mammoth Lakes area when assessing cumulative impacts to public services. (CEC)

RESPONSE: See page 5-3 in the Draft EIR.

COMMENT:

Page 5-14. The EIR/EA state a that the cumulative public service demand caused by the simultaneous construction of two plants "would probably exceed a 'threshold' level and require the addition of fire, police and school personnel." These potential impacts should be quantified, their significance assessed, mitigation discussed, and the significance of residual impacts described. (CEC)

RESPONSE: As stated, the effects "would probably exceed a threshold level". Supervisory personnel for police, fire and school services indicated that the addition of personnel and equipment (except fire equipment) is not likely to be required and that the exact point of addition can not be quantified. Quantification of the impacts in terms of the number of construction workers, operators and family size can be derived by multiplying the figures found in 4.1.3.2.2, p. 4-46,47,48. Except for fire services, these impacts would not be significant.

COMMENT:

The draft EIR/EA should address methods for disposal of liquid or solid waste that could result from construction or operation of the proposed facility. Some wastes may be hazardous and require special disposal practices. (CEC)

RESPONSE: Disposal of liquid waste would be handled by pump truck and solid waste by other truck (see page 4-11). All waste, including potentially hazardous wastes would be handled in accordance with the standards of the Lahontan Regional Water Quality Control Board and disposed in an appropriate method at a legal point of disposal. The exact method of removal and disposal of any hazardous material would depend on the nature of the hazardous material involved and the extent of any contamination. Reserve pits (see page 2-9) and bermed, emergency containment basins (see page 4.7) would be in place to hold the wastes. The need for and emergency spill containment plan is noted on page 4-2. Properly handled, the effects of disposal operations are not expected to cause a significant environment effect in and of themselves.

COMMENT:

Page 3-57. The area is rated as a high fire hazard as a result of seasonal conditions, not all the time. Mutual aid agreements are illegal. (BLM/USFS)

RESPONSE: Fire hazard noted. Neither the USFS nor BLM participates in the state-wide Master Mutual Aid Agreement. The USFS can and does enter into cooperative agreements with surrounding fire jurisdictions. The phrase "or cooperative" should be inserted after "Mutual aid".

COMMENT:

See attached letter from George Lucas, Chief, Long Valley Fire Protection District.

RESPONSE: Noted.

RECREATION

COMMENT:

How many visitor days occur at Hot Creek? (SQ)

RESPONSE: See page 3-59 in the Draft EIR.

COMMENT:

Page 4-61, first paragraph. Worst case analysis is not required under NEPA (or CEQA, is it?). To analyze a situation determined as unlikely in this document, 2) which would take 100 years to begin to affect this feature, 3) with a proposed early warning system and 4) mitigation such as reduce pumping, relocate injection, or ultimately plat shutdown available to us, then go directly to dryed up springs is misleading at best. (BLM/USFS)

RESPONSE: This is not necessarily a worst case analysis. It is, however, an acknowledgement that there is considerable uncertainty over how fluids move in the geothermal reservoir(s) between the Casa Diablo and Hot Creek areas. It is impossible to say that the mitigation measures would be totally and unconditionally effective at protecting the reservoir supplying the hatchery and Hot Creek Gorge.

TIMBER RESOURCES

COMMENT:

Page 4-63, fourth and sixth bullets. All these fences plus well head fences are going to add up to a big visual impact. SF 35-32 is doing just fine without a fence. (BLM/USFS)

RESPONSE: Noted.

COMMENT:

Page 4-62. The EIR/EA should assess whether the specific effect of harvesting timber due to the project would be significant either before or after proposed mitigation. (CEC)

Page 5-15. The document should assess whether the cumulative impact of harvesting would be significant either before or after mitigation. (CEC)

RESPONSE: See page 5-1. Effects on timber are not significant.

COMMENT:

Page 5-3. The EIR/EA should also provide the specific reasons(s) for including only Mammoth Pacific II & III and PLES-I from among the proposed projects in the Mammoth Lakes area in the assessment of cumulative impacts to timber resources. (CEC)

RESPONSE: No timber loss would occur with the construction of the Mammoth Chance geothermal projects. It is beyond the scope of this report to discuss timber impacts of other projects which could have impacts orders of magnitude greater than those of the geothermal projects.

CULTURAL RESOURCES

COMMENT:

Page 4-64. We had a big problem with this--all it says is we did a survey but don't know where these features are. We required another survey and found no conflicts. BLM management was not willing to approve or disapprove without knowing if a conflict existed or not. The most common mitigation in cultural is relocation and relocation can result in multiple unknown new impacts.(BLM/USFS)

RESPONSE: The second survey referred to by the commenter was done on archaeological site PLES-10 with reference to the PLES I project. This document is referring to archaeological sites PLES-8 and PLES-9. Linda Reynolds, the USFS archeaeologist who did the second survey, did not visit PLES-8 and PLES-9 during that survey (Reynolds, 1987). As stated in the Draft EIR on page 4-64, it would be necessary to visit the sites again to more precisely locate the cultural resources.

COMMENT:

Page 4-64. A qualified archaeologist with the authority to halt construction should be on-site during the construction phases to monitor and map existing or new cultural sites as well as gather data. (FS & LJ)

Page 4-65. The recommendation that "to the extent possible, an effort be made to monitor development activities that may uncover buried cultural deposits" is too vague to ensure protection of potential resources. Either a qualified cultural resources specialist should be on site to monitor subsurface disturbance, or an approved training program for employees should be required, with a qualified cultural resources specialist to be called in to assess any resources discovered during construction. If human remains are discovered, the County Coroner must be notified, and if the remains are of Native Americans, a local Native American representative must be consulted as to proper treatment of the remains. (CEC)

RESPONSE: Noted.

COMMENT:

Page 4-65, fifth paragraph. Inconsistent with the recreation section--this project is not expected to increase recreation use. (BLM/USFS)

RESPONSE: Acknowledged. Recreational use is not likely to increase. The impact should state that new roads may improve access to areas where cultural resources are located, making it more likely that the general public would find them.

COMMENT:

Page 4-65, third bullet. This would negatively affect Native American access. (BLM/USFS)

RESPONSE: Noted

COMMENT:

Page 4-65, last bullet. Ususally archaeologists would rather not make cultural sites known to the general public as it can result in increased collecting. (BLM/USFS)

RESPONSE: Noted.

COMMENT:

Page 4-66. The draft EIR/EA should address the potential depletion of thermal springs as a potential impact to the traditional Native American interests. (CEC)

RESPONSE: See discussion of monitoring program and resulting mitigation measures in hydrology section of the DEIR (pages 4-18 through 4-21) and in the response to comments on the hydrology section of this document.

TRANSPORTATION AND ACCESS

COMMENT:

Page 4-66. The traffic, including heavy equipment, created by the project should be quantified. Current traffic levels on local roadways as well as anticipated nonproject levels during construction should be quantified. An assessment should be made of the impact of project-related traffic on local traffic conditions, considering the effect of the proposed mitigation. (CEC)

RESPONSE: None of the traffic impacts of the geothermal projects would be considered significant, singly or in the cumulative case.

IV. REFERENCES CITED

Bay Area Air Quality Management District November 1985. Air Quality and Development Guidelines for Assessing Impacts of Projects and Plans. Page VI-19.

California Air Resources Board. July 3, 1987. Daily Average Emissions for Iso-Butane: ARB Emissions Data for Inventory Year 1985.

Holland, R.F. 1986. Preliminary Descriptions of Terrestrial Natural Communities of California. Department of Fish and Game, Sacramento, California.

Reynolds, Linda -- Archaeologist, Inyo National Forest. 1987. Telephone conversation September 25, 1987.

Warner, Susan et al. 1986. Storage, Transport, and Spills of Hazardous Materials in the Russian River Basin. Regional Water Quality Control Board, North Coast Region, Santa Rosa, California.

V. DISTRIBUTION OF DRAFT EIR

Bureau of Land Management
California Energy Commission
California Department of Fish and Game
Califoria Division of Oil and Gas
California State Clearinghouse
California Trout
Eastern Sierra Audubon Society
Environmental Management Associates (formerly Carey and Thomas)
Great Basin Unified Air Pollution Control District
Lisa Jaeger
Long Valley Fire Protection District
Mammoth-Pacific
Mono County Board of Supervisors
Mono County Planning Commission
Mono County Planning Department
Mono County Public Library
Regional Water Quality Control Board
Frank Stewart
Sierra Club
U.S. Fish and Wildlife Service
U.S. Forest Service
U.S. Geological Survey

VI. WRITTEN COMMENTS AND HEARING SUMMARY

August 18, 1987

Dan Lyster
Director Energy Mgt. Dept.

Please find enclosed our comments regarding the Mammoth Pacific Geothermal Development Project Units II and III. Thank you for your time and consideration.

Sincerely,

Frank Stewart

Lisa Jaeger

ABANDONMENT

pg 2-20 Sump muds should not be left in the sumps but should be disposed of at a Class II waste site if toxic

1.

Alternative project

pg 2-22 The alternative plant location seems to be less visually sensitive as it can be partially screened by existing Jeffery pines. This would be a preferred location.

pg 2-28 New Electrical transmission lines should be buried adjacent to road easements.

pg 3-21 Reduced noise levels at MP II III should be a design priority. A duplication of noise complaints associated with plant MP I is unacceptable.

pg 3-46 MP II, III will contribute to the continued degradation of the Hwy 395 scenic corridor.

pg 4-25 Air Quality -

Although the air quality within the boundries of the John Muir Wilderness area may not be affected, ... Air pollution emissions may be viewed by visitors within the Wilderness area

Pg 4-26 What will be the source of fresh-water needed to reduce construction dust. Perhaps reclaimed water from MCWD could be utilized.

Pg 4-29 No more than 250 lb/day of isobutane should be allowed to escape into the atmosphere.

Biological environment

pg 4-36 Seedling survival should be monitored and if less than 75% of seedlings have survived then replacement planting should be conducted.
Three years is much too long.

Pg 4-38

I have personally observed over 250 mule deer during spring migration/staging in the riparian area along Mammoth Creek just below the bridge over 395. The mule deer study makes no reference to the impacts on these animals due to noise during construction and operation. It's focus is too site specific when it only considers the dozens of deer that may pass directly thru the project site.

Pg 4-40

Once again - the proposed mitigation is much too vague. How will the proponent reduce the maximum flow of geothermal fluid that may reach mammoth creek in the event of a major spill of geothermal fluid (As during an earthquake)

The Detrimental effect on the catch & release section due to trout mortality from high water temperatures would be severe. In that event, a census of # and size of destroyed trout should be made.

and the same size and species of fish replaced by the proponent responsible. A similar mitigation should apply to impacts that may occur at the hatchery. A specific performance bond tied to riparian life destruction is in order.

Socian environment

pg 4-43 All new power transmission lines should be underground to reduce visual impacts with revegetation of disturbed soil.

pg 4-44 the alternate site for MP II III should be used to reduce its visability.

fluid conveyance lines should be concealed behind berms along adjacent road easements.

In general MP I is a very poor example of the ~~proper~~ proponents sensitivity to the high visual quality associated with the Eastern sierra region. I feel it is audacious

on their part to (on page 3-46) include "the existing geothermal development" as part of their justification of the other visual pollution in the area.

In light of Mammoth Pacific's track record in this area, a full & detailed visual impact analysis including revegetation and the use of berming etc. should be submitted prior to the issuance of the C.U.P.

Pg 4-61 Impact
A significant mortality of trout in Hot Creek is not a temporary effect.

Pg 4-64 A qualified archaeologist with the authority to halt construction, should be on-site during the construction phases to monitor & map existing or new cultural sites. as well as gather data.

Overview of Impacts

pg 5-1 As the MP II, III geothermal power plants are in direct conflict with the USFS VMO of "retention" I urge that the no-~~action~~ project alternative be adopted.

Cumulative Impacts

pg 5-6 As the EIR correctly points out, the probability of contamination from spills to surface water increases with each additional power plant installed or under construction. . . .

pg 5-9 Air Quality
the cumulative amt of construction time for constructing all proposed Geothermal plants of 4 years is considerable. The impact on regional air quality when viewed in this light is considerable. Perhaps tighter constraints on air ~~quality~~ quality during the construction phases is necessary.

Visual Resources

pg 5-12 }
5-14 }

Is the appearance of an "Industrial park" type of viewscape appropriate ~~for Eastern~~ Sierra visitors just as they are exiting 395? Since Recreation is certainly the emphasis of our regional economy, and further Geothermal Development and the continued industrialization of the Long Valley area is in Direct contrast with these economic and aesthetic values, We strongly recommend a no-project alternative for Mammoth Pacific I and II

Sincerely

Frank Stewart

Lisa Gaiger

THE RESOURCES AGENCY OF CALIFORNIA

Memorandum

To : Dr. Gordon F. Snow
Assistant Secretary for Resources

Mr. Daniel Lyster
Mono County Energy Management
P. O. Box 8060
Mammoth Lakes, CA. 93546

Date : August 24, 1987

Subject: SCH No. 86112408
Mammoth Pacific II & III
Geothermal Project,
DEIR, Mono County

From : Department of Conservation—Office of the Director

The Department of Conservation, Geothermal Section of the Division of Oil and Gas has reviewed the subject environmental document. Because geothermal well permits must be issued by the Division prior to drilling, we should be considered a responsible agency. We offer the following comments:

Page 1-3, Environmental Category, Geology, Geologic Hazards, and Soils:

- The following statements about the hydrothermally altered rock at, and near the proposed drill sites should be included. The area of concern has a history of impacts from previous drilling activity.

  Major Impacts: The proposed project is located in an area of hydrothermally altered rock and the well sites may be affected by unstable ground.

  Mitigation Measures: A geotechnical report for the drill sites will be required by the Department of Conservation, Division of Oil and Gas, prior to the issuance of a permit. This report should be included in the Final EIR.

  Expected Results of Mitigation: The potential impacts of drilling & production can be reduced by proper well siting and well construction determined by the geotechnical report.

Page 2-20, third paragraph: "The sumps would be drained of liquids and these liquids would be trucked to a reinjection well or, if toxic, disposed of at the Class II waste site."

Clarification is needed on this statement. The geothermal injection wells are permitted by the Division of Oil and Gas. However, the injection wells are only permitted to inject produced geothermal fluids. If the sump liquids are to be injected into the geothermal injection wells, waste discharge requirements may be required by the Regional Water Quality Control Board; this operation is not covered by the Division of Oil and Gas permit.

If you have any questions, please contact Robert Habel at the Division of Oil and Gas, Geothermal Section, 1416 Ninth Street, Room 1310, Sacramento, California 95814; telephone (916) 323-1786.

Dennis J. O'Bryant
Environmental Program Coordinator

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SEP 08 1987
MONO COUNTY
OFFICE OF ENERGY MANAGEMENT

RSH:DJO:sr

cc: R. Habel
R. Reid

United States Department of the Interior

GEOLOGICAL SURVEY

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AUG 2 8 1987

August 24, 1987

MONO COUNTY
OFFICE OF ENERGY MANAGEMENT

Dan Lyster
Mono County Energy Management Department
P.O. Box 8060
Mammoth Lakes, California 93546

RE: COMMENTS - Draft EIR/EA for Mammoth Pacific Geothermal Development Project Units II and III

The following comments are submitted regarding the subject report.

Models of Thermal Fluid Flow

The claim is made on p. 3-7 and 4-12 that the Upwelling/Fracture Flow Model implies that there is no hydraulic communication between the Casa Diablo area and thermal springs at the Fish Hatchery and Hot Creek gorge. This claim would not be valid if hydraulic communication existed between these areas via deeper, hotter reservoirs and the faults which provide conduits for upflow of thermal water. I don't feel either model precludes the potential for adverse impacts on thermal springs.

Simulated Reservoir Performance Calculations

Some discussion is needed in this section (p. 4-13 to 4-15) of the basis for assuming complete hydraulic communication between injection and production zones because the effects of injection dominate these simulations. The GeothermEx (1986) report, in fact states (p. 4-18) that it is unlikely that recharge (i.e. pressure support) is provided by reinjection because production and injection zones are separated by 500 to 700 feet of relatively impermeable rhyolite. The model results show pressure rises east of Casa Diablo - what effects would that have on spring flows?

Bulk Model Calculations

Calculations of the rate of propogation of a cold temperature front (1400 ft in 30 yrs - p. 4-16) suggest that the front could reach the vicinity of the nearest production well (650 ft) at Casa Diablo in less than 10 years. Some discussion is needed of the possbility that premature breakthrough of cold water could limit the productive life of the field. The value used in these calculations for the reservoir width should be stated.

Colton Spring Area springs

Of the three thermal springs in the Colton Spring area noted on p. 3-13, only Colton Spring itself is continuously monitored.

Fish Hatchery Area springs

Spring discharge at the Fish Hatchery appears to be relatively constant only during the late fall and winter. Continuous measurements in 1985 and 1986 show that the peak flows in July of each year were 32% and 75% greater than the wintertime flows at the AB spring group.

Mike Sorey
Research Hydrologist
U.S. Geological Survey
Menlo Park, California

The Resources Agen

Memorandum

To : 1. Projects Coordinator
Resources Agency

2. County of Mono
Energy Department
P.O. Box 8060
Mammoth Lakes, CA 93546

Date : August 26, 1987

RECEIVED

SEP 08 1987

MONO COUNTY
OFFICE OF ENERGY MANAGEMENT

From : Department of Fish and Game

Subject : Draft EIR: Mammoth Pacific Geothermal Development Project: Units II and III, Mono County - SCH 86112408

Department of Fish and Game (Department) biologists familiar with the project area have reviewed the Draft EIR for Units II and III of the proposed Mammoth Pacific Geothermal Project. We find this project poses serious certain and potential threats to the wildlife ecology of Mammoth and Hot creeks and to the existence of certain plants and animals residing in hot springs, artesian springs, and surface waters in and around the project area. Due to the overwhelming recreational values of the Mammoth Lakes/Long Valley area and the long-term adverse impacts of this project, we recommend adoption of the "No Project" alternative. Our comments on the Draft EIR are as follows:

Wildlife

Although this project by itself appears to present limited direct impacts to the wildlife resources on site, closer scrutiny of the current deer survey indicates significant cause for concern.

1. Page 3-37: A more accurate picture of deer migration over the Sierra Crest would include mention of Deadman Pass and San Joaquin Ridge as key migration routes.

   Additional discussion of the importance of spring migration habitat to herd viability is required. The fact that does are carrying fawns in the spring and therefore are particularly vulnerable to stresses and disturbances, such as new developments on or near migration pathways, should be stressed in the discussion.

2. Page 4-38: Though some negative impact from pipelines and fencing is unavoidable, we concur with the stated mitigation to design these obstacles so as to minimize the impact. Even so, some migratory deer impacts will still occur through unavoidable increases in noise, visual obstructions, and physical barriers. A detailed map of pipeline routes should be included to enable specific evaluation of these problems and this measure's ability to mitigate them. Burial of 100-foot segments of pipeline is also recommended to better provide for deer passage.

3. Page 4-67: Due to its greater unavoidable impacts, we oppose the alternative location proposal.

4. Page 4-72: We favor the "No Project" alternative in order to prevent unmitigable adverse impacts to hydrological, biological, and recreational resources.

5. Page A-3 (Appendix): We concur with the environmental checklist, item 5-C, that the project will result in a barrier to animal movements. This impact is not mitigable to a level of non-significance.

6. Appendix C, Page C-14: We concur with the methods and findings of the deer migration study. However, the interpretation that deer show preference for the less developed portions of the area is substantiated by prior collection of information by the Department on deer migration. Considering historic deer migration use, a more accurate interpretation would be that deer actively avoid the existing MP I power plant due to noise and visual impacts and the presence of substantial physical barriers in the form of fences and pipelines. This avoidance response effectively results in project impacts to deer use area beyond that physically occupied by project features.

7. Appendix C, Page 7, C-19: The apparent avoidance of [illegible] development by deer demonstrates the importance of [illegible] considering cumulative impacts of additional projects such as MP II and MP III. As projects multiply, habitat options for various wildlife species decrease, unavoidably causing stress and direct losses to wildlife populations. To quantify such losses, we recommend that all geothermal development project approvals in the area be kept in abeyance until an areawide study of cumulative impacts to all natural resources, including deer, can be completed by the permitting authority. Such a study would allow decision makers to recognize those projects which provide for retention of aesthetically and economically important natural resources and those that do not.

Fisheries

Temperature, flow, and water chemistry of the head springs of Hot Creek Hatchery.

Pressure decline within the hot producing zone due to power plant operation can affect flow patterns to other areas within the Long Valley Known Geothermal Resource Area (KGRA). Thus far wells MBP-3 and MBP-5 have shown some decline in productivity index, indicating pressure loss. However, direct pressure changes are still undetermined due to changes in monitoring equipment. Accurate measurements of pressure changes are necessary and should

be documented prior to construction of additional power producing plants. Also, additional monitoring wells, as mentioned in Section 2.3.4 (page 42-45) should operate without the influence of further development for several years to establish baseline data, and if possible, to determine whether these wells provide an accurate assessment of pressure changes due to plant operations.

We are concerned over the cumulative effects of overall geothermal development in the Long Valley KGRA on the temperature gradient throughout the basin. Although one project by itself might seem to exert no theoretical impact, we are concerned over the impact of several such projects. It must be recognized that the recreational demand on the area will increase annually, and it will be substantial over the 30-year life of the project.

Impact to Casa Diablo Geyser, hot springs, artesian springs, and surface waters.

Page 3-31. The operation of the existing MP I plant has apparently disturbed the natural discharge rate of the Casa Diablo Geyser to such an extent that since April of 1987 this geyser spring has ceased to flow. Obviously any plant or animal life which at one time relied upon this spring source has been adversely affected. Our concern over the loss of other hot springs, artesian springs, and surface waters in the area of influence of the proposed project extends to all aquatic resources present, including endemic plants and animals. An extensive basin-wide survey on all known hot springs, artesian springs, and surface waters should include all associated habitat types and provide complete lists of all plants and animals present. This is necessary, for without even listing their names and the quantity of habitat potentially to be lost as a result of temporary or permanent disruption of flows, it will be impossible to develop measures capable of preventing their loss.

Page 4-39. No impacts to the Casa Diablo Geyser, hot springs, artesian springs, or surface waters relating to loss of habitat were identified, yet the potential for this loss exists.

Discharge of hot geothermal fluids in Mammoth and Hot creeks.

Page 28, Technical Appendix: The Department documented a decrease of natural biota as the result of excessive silt from Casa Diablo thermal well discharge into Mammoth Creek in 1960. The 1962 incident further exacerbated an already existing water chemistry problem.

The document fails to discuss the provision of containment facilities in areas where pipe ruptures could release several

thousand gallons of hot geothermal fluids into creeks. The temperature effects of such a slug of hot fluid would be catastrophic to trout and invertebrate populations in Mammoth Creek, and perhaps, Hot Creek, a recognized blue-ribbon trout stream. Full recovery of the fish and invertebrate populations would require several months to a year and may never completely achieve the ecological balance present before the spill if more than temperature effects are involved.

The water quality characteristics of the fluids contained in the geothermal wells (Table 1-3) are such that they would significantly impact aquatic resources should a pipeline rupture or spill of these fluids occur. Specifically, the concentrations of arsenic (0.1 to 2.5 mg/L) and mercury (1.2 to 2.6 mg/L) pose the greatest threat. EPA's 1986 Quality Criteria for Water specifies concentrations for various water quality parameters. Arsenic concentrations should not exceed 0.19 mg/L and mercury should not exceed 0.00014 mg/L once every three years. Should an accident occur in the project area, concentrations of both these metals in existing waters could be exceeded in a relatively short period of time. The long-term impact to the downstream resources as well as to the use of these resources by sportsmen could be devastating.

Page 40 of the EIR/EA.

Proposed mitigation does not identify how the developer is to keep hot geothermal fluid from entering [illegible] the event of pipe rupture. Therefore, mitigation for this potential occurrence has not been identified.

Appendix A-3, #5 Animal Life.

This project has the potential to change the diversity and/or number of species of animals present throughout the Long Valley KGRA, not only within the project area as stated in the document. However it has not yet been determined if there exists within this potentially affected area any unique, rare, or endangered invertebrate species. Therefore, it is necessary to survey all hot springs, artesian springs, and surface waters in the Long Valley KGRA in order to inventory all aquatic oriented animals including fish, reptiles, amphibians, and invertebrates.

A Long Valley Technical Advisory (Hydrological) Committee is being formed under the auspices of the Mono County Energy Department to provide a monitoring plan to assure the protection of all environmental concerns resulting from geothermal development. By means of this letter, the Department requests that effective enforceable safeguards be built into the monitoring plan to protect the jeopardized natural resources.

The Department recommends the "No Project" alternative until a cumulative impact analysis of all geothermal projects in the Long Valley KGRA is completed. We can no longer concur with piecemeal consideration of similar projects or project phases that may result in cumulative long-term adverse impacts to the important biological, hydrological, and recreational resources of the area.

Thank you for the opportunity to review and comment on this project. If you have any questions, please contact Fred Worthley, Regional Manager of Region 5, at 245 W. Broadway, Suite 350, Long Beach, CA 90802-4467, or by telephone at (213) 590-5113.

Edward O. Wills

for Pete Bontadelli
Acting Director

Ellen Hardebeck
Control Officer

SEP - 8 1987

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

157 Short St. Suite #6 - Bishop, CA 93514
(619) 872-8211

August 31, 1987

Mr. Dan Lyster, Director
Mono County Energy Management Dept.
P.O. Box 8060
Mammoth Lakes, CA 93546

Dear Mr. Lyster:

We have received the Draft EIR/EA on the Mammoth Pacific Geothermal Development Project: Units II and III, and have the following comments:

1. page 3-30: GBUAPCD has no permit program for wood-burning devices

2. page 4-27: GBUAPCD will require mitigations on flow tests of wells so that H2S emissions will not exceed emissions limits and ambient standards. The long-term test flows should be run through the existing MP-I plant and reinjected as will be done for the PLES-1 flow tests.

Thank you for this opportunity to comment.

Sincerely,

Ellen Hardebeck

Ellen Hardebeck
APCO

EH/dl

...ORNIA—THE RESOURCES AGENCY GEORGE DEUKMEJIAN, Gove

CALIFORNIA ENERGY COMMISSION
1516 NINTH STREET
SACRAMENTO, CA 95814

September 3, 1987

Mr. Daniel Lyster
Mono County Energy Management
P.O. Box 8060
Mammoth Lakes, CA 93546

Dear Mr. Lyster:

Re: Comments on the Draft Environmental Impact Report/Environmental Assessment for the Mammoth Pacific Geothermal Development Project: Units II and III (SCH# 86112408)

The California Energy Commission (CEC) staff has reviewed the Draft Environmental Impact Report/Environmental Assessment (EIR/EA) for the Mammoth Pacific Geothermal Development Project: Units II and III. The staff offers the following comments for your consideration.

General Comments

Section 5.3.1.4 (Air Quality) of the draft EIS/EA indicates that six identical geothermal electrical generation units--Mammoth/Chance I & II, Mammoth Pacific I, II & III and Pacific Lighting Energy Systems I--will be developed in close proximity to each other and that each unit will produce 12 megawatts (MW) of electricity with a total power output of 72 MW. The CEC has exclusive permitting authority for all thermal power plants 50 MW or greater in capacity (Public Resources Code 25000 et seq.). As a multi-unit project, these units may fall within CEC jurisdiction. We are currently in the process of contacting the developers and gathering information which will assist us in making a determination on jurisdiction. We should be able to resolve this issue within 45 days.

The California Environmental Quality Act guidelines (Sect. 15126) require that an EIR identify and discuss the significant effects of a project. The draft EIR/EA does not consistently specify the significance of adverse impacts identified. In addition, while the document does suggest possible mitigation measures, it should also assess the residual impact level after mitigation, and which measures are actually proposed.

Biological Resources

The draft EIR/EA fails to provide adequate information on the existing biotic conditions or possible impacts on rare or endangered species or natural communities. The draft EIR/EA cites a "biotic assessment" by Dean Taylor and Richard Buckberg (1987) as the basis for the discussion on vegetation. However, this study was conducted at an inappropriate time of year (winter), without an appropriate level of study for impact analysis (D. Taylor, personal communication, 8/27/87). According to Dr. Taylor, these limitations are stated in his report, which was intended to be only a general scoping study. Although other supporting data were attached as appendices, the "biotic assessment" was not attached.

A detailed rare plant survey report which follows guidelines provided by the California Department of Fish and Game should be prepared to serve as a data base for assessing potential impacts to rare plants. Information should also be provided regarding disturbance to areas identified as "thermal marsh" and mountain meadow communities, as these may be wetlands and thus subject to state and federal policy. All wetland areas should be completely avoided. Wetlands areas that have been degraded without federal permits should be rehabilitated.

The draft EIR/EA should identify wildlife species that occur on or near the project site. Specific information on the occurrence of Sage Grouse on the project site (as opposed to a general discussion about the regional occurrence) should be provided.

Cumulative biological impacts of geothermal development in the Long Valley Geothermal Resource Area are not adequately addressed. A study of the cumulative biological impacts of this and other developments in this area should be completed prior to the approval of any additional power plants, and should be included in the data used to determine the cumulative impacts related to the proposed project.

Air Quality

The document, on pages 5-9 to 5-10, states that construction activities could cause new or continued violations of the state's ambient PM10 standard. This is likely to be considered a significant impact, yet there is no indication that impacts will be mitigated to the extent feasible. Additionally, the document states, on page 5-9, that the facility may emit 1,500 to 6,000 lbs/day of non-methane hydrocarbons. This may also be considered to be a significant impact. It is unclear that this impact will be mitigated to the extent feasible.

Public Health

The draft EIR/EA states, on pages 4-30 to 4-32, that substantial emissions of both H_2S and isobutane could result during upsets of the facility. Ambient concentrations that would result from such events should be compared to levels that are considered acceptable for public exposure. Criteria used to gage such exposures should consider the effects on sensitive members of the general public.

The geothermal fluid released during upsets can contain trace amounts of arsenic, lead, and mercury. The resultant public exposure to these pollutants should also be evaluated.

Noise

From information in the draft EIR/EA it is unclear what project-related noise levels will occur off-site, or if such levels will conflict with proposed land uses around the proposed facility. An analysis of noise levels at the property lines of the proposed facility should be provided, and noise levels that are acceptable for the proposed use of the surrounding lands should be identified and discussed.

Waste

The draft EIR/EA should address methods for disposal of liquid or solid waste that could result from construction or operation of the proposed facility. Some wastes may be hazardous and require special disposal practices.

Visual Resources

The draft EIR/EA states (p. 4-46) that even with mitigations the plant would be noticed by casual observers and the project would therefore be inconsistent with the Visual Management Objective of "retention." However, the text does not state whether this inconsistency would constitute a significant environmental impact. The document should make a determination on this issue.

The document describes (p. 5-14) the cumulative visual effect of the project in combination with the existing Mammoth Pacific I project and the proposed PLES I project. However, it does not assess whether this impact would constitute a significant environmental impact, either before or after mitigation.

Land Use

The draft EIR/EA states (p. 4-46) that the project is compatible with current County and United States Forest Service plans, with the exception of the applicable visual resource management policies. However, the text does not discuss whether the project would conflict with existing and planned land uses in the area. Conflicts with recreational uses are of particular concern and should be addressed.

The document should assess whether the cumulative land use effect of "transforming several undeveloped areas to industrial uses" (pp. 5-14 to 5-15) would be a significant environmental impact, even though it would be consistent with Mono County and Inyo Forest Plans except for the Visual Management Objectives for the area.

Housing

The EIR/EA states (p.4-48) that construction of some additional housing can be expected due to the project. However, the text does not state whether this additional housing would constitute a significant environmental impact. The document should make a determination on this issue.

The number of temporary and permanent housing units in the area as well as the vacancy rate for each category should be specified. Given the lack of data on how many workers will be from the local area, the population figures used to determine the additional housing required should be calculated on the minimum local employment scenario (p. 4-47). Alternatively, an analysis of workers needed by trade compared to locally available workers in those trades could provide a more specific estimate of non-local employment and thus housing needed.

The document states that "simultaneous construction of two plants could tighten the housing market" (p. 5-14). The document should quantify the effect on the housing market and assess whether this effect would constitute a significant environmental impact. The EIR/EA should also provide the specific reason(s) for including only Mammoth Pacific II & III and PLES I from among the proposed projects in the Mammoth Lakes area in the assessment of cumulative housing impacts.

Economy

A determination should be made as to the significance of the potential depletion of geothermal water at the Hot Creek Fish Hatchery (p. 4-49). The feasibility of the proposed mitigation

measure of heating water with conventional fuels (p. 4-50) should be analyzed. The potential environmental impact of this mitigation should also be considered.

Public Services

The EIR/EA should provide the specific reason(s) for including only Mammoth Pacific II & III and PLES I from among the proposed projects in the Mammoth Lakes area when assessing cumulative impacts to public services (p. 5-3).

The EIR/EA states that the cumulative public service demand caused by the simultaneous construction of two plants "would probably exceed a 'threshold' level and require the addition of fire, police and school personnel" (p. 5-14). These potential impacts should be quantified, their significance assessed, mitigation discussed, and the significance of residual impacts described.

Timber Resources

The EIR/EA should assess whether the specific effect of harvesting timber due to the project (p. 4-62) would be significant either before or after proposed mitigation.

The document should assess whether the cumulative impact of harvesting (p. 5-15) would be significant either before or after mitigation. The EIR/EA should also provide the specific reason(s) for including only Mammoth Pacific II & III and PLES I from among the proposed projects in the Mammoth Lakes area in the assessment of cumulative impacts to timber resources (p. 5-3).

Cultural Resources

The recommendation that "to the extent possible, an effort be made to monitor development activities that may uncover buried cultural deposits" (p. 4-65) is too vague to ensure protection of potential resources. Either a qualified cultural resources specialist should be on site to monitor subsurface disturbance, or an approved training program for employees should be required, with a qualified cultural resources specialist to be called in to assess any resources discovered during construction. If human remains are discovered, the County Coroner must be notified, and if the remains are of Native Americans, a local Native American representative must be consulted as to proper treatment of the remains.

The draft EIR/EA should address the potential depletion of thermal springs as a potential impact to the traditional Native American interests referred to on page 4-66.

Transportation and Access

The traffic, including heavy equipment, created by the project should be quantified. Current traffic levels on local roadways as well as anticipated non-project levels during construction should be quantified. An assessment should be made of the impact of project-related traffic on local traffic conditions, considering the effect of the proposed mitigation (p. 4-66). The potential cumulative traffic impact of constructing more than one geothermal plant in the area at one time (p. 5-16) should be quantified and its significance assessed.

If you have questions or would like clarification on the CEC staff's comments, please contact Sharron Taylor of my staff at (916) 324-3231.

Sincerely,

Robert L. Therkelsen

ROBERT L. THERKELSEN, Chief
Siting and Environmental Division

cc: Office of Planning and Research

RLT:GW:st

Sierra Club

130 Polk Street
San Francisco
California 94109
415·776·2211

6 September 1987

Mr. Daniel L. Lyster, Director
Energy Management Department
County of Mono
P.O. Box 8060
Mammoth Lakes, CA 93546

Dear Mr. Lyster:

I have been provided with a copy of the Draft Mammoth Pacific Geothermal Development Project: Units II and III, Environmental Impact Report, Environmental Assessment to review on behalf of the Sierra Club. Regrettably, the demands of my own work have prevented me from reviewing this document until the present moment. Your cover letter has stated that the comment period extends until forty-five days after receipt of the document. As I received the Draft EIR in England on July 26th, I trust that these comments will still be accepted.

In terms of scientific analysis and professional quality, this Draft EIR is considerably superior to other environmental documents that have been prepared for Mono County for geothermal project proposals. While it generally reflects a pro-project bias (which an EIR should not reflect) it does draw a number of cautionary conclusions from the evidences and data upon which it is based. It concludes that too little is known about the hydrothermal reservoir, or reservoirs, in the Casa Diablo-Hot Creek region to be able to predict the consequences for Hot Creek and the state fish hatchery if the proposed Mammoth Pacific project is to go forward (pages 2-4; 3-17, 19, 20; 4-12, 15; and 5-2). It acknowledges that if the thermal springs at Hot Creek were to be degraded as a result of project operations no mitigations are available for the loss of this "unique recreational resource" (pages 4-50 and 61). It states that the Forest Service policy and standards for visual quality retention and of the Mono County Scenic Element will be violated in the Casa Diablo area if Mammoth Pacific II and III are built (pages 3-42, 49; 4-44,46; and 5-1). It recognizes the outstanding scenic quality of the area (pages 2-4 and 3-45) and its high volume of recreational use (page 3-59). In its brief review of the cumulative impacts to be anticipated from the one presently operating and the five proposed geothermal power plants in the region, the report concludes that the overall and long-term impacts from their construction and operation could be significant with respect to water quality (page 5-6), pressure changes in the geothermal reservoir(s) (page 5-7), degradation of hot springs in the Hot Creek gorge with the consequent loss of its recreational value (page 5-15), the disturbance of deer migration (page 5-11), and in the creation of an indus-

trialized atmosphere in the region (page 5-14).

These basic findings reached in the DEIR raise serious questions about the justifiability of the proposed project. In exchange for a meagre 24 MW of electricity produced for the relatively short period of thirty years, it would contribute to the at least moderate -- and perhaps disastrous -- degradation of one of the nation's two or three most heavily used, appreciated and needed mountain recreational playgrounds and, together with the other presently proposed geothermal project in Long Valley, would turn the energy producing area into an industrial park. Unfortunately, the DEIR ignores these fairly obvious conclusions to be drawn from its own findings and it justifies the project with gratuitous claims that all of the problems, except for the possible degradation of temperatures in Hot Creek and loss of visual quality, can be mitigated. The overly facile dismissal of the problems of stream pollution and noise, especially, should be remedied in the Final EIR.

The Alternatives section of the report (Section 4.3) fails to meet the requirements of the California Environmental Quality Act, whereby a full discussion of reasonable alternatives must be provided (CEQA Guidelines, Section 15126(d)). The DEIR confines itself to a discussion of the "no project" alternative, and this only from the standpoint of financial loss if the project is not implemented.

Specific comments are as follows:

pages 2-5 to 2-8 -- Further details are needed with regard to proposed well sites: terrain, cut slopes, quantities of soil to be removed, slope stability, proximity to faults.

page 2-9 -- What are the locations of the additional wells that may be required? What permitting process will be followed when and if these wells are proposed?

page 2-21 -- Will the power plant site be paved as well as bermed to ensure retention of spilled fluids for proper disposal?

page 2-22 -- Why is a different power plant location proposed for the Ormat alternative?

page 3-11 -- A chemical analysis of Hammoth Creek tributary stream waters should be undertaken by the applicant so that baseline data can be provided.

page 3-34 -- Complete botanical (and faunal) knowledge should have been obtained for the leasehold and included within this DEIR.

page 4-4, top of page -- It is also necessary to design and build all facilities in such a way as to protect the natural environment.

page 4-8, second bullet -- All disturbed areas should be stabilized at the latest by October 1st.

page 4-8, third bullet -- All work performed between October 15th and May 1st should be conducted in such a manner as to be stabilized in four hours. A winter storm can have come and gone in 48 hours.

page 4-17, third line, third paragraph -- misprint of "winter" for "water".

page 4-34 -- It seems to be implied in the last paragraph that the previous disturbance of three acres of the power plant site somehow softens the impact of further vegetation loss. Furthermore, the case is editorially put in a minimizing fashion. Could it not also be put that "more than 12 acres of Jeffrey pine, more than six acres of sagebrush scrub . . . would be directly affected"? This instance is characteristic of the recurrent pro-project tone of the entire document.

page 4-40, last paragraph -- How is it proposed that the maximum flow of geothermal fluid to reach Mammoth Creek could be reduced?

page 4-43, first paragraph -- Grading for pads and access roads can alter the landscape form more than "slightly", depending on slope and layout.

page 4-44, last bullet -- Exterior light should be directed inward and downward toward work areas, should be shielded so that no light shines outward nor upward, and should be equipped with operational switches so that light may be turned off when not needed.

page 4-48, bullet at bottom of page -- In the interests of the reduction of housing needs construction activity should also be timed so as not to coincide with Mammoth/Chance construction nor PLES construction if these projects are implemented.

pages 5-2 to 5-16 -- The discussion of cumulative impacts from the several geothermal projects presently operating or proposed for the area is much needed and is a good beginning. A more comprehensive study of cumulative impacts from all geothermal projects together with others, such as the airport expansion project is urgently needed. The study needs to be free of a pro-development bias, under which the present brief discussion suffers, and should be undertaken by a consultant employed jointly by the County and the federal goverment and paid for by all project applicants in the Long Valley region proportionate to the costs of their projects.

Sincerely yours,

Hamilton Hess
Geothermal Coordinator
255 Ursuline Road
Santa Rosa, CA 95401

cc: Gil Davis, Chair, MC/MRCC
Lisa Jaeger, Eastern Sierra Nevada T.P.
Julie McDonald, Esq., Sierra Club Legal Defense Fund, Inc.
Forest Supervisor, Inyo National Forest

Mammoth-Pacific

6055 Washington Boulevard
Suite 830
Commerce, CA 90040

213/725-1139

September 10, 1987

Mr. Daniel L. Lyster
Director,
Energy Management Department
MONO COUNTY
P. O. Box 8060
Mammoth Lakes, California 93546

Subject: Comments on draft Mammoth-Pacific Geothermal Development Project: Units II and III Environmental Impact Report/Environmental Assessment, July 1987

Dear Mr. Lyster:

As the proponent of the above-referenced proposed development, we hereby take this opportunity to provide additional project information; update and clarify information contained in the above-referenced Draft Environmental Impact Report ("DEIR"); and provide comments on the DEIR assessments and suggested mitigation measures.

Reference	Comments
Page 2-7, Figure 2-2	Well MP 12-32 is incorrectly identified in the figure as MP 12-52.
Page 2-23, Figure 2-7	Well MP 12-32 is incorrectly identified in the figure as MP 12-52. The production pipeline extending from the proposed site to the alternative site is not shown on the figure; however, it would parallel the existing plant injection pipeline route to the MP II & III alternate sites.
Page 3-17, Par. 4	Reference is made to our considering a proposal to greatly improve the quality of such data. Mammoth-Pacific is currently nearing completion of a comprehensive program to enhance and upgrade the geothermal resource monitoring instrumentation of the

operating Mammoth-Pacific geothermal power plant in order to provide highly accurate and continuous reservoir data, including capillary tubes which are being installed to provide downhole pressure measurement with an accuracy of ± 0.1 psi. Additional instrumentation will provide the following data: Produced fluid temperature at each well (± 0.2 °F); Injected fluid temperature at each well (± 1.0 psi); and injected fluid pressure at each well (± 1.0 psi). All data will be transmitted to an onsite computer for processing. The upgraded reservoir monitoring and data acquisition system should be completely operational by October 1, 1987. It is our intention to provide similar instrumentation for MP-II, MP-III, and the Long Valley Hydrological Advisory Committee ("LVHAV", formerly Long Valley Technical Advisory Committee) monitoring well which will greatly improve the degree of accuracy and overall quality of reservoir data obtained from power plant operations at Casa Diablo.

Page 3-21, Par. 3

Silencers have been re-installed on the expander exhausts of the operating plant, resulting in a greatly reduced overall noise level from the plant. The current noise level recorded at 0.5 mile distance is approximately 40 dBA. The noise level adjacent to the plant along Hot Springs Road (old Highway 395) has been reduced from an average of approximately 80 dBa without the silencers to 69 dBA with silencers and other noise reduction equipment installed on both units.

Page 3-40, Par. 2

A report titled Biological Assessment of Proposed Geothermal Energy Development in Casa Diablo Hot Springs Area on the Owens Tui Club (Gila bicolor snyderi) and Hot Creek Headsprings Refugia, August 1987, has been submitted for review by the U. S. Fish and Wildlife Service in conformance with Section 7 of the Endangered Species Act. The submitted report can be fairly and succinctly summarized by stating that the proposed development will have no significant impact on the Tui Chub.

Page 4-27, Par. 2

The assessment of hydrogen sulfide emissions during well testing operations assumes the well will be pumped during the short-term (2-4 hour) well cleanout period. This assumption is incorrect and the 2,000 gpm pumped well flow rate overestimates the expected hydrogen sulfide emissions. The proposed operations would allow the wells to flow naturally without pumping (flow rate estimated not to exceed 500 gpm) to on-site tanks. This rate of flow would not result in emissions in excess of those allowable under GBUAPCD emission standards (2.5 kg per hour per well), as conservatively calculated below:

500 gpm x 3.785 l/gal x 8 mg/l x

$kg/10^6$ mg x 60 min/hr = 0.9 kg/hr

The 2,000 gpm flow rate refers to the estimated pumped flow rate of the wells during long-term flow testing. The long-term flow tests would be conducted in a closed system (page 2-29), and would, therefore, not release any hydrogen sulfide to the atmosphere.

Page 4-31, Par. 4

States isobutane is normally stored as a colorless, <u>odorless</u>, ... gas. However for the MP II & III project, it is proposed that an odorant would be added to the hydrocarbon working fluid, prior to storage and use.

Page 4-33, Par. 1

States vacuum truck would collect hydrocarbon <u>vapor</u> for potential reuse. Should state vacuum trucks would be used to collect <u>non-vaporized</u> hydrocarbon liquid for potential reuse <u>or disposal</u>.

Page 4-34, Par. 1

States relief valves and discharge valves would be <u>opened</u> to reduce the quantity of material available for combustion. Should state these valves would be <u>closed</u> to reduce ...

Page 4-34, Par. 2

States a <u>mercaptan</u> should be added to the isobutane as an odorizer. However, it has been demonstrated that mercaptans are not stable at the temperatures expected in the geothermal heat exchanger. As such, should state a <u>temperature-stable odorizer</u>, such as tetrahydrothiophene should be maintained in the system.

Page 4-19, Table 4-3

Mammoth-Pacific is actively participating in the LVHAC and has attended all organizational meetings, including the meeting of August 6, 1987, at which Mammoth-Pacific agreed to participate in the drilling of a monitoring well on the adjoining property. The location was acceptable to all the experts present. By being on the far edge of the established Casa Diablo geothermal reservoir, the monitoring well will provide very early warning of any significant changes taking place within the reservoir. At the same meeting, we supported the general area-wide monitoring program which was proposed by the members. We believe that such monitoring will provide important baseline data which will help greatly in the development of an area-wide model of geothermal resources and will enable permitting agencies to quickly identify changes that are taking place within the Long Valley Caldera.

Page 4-35, Par. 2

We have worked closely with a Subcommittee of the Owens Valley Interagency Council ("OVIAC") and representatives of Mono County on landscaping of the operating plant. We have always agreed with and continue to completely agree with, the need for landscaping, but believe that the following points should be acknowledged:

A) The soil in the area is infertile with low moisture holding capacity which inhibits rapid plant growth in the relatively short growing season available.

B) There are natural open areas where vegetation currently does not grow. These areas are especially hard to vegetate.

C) The project area is geothermal in character and there are considerable portions of the area where the surface or sub-surface ground temperature is high enough to kill vegetation. It will not likely be possible to establish vegetation to grow in these already denuded areas.

D) Fencing can be used in some, but not all, locations for effective screening of pipelines because of terrain.

There are a certain number of plants and trees that will necessarily have to be removed by reason of selection of the proposed alternate plant site. We propose, wherever feasible, to transplant existing trees to other locations including the existing plant site so as to improve the overall landscape. However, it should be noted that Jeffrey pines are difficult to transplant successfully, and it may be more practical to plant seedlings.

Page 4-37, Par. 1

States the pipeline from wells MP 12-32 and MP 12A-32 should be moved approximately 50 feet north to avoid the botanically sensitive area to the west of the proposed power plant site. However, the pipeline route proposed would actually follow the operating plant pipeline along an existing access road and would not impact the botanically sensitive area identified in the Draft EIR/EA. Further, moving the pipeline 50 feet north would increase the visibility of the pipeline along the bluff north of the existing MP Unit I power plant.

Page 4-38, Par. 4

The Draft EIR/EA suggests the applicant adopt [illegible] mitigation measures for impacts on deer migration which are characterized in Appendix C to the document to be "trivial" even under a "worst case" scenario. Therefore, the mitigation measures appear unjustifiable.

Page 4-38, Par. 5

The Draft EIR/EA suggests the applicant consider acquisition of mule deer winter range habitat as a mitigation measure. This appears unjustifiable because: (1) the project does not specifically impact mule deer winter range habitat; and (2) the project is not expected to significantly impact mule deer.

Page 4-46, Par. 2

Based on further review, we agree with the recommendation of others to relocate the proposed plants about 400 feet east (alternate power plant site) of the initially proposed site in order to take advantage of the screening effect which would be provided by existing mature trees. We have also decided to reduce the visual impact of the existing plant by putting redwood slats in

all of the chain link fence around the plant as well as all existing and proposed well sites that would be visible from public roads in the area.

Page 4-52

It is suggested that the proposed plants, MP-II and MP-III, will generate costs that are greater than the funds that will be received by the county and special fees should be charged to cover costs for services provided. On Page 3-54, Section 3.3.2.4. County Fiscal Considerations, it is noted that the County receives 20% of the geothermal lease and royalty revenues from federal lands within its borders. In the economic impact section (page 4-51), no mention is made of funds the county will receive from the geothermal wellfield located on Federal Lease Number CA-1667A which will supply MP-III. It is estimated that MP-III would generate about $100,000 in Federal County of Origin funds during the first full year of operation for the County. The adjoining PLES-I development on Federal Lease Number CA-11667 would also generate about $95,000 for the County in County of Origin funds. Annual property taxes on the MP-II and MP-III are estimated at $300,000 per plant, plus taxes from MP-I and PLES-I are estimated at $500,000. Therefore, the proposed plants at Casa Diablo would provide over $1.3 million annually in revenue to the County. Given these funds, the total development at Casa Diablo could generate approximately 10% of the County's operating income. Using the County labor force figure of 5,559 as shown on page 3-52, less than 1% of the County's labor force (i.e., less than 56 people) would be employed at Casa Diablo. On this basis, it appears that the proposed projects would be paying ten times its proportional share based on employment. On an income-revenue basis, these proposed plants appear to be very advantageous to the County.

Page 5-10, Par. 3

The analysis for cumulative impacts from fugitive emissions of hydrocarbons (see Table 4-7) is overstated in that two of the six proposed power plants (Mammoth/Chance Units I and II) would be located at least two miles east of the Casa Diablo area and would

not perceptibly influence the maximum ground-level concentration of hydrocarbon resulting from fugitive emissions in the Casa Diablo area. As such, they should not be considered in the single source, PTPLU model, analysis.

In addition to the above comments, we have asked three highly qualified independent geothermal resource consultants with direct experience in the Long Valley Caldera to review the DEIR and Technical Appendix with regard to all matters relating to ground water hydrology, reservoir performance, and the agreed upon monitoring program that will be administered by the LVHAC. The summary opinions and comments of Cascadia-Pacific, Geothermex, and the Mesquite Group, are attached as exhibits to this letter. All of the experts agree that it is extremely unlikely that the proposed development will affect the Fish Hatchery or Hot Creek, and that the monitoring program developed by the LVHAC will detect any potential thermal reservoir changes well in advance of them becoming a significant problem to either the Fish Hatchery or Hot Creek.

Thank you for the opportunity to comment on the Draft Environmental Impact Report/Environmental Assessment for the MP-II and MP-III Project. Please feel free to contact our office if we can further clarify any aspect of the proposed project.

Sincerely,

Donald C. Liddell

DCL:rj
Enclosures

Cascadia Pacific Corporation

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Re: Comments in response to "Draft Joint Environmental Impact Report and Environmental Assessment" for MP II and MP III Geothermal Development Projects with Discussion of Specific Mitigation Measures.

Summary

1. Expansion of the geothermal energy development at Casa Diablo will require increases in fluid production and injection equal to 2-4 times the current use.

2. The performance of the existing producing wells at Casa Diablo coupled with available geologic information indicates that, the expansion of production/injection would have no effect on the Fish Hatchery or other features.

3. The proposed monitoring well located to the east of the project would provide an "early warning" of any potential temperature or flow disruption that could interfere with the Fish Hatchery or other features which would allow time for mitigating measures to be put in place.

Purpose and Scope

The purpose of this discussion is threefold: (1) To review the referenced EIR/EA and present comments on the content and adequacy of the hydrologic and geologic portions of the report particularly as it relates to the impact of expanded geothermal development at Casa Diablo on certain surface geothermal features, (2) To evaluate and comment on the impact mitigation measures proposed in the report, by the developer, and by the Long Valley Hydrologic Monitoring Program (LVHAC), and (3) To present the conclusions and recommendations of Cascadia Pacific Corporation regarding the report and proposed mitigation measures. The discussion is limited in scope to the information contained in the referenced report and in documents prepared by or for the LVHAC and does not present technical information from other sources except by reference. Finally, the discussion, comments, and conclusions presented herein are considered to apply to PLES I as well as both MP II and MP III.

Conclusions and Comments

The sections of the referenced report which deal, in general terms, with the hydrology, geology and related matters present a discussion of the possible impact of expanded geothermal

development at Casa Diablo on surface and sub-surface geothermal features in both the immediate area and at the other major features such as the Fish Hatchery and Hot Creek that are located 3 to 5 miles from the site of the project(s). In summary the report concludes that:

1. Expansion of the Casa Diablo development beyond the existing geothermal production and electric power generating facilities will require a substantial increase in fluid withdrawals from the geothermal reservoir(s) at Casa Diablo.

2. All produced fluid would have to be injected into sub-surface zones that are permeable and not in communication with the producing intervals.

3. The nature and extent of the reservoir are not yet clearly defined and at least two geologic models can be described and supported with existing data.

   a. A Lateral Flow model which envisions direct communication of geothermal fluid flowing from Casa Diablo toward the Fish Hatchery, Hot Creek, and other features to the east.

   b. A Fracture Flow model which proposes that geothermal fluid flows upward in faults and fractures which occur throughout the study area and that each fault/fracture system is independent of the others so that there is no direct communication between Casa Diablo and any other feature such as the Fish Hatchery.

4. Reservoir analysis employing a very basic model and several limiting assumptions and using the Lateral Flow concept indicates that (a) the pressure drawdown effects due to increased Casa Diablo production, which could eventually cause reductions in flow at other geothermal sites, can be expected to be minimal if all produced fluid is re-injected and (b) that injection of cooler waste water at Casa Diablo will not produce either thermal or water quality interference at the Fish Hatchery or Hot Creek for at least 50 to 100 years, if ever.

5. If the Lateral Flow model is correct early warning of pressure/temperature reductions due to production at Casa Diablo could be obtained by the maintenance of a fully instrumented monitor well located to the east of, but reasonably close to, the project area.

It is the conclusion of this firm that despite a generally simplistic approach to geology and reservoir characterization and

certain fundamental limits in the analysis, the EIR/EA Hydrology report presents a reasonable and generally correct assessment of the risks posed to other geothermal features by expanded development. Years of study, research, and field experience on the Casa Diablo area lead this firm to conclude that communication and potential detrimental effects are extremely unlikely and that such effects would require many years to become manifest. It is further concluded that the use of a monitoring well provides a reasonable "insurance policy" against detrimental communication by allowing changes in pressure and/or temperature caused by production and/or injection to be noted and monitored near the project site long before features to the east would be affected.

Finally, it has been the long held opinion of this firm based on extensive research and reservoir evaluation that there is no proximate connection between Casa Diablo and the major features such as the Fish Hatchery. Production and injection of geothermal fluids at Casa Diablo will have no effect on geothermal features located outside the project area.

DISCUSSION

A resolution of the concerns regarding possible pressure/temperature degradation at the Fish Hatchery, Hot Creek and other sites due to geothermal production and/or injection at Casa Diablo depends, to a large extent, on the choice of a geologic/reservoir model for Casa Diablo. The large body of geologic, geophysical, and reservoir engineering analysis indicates that the Lateral Flow model is not correct and that the Fault/Fracture Flow model applies to Casa Diablo as it does to most geothermal systems. This model was developed by Cascadia Pacific in 1980-81 and has been reinforced and substantiated by subsequent development, well testing, and production at Casa Diablo.

In the Fault/Fracture flow model geothermal fluid flows upward from deep in the caldera through one or more near vertical faults which occur on or near the project site and which (may) penetrate the surface. Over time the seismic activity along the faults helps to create and maintain open (permeable) fractured zones in the hard, brittle rocks that occur at depth in the Casa Diablo area. These fractured zones are of limited aerial extent and provide very little fluid storage. Wells drilled into the fracture zones and/or faults (such as the existing MBP wells) can produce large volumes of high temperature fluids with virtually no pressure drawdown because they are recharged by fluid flow from very large hot fluid sources much deeper in the caldera.

Because of the fluid flow along faults and the limited extent of the fractured zone "reservoirs" there is virtually no communication between one surface site and another. The only connection is through the deep reservoir(s) that feed the fault

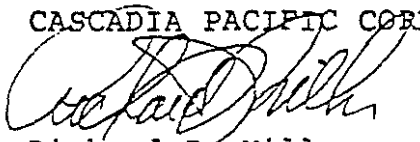
flow systems. Since total production is very small compared to the recharged reservoir volume, any pressure/temperature effects upon the source reservoir are insignificant and consequently are not transmitted to other near surface features.

If this model is correct, and the production history of the MBP wells indicate that it is, then development of Casa Diablo will have no adverse effect on any other feature.

If the Fault/Fracture Flow model is partially or wholly incorrect, which is contrary to geologic evidence and well test/production data, and the Lateral Flow model is found to apply, the reservoir analysis presented in the report indicates that pressure/temperature interference between Casa Diablo, the Fish Hatchery and/or Hot Creek would require 100-150 years under the worst case. Other assumptions could shorten or lengthen the time required but the analysis reasonably supports the premise that the project would have to run for 3-5 times the planned economic life before interference would occur. In any event, the proposed monitor well is a correct and responsible means to control the interference risk and allow sufficient warning so that further mitigating measures can be taken to prevent adverse interference. While any pressure/temperature degradation will be noted first in the project wells the monitor well will signal the expansion of degradation effects beyond the project area and will do so long before such effects could reach other features.

It is this firm's conclusion that the monitor well will be unnecessary but is a reasonably priced "insurance policy." Of course, no system of monitor wells or other measures will be able to anticipate the natural degradation of flow or temperature at the Fish Hatchery or Hot Creek.

CASCADIA PACIFIC CORPORATION



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DISCUSSION AND COMMENTS

The Long Valley thermal system is of great interest both scientifically and economically, and has received increasing study by industry and public agencies in recent years. However, the size of the thermal system, its main centers of upwelling and outflow, and the amount and direction of thermal flow in the subsurface are still uncertain, despite this recent interest. The available evidence is ambiguous, and in some cases is contradictory. There is a general agreement that a system of monitoring should be instituted, to help resolve some or all of these uncertainties.

A comprehensive basinwide monitoring program probably would include meteorological data collection, stream gauging, and calculation of a basinwide water balance, as well as measurement of temperature, flow rate and chemical parameters in selected thermal and cool springs, plus the collection of these same parameters along with pressure data from geothermal and cool-water wells. Numerical simulation of the hydrologic system and the geothermal aquifers would be necessary. Such a program might require two or three years of data collection and analysis before comprehensive answers would become available.

However, much of the interest in the Long Valley thermal system is focused on the area extending from Casa Diablo to the Hot Creek Gorge. Because of this, it is possible to design a monitoring program that focuses directly on the issues specific to that region. One specific question, with two conditional corollary issues, would be addressed by such a monitoring program: Is there a direct hydrological connection between the Casa Diablo thermal area and springs supplying

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September 8, 1987

Mr. Michael A. Clinton
Director and General Manager
- Geothermal
Pacific Lighting Energy Systems
6055 East Washington Boulevard
Commerce, CA 90040

Dear Mr. Clinton:

COMMENTS IN RESPONSE TO THE DRAFT ENVIRONMENTAL IMPACT REPORTS ON MAMMOTH PACIFIC UNITS II AND III

JAMES B. KOENIG,
PRESIDENT, GEOTHERMEX, INC.

SUMMARY STATEMENT

Numerical analysis of well-production data by GeothermEx, Inc. in 1986 showed no discernible presure drawdown in the thermal aquifer supplying the Mammoth Pacific I power plant. Before any pressure or temperature effect would be observed at the Fish Hatchery or at Hot Creek Gorge pressure drawdown would be experienced at the Casa Diablo wells. The analysis of temperature-gradient and geochemical data also performed by GeothermEx in support of the production data analysis suggests that the power plant capacity can be expanded as proposed by Mammoth Pacific. Monitoring of pressure trends is recommended, supported by suitable data analysis.

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both the Fish Hatchery and the Hot Creek Gorge? As a first conditional corollary to this question, if there is a direct hydrological connection, how much withdrawal of thermal water can be sustained without there being noticeable effects at the Fish Hatchery and Hot Creek Gorge? As a second conditional corollary, if effects of production become noticeable over time at the Fish Hatchery and/or the Hot Creek Gorge, what actions can be taken to mitigate such effects without curtailing the commercial production of geothermal energy?

GeothermEx has performed the only numerical analysis of all production data for wells presently supplying Mammoth Pacific power plant 1. This analysis, completed in mid-1986, showed that at the current rate of production there is no discernable pressure drawdown in the aquifer supplying the power plant. It appears to be possible to expand the capacity of the power plant significantly without causing measurable drawdown at the Casa Diablo site. Therefore, even if there is direct communication between the Casa Diablo thermal aquifer and the springs supplying the Fish Hatchery or Hot Creek Gorge, there is no evidence that pressure drawdown would be experienced at the Fish Hatchery. Indeed, based on highly idealized models of the hydrologic system performed as part of the Draft Environmental Impact Report on Mammoth Pacific #II and #III prepared for the County of Mono, it was concluded that despite the relative lack of data it was unlikely that there would be any pressure or temperature effect at the Fish Hatchery as a result of additional production at Casa Diablo.

With regard to temperature effects at the Fish Hatchery springs, it has been postulated that a drop of as much as 2° to 3°F might ultimately be the result if the thermal component of the spring

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water was cut off. There has been extensive speculation regarding the source of this thermal water component relative to the Casa Diablo thermal area. However, although nothing is proven regarding any possible connection between these areas at depth, there is one important conclusion regarding the possible temperature effects of further development of the geothermal resource at Casa Diablo by Mammoth Pacific: the geothermal fluid is to be reinjected into the aquifer system from which it is withdrawn, and the temperature of injection (160°F) is significantly higher than the temperature of the Fish Hatchery springs (average about 55°F). Therefore, there is unlikely to be any marked temperature degradation of the Fish Hatchery springs unless there is both: (a) a direct hydrologic connection between the Fish Hatchery and Casa Diablo; and (b) a severe pressure decline over a period of years at Casa Diablo.

As mentioned above, GeothermEx's 1986 analysis of well-test data and matching of well-production data at Casa Diablo indicates that the commercial generation of electric power can be expanded significantly with no pressure drawdown effect at Casa Diablo. This finding tends to obviate the question of hydrologic connection at depth between the two areas.

It is recognized that there will be a need for close monitoring of production wells and those wells to be drilled in connection with expansion of the Casa Diablo power project, in order to identify pressure trends with time as the project is expanded. Data from well tests and production monitoring can be analyzed most rigorously by numerical simulation monitoring, in which the results of mathematical simulation are matched with the entire production history. This

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matching allows the reservoir engineers to forecast future well behavior, including any pressure or temperature declines, with a degree of confidence not attainable otherwise.

Work done in 1985 and 1986 by GeothermEx, including an analysis of temperature distributions in the subsurface, and a comprehensive assessment of the chemistry and isotopy of cool and thermal waters of Long Valley, has suggested the following: there is a general flow of thermal waters from W to E or SW to NE in the Casa Diablo area; there are multiple subsurface flow paths for the thermal waters; there have been varying degrees of mixing with cool waters, along with conductive cooling and degassing en route to surface discharge points; and the parent source water has not yet been identified by drilling. Given this picture, plus the results of GeothermEx's 1986 analysis of production data at Casa Diablo, it appears very reasonable to allow continued development of geothermal power at Casa Diablo.

Sincerely,

James B. Koenig
President

JBK:mjm

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Comments Regarding the Draft Environmental Impact Report
Mammoth-Pacific Geothermal Development Project:Units II and III
(July 1987, for the County of Mono
by ESA and Berkeley Group, Inc.)

Summary

Pursuant to the request of Mammoth-Pacific, Mesquite Group, Inc. (Mesquite) has reviewed the July 1987 Draft Environmental Impact Report (DEIR) concerning the proposed Mammoth-Pacific Geothermal Development Project: Units II and III. While there are some minor differences of opinion, Mesquite believes the overall document to be adequate. Additional discussion appears to be warranted, however, with respect to four aspects of the Project. Mesquite's comments in this regard may be summarized as follows:

1. The "upwelling/fracture" model for the Long Valley hydrothermal systems better fits the known geology, temperature and chemistry data than does the historically accepted "lateral flow" model. As a consequence, Mesquite believes that there is no shallow lateral connection between the Casa Diablo geothermal reservoir and the hydrothermal systems at the Hot Creek Fish Hatchery and Hot Creek Gorge.

2. Even if a shallow lateral flow connection is assumed to exist, Berkeley Group's numerical modeling indicates that the impact of Casa Diablo development on the fish hatchery and Hot Creek thermal springs would be negligible or non-existent. In the extreme case of significant pressure, temperature, or chemistry changes in the Casa Diablo reservoir, corrective action in terms of revised well field management would likely be required long before such changes could propagate as far as the fish hatchery.

3. Subsequent to the DEIR writing, Mammoth-Pacific committed during discussion with the Long Valley Hydrologic Advisory Committee to drill an observation well between Casa Diablo and the fish hatchery. This well is intended to penetrate the geothermal reservoir and provide very early warning of any changes propagating in the direction of the fish hatchery.

4. Existing MP I well monitoring instrumentation is currently being upgraded. The DEIR states that the original MP I instrumentation was inadequate for detecting subtle changes in pressure, temperature and rate during the first two years of operations. While Mesquite believes it is clear that there have been no changes, Mammoth-Pacific is proceeding with upgrading the instrumentation in order to eliminate any future uncertainty.

Introduction

The comments below regarding the Draft Environment Impact Report (DEIR) for the Mammoth-Pacific II and III Geothermal Project were prepared by Mesquite Group, Inc. (Mesquite) in response to Mammoth-Pacific's request. The main purpose of these comments is to more fully present and document Mesquite's concept of the "upwelling/fracture" model for the Long Valley hydrothermal systems and contrast it to the historically accepted shallow "lateral flow" model.

It is important that the distinction between the models and their respective supporting data bases be understood. The upwelling/fracture model essentially precludes a shallow connection between the Casa Diablo Geothermal System and the surface thermal features of concern to the east (i.e., the Hot Creek Fish Hatchery warm springs and the thermal springs in Hot Creek Gorge). The lateral flow model, on the other hand, postulates possible interference with these surface thermal features due to the proposed expanded geothermal development. While Mesquite does not believe a shallow connection between the areas exists, additional comments are also offered concerning the minimal impacts believed likely, even if such a connection were to exist via shallow lateral flow.

An additional area deserving of more discussion concerns the data monitoring program and planned observation well agreed to in principle with the Long Valley Hydrologic Advisory Committee (LVHAC) subsequent to the draft EIR issuance. Mammoth-Pacific (MP) supports the caldera wide data gathering program proposed by the LVHAC, as much of the current uncertainty and concern is believed to stem from a lack of accurate historical data. In addition to monetary support for the overall monitoring program, Mammoth-Pacific has committed to an extensive upgrading of the current data gathering system for the existing MP I operation and, most importantly, a new observation well located between Casa Diablo and the fish hatchery.

Long Valley Hydrothermal System Models

The hydrology section of the EIR discusses two models of the Long Valley Hydrothermal System. One of these, the "lateral flow" model, postulates that hot water rises in the western portion of the Long Valley Caldera and flows within a confining aquifer eastward to Lake Crowley to form one continuous thermal system. The second model, the "upwelling/fracture" model, proposes that thermal fluids rise along open fractures that accompany the major north-northwest trending faults, with separate thermal systems existing within each of the three southern Long Valley grabens (i.e., down-dropped fault blocks).

Lateral Flow Model

The continuous lateral flow model, which was originally proposed in the mid-1970's (Lachenbruch et al, 1976), is based primarily on the widespread occurrence in a number of wells of a similar shallow high temperature zone underlain by cooler

temperatures. A common thermal parent located in the western portion of the caldera was believed to exist (Figure 1). Recently obtained temperature data from the Shady Rest Campground and Union 14-16 wells led Sorey (1987) to propose that the parent hot water upwells from the basement beneath the western moat rhyolite to the shallow thermal aquifers. The thermal waters then migrate in a western direction towards the Union 14-16 well and in a southeast direction towards the Shady Rest area and the Casa Diablo Geothermal Field. While flowing eastward, the parent waters cool by boiling, conduction and mixing with fresh, cold ground waters (Shevenell et al, 1987), emerging in the Hot Creek Fish Hatchery area and at Hot Creek Gorge. The waters cool additionally on their continued eastward migration towards Lake Crowley.

A geologic cross section depicting this model is provided in Figure 2. It has been modified from Sorey et al, (1984) by including the recently acquired thermal data from the Union 44-16 and Shady Rest wells. In this model, meteoric waters provide cold water recharge to the system by flowing down the ring faults around the edge of the caldera to the deep, hot basement rock. The parent thermal water (±420°F) then upwells from the basement along a separate fault system beneath the western moat rhyolite. A limited portion of this water flows westward towards the Union 44-16 well at two different depths. Upon reaching the shallow aquifer, defined roughly as the rocks within a few hundred to 1000 feet of the surface, the water migrates eastward and cools to ±400°F at Shady Rest. Between Shady Rest and Casa Diablo, the thermal fluids pass through a major fault and rise again approximately 500 feet while cooling ±50°F to a resource temperature of ±350°F. From the Casa Diablo area, the hot water flows eastward across two additional major faults, cooling to ±270°F in the fish hatchery area. As the flow continues to the east, the water cools to approximately 200°F at Hot Creek Gorge and 160°F near Lake Crowley. Sorey (1985) suggested that a separate thermal system exists in the eastern portion of the Long Valley Caldera. Water from this separate system rises in the vicinity of Lake Crowley and mixes with the thermal waters of the main Long Valley thermal system.

Upwelling/Fracture Model

Geologists and engineers from Mesquite began reviewing the large amount of detailed data available from Casa Diablo in early 1986. Instead of having to relate data from wells and springs miles apart, the seventeen wells at Casa Diablo are within a few hundred feet of each other, and they present a unique opportunity for detailed study. Initially, the lateral flow model was accepted by Mesquite as a basis for development planning. However, close examination of the Casa Diablo data revealed numerous features that did not fit the lateral flow concept. In addition, recently released data from the Chance Meadow/fish hatchery area also appears to be difficult to reconcile with the lateral flow model. A review of the complete Long Valley chemical data base further highlighted problems with the model.

Casa Diablo Data

The seventeen geothermal wells and two deep temperature observation wells at Casa Diablo range in depth from a few hundred feet to 5265 feet. Lithologic (i.e., rock cutting) logs, electric logs, drilling histories, and pressure and temperature surveys combined with geologic mapping (Bailey, 1974) indicate that the Casa Diablo Geothermal System occurs in the eastern part of a large graben bounded by two major normal faults and cut by at least four interior faults. One of these interior faults is the active Taylor/Bryant Fault, movement of which during the 1980 earthquake caused significant ground breakage and surface displacement. This and similar movements in the past are believed to have fractured the competent rocks in the vicinity of these faults. The degree of fracture concentration appears to be highest near and between closely spaced faults, decreasing with distance away from the faults. Only the hard, brittle, competent rhyolite lavas appear to be able to maintain open fractures.

Several geothermal development geologic maps similar to the Maximum Observed Temperature Map shown in Figure 3 have been constructed by Mesquite. All of these maps show that the Casa Diablo Thermal System trends north-northwest and is bounded by faults on both the west and east. A lobe of maximum temperature lies along and to the east of the Taylor/Bryant Fault. This maximum temperature lobe is open to the south, but quickly cools to less than 300°F in the north. The MBP-5, Endogenous #2 and Endogenous #3 wells indicate that temperature dissipates rapidly to the west of the Taylor/Bryant Fault. In the eastern part of the field, maximum temperatures decrease from 338°F to 304°F in a distance of 800 feet. A simple west to east flow of thermal water cannot be accomodated with such a temperature distribution.

The cross section of Casa Diablo (Figure 4) further illustrates the complexity of the thermal system with depth. The nine wells along the section indicate that the thermal reservoir is concentrated to the east of the Taylor/Bryant Fault and disappears rapidly to the west of the fault. East of the main production area, the reservoir thins to less than 100 feet in the vicinity of the Union Mammoth #1 well and then drops 400 feet and thickens near well IW#2. Between wells IW#2 and IW#1, the "reservoir" drops an additional 1000 feet. East of well IW#1 at Magma Mammoth #1, the reservoir does not exist. Again such a complex temperature distribution does not lend itself to interpretation in terms of a simple west to east lateral flow.

The reservoir pressure and water chemistry in the Casa Diablo Field also varies somewhat between wells. Within the main production area, static pressures may be as much as 15 psi different at a given datum between wells. The chemical concentrations of boron in the thermal water ranges from 7.8 to 11 mg/l, while the sodium values vary from 340 to 382 mg/l. These variable pressure and chemical data are further indications of a complex system, even within the limited Casa Diablo area.

Mesquite now believes that the distribution of fault associated, open fractures controls the Casa Diablo Geothermal Resource, as depicted in the schematic cross section (Figure 5).

These open fractures are concentrated along and between faults and do not occur everywhere, as would be required in a continuous lateral flow model. The thermal fluids appear to rise along the Taylor/Bryant Fault system and along the Eastern Casa Diablo Graben boundary fault system. Upon reaching an interval of hard, competent, highly silicified rhyolite rock which maintains open fractures, the thermal fluids migrate away from the upward transmitting faults. Between the Taylor/Bryant Fault and an unnamed fault immediately east, the fractures are highly concentrated and this constitutes the main production area. West of the Taylor/Bryant fault the fractures dissipate quickly. East of the main production reservoir, fractures dissipate and then again concentrate along the Eastern Graben Boundary Fault at a greater depth.

Regional Data

The disagreements between observed data in the Casa Diablo area and the lateral flow concept led Mesquite to review other Long Valley data for consistency with the two different models. Geologic, geochemical, and thermal data were examined in detail. Several additional features were apparent that did not conform to a simple lateral flow system. For example:

1. Structural and stratigraphic interruptions in the fluid flow paths - The Hot Creek Fish Hatchery is located within a separate graben to the east of the Casa Diablo Graben. The hot springs located on Hot Creek and Little Hot Creek, along with the Whitmore Hot Springs, occur in still a third graben situated on the eastern flank of the resurgent dome. Unnamed horsts (elevated fault blocks) are located between these three grabens. The relative vertical movements along the normal faults separating these structural blocks displaces and make discontinuous any horizontal stratigraphic units, as illustrated schematically on Figure 6. Thus, if a common shallow thermal aquifer were to exist, the thermal waters would have to rise and fall as they crossed these multiple faults, some of which have displacements of exceeding 400 feet. Yet one of the main evidences for a regional aquifer cited by Sorey et al (1978), is a nearly flat water table. The detailed geologic structure of the area indicates that any such "flat" and continuous water table is illusionary and that a multiple, segregated thermal aquifer with an independent reservoir located in each graben is more likely. This is also consistent with the observation that the thermal features are always associated with the grabens and never the horsts, and certainly suggests that the shallow thermal zones are not continuous across the horsts.

The shallow geothermal reservoirs in the Casa Diablo and Chance Meadow areas are situated within rhyolite lavas. These crystalline rocks have very low natural permeability (i.e., ability to flow fluids). In addition, the reservoir rocks at Casa Diablo have been highly silicified, reducing their matrix permeability to essentially zero. However, drilling cuttings from Casa Diablo exhibit quartz/pyrite veins, euhedral quartz crystals, and quartz-cemented breccia

zones which clearly indicate the presence of open fractures. For such fracture permeability to continue uninterrupted across the entire caldera, a distance of ten miles, in a nearly flat horizon is inconceivable in the context of the caldera's geology.

As shown on Figure 7, thermal manifestations occur mostly along the numerous known faults in the caldera and are not at all continuous across it. These faults and their associated fractures allow thermal waters to accumulate in shallow reservoirs. Such structural control is clearly illustrated in Figure 7 where active and fossil hot springs along with hydrothermally altered ground generally occur only in alignment along the faults. the lack of thermal features between the faults suggests that a continuous thermal aquifer is not located throughout the caldera.

2. Thermal water chemistry inconsistencies - Analyses of Casa Diablo geothermal waters are listed in the table below. Also shown are chemical analyses of fluids from the Mammoth/Chance #2 geothermal well and a fresh, cold ground water (Laurel Spring). The concentration of individual ions at Casa Diablo is generally higher than that in Chance #2. Sorey (1984) models this chemical difference as being due to dilution of Casa Diablo type thermal water by a Laurel Spring type ground water. The average mixing percentage of Casa Diablo type water required to form Chance #2 type water by dilution with Laurel Spring water is about 82 percent.

CHEMICAL ANALYSES TABLE
LONG VALLEY GEOTHERMAL AND GROUND WATERS
MONO COUNTY, CALIFORNIA
(Unflashed Samples)

Parameter (mg/l)	MBP-1*	MBP-3*	MBP-4*	MBP-5*	25-32**	Chance 2*	Laurel Spring *
TDS	1392	1376	1381	1382	1553	1060	193
SiO2	254	255	240	240	275	140	60
Ca	3.1	1.3	1.8	6	6.1	1.4	5.3
Mg	.13	.12	.1	.1	<1	.1	6.6
Na	352	350	340	340	382	290	24
K	35	36	35	31	29.6	20	4
HCO_3	355	345	360	360	460.7	290	81
SO_4	108	112	110	110	115	88	6.4
Cl	260	253	270	270	251	210	4.5
F	11	10.2	10.5	10.5	11.6	8.7	.5
B	11	10.7	11	11	7.8	9.1	.26
Li	2.7	2.6	2.6	2.7	2.6	2.1	.04

*Farrar, et al, 1986
**Mesquite, 1986

Hydrogen and oxygen isotope ratios of many of the thermal and non-thermal waters in the caldera are plotted in Figure 8 (Farrar et al, 1985). Ground waters plot near the

meteoric water line, with fractionation causing isotopically heavier precipitation to fall west of Long Valley. Isotope values for the thermal waters plot to the right of the meteoric waterline. This relation results from water/rock reactions at elevated temperatures that preferentially exchange rock 18_O for water 16_O, without change in hydrogen isotope values because of the lack of hydrogen in the rocks. The hydrogen and oxygen isotopes of Long Valley waters reflect four groupings. The heavier isotope group contains Casa Diablo samples. The second heaviest isotope group corresponds to Hot Creek waters. The third heaviest group originates from Little Hot Creek waters. The lightest group is associated with eastern caldera hot springs. Other investigators have indicated that if the parent geothermal water is mixed with a Laurel Spring type water, all of the observed Long Valley thermal water types can be produced. This proposed mixing would occur along the straight line drawn in Figure 8. For example, Spring H-II, III could be a mixture of Laurel Spring (LS) water and Hot Creek water (HC 1,2,3). Note, however, that Casa Diablo water (MBP-3 & MBP-1) and Little Hot Creek (LHC-F&T) do not occur on the mixing line and cannot be generated in the proposed way. Mesquite believes that lack of a common mixing line and the distinct grouping indicate that separate hydrothermal systems exist within each of these four areas and, most significantly, that each group has its own recharge area.

As noted above, dilution can explain the ionic chemistry of the Chance #2 type water. However, similarly accounting for the stable isotope values and the observed temperatures requires conflicting percentages of dilution. The hydrogen and oxygen isotope values shown in Figure 8 suggest that a mixture of 43 percent Casa Diablo well water (MBP-2 & 5) with 57 percent Laurel Spring water would be required to yield the observed stable isotope concentrations of Chance #2 water. Furthermore, the geothermal reservoir at Casa Diablo has a temperature of 350°F. At Mammoth/Chance, the reservoir has a subsurface temperature of 271°F. A mixture of 73 percent Casa Diablo water at 350°F with 27 percent water at 54°F (the temperature of Laurel Spring), yields the required temperature of 271°F. Thus, simple dilution does not explain the observed chemistries, and a common shallow aquifer model at Long Valley <u>does not</u> appear to be supported by the collective consideration of the ionic chemistry, temperature and stable isotope values. The basic similarity in the ionic chemistry of Casa Diablo and other thermal waters in the caldera may simply be representative of similar recharge waters and reservoir lithology. In fact, it would be surprising if all thermal waters in the caldera were not similar given the presence of limited number of rock types and a common meteoric recharge source.

3. Temperature complexity - Similar temperature profiles in many of the wells showing a shallow thermal zone underlain by lower temperatures have been utilized as evidence of single aquifer transmitting hot water laterally from Casa Diablo eastward to Lake Crowley. Figure 9 shows such a

temperature profile from Union Mammoth 1, the deepest well at Casa Diablo. Recent closely spaced drilling in the Chance Meadow area has revealed that, as at Casa Diablo, a continuous, lateral flow aquifer does not appear to exist here either. The Chance #1 well intersects a 271°F geothermal reservoir at approximately 250 feet below the surface. An observation well (M-2) located 650 feet south of Chance #1 measured only 130°F at 250 feet. Well M-5 situated 800 feet southeast of Chance #1 recorded only 140°F at 325 Feet. While half way between Chance #1 and Hot Creek Gorge (±200°F), observation Well M-4 has a maximum temperature of only 125°F at a depth of 480 feet. A continuous lateral flow aquifer should have yielded similar temperatures at the comparable depths in these wells.

The complexity of the regional temperature/depth relationship within the caldera is illustrated in Figure 10. In this west to east thermal cross section, the depth to the 100, 200 and 300°F temperatures has been plotted in eleven wells and contoured. These temperature contours rise and fall as the caldera is traversed. A continuous, lateral flow would have flat or nearly horizontal temperature contours. The oscillating thermal contours suggest again that separate thermal systems are segregated by cool areas without active shallow thermal reservoirs.

In summary, Mesquite believes the data discussed above best fit an upwelling/fracture model that has several, possibly four, isolated shallow geothermal systems situated adjacent to the major Long Valley fault systems. As shown on the geologic cross section (Figure 11), cold recharge water from different locations outside the caldera migrates downward along the caldera's ring faults into the basement. In the basement, the water is heated conductively from a magma located beneath the western portion of the caldera. The maximum temperature the waters obtain is a function of their distance from the magma. Clearly, waters of the Casa Diablo system are nearer the magma than are waters of the Chance Meadow/fish hatchery area and Hot Spring Gorge systems. The heated waters upwell towards the surface along the major faults that intersect basement rocks. These hot fluids may then migrate short horizontal distances away from the faults where fractures in competent rocks occur. Note that this depiction has many features in common with the lateral flow cross section discussed initially (Figure 2). The main difference being that the thermal waters upwell in several separate systems rather than a single one in the west. In the eastern portion of Long Valley between Hot Creek and Lake Crowley, Mesquite does recognize that a shallow aquifer is transmitting thermal waters laterally. In this area a thick section of lacustrine sediments occurs which has the type of porosity and permeability that allow a regional aquifer to exist.

Minimal Impact Potential

Berkeley Group, Inc. (BGI) presented several numerical modeling results in the DEIR which attempted to quantify the potential effects of Casa Diablo geothermal development on the surface thermal features of concern. While admittedly based on

simplistic models, the results are illustrative of the magnitude of potential impacts if these areas are truly connected. Even in the worst case, the predicted pressure changes were only increases of a few psi (relative to ±200 psi currently at the top of the Casa Diablo reservoir). An increase in pressure could theoretically increase the thermal water flow rate at the fish hatchery or Hot Creek, but such a relatively small change is likely that it would almost certainly be masked by the natural variations known to occur. BGI's separate numerical modeling of the cold temperature front movement away from the injection point at Casa Diablo (±160°F plant reject water) indicated that even in the worst case, more that 100 years would be required for the slightest cooling to reach as far as the fish hatchery.

It should be further emphasized that for any significant change to propagate away from Casa Diablo, an even bigger change must be seen in the geothermal field itself. Thus far, after two years of MP I operations, no change in pressure, temperature or chemistry has been detected in the field. If a major change were to occur at some point in the future, it is quite likely that corrective adjustments in the management of the production/injection well field would be required before such changes propagated very far. Economic optimization requires that the resource supply the MP II and III plants consistently over their 30± year lifes. Significant deviations in the resource from design specifications are undesirable and would result in a strong economic incentive for corrective action as soon as possible.

Monitoring

Observation Well

Mesquite does not believe that geothermal operations at Casa Diablo will effect thermal springs at either the Hot Creek Fish Hatchery or Hot Creek Gorge. However, subject to receiving the required permits, Mammoth-Pacific has committed to drilling and monitoring an observation well located between the Casa Diablo development and the fish hatchery. The main purpose of this well will be to detect changes in reservoir pressure, temperature, and/or chemistry which might indicate propagation of such changes in the direction of the surface thermal springs at the fish hatchery and Hot Creek.

Mammoth-Pacific met with the rest of the LVHAC in early August and discussed the advantages and disadvantages of the sites available to drill a Casa Diablo observation well. The LVHAC recommended locating the well immediately south of the well field at the 65-32 site (Figure 12). It was recognized that this location, which is only 1700 feet east of the nearest production well and only 1400 feet south of the nearest injection well, would very quickly detect any changes in the Casa Diablo Reservoir. Such early warning would give Mammoth-Pacific ample opportunity to modify, as necessary, the production/injection well field operations in order to curtail any potentially detrimental changes propagating towards the fish hatchery. In addition, Colton Spring is located between the proposed observation well site and the fish hatchery. This spring provides an additional back-up observation point for confirming changes.

although its historical record of fluctuation makes it less reliable than the well.

It was also clearly recognized at the August LVHAC meeting that changes in the Casa Diablo reservoir detected by reservoir monitoring or the proposed observation well would not necessarily mean that there would be an interaction with the fish hatchery and Hot Creek thermal springs. If the upwelling/fracture model is correct, there is no connection and none of the detected changes would be propagated beyond the graben bounding fault to the east. If significant changes in the reservoir at Casa Diablo continue unarrested, a second observation well east of the Casa Diablo graben, between Colton Springs and the fish hatchery, would probably be required. If this second well confirmed significant changes in a "connected" thermal aquifer, the LVHAC would probably recommend measures be undertaken by Mammoth-Pacific to mitigate such changes.

At this point Mesquite has designed and documented the detailed drilling, completion, testing, and monitoring programs for Observation Well 65-32 for Mammoth-Pacific. After LVHAC concurrence, the required permits to drill the well will be applied for. The well should be drilled and tested this fall, which would allow a full year of baseline data collection before the MP II plant begins operation.

As shown on Figure 12, the 65-32 well site is slightly north of the old 395 Highway, approximately 800 feet south of the old 395 and 203 Highway intersection. The well will be drilled to a maximum total depth of 1000 feet (Figure 13), with an option to stop at a shallower depth if, as expected, an active geothermal reservoir is penetrated. After installing casing and wellhead equipment, Mammoth-Pacific plans to flow test the well and collect samples of the thermal waters for chemical analyses. Following the flow test, the well will be instrumented with a temperature compensat-ed quartz crystal pressure transducer that will transmit the reservoir pressure to an automatic recording computer. This instrumentation will allow continuous observation of reservoir pressure with an accuracy of ± 0.01 psi.

The currently proposed data collection program consists of reservoir pressure measurements continuously for one year before and one year after the start-up of the proposed expansion development and then monthly thereafter. Temperature profile surveys and flowing of the well for reservoir fluid chemistry samples will be performed immediately after drilling and then semi-annually. All the data collected from the observation well will be assembled quarterly and submitted to the LVHAC within one month following the end of each quarter.

Mesquite believes that the proposed monitoring program will safely guard the thermal springs at the fish hatchery and Hot Creek from any interference due to Casa Diablo geothermal development.

Mammoth-Pacific I Instrumentation Upgrading

The original well data gathering instrumentation for the

existing MP I operations is currently being supplemented and upgraded. While the original instrumentation was adequate for most field management purposes, the present desire to detect very small changes in pressure and temperature requires enhanced capabilities.

The new pressure monitoring instrumentation for the production wells is essentially the same as that described for the observation well, i.e., continuous recording with a quartz crystal pressure transducer attached to a downhole capillary tube filled with Nitrogen. Wellhead pressures on the injectors will be measured and recorded three times each day using a manual, plug-in type pressure transducer with an accuracy of ± 1.0 psi.

Rates (producers and injectors) will likewise be recorded manually three times each day using a manual, plug-in type pressure transducer to measure the pressure differential across an orifice meter (accuracy ± 5 percent). A plug-in type RTD will be used similarly to measure wellhead temperatures (accuracy $\pm 1.0^{\circ}F$). Samples for chemical analysis will be taken from each production well on a semi-annual basis.

This upgrading effort should be completed by October 1, 1987, in time for a full year of data before MP II and PLES I are started up. Eventually the entire data gathering system, except for chemical sampling, will be fully automated for all the Casa Diablo wells. Such a comprehensive system will provide good quality data for detection of even small changes in resource character long before they become problems.

Don A. Campbell

Don A. Campbell
President
Mesquite Group, Inc.
September 8, 1987

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FIGURE 1

REGIONAL HYDROTHERMAL FEATURES MAP
LONG VALLEY CALDERA

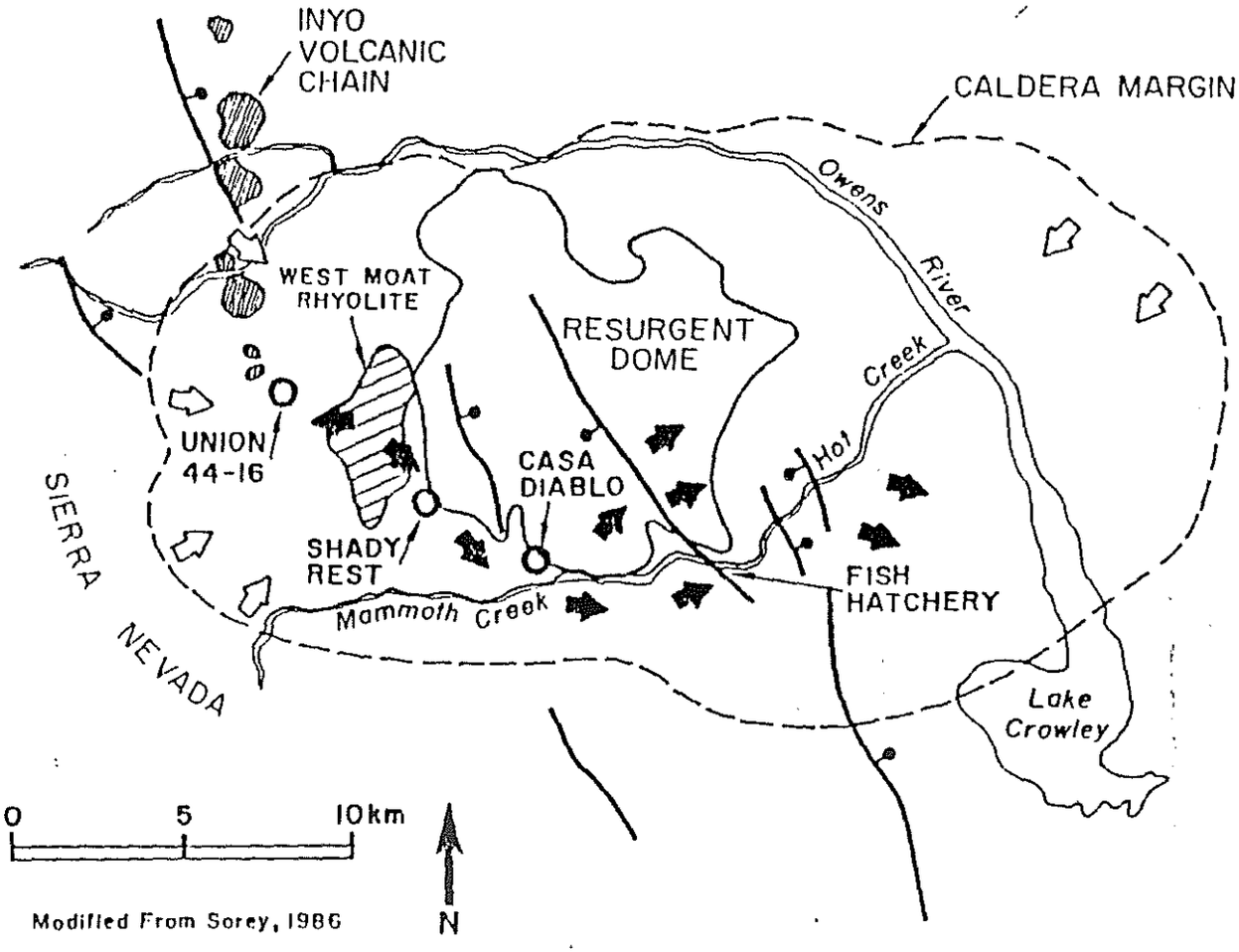


FIGURE 2

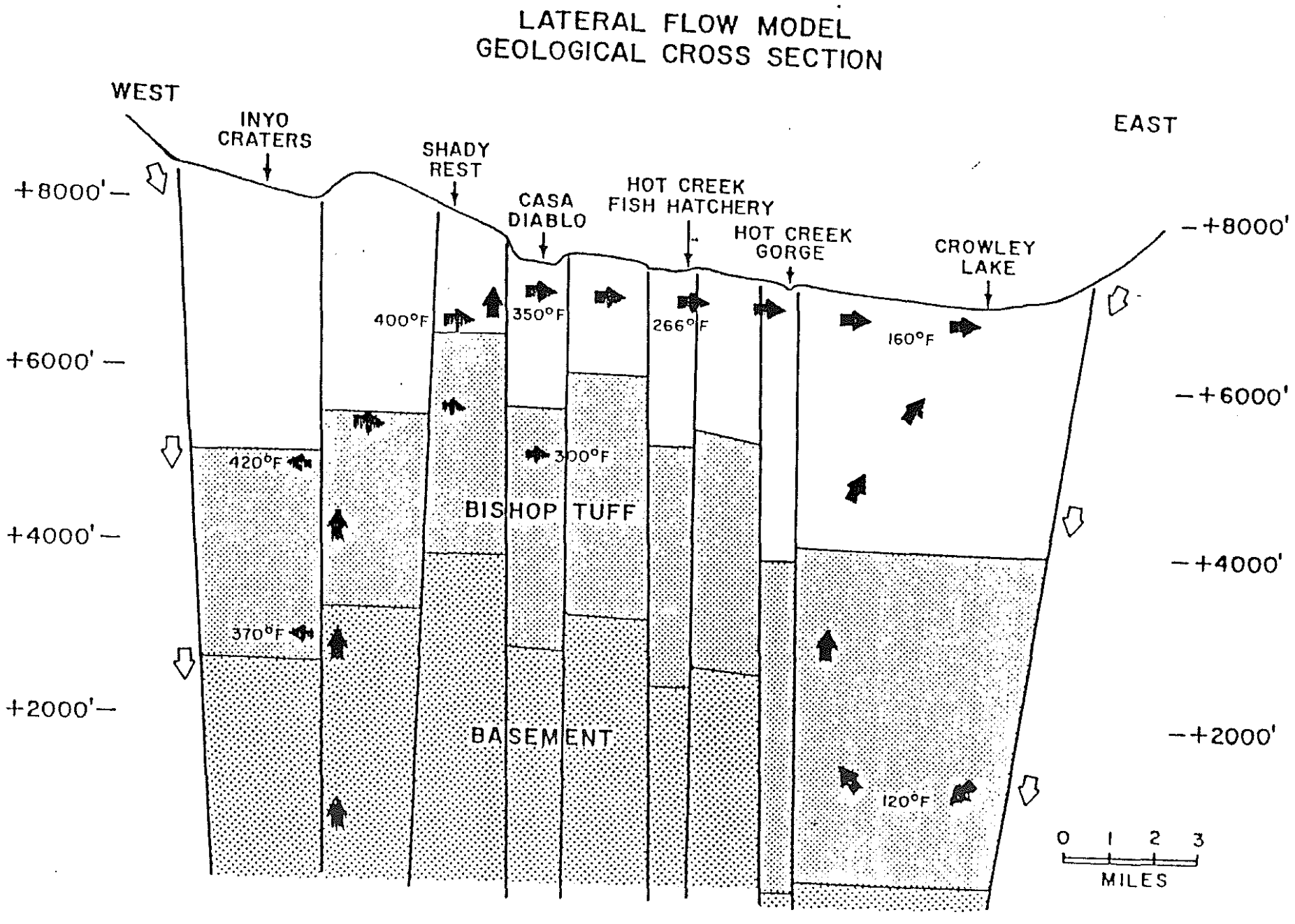

LATERAL FLOW MODEL
GEOLOGICAL CROSS SECTION
WEST
EAST
INYO CRATERS
SHADY REST
CASA DIABLO
HOT CREEK FISH HATCHERY
HOT CREEK GORGE
CROWLEY LAKE
+8000'
+6000'
+4000'
+2000'
400°F
350°F
266°F
160°F
420°F
300°F
370°F
120°F
BISHOP TUFF
BASEMENT
0 1 2 3
MILES

FIGURE 3

MAXIMUM OBSERVED TEMPERATURE MAP
CASA DIABLO GEOTHERMAL FIELD
MONO COUNTY, CALIFORNIA

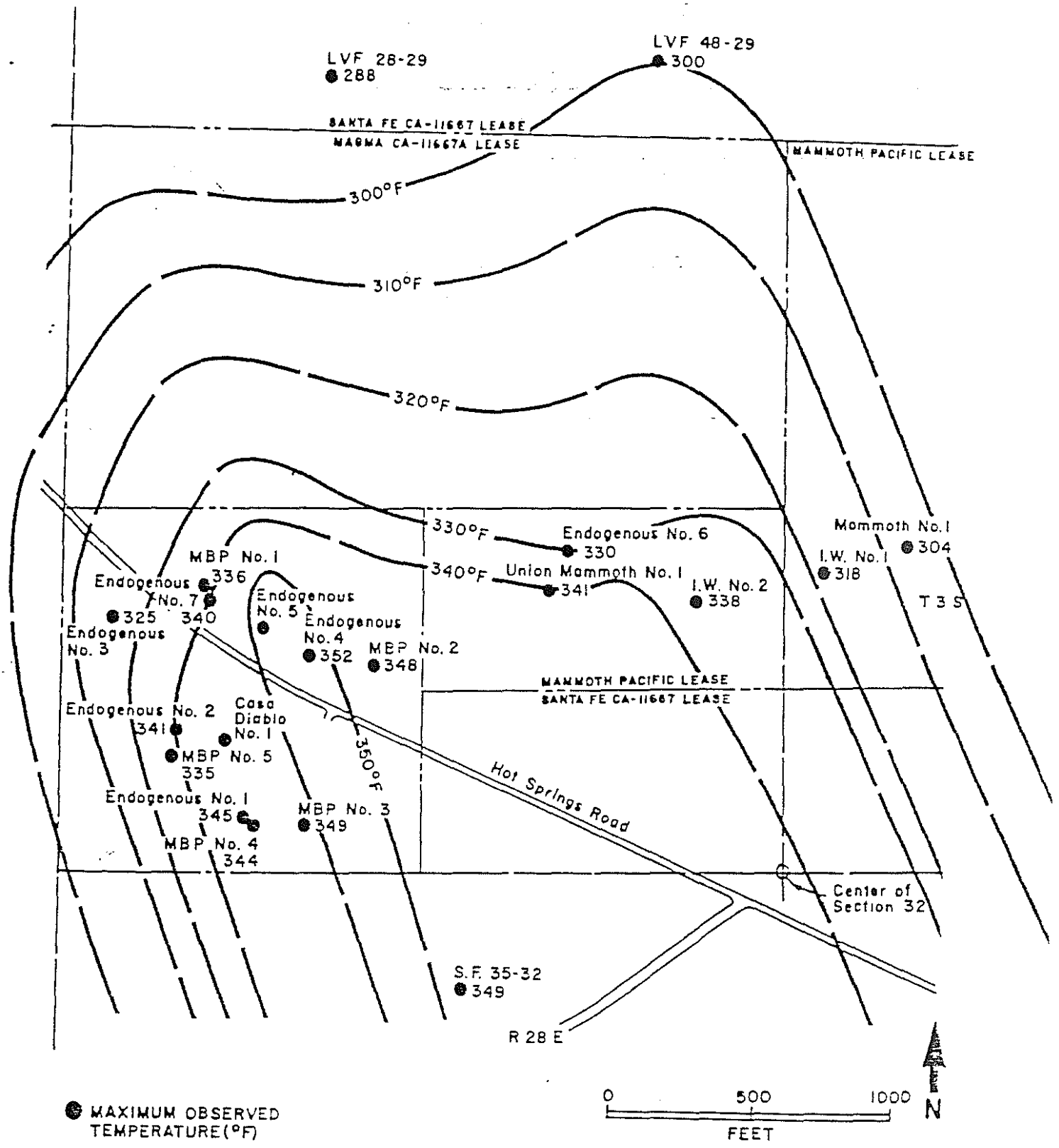


FIGURE 4

CASA DIABLO CROSS SECTION
335°F RESERVOIR

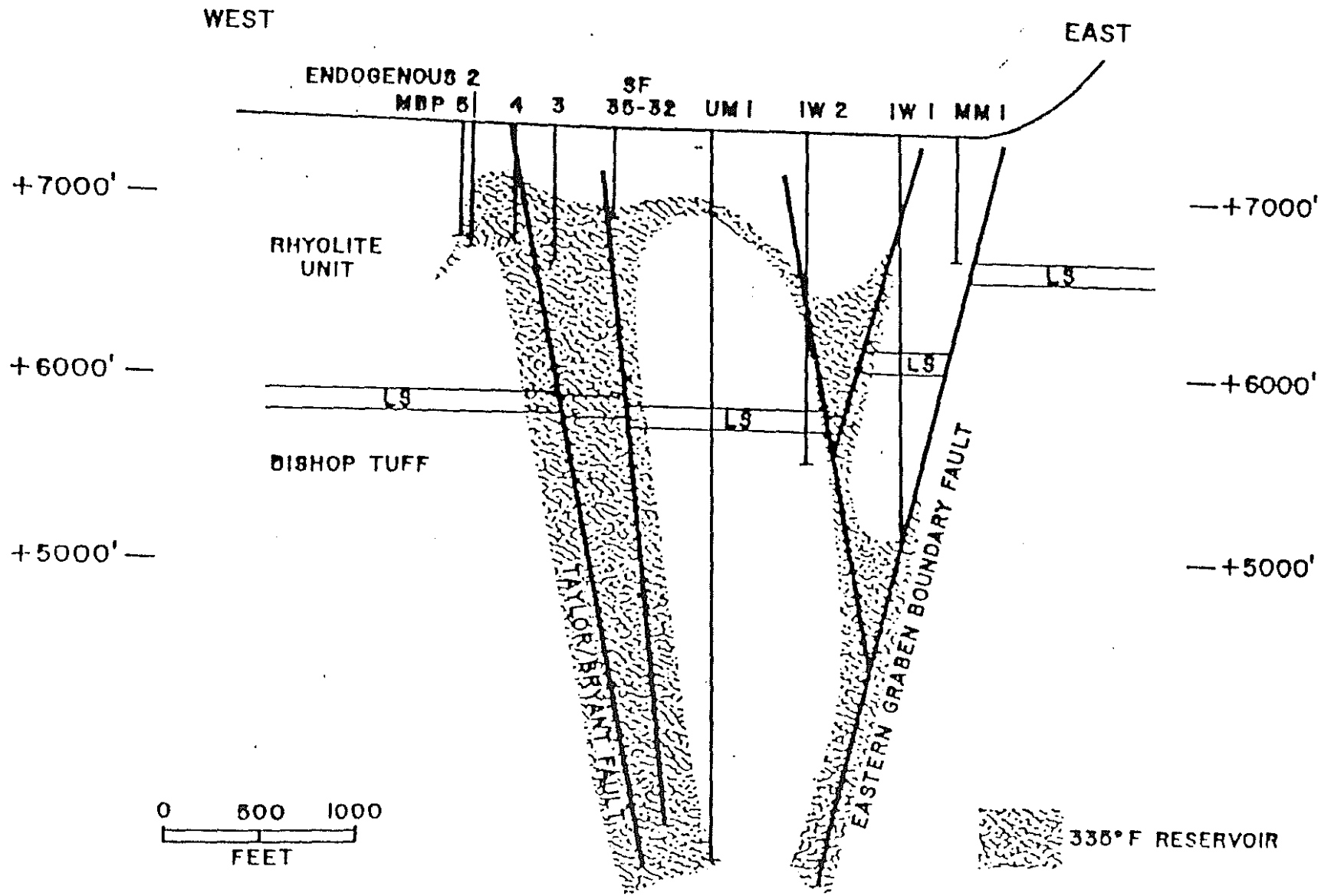


FIGURE 5

UPWELLING / FRACTURE MODEL
SCHEMATIC CROSS SECTION
CASA DIABLO GEOTHERMAL FIELD

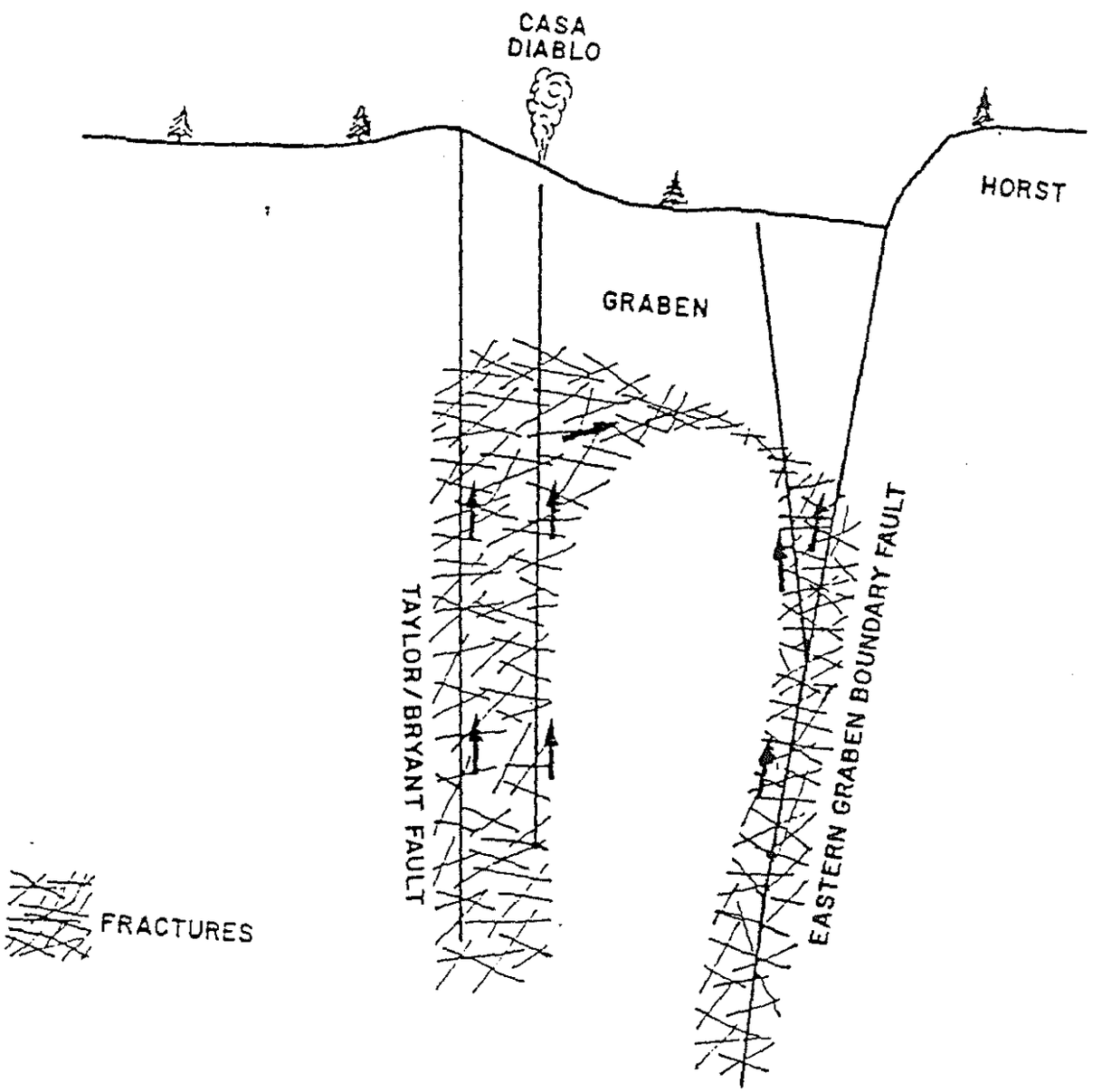


FIGURE 6

LATERAL FLOW MODEL
SCHEMATIC CROSS SECTION

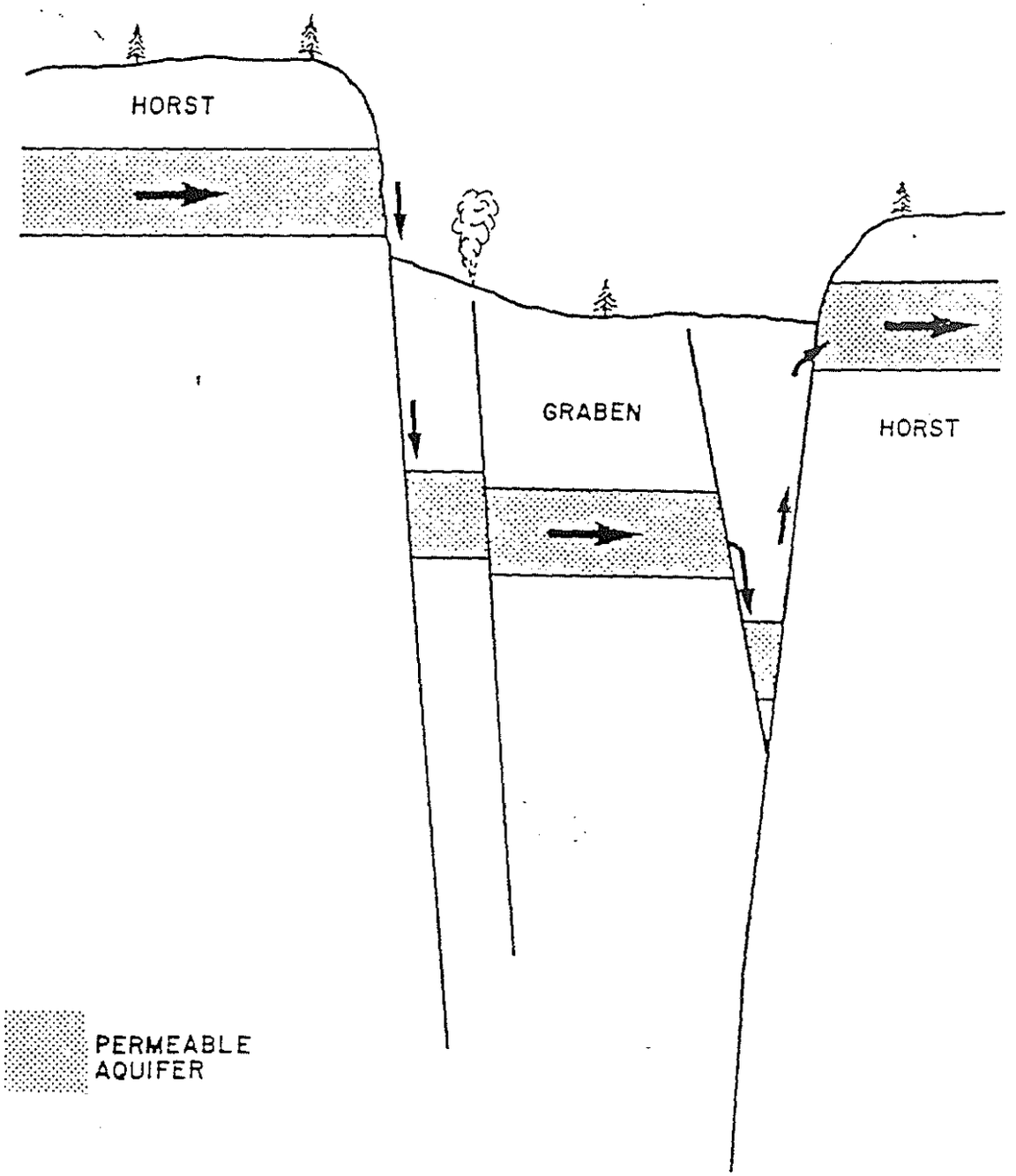


FIGURE 7

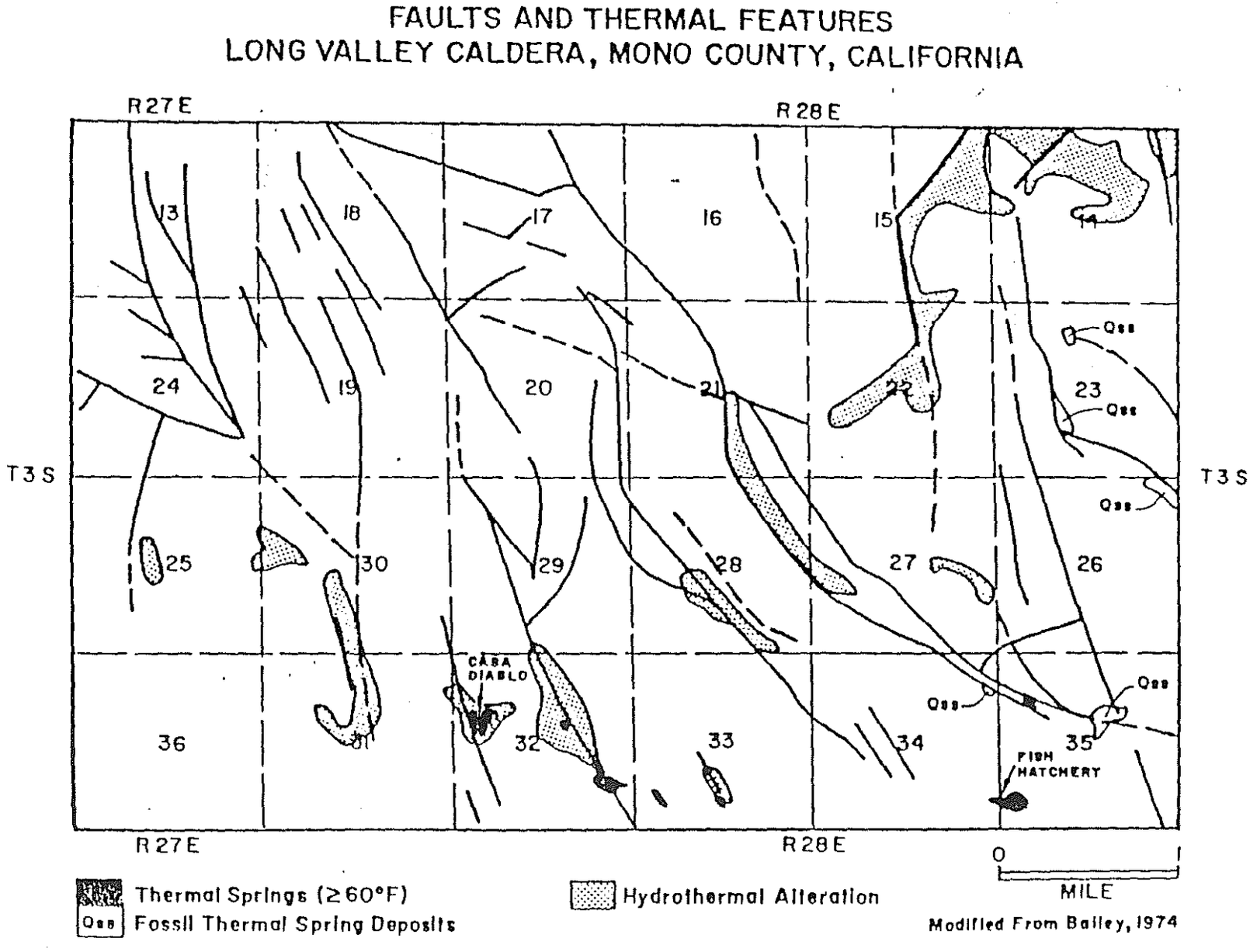
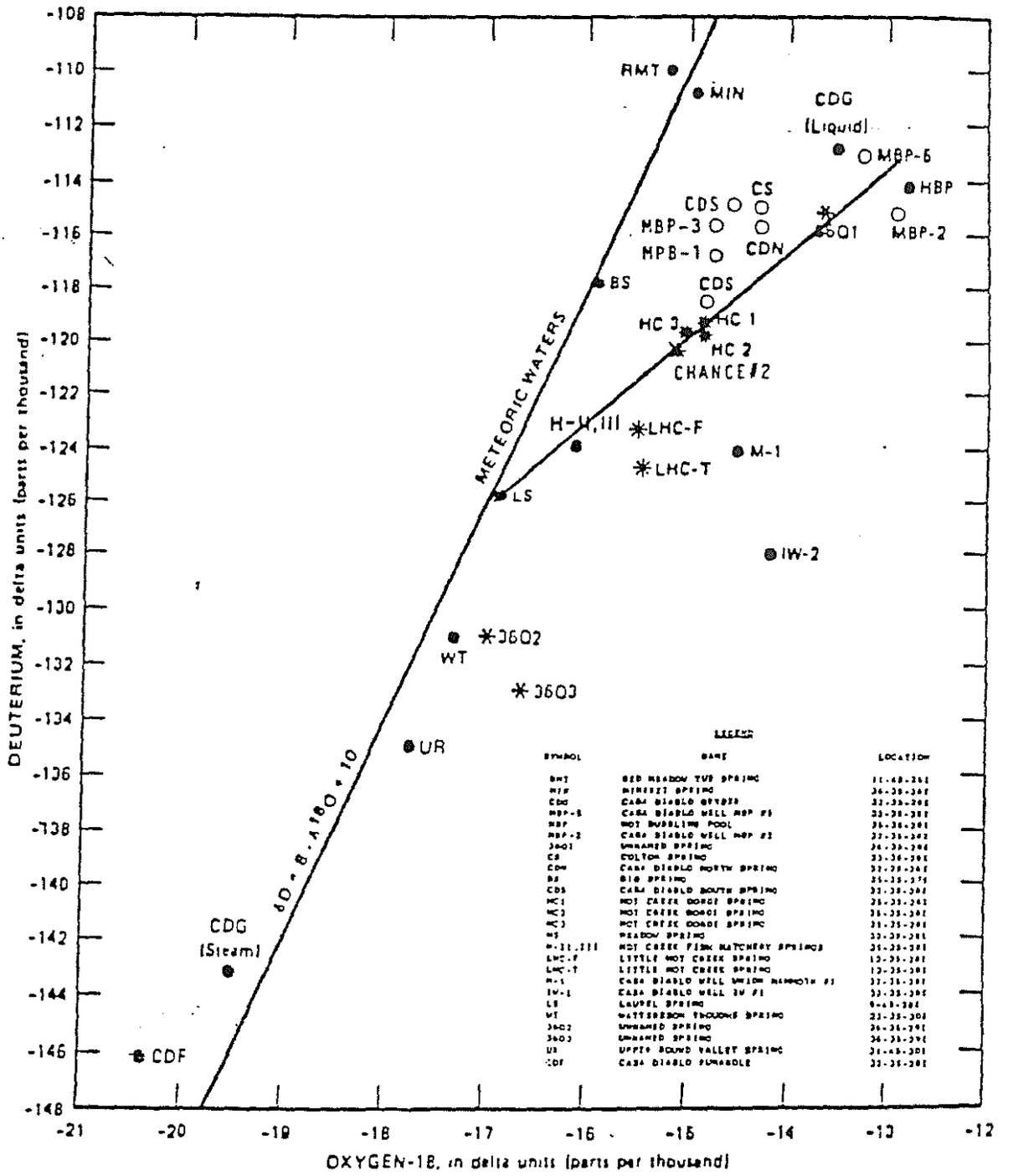

FAULTS AND THERMAL FEATURES
LONG VALLEY CALDERA, MONO COUNTY, CALIFORNIA
R27E
R28E
T3S
13
18
17
16
15
14
24
19
20
21
22
23
25
30
29
28
27
26
36
31
32
33
34
35
CASA DIABLO
FISH HATCHERY
Qss
R27E
R28E
0
MILE
Thermal Springs (≥60°F)
Fossil Thermal Spring Deposits
Hydrothermal Alteration
Modified From Bailey, 1974

FIGURE 8



Hydrogen vs. Oxygen Isotopes from Long Valley, California Waters (After Farrar, et al., 1985)

FIGURE 9

CASA DIABLO GEOTHERMAL FIELD
TEMPERATURE SURVEY, WELL UNION MAMMOTH I

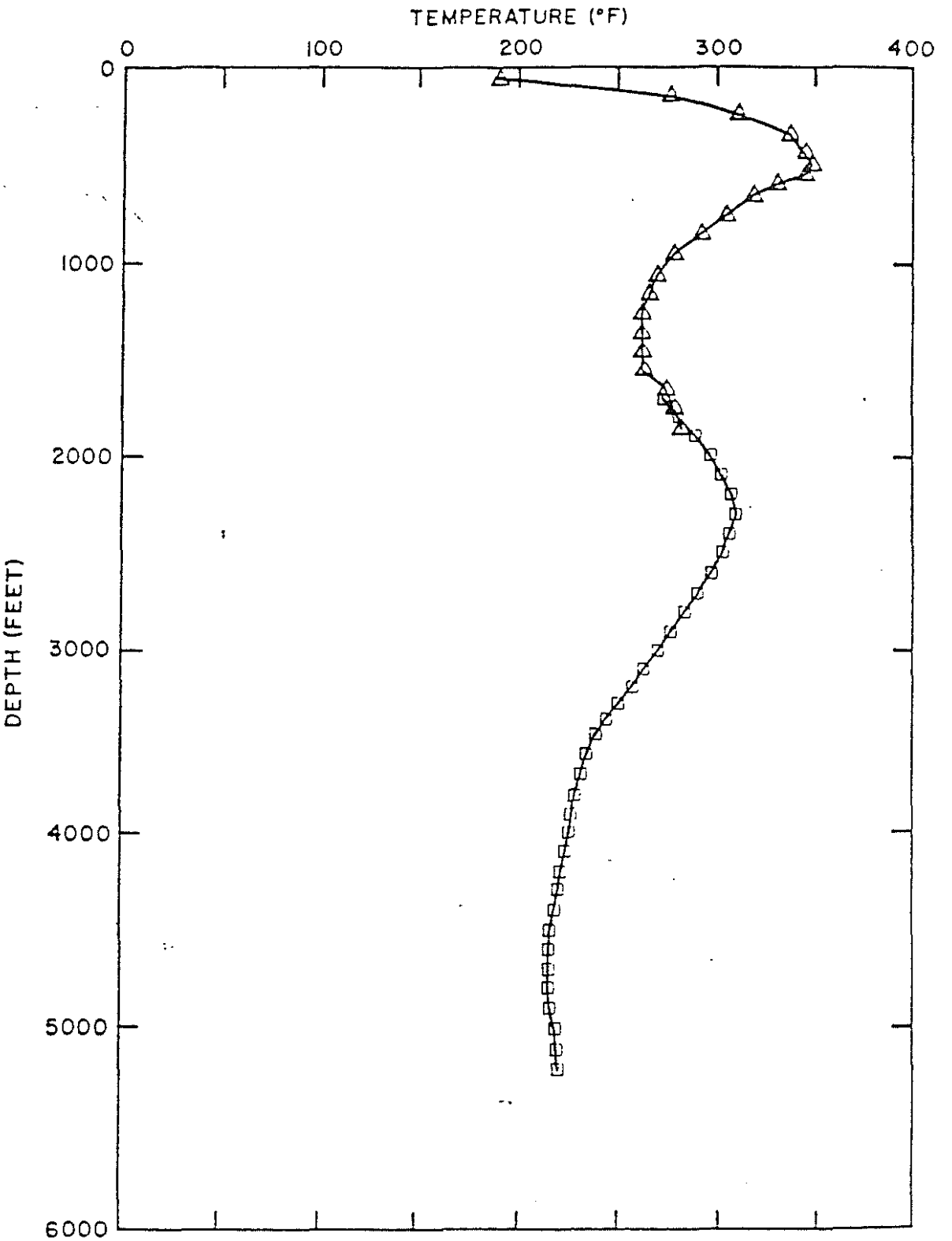


FIGURE 10

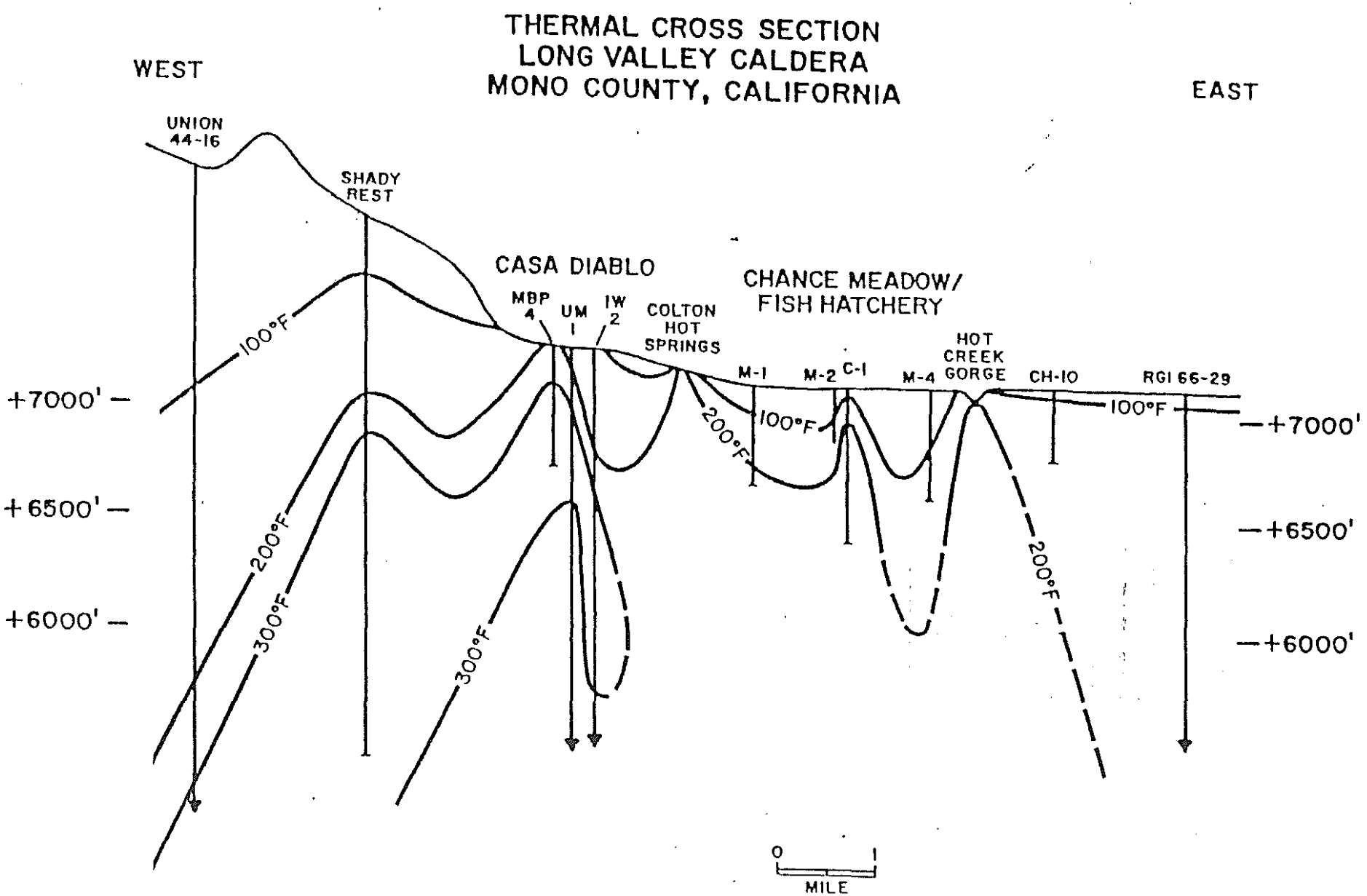

THERMAL CROSS SECTION
LONG VALLEY CALDERA
MONO COUNTY, CALIFORNIA
WEST
EAST
UNION 44-16
SHADY REST
CASA DIABLO
CHANCE MEADOW/ FISH HATCHERY
MBP 4
UM 1
IW 2
COLTON HOT SPRINGS
M-1
M-2
C-1
M-4
HOT CREEK GORGE
CH-10
RGI 66-29
100°F
200°F
300°F
+7000'
+6500'
+6000'
0
1
MILE

FIGURE 11

UPWELLING/FRACTURE MODEL GEOLOGICAL CROSS SECTION

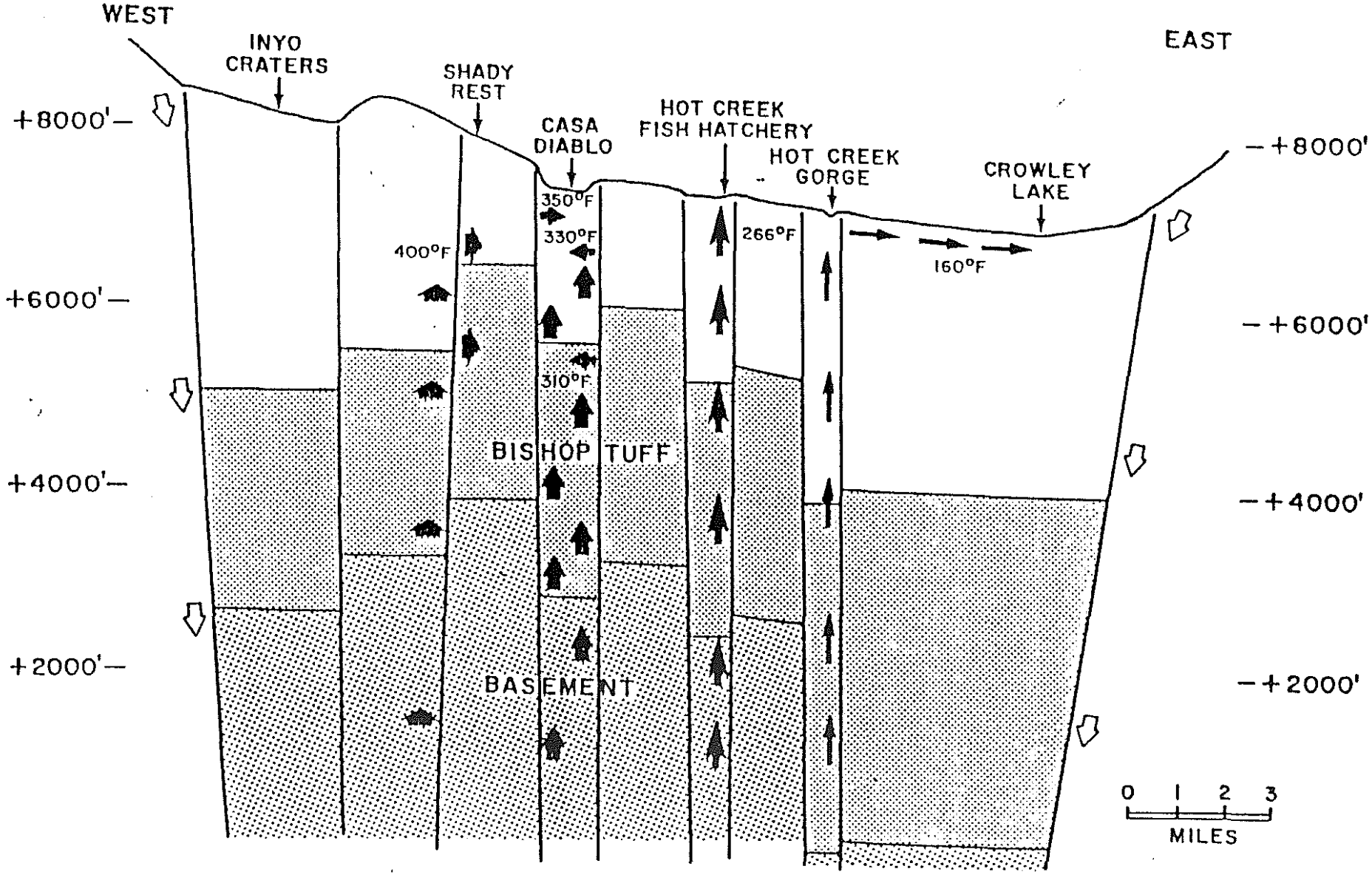


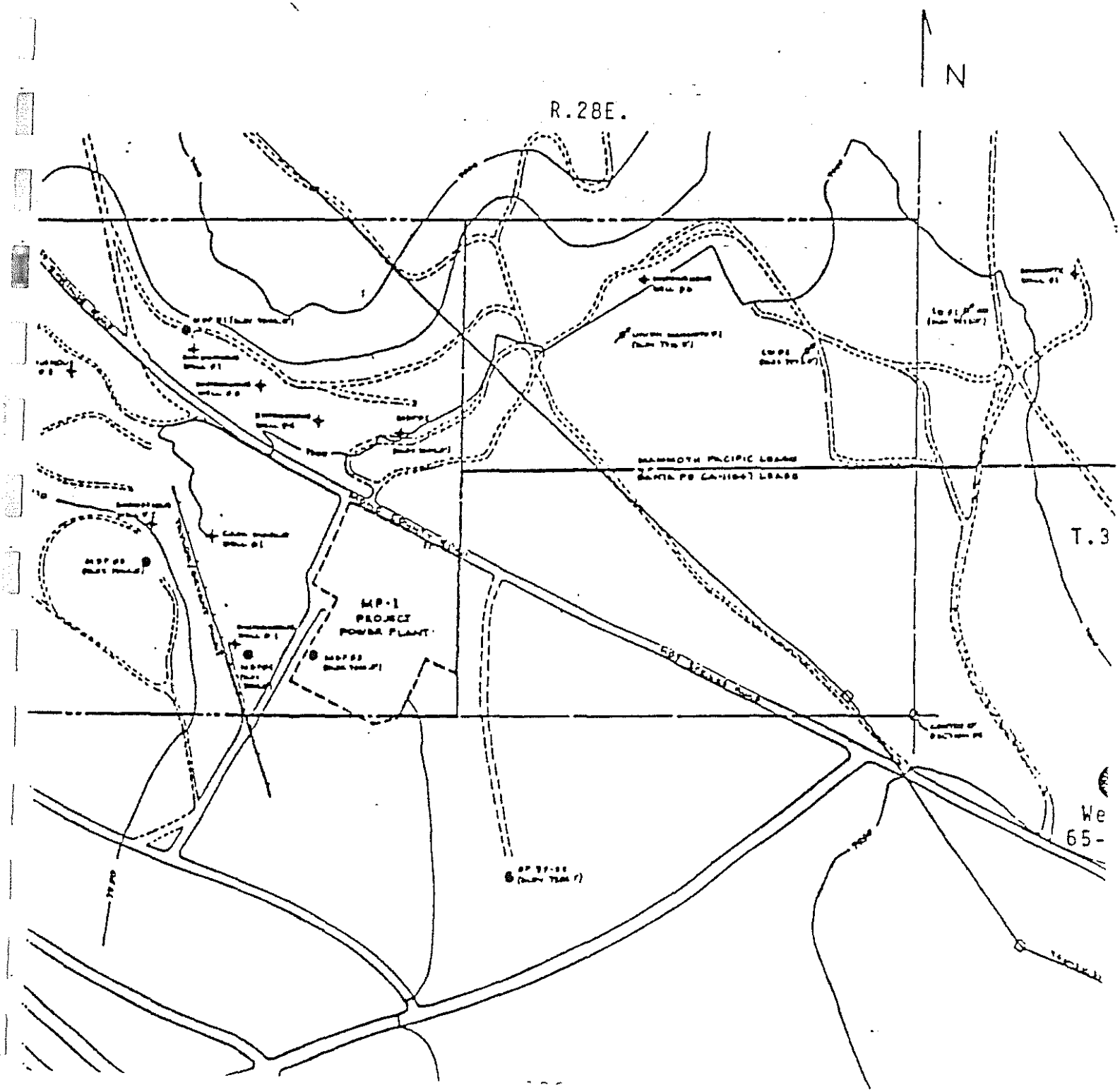
FIGURE 12

LOCATION MAP

CASA DIABLO OBSERVATION WELL 65-32

MONO COUNTY, CALIFORNIA

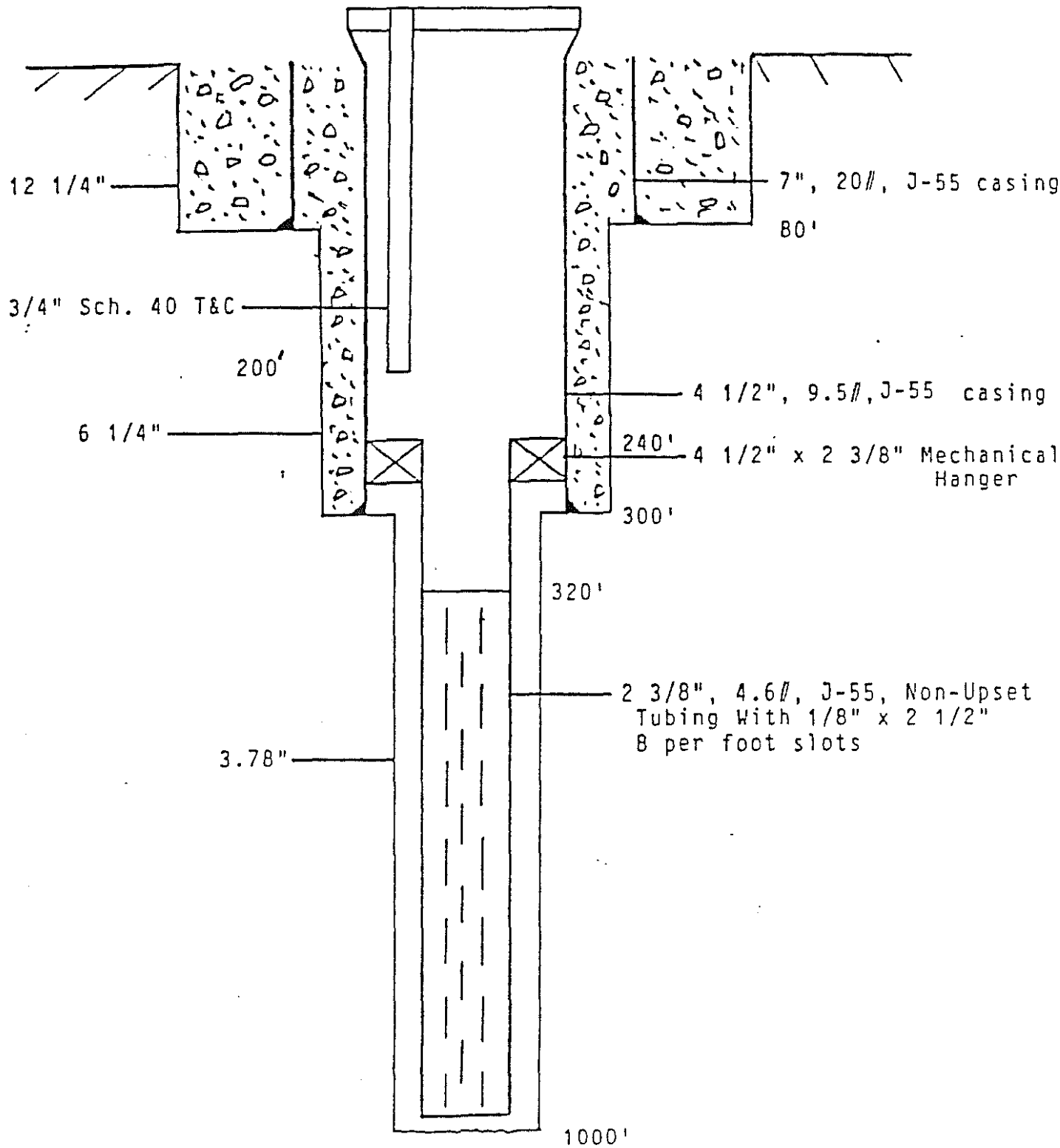
LOCATION: Approximately 2950' South and 2150' West of the NE Corner of Section 32, Township 3 South, Range 28 East, M.D.B. & M.



WELL COMPLETION DRAWING

CASA DIABLO OBSERVATION WELL 65-32

MONO COUNTY, CALIFORNIA



Not Drawn To Scale

SUMMARY OF COMMENTS AT PUBLIC HEARING BEFORE
MONO COUNTY PLANNING COMMISSION

SEPTEMBER 14, 1987

1. Frank Stewart, speaking for Hamilton Hess, Sierra Club:
   - See Sierra Club letter dated 9.6.87.

2. Robert Brown, California Department of Fish and Game, Bishop.
   - No-Project Alternative should be pursued.
   - EIR should more fully discuss economic value of hatchery to the County.
   - EIR should fully discuss effects of past spills at Casa Diablo using CDFG records.
   - Cite experiences at the Geysers to discuss changes in aquatic fauna.
   - Discuss spill containment and waste discharge using the Geysers as a model.
   - Be more specific about proposed containment

3. Lisa Jaeger, Interested Citizen.
   - If the geothermal component of water at the hatchery or Hot Creek Gorge decreases, it should not be the County's responsibility to prove that use of the resource for power generation has caused the loss. The burden of proof should rest with the power plant owners and operators to prove that the power plants are not responsible.
   - Mammoth-Pacific should post bond to cover abandonment or any damage to aquatic resources.
   - EIR should discuss economic loss due to degradation of visual resources.
   - EIR should give cost to administer and monitor geothermal projects.
   - A comprehensive cumulative analysis is needed.

4. Dan Dawson, Mono County Planning Commissioner.
   - EIR should include summary of unmitigable significant impacts. He listed visual, hydrothermal resource, and industrialization of Long Valley in that category.
   - Put all fluid transmission lines below grade.
   - Put all power lines underground.
   - Alternatives are not well developed. Should discuss other alternatives and alternative mitigation measures.
   - Discuss mitigation measures used at the Geysers.
   - EIR should discuss industrialization of Long Valley.

5. Bob Kimball, Mono County Planning Commissioner.
   - Put pipelines below grade in ditches.
   - Burden of proof for damage should not rest on the County.

6. Sydney Quinn, Mono County Planning Commissioner.
   - How many visitor days occur at Hot Creek?
   - There should be much more economic detail, especially about the direct costs and benefits ot the County.
   - There should be a definitive discussion of the hydrology.

additional OFKC comment at 1980 hearing

1) Supply of water, geothermal fluid etc to compensate or restore and "existing or present" condition (IE temp D.O. WATER CHEMISTRY @ HOT CREEK HATCHERY SPRINGS OR HOT CREEK HOT SPRINGS) is not a realistic or acceptable mitigation measure. If the project proponent believes this to be "acceptable mitigation" further analysis + discussion must be presented in the final EIR, and demonstration of capability to deliver "acceptable" "supply" undamaged must be done.

2.) Full discussion of and the OFKC suggests that a bond or other mechanism be posted to cover any loss in hatchery production or aquatic fauna.

~~NCL CHASSEL...~~ (Hydrology Overview relationship)

3.) The probable relationship between surface flow shallow groundwater "constant temperature" springs and the geothermal fluid must be assessed to the present "state of knowledge" "state of the art" or state of risk or uncertainty.

FROM 1 CFS TO 90 DAY
RYAN REGRESSION THERMOGRAPH
5-21-87

THERMOGRAPH DATA
HOT CREEK HATCHERY

1986

DATE	A-B Supply Pond	C-D Supply Pond	C-D Supply Spring	Select Pond I	Hatch I Supply	Hatch II & III Supply	Coyote Ditch	Hot Creek Gorge
1-2-86	60.9	57.7	55.2	54.4	52.8	51.8	54.7	50.8
1-8-86	61.2	57.9	55.2	54.3	53.8	51.7	54.4	—
1-22-86	61.0	57.8	55.2	54.0	53.7	51.6	54.5	—
2-4-86	61.0	57.8	55.1	53.7	53.7	51.5	54.6	49
2-21-86	61.5	57.6	55.0	53.2	53.6	51.4	54.5	—
3-7-86	60.7	57.6	55.0	53.0	53.6	51.3	54.5	49
3-21-86	60.2	57.2	54.8	53.6	53.6	51.2	54.4	—
4-1-86	60.0	—	54.6	53.2	53.4	51.9	54.2	—
4-14-86	59.8	56.5	54.4	53.4	53.2	50.9	52.4	58.8
4-28-86	59.9	57.2	54.4	53.4	53.2	51.0	54.1	58.6
5-12-86	60.8	57.8	54.1	52.6	53.6	51.0	54.1	62.5
5-29-86	60.0	56.4	54.2	52.6	53.5	51.2	53.8	—
6-9-86	61.2	—	54.1	52.7	53.4	51.0	53.6	52.5
6-24-86	60.4	56.3	54.2	53.5	53.6	51.3	53.6	—
7-15-86	—	—	—	—	53.8	51.4	53.5	—
7-16-86	60.6	56.6	54.1	53.6	—	—	—	—
8-1-86	60.4	56.4	54.4	54.4	53.8	51.8	33.8	—
11-5-86	62.3	57.3	55.0	54.4	53.4	51.7	55.9	56.1
12-12-86	62.0	58.1	55.1	54.2	53.4	51.8	54.0	50.1

THERMOGRAPH DATA
HOT CREEK HATCHERY

1987

DATE	A-B Supply Pond	C-D Supply Pond	C-D Supply Barrel	Rearing Pond II	Hatchery Supply	Rearing Pond III Supply	Coop to Gulch	Hot Creek Gorge
3-30-87	60.8	55.2	59.0	53.7	53.2	51.3	54.2	60.4
4-8-87	61.2	58.5	55.2	53.4	53.1	51.4	54.2	67.2
4-18-87	61.3	58.8	55.4	54.4	53.2	51.3	54.2	64.1

5-21-87

THERMOGRAPH DATA
Hot Creek Hatchery

1985

DATE	A-B Supply Pond	C-D Supply Pond	C-D Supply Spring	Select Pond I	Hatch I Supply	Hatch II & III Supply	Coyote Gulch	Hot Ck Gorge
1-24-85	60.8	57.8	55.0	54.5	53.9	51.3	54.9	53.0
2-8-85	60.8	57.6	55.2	54.0	54.2	51.6	55.2	—
3-7	60.2	57.6	55.0	54.8	54.0	51.4	55.2	54.2
3-20	60.3	57.4	55.1	55.7	54.2	51.4	55.2	54.8
4-11	60.1	57.9	54.8	53.5	55.4	51.4	54.8	62.4
4-17	60.0	58.0	54.8	53.2	53.8	51.4	54.8	49.2
5-20	60.6	57.4	55.0	53.6	54.2	51.3	54.3	< 50
5-31	60.4	58.2	55.0	53.4	54.1	51.3	54.4	49
6-10	60.6	56.8	54.8	53.6	54.0	51.2	54.3	57.3
6-24	60.7	56.7	54.8	53.7	54.1	51.3	54.3	—
8-2-85	61.3	56.8	55.1	53.9	54.2	51.8	54.4	59.2
8-19	61.4	57.1	55.1	54.7	54.2	51.8	54.3	—
9-3	61.5	57.3	55.0	54.7	53.9	51.8	54.2	55.3
9-16	61.7	57.6	55.2	54.7	54.0	51.8	54.2	63.9
10-2	61.7	57.7	55.3	54.9	53.9	51.9	54.3	—
10-16	61.6	57.6	56.2	54.2	53.8	51.8	54.3	53.3
11-13	61.6	57.7	55.3	54.6	53.8	51.9	54.3	52.2
12-2	61.3	57.8	55.2	53.2	53.4	51.8	54.4	—
12-16	61.3	58.0	55.3	53.7	53.8	51.9	54.6	52.6

5-21-87

THERMOGRAPH DATA
HOT CREEK HATCHERY

1984

DATE	A-B supply pond	C-D supply pond	C-D supply spring	SOLDIER POND I	HAT I supply	HAT II supply	COYOTE Gulch	HATCH BARGE
1-9-84	60.7	57.4	55.5	54.4	53.8	51.9	51.9	52.5
1-25-84	60.6	57.4	55.8	54.0	53.7	51.8	54.5	50.8
2-7-84	60.5	57.4	55.8	53.6	53.7	51.8	54.5	50.1
2-29	60.5	57.6	55.9	53.7	53.7	51.8	54.6	56.4
3-9	60.4	57.6	56.0	53.6	53.6	51.3	54.6	54.0
3-19	60.2	57.5	55.9	53.5	53.6	51.6	54.6	56.7
4-3	60.2	58.0	56.1	53.4	53.6	51.6	54.2	57.2
4-19	60.3	57.4	55.9	53.5	53.7	51.5	54.9	49.6
4-30	60.3	57.4	56.0	53.4	53.7	51.5	54.6	59.0
5-14	60.3	57.5	55.5	53.4	53.7	51.5	54.7	—
5-30	60.3	57.2	55.8	53.7	53.8	51.5	54.8	53.2
6-11-84	60.6	57.4	55.8	54.1	53.8	51.8	54.9	50.4
6-25	60.7	57.1	55.9	54.4	54.0	51.7	55.0	64.0
7-12	60.7	57.1	55.9	54.8	54.1	51.8	55.1	—
7-24	60.8	57.0	55.8	54.9	54.2	51.8	55.2	58.4
8-17	61.1	57.8	55.8	54.8	54.4	52.0	55.4	59.2
8-31	61.2	57.8	55.6	55.7	54.7	52.2	54.4	57.6
9-6	61.3	58.0	55.8	55.9	54.6	52.2	53.6	56.0
10-1	61.2	57.1	55.6	56.0	54.4	52.1	55.5	56.4
10-15	61.5	57.6	55.8	56.2	54.4	52.4	55.8	49.6
10-29	61.6	57.2	55.6	56.2	54.8	52.2	55.6	—
11-30	61.6	57.4	55.4	55.8	54.6	52.2	55.4	52.2

5-21-87

THERMOGRAPH DATA
HOT CREEK HATCHERY

1983

DATE	A-B Supply POND	C-D supply POND	C-D supply SPRING	SELECT POND	HAT I supply	HAT II & III supply	COYOTE GULCH	HOT CK GORGE
1-4-83	61.8	58.2	56.2	55.2	58.8	52.4	54.9	48.0
1-10-	61.6	58.6	56.2	54.8	53.8	52.2	55.0	48.2
1-26	61.6	58.0	56.2	54.2	—	52.2	54.4	—
2-7	61.6	58.2	55.4	54.2	54.0	52.0	54.8	
2-24	60.8	58.1	55.2	54.6	54.4	—	55.2	—
3-11	61.3	—	55.8	54.2	54.2	52.0	54.8	48.8
3-21	60.8	58.0	55.8	54.8	63.7	51.8	54.4	47.4
4-5	60.8	58.4	54.8	54.4	56.2	51.6	54.8	52.9
4-19	60.4	58.1	55.6	53.0	54.1	51.6	54.8	50.6
5-2	60.2	57.8	55.4	52.8	53.8	51.4	54.6	49.2
5-16	60.1	57.4	55.1	52.4	53.8	51.2	54.6	50.4
6-2-83	60.0	58.4	54.9	53.1	53.9	51.4	54.5	52.9
6-13	59.9	57.2	55.1	52.9	54.0	51.4	54.2	49.8
7-6	59.8	59.1	55.0	53.4	54.0	51.8	54.2	66.2
7-13	59.7	56.9	54.9	53.6	54.8	51.8	53.9	52.9
7-28	59.6	56.9	54.9	54.1	54.0	51.9	54.2	56.9
8-8	59.5	56.8	54.9	54.4	54.2	52.0	54.0	65.3
8-25	59.4	57.0	54.8	54.8	54.1	52.0	54.1	—
9-12	59.8	57.0	54.9	55.1	54.2	52.2	54.3	57.6
9-26	59.4	56.9	55.0	55.2	54.1	52.3	54.0	54.8
10-18	59.8	57.6	55.0	55.3	54.0	52.2	54.3	57.1
11-3	60.6	58.2	55.2	55.1	54.0	52.3	54.4	56.9
11-19	60.5	57.4	55.2	55.4	53.6	52.1	54.3	48.8
12-1	60.9	57.3	55.2	55.1	53.8	52.0	54.4	48.2
12-15	61.0	57.5	55.4	54.9	53.8	52.0	54.4	51.1
12-30	60.9	57.4	55.5	54.6	53.8	52.1	54.6	—

5-21-87

THERMOGRAPH DATA
HOT CREEK HATCHERY

982

DATE	A-B Supply Pond B	C-D Supply Pond D	C-D Supply Spring	SELECT Pond E	Hot I Supply	Hot II & III Supply	Upper Gulch	Hot Ck Gorge
2-22	61.3	57.2	55.4	55.8	54.2	54.4	55.2	
-26-82	61.6	57.8	56.2	56.0	54.4	52.2	55.4	
:8-82	61.4	57.6	56.4	55.4	54.4	52.6	55.5	49
-23-82	62.6	59.9	56.9	55.4	54.6	52.4	55.2	
-5-82	62.2	59.8	56.8	55.4	54.8	52.6	55.4	58.9
3-24-82	61.8	58.8	56.8	55.8	55.8	52.2	55.5	51
-5-82	61.6	58.8	56.2	54.8	54.2	52.2	55.5	52.4
-19-82	61.0	59.5	56.6	55.5	55.5	52.4	55.2	
5-6-82	60.7	59.4	56.4	54.2	54.9	52.2	55.2	
-17-82	61.4	60.0	58.9	54.9	56.9	53	55.8	60.4
-1-82	59.9	59.2	57.6	55.2	54.8	52.8	54.9	57.2
6-15-82	61.9	58.4	56	55.8	54.4	52.5	55.6	58.2
7-15-82	61.5	58.6	56.2	54.8	55.4	53.8	54.9	58.4
7-26-82	61.5	58.8	56.4	55.4	55.2	52.5	54.8	59.2
8-12-82	61.4	57.6	57.0	55.2	54.9	52.9	54.8	
8-23-82	61.8	57.2	56.1	55.8	55.2	52.6		
0-1-82	61.2	57.8	56.0	56.2	55.4	53.0	54.2	54.3
10-21-82	62.4	57.9	56.1	55.9	55.0	52.8	55.2	56.4
11-10-82	61.9	57.9	55.9	55.6	54.8	53.0	54.8	55.2
11-16-82	61.8	57.9	56.1	55.9	54.6	52.6	54.8	51.4
12-2-82	61.4	57.8	55.6	55.0	53.6	52.2	55.0	46.2
12-14-82	60.9	57.8	56.2	55.4	53.8	52.4	55.2	48.4

5-22-87

THERMOGRAPH DATA
HOT CREEK HATCHERY

1981

DATE	A-B Supply Pond	C-D Supply Pond	C-D Supply Spring	Select Pond I	Hat I Supply	Hat II & III Supply	Coyote Gulch	Hot Creek Gorge
1-16-81	62.1	58.8	56.2	55.4	54.4	52.4	—	—
2-9-81	61.8	58.8	56.2	54.8	54.2	54.2	55-	
2-28-81	—	58.9	56.1	54.8	54.2	—	—	—
3-10-81	—	58.7	56.1	54.7	54.2	—	—	—
3-31-81	—	58.5	56.2	54.6	54.4	51.8	55.6	60.4
4-7-81	—	58.4	56.2	54.6	54.2	52.0	55.4	58.2
4-20-81	61.2	58.6	56.2	53.8	54.4	54.2	55.2	54.6
5-5-81	60.9	58.6	55.9	54.0	54.5	—	—	—
5-8-81	—	58.6	56.2	54.8	54.3	—	—	—
6-1-81	—	58.8	56.2	54.9	54.6	—	—	—
7-2-81	—	58.8	56.5	54.6	54.6	—	—	—
7-13-81	—	59.0	56.2	54.9	54.8	—	—	—
9-23-81	62.5	59.5	57.0	56.8	54.9	52.7	55.1	62.6
10-22-81	62.2	58.6	56.6	56.2	54.8	52.4	55.1	
11-4-81	62.6	58.6	56.4	56.6	54.9	53.6	55.6	55.0
11-18-81	62.4	58.8	56.8	56.6	54.8	—	55.5	—
12-7-81	62.6	58.6	56.0	56.0	54.6	52.9	55.4	—
12-21-81	61.9	58.6	56.6	56.0	54.2	52.4	55.4	49.9

THERMOGRAPH DATA

HOT CREEK HATCHERY

1980

DATE	A-D SUPPLY POND	C-D SUPPLY POND	C-D SUPPLY SPRING	SELECT POND	HAT. I SUPPLY	HAT. II SUPPLY	COYOTE GULCH	HOT CREEK GORGE
1-3-87	62.5	58.9	56.9	—	54.6	—	—	—
1-30-87	62.0	59.0	56.9	55.8	54.8	—	—	—
2-11-87	62.0	59.0	56.8	54.4	54.6	52.5	55.0	
2-22-87	62.8	58.8	56.8	55.4	54.6	52.2	55.6	—
3-18-87	62.6	58.6	56.6	55.0	54.2	52.4	55.4	49.8
3-27-87	61.2	58.6	56.5	54.9	54.4	51.2	55.2	53.0
4-16-87	61.3	58.9	56.4	55.0	54.7	51.9	55.4	60.8
4-25-87	—	58.9	56.1	54.4	54.2	52.0	55.4	60.5
5-13-87	—	59.4	56.2	53.9	54.5	51.9	55.3	61.5
6-4-87	—	59.1	56.1	54.6	54.4	51.7	55.2	46.2
6-17-87	62.2	59.2	56.0	53.9	54.6	51.8	55.2	62.3
7-2-87	—	59.1	56.2	53.9	54.8	51.7	55.1	61.4
7-15-87	—	58.8	56.0	54.4	54.6	51.6	54.9	54.8
8-15-87	—	58.2	55.9	55.2	54.2	52.0	54.8	53.6
8-26-87	62.2	58.2	56.0	55.4	54.6	52.0	54.9	62.2
10-14-87	61.4	58.6	56.2	55.2	54.5	52.0	55.0	51.0
10-28-87	61.5	57.6	56.2	55.9	53.8	51.8	54.9	—
11-12-87	62.1	58.8	56.1	55.9	54.8	51.9	55.0	55.6
12-16-87	62.6	58.9	56.2	55.8	54.8	52.6	55.2	47.5
12-30-87	—	58.9	56.4	55.6	54.2	—	—	51.2

[illegible] DATA

HOT CREEK HATCHERY

1979

DATE	A-B POND	C-D POND	C-D SPECIAL SPECIES	SELECT POND	HATCH SUPPLY	HATCH III SUPPLY	COYOTE CREEK	HOT CR. GORGE
1-[illegible]-79	[illegible].0	[illegible]	57.0	56.0	55.0	53.5	—	—
1-[illegible]-79	[illegible]	[illegible]	56.2	55.8	54.2	52.3	—	—
2-[illegible]-79	[illegible]	[illegible]	56.6	54.8	54.2	52.2	—	—
2-[illegible]-79	[illegible]	[illegible]	56.8	55.9	54.4	52.2	54.4	55.0
3-13-79	[illegible]	[illegible]	56.2	54.8	54.4	52.1	—	—
3-27-79	[illegible]	58.8	56.3	54.4	54.0	52.0	55.3	—
4-10-79	62.2	58.8	56.2	54.6	54.4	51.8	54.2	56.3
4-24-79	62.4	58.8	56.5	54.6	54.2	51.8	—	—
5-8-79	62.4	58.4	56.0	53.9	54.2	51.6	—	—
5-23-79	63.0	59.0	56.2	54.4	54.4	51.6	55.0	54.9
6-5-79	62.6	59.4	56.8	54.6	54.2	51.9	—	—
6-19-79	62.5	59.2	56.4	54.2	54.2	51.9	—	—
7-12-79	64.[illegible]	59.8	56.2	54.7	54.8	52.1	—	—
7-29-79	63.0	[illegible]	56.4	55.4	54.8	52.4	55.2	56.4
8-14-79	63.[illegible]	[illegible]	56.4	55.4	54.8	52.6	55.2	—
9-18-79	—	[illegible]	56.6	56.1	54.9	—	—	—
10-2-79	64.5	[illegible]	56.8	56.8	54.4	—	55.4	58.0
10-24-79	64.2	[illegible]	57.0	56.5	55.2	—	—	—
11-6-79	63.9	[illegible]	56.9	56.5	55.2	—	—	—

THERMOGRAPH DATA
HOT CREEK HATCHERY

1978

ATE	A-6 SUPPLY POND	C-0 SUPPLY POND	C-2 SUPPLY SPR. 26	SELECT POND	HAT I SUPPLY	HAT II SUPPLY	ROOSTER Gulch	HOT DR. CREEK
-14-78	61.8	58.8	57.0	55.9	54.9	52.4	—	61.0
3-29-78	61.6	58.6	57.2	54.5	54.7	52.8	56.1	—
1-18-78	61.2	58.4	56.8	54.7	54.8	52.2	56.0	—
5-10-78	60.6	58.8	56.5	54.6	54.6	51.8	—	—
5-31-78	60.6	58.2	56.4	54.2	54.4	51.9	55.9	44.8
7-21-78	61.9	57.4	56.2	54.3	55.8	52.0	—	—
3-15-78	63.0	59.2	56.2	55.4	55.2	52.4	55.2	—
8-29-78	63.6	58.5	56.2	55.4	55.0	52.6	55.2	57.6
9-12-78	—	58.8	56.0	56.0	55.0	52.0	55.0	—
0-5-78	64.5	59.0	56.5	56.2	55.5	53.0	55.0	—
10-17-78	—	59.5	56.5	56.5	55.5	53.0	55.0	—
11-1-78	64.5	59.0	57.0	56.5	55.0	53.0	—	—
11-27-78	62.5	60.0	57.0	56.5	55.0	53.0	—	—
12-5-78	61.5	60.0	57.0	56.5	55.0	53.5	55.0	—
12-19-78	—	59.5	—	56.0	55.0	53.0	—	—

THERMOGRAPH DATA
HOT CREEK HATCHERY

1977

DATE	A-B SUPPLY POND	C-D SUPPLY POND	C-D SUPPLY SPRING	SECT POND II	HAT II SUPPLY	HAT II SUPPLY	COYOTE GULCH	HOT CK GORGE
1-7-77	62.8	59.2	56.9	56.5	54.9	52.5	—	—
1-25-77	62.5	59.0	56.9	56.4	54.6	52.5	55.7	—
2-7-77	62.4	59.1	56.8	56.3	54.9	52.5	—	—
2-22-77	62.2	58.9	56.8	56.1	54.9	52.5	—	—
3-7-77	62.1	58.8	56.7	55.9	54.8	52.4	55.8	—
3-22-77	61.8	58.7	56.8	55.8	54.9	52.2	—	—
4-4-77	62.0	58.8	56.8	55.1	54.8	52.2	—	—
4-20-77	61.8	58.9	56.7	55.1	54.9	52.1	55.8	65.5
5-4-77	61.8	58.8	56.8	55.4	54.9	52.1	—	—
5-31-77	61.8	58.7	56.9	55.1	54.9	52.1	55.8	70.2
6-30-77	62.0	58.6	56.9	55.0	54.9	52.4	—	—
7-2-77	62.4	58.7	56.7	55.7	55.1	52.3	55.8	—
7-25-77	62.8	59.0	56.2	55.7	55.2	52.4	55.9	—
8-8-77	62.6	58.9	57.0	55.9	55.2	52.4	—	60.8
8-23-77	62.7	58.7	56.8	55.7	55.2	52.5	55.8	—
9-22-77	64.2	59.0	57.1	—	—	—	—	—
10-14-77	63.5	59.0	57.0	56.5	55.0	52.5	—	—
11-15-77		59.3	57.4	56.8	55.0	52.8	55.8	—
11-30-77	63.2	—	—	—	—	—	—	—
12-9-77	—	58.9	56.8	56.5	54.8	52.7	—	—
12-27-77	—	59.3	57.2	56.7	54.9	52.8	—	—

THERMOGRAPH DATA
HOT CREEK HATCHERY

1976

DATE	A-B Supply Pond	C-D Supply Pond	C-D Supply Pond	Select Pond	HAT I Supply	HAT II Supply	Coyote Gulch	Hot Ck Gorge
1-2-76	62.1	58.2	56.4	55.3	53.8	52.1	55.4	—
1-7-76	61.9	58.6	56.7	54.8	54.5	51.8	—	—
1-21-76	61.9	58.1	56.7	54.5	54.4	51.8	55.5	—
1-4-76	62.2	60.0	57.5	54.8	55.9	52.2		—
1-2-76	62.6	58.7	56.8	55.3	55.2	52.1	55.5	—
7-26-76	63.2	58.9	57.0	55.8	55.8	52.4	55.0	—
1-11-76	63.0	58.7	57.5	56.0	54.9	52.5	55.5	—
1-22-76	64.2	59.0	57.1	—	—	—	—	—
9-25-76	—	—	—	56.5	55.5	52.5	55.5	—
1-14-76	63.5	59.0	57.0	56.2	55.0	52.5		—
1-15-76	—	59.3	57.4	56.8	55.0	52.8	55.8	—
11-30-76	63.2	—	—	—	—	—	—	—
12-9-76	—	58.9	56.8	56.5	54.8	52.7	—	—
12-27-76	—	59.3	57.2	56.7	54.9	52.8	—	—

043/I.E.

Long Valley Fire Protection District

Rt.1, P. O. Box 1145 • Crowley Lake, CA 93546

Date: September 14, 1987

To: Mono County Planning Department

From: George Lucas, Chief

RE: Fire Protection Requirements for Geothermal Facilities Producing Electrical Power

The Long Valley Fire Protection District is governed by the 1982 Uniform Fire Code, other nationally recognized standards and certain County and District guidelines. Due to the geographic areas that are being considered for geothermal use and the specific hazards encountered with this type of facility, the Long Valley Fire Protection District is in the process of setting specific guidelines for geothermal facilities within its district.

At this time, specific requirements include:

A. Access/egress to all areas of a facility

B. Access/egreee shall be an all-weather driving surface capable of supporting the imposed loads of fire apparatus

C. Access/egress shall be kept clear at all times, i.e. snow

D. Quantities and locations of water supplies, pump stations, hydrants and fire suppression appliances shall be determined by this Department and the design engineer of specific facilities

E. Automatic safety shut-downs, alarm systems and back-up systems

F. Facilities shall provide the Long Valley and Mammoth Lakes Fire Departments with pre-emergency plans and periodic "walk-throughs" of the facility as required

G. The Long Valley and Mammoth Lakes Fire Departments shall be notified of any impairment to any phase of fire protection or possible hazards, immediately

H. Mitigation fees, as applicable, shall be imposed (See attached)

Comment-2 (Page 1, Paragraph 2): Discussion is needed for assuming complete hydraulic communication between the injection and production zones because the effects of injection dominate the simulated reservoir performance calculations. The GeothermEx report (1986) states that pressure recharge of the production interval is unlikely because the injection and production zones are separated by impermeable rhyolite.

Response-2: While it is true that the injection zones at Casa Diablo are separated from the production zone by 500 to 700 feet of impermeable rhyolite, this interval is transected by numerous faults which are believed to readily conduct fluid vertically between zones in response to pressure gradients.

Comment-3 (Page 1, Paragraph 2 last sentence): The model results show pressure rises east of Casa Diablo - what effects would that have on spring flows?

Response-3: Theoretically, pressure increases to the east should increase thermal spring flows. However, the pressure increases as modelled are small and the degree of spring response is unknown, but likely to be negligible.

Comment-4 (Page 1, Paragraph 3): Calculations of the rate of propagation of a cold temperature front suggest that the front could reach the vicinity of the nearest production well (about 650 feet) at Casa Diablo in less than 10 years.

Response-4: In addition to the 650-foot radial advance modelled, reality would require injected fluids to also rise 500 to 700 feet through mostly hot rock. Furthermore, density effects (not modelled) would probably result in the injected water initially flowing downward along the faults until sufficiently heated by conductive heat transfer from the rock and mixing to rise along with other upwelling hot water. Even if breakthrough of cold injected water does occur, such events are commonly handled in oil field waterflooding by appropriate adjustments in injection and/or production patterns, and should not be a threat to project longevity.

All geothermal facilities shall be analyzed on a case-by-case basis and final determination shall be the result of reviews and agreements of District requirements between facility owner/operator, design engineers, any other agencies involved and the Long Valley Fire Protection District.

Note: For review, refer to Mammoth/Chance Geothermal Development Project, section on Fire Protection, July 1987

cc: Dan Lyster

Long Valley Fire Protection District files

Long Valley Fire Protection District

Rt.1, P. O. Box 1145 • Crowley Lake, CA 93546

AMENDMENT TO RESOLUTION NO. 82-J

Page 2, Item No. 2

Paragraph 3: The inclusion of Geothermal Facilities producing electric power within the Long Valley Fire Protection District does represent a distinct, significant impact to the District.

A. Geothermal Facilities are essentially constructed of non-combustible materials.

B. Impacts to the District are directly related to the storage and use of secondary working fluids, such as iso-butane and iso-pentane. Other impacts would include high temperature, primary fluids and hydrogen sulfide.

Therefore the assessment of Geothermal Facilities based on square footage is not applicable. To correlate this type of assessment, the British Thermal Unit, or B.T.U. shall be used.

Example: Iso-pentane

Fire of the average structure produces approximately 3,000 B.T.U.'s per square foot per minute.

Iso-pentane produces approximately 21,000 B.T.U.'s per pound with a weight of 5.17 pounds per gallon, or approximately 108,000 B.T.U.'s per gallon, or 36 square feet of average structure fire.

In correlating, 36 square feet x .30 = $10.80 would be the approximate base rate for one gallon of iso-pentane.

Credit for Reduction to Base Rate:

A. Reduction up to 50% Upon review of location, population, local hazards, and access

B. Reduction up to 20% Automatic shut-down, safety systems, back-up systems, alarm systems

C. Reduction up to 00% Stationary fire suppression systems, general safety features, etc.

Example cont'd: With highest [illegible] B, and C, the base rate would be $2.27 per gallon of iso-pentane.

043/I-E.

AMENDMENT TO:

RESOLUTION NO. 82-1

A RESOLUTION OF THE LONG VALLEY FIRE PROTECTION DISTRICT DECLARING EXISTING FACILITIES FOR FIRE PROTECTION INADEQUATE TO PROTECT ADDITIONAL STRUCTURES WITHOUT MITIGATION

Subject: Geothermal Facilities

WHEREAS, the inclusion of Geothermal Facilities producing electric power within the Long Valley Fire Protection District does represent a distinct, significant impact to the District; and

WHEREAS, Geothermal Facilities are essentially constructed of non-combustible materials; and

WHEREAS, impacts to the District are directly related to the storage and use of secondary working fluids, such as iso-butene and iso-pentane, other impacts would include high temperatures, primary fluids and hydrogen sulfide.

THEREFORE, the assessment of Geothermal Facilities based on square footage is not applicable. To correlate this type of assessment, the British Thermal Unit, or B.T.U. shall be used.

Example: Iso-pentane

1. Fire of the average structure produced approximately 3,000 B.T.U.'s per square foot per minute.
2. Iso-pentane produces approximately 21,000 B.T.U.'s per pound, with a weight of 5.17 pounds per gallon, or approximately 108,000 B.T.U.'s per gallon, or 36 square feet of average structure fire.
3. In correlating, 36 square feet x .30 = $10.80, would be the approximate base rate for one gallon of iso-pentane.

Credit for Reduction to Base Rate:

A. Reduction up to 50% Upon review of location, population, local hazards and access

B. Reduction up to 20% Automatic shut-downs, safety systems back-up systems, alarm systems

C. Reduction up to 09% Stationary fire suppression appliances, safety features, etc.

Example only:

With the highest % of items A, B, and C, an assessed rate would be $2.27 per gallon iso-pentane.

2

RECEIVED

SEP 15 1987

MONO COUNTY
OFFICE OF ENERGY MANAGEMENT

This Board hereby requests that the Board of Supervisors of the County of Mono adopt an amendment to existing Ordinance or Resolution disapproving any tentative tract map, parcel map, conditional use permit, or planned unit development providing for new geothermal facilities within the boundaries of the District unless its developers have agreed in writing to a means by which the impact caused by the project will be adequately mitigated.

This Board also requests that any permit for development, and any use or building permits for geothermal facilities, approved by the County, be conditioned to require such mitigation.

The Clerk of the Board of the Long Valley Fire Protection District is directed to transmit a copy of this resolution forthwith to the Board of Supervisors of the County of Mono, and to both the Mono County Planning Department and the Mono County Building Department.

ADOPTED by the Long Valley Fire Protection District of the County of Mono, State of California, this _____ day of _____, 1987.

_____
CHAIRMAN,
Board of Commissioners
Long Valley Fire Protection District

ATTEST:

_____
Secretary, Board of Commissioners
Long Valley Fire Protection District

* *

I, _____ Secretary of the Board of Commissioners of the Long Valley Fire Protection District, do hereby certify that the foregoing resolution was regularly introduced and adopted at a regular meeting of said Board, duly called and held on the _____ day of _____, 1987, and was duly passed and adopted by the following vote, to wit:

AYES:

NOES:

ABSENT:

_____
Secretary
Board of Commissioners
Long Valley Fire Protection District