MINUTE ITEM
This Calendar Item No. C125
was approved as Minute Item No. 125 by the State Lands Commission by a vote of 3 to 0 at its 11/15/94 meeting.

CALENDAR ITEM
C125

11/15/94
W 40668
Willard
Kruger

PRC 7810

APPROVE A NEGOTIATED SUBSURFACE GEOTHERMAL RESOURCE LEASE, THE GEYSERS STEAM FIELD, SONOMA COUNTY

APPLICANT:

Calpine Corporation
Attn: Kevin Rupp,
Corporate-Land & Property Tax
50 W. San Fernando, 5th Floor
San Jose, California 95113

AREA, TYPE LAND AND LOCATION:

Approximately 224 acres of State reserved mineral interest land in the northwest portion of The Geysers Geothermal Steam Field, in Sonoma County (see Exhibits "A" and "B" for land description and location map).

LAND USE:

The State has reserved mineral rights in excess of 15,000 acres at The Geysers, with 6,016 acres currently under lease. The reserved mineral interest lands (and in certain cases fee parcels) are a portion of the "school lands" which the State received as a grant from the federal government in 1853 to support public schools. Revenue received from the use of school lands is for the benefit of the State Teacher's Retirement System (STRS). Further leasing must occur if idle State parcels are to be brought into production and thereby eliminate the potential of drainage from wells on adjacent lands.

LEASE TERMS:

1. Primary term of ten years and for so long thereafter as geothermal resources are produced in paying quantities from the leased land, or so long as the Lessee is diligently conducting, producing, drilling, deepening, repairing, redrilling or other necessary lease or well maintenance operations in the leased land.

2. Initial drilling term of three years, subject to extension of one additional year upon approval by the State.

3. Rent of $10 per acre per year, payable in advance.

4. Royalty of twelve and one half percent (12.5%) of the value of steam produced from the leased land. The value of steam is the higher of (a) gross revenue received pursuant to an approved steam sales contract or (b) the ratio of the lease steam delivered to the Aidlin power plant to the total steam delivered to the plant times thirty percent (30%) of the gross revenue received pursuant to the Power Purchase Contract between Mission Energy Company and PG&E.

5. Performance bond or other security in the amount of $50,000.

6. The form of lease will provide for "Subsurface Only - No Surface Use".

BACKGROUND:
On December 17, 1992, the State Lands Commission (Commission) authorized the leasing of those lands within The Geysers area not currently under lease. On June 15, 1993, certain lands were offered for lease by competitive public bid. No bids were received.

Calpine Corporation (Calpine) has submitted an application for a negotiated subsurface geothermal resources lease on approximately 224 acres of reserved mineral interest land not currently leased. These lands are within the area previously authorized for lease by the Commission. All drilling and production operations would be conducted on privately-owned or leased lands by Calpine as operations would not be permitted on the surface of the State leased lands.

STATUTORY AND OTHER REFERENCES:
A. P.R.C.: Div. 6, Parts 1 and 2; Div. 13.

B. Cal. Code Regs.: Title 3, Div. 3; Title 14, Div. 6.

AB 884:
N/A

OTHER PERTINENT INFORMATION:

1. Pursuant to the Commission's delegation of authority and the State CEQA Guidelines (14 Cal. Code Regs. 15025), the staff has prepared an EIR identified as EIR No. 498, State Clearinghouse No. 90030208. Such EIR was prepared and circulated for public review pursuant to the provisions of CEQA and certified by the Commission on June 30, 1992.

   The leasing action in and of itself will not result in any direct impact on the environment. Subsequent geothermal development will have an impact on the environment, and the EIR was an analysis of the potential impacts of the development. Because no specific development has been proposed, the impact analysis represents reasonable worst-case estimates of probable effects without being specific to a project site. Future site-specific projects will be subject to environmental impact analyses and reports. The Commission may not be the Lead Agency for the subsequent exploration and development projects.

2. A Mitigation Monitoring Plan has been prepared for the mitigation of impacts likely to occur subsequent to leasing. Although there will likely be modifications to the mitigation measures and required monitoring as a result of future site-specific environmental studies, the plan does provide an overview of the anticipated measures which will be implemented. Because future activities may be permitted by other state and local agencies, certain monitoring requirements may be delegated to those agencies. However, the Commission will be responsible for assuring full compliance with the plan.

3. Findings made in conformance with Section 15091 of the State CEQA Guidelines are contained in Exhibit "C" attached hereto.

4. A Statement of Overriding Considerations made in conformance with Section 15093 of the State CEQA Guidelines is contained in Exhibit "E" attached hereto.

EXHIBITS:

A. Land Description
B. Location Map
C. CEQA Findings
D. Mitigation Monitoring Plan
E. Statement of Overriding Considerations

IT IS RECOMMENDED THAT THE COMMISSION:

1. DETERMINE THAT A FINAL EIR SCH. NO. 90030208, FOR THE PROPOSED GEOTHERMAL RESOURCES LEASE OF CERTAIN STATE LAND WITHIN THE GEYSERS STEAM FIELD IN SONOMA COUNTY WAS PREPARED AND CERTIFIED BY THE COMMISSION ON JUNE 30, 1992.

2. ADOPT THE FINDINGS, MADE IN CONFORMANCE WITH SECTION 15091 OF THE STATE CEQA GUIDELINES, AS CONTAINED IN EXHIBIT "C", ATTACHED HERETO.

3. ADOPT THE MITIGATION MONITORING PLAN, AS CONTAINED IN EXHIBIT "D", ATTACHED HERETO.

4. ADOPT THE STATEMENT OF OVERRIDING CONSIDERATIONS MADE IN CONFORMATION WITH SECTION 15093 OF THE STATE CEQA GUIDELINES, AS CONTAINED IN EXHIBIT "E", ATTACHED HERETO.

5. DETERMINE THAT A NEGOTIATED GEOTHERMAL RESOURCES LEASE IS IN THE BEST INTEREST OF THE STATE AND AUTHORIZE ISSUANCE TO CALPINE CORPORATION, A GEOTHERMAL RESOURCES LEASE, COVERING THOSE LANDS DESCRIBED IN EXHIBIT "A", ON FILE IN THE OFFICE OF THE COMMISSION.

NO TEXT ON THIS PAGE

EXHIBIT "A"

LAND DESCRIPTION

Lots 6, 7, 8 and 9, and SE1/4 of NE1/4, and N1/2 of NE1/4, all in Section 4, T11N, R9W, MDB&M, Sonoma County containing 224 acres more or less based upon the Mitchell & Heryford Record of Survey filed in the office of the County Recorder, County of Sonoma, on March 27, 1991 in Book 470 of Maps at Pages 37 & 38 and the Mitchell and Heryford acreage compilation map of May 13, 1994 on file at the State Lands Commission.

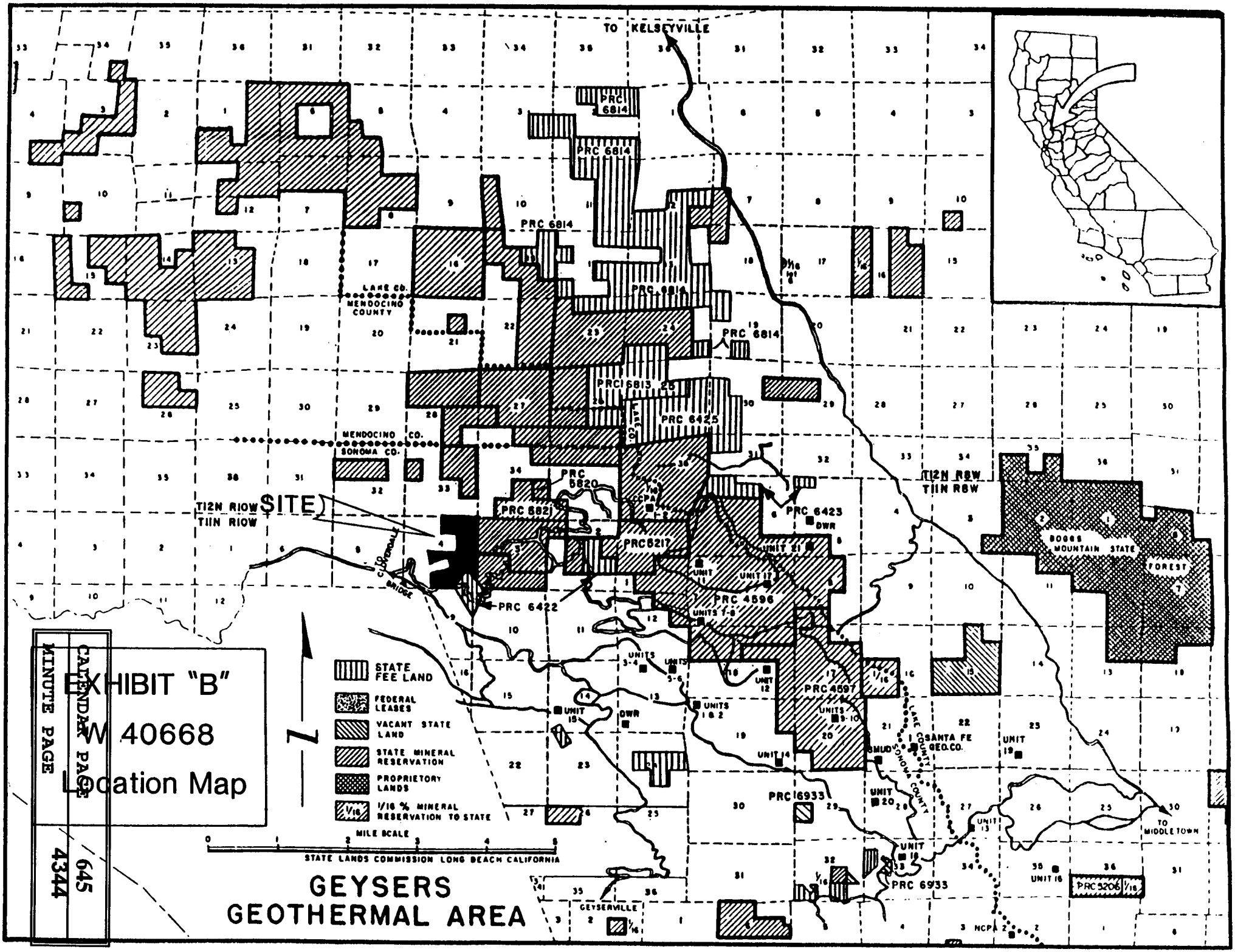
TO KELSEYVILLE
PRC 6814
PRC 6814
PRC 6814
PRC 6814
PRC 6814
PRC 6813
PRC 6425
LAKE CO.
MENDOCINO COUNTY
MENDOCINO CO.
SONOMA CO.
T12N R10W
T11N R10W
SITE
PRC 6820
PRC 6821
PRC 6217
PRC 6423
DWR
T12N R8W
T11N R8W
80668
MOUNTAIN STATE
FOREST
PRC 6422
PRC 4596
UNITS 1-8
UNIT 21
UNIT 17
UNIT 11
UNITS 3-4
UNITS 5-6
UNIT 12
PRC 4597
UNITS 1 & 2
UNITS 9-10
UNIT 15
DWR
UNIT 14
SMUD
SANTA FE GEO. CO.
LAKE COUNTY
SONOMA COUNTY
UNIT 19
PRC 6933
UNIT 20
UNIT 13
UNIT 18
UNIT 16
PRC 5206
TO MIDDLETOWN
GEYSERVILLE
NCPA
STATE FEE LAND
FEDERAL LEASES
VACANT STATE LAND
STATE MINERAL RESERVATION
PROPRIETORY LANDS
1/16 % MINERAL RESERVATION TO STATE
MILE SCALE
0 1 2 3 4 5
STATE LANDS COMMISSION LONG BEACH CALIFORNIA
GEYSERS
GEOTHERMAL AREA
EXHIBIT "B"
W 40668
Location Map
CALENDAR PAGE 645
MINUTE PAGE 4344

EXHIBIT C

FINDINGS AND STATEMENT OF OVERRIDING CONSIDERATIONS REGARDING THE ENVIRONMENTAL EFFECTS OF THE GEOTHERMAL DEVELOPMENT OF CERTAIN STATE LANDS WITHIN THE GEYSERS AREA, LAKE, MENDOCINO, AND SONOMA COUNTIES, CALIFORNIA

INTRODUCTION

Herewith are presented the findings made by the State Lands Commission, pursuant to Section 15901, Title 14, California Administrative Code, on the proposed Geothermal Development for certain State Lands within the Geysers Area, Lake, Mendocino, and Sonoma Counties, California. All significant impacts of the project identified in the Final EIR are included herein and organized according to the resource affected (air quality, geology, vegetation, etc.).

For each significant impact, a finding has been made as to one or more of the following as appropriate:

a) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR;

b) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency; and

c) Specific economic, social and or other considerations make infeasible the mitigation measures or project alternatives identified in the Final EIR.

The appropriate findings are followed by a narrative of the facts supporting them. When possible, reference is made by number to the specific mitigation measure presented in Section 4 of the EIR. For many of the impacts, all three findings described above have been made. Finding b) appears because although the State Lands Commission is the CEQA Lead Agency, it has the jurisdiction over only a portion of the project thus has limited power to require or enforce mitigation. Whenever Finding b) occurs, agencies with jurisdiction have been specified. It is these agencies, within their respective spheres of influence, which would have the ultimate responsibilities to adopt, implement, and enforce the mitigation discussed within each type of potential impact which could result from project implementation. However, under recently adopted California statutory legislation (AB3180, CORTESE), the CEQA Lead Agency has the responsibility to ensure that mitigation measures contained in an EIR are effectively implemented.

Whenever finding c) was made, the State Lands Commission has determined there will be, even after mitigation, an unavoidable significant level of impact due to the project, and sufficient mitigation is not practicable to reduce the impact to a level of insignificance. This impact is

always specifically identified in the supporting discussions. The Statement of Overriding Considerations, applies to all such unavoidable impacts, as required by Sections 15902 and 15903, Title 14, California Administrative Code.

PROJECT BACKGROUND

The proposed leasing of state land for geothermal resource development is a discretionary act that may ultimately commit previous undeveloped areas to long-term industrial activity. The leasing action itself, which is under the jurisdiction of the State Lands Commission, results in no direct physical impact to the environment. The subsequent phases of activity (non-drilling exploration, exploratory drilling, lease development, operation and maintenance, and abandonment) do result in environmental impacts that will be concentrated within the three specific project areas. Impacts will occur in the form of areal disruption and loss or restriction of present land use functions. Areas will be transformed from undisturbed rural uses to industrial uses. Areas of incompatibility with sensitive land uses or nearby sensitive receptors such as biological habitats, residences, or recreational uses may result even with adherence to policies related to buffering and facility siting. The extent of potential conflict will vary and is dependent on the ultimate amount of development that may occur within the project boundary. No specific subsequent development projects have been proposed, thus the impact analyses represents reasonable worst-case forecasts of probable effects without being specific to a project site.

The exploratory drilling and geothermal field and plant development stages will involve additional discretionary action by local governmental agencies and may require additional or supplemental site-specific environmental analyses and/or more specific mitigation measures in addition to those provided herein. Any additional or supplemental CEQA documents would be prepared by local agencies with jurisdiction over development permitting. For leasing Project Area No. 1, the County of Sonoma is the local agency with jurisdiction. For leasing Project Area No. 2, the Counties of Sonoma, Lake and Mendocino have jurisdiction, depending upon where in the area geothermal development is proposed. For leasing Project Area No. 3, Lake County is the local agency with jurisdiction.

It is noted that the mitigation measures presented herein are derived from various sources and are considered a compendium of the available measures which have been included in previous projects and/or which have been adopted as standards by local agencies. These measures together represent model of development conditions, which when applied to future geothermal development, will achieve a large measure of protection for the unique environmental and human features of The Geysers area.

SYSTEMS SAFETY: Non-Drilling Exploration Activities

Impact: Offroad vehicle operation will increase the possibility of wildland fires.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

Facts Supporting the Finding:

Exploration activities will include off-road vehicle operations in brushy and/or forested wildland areas. During such operations, a vehicle could ignite a wildland fire as a result of tailpipe sparks, or if brush contacted a hot catalytic converter. A wildland fire could also result from exploration personnel carelessly disposing of a cigarette, or if a campfire was improperly extinguished or left unattended.

Mitigation measures to eliminate ignition sources have been proposed which shall be implemented to reduce these impacts to insignificant levels. These measures include:

- All vehicles and motorized equipment shall be equipped with a CDF-approved spark arrestor (FEIR Mitigation Measure #1).

- All personnel involved in exploratory activities will be prohibited from smoking at any time in wildland or forested areas. Further, all personnel will be prohibited from building campfires while in wildland or forested areas (FEIR Mitigation Measure #2).

SYSTEMS SAFETY: Exploratory Drilling

Impact: There is a potential for blowout of a well during exploratory drilling which could cause death or injury to site personnel.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

Facts Supporting the Finding:

By definition, exploratory drilling involves advancing the drill string into subsurface regions of uncertain lithologic and geothermal composition (i.e., liquid or vapor dominated) and unknown temperature and pressure. Thus, there is a potential for encountering unanticipated conditions, resulting in an upset, loss of well control and ultimately, a blowout. A blowout could release steam, water, and/or toxic gases such as hydrogen sulfide or ammonia. Both of these gases are toxic in relatively concentrations, and therefore might pose a significant threat of injury or death to on site personnel, if such an upset condition occurred.

Mitigation measures regulating operating procedures and requiring special safety equipment have been proposed which shall be implemented to reduce these impacts to insignificant levels. These measures include:

- o During all drilling operations, down-hole conditions, (such as temperature, pressure, drilling fluid returns, and other system components) will be carefully monitored such that approach to high pressure zones, including geothermal zones is forewarned (FEIR Mitigation Measure #3).

- o Casing anchored Blowout Prevention Equipment (BOPE) will be installed on all wells, and drilling fluid balance will maintained to ensure well control (FEIR Mitigation Measure #4).

SYSTEMS SAFETY: Full Field Development

Impact: There is a potential for construction activities to ignite a significant wildland brush or forest fire.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties).

Facts Supporting the Finding:

Development of the geothermal field will likely require the installation and construction of field facilities such as pipelines, heat exchangers, pumps, cooling towers, turbine generators and other ancillary equipment. During construction of these facilities, there will be potential for ignition of a significant brush or forest fire. This potential will be heightened because of the substantial amount of welding required during construction.

The potential for a wildland fire resulting from construction-related activity will be reduced to an insignificant level by implementing the following mitigation measures:

- o All development and work areas including pipeline routes will be cleared of brush, weeds, and other combustible materials to a distance recommended by the CDF (FEIR Mitigation Measure #5).

- o Reconstruct or consolidate existing transmission facilities and corridors to accommodate additional line capacity in an environmentally sound manner (FEIR Mitigation Measure #6).

SYSTEMS SAFETY: Operation and Maintenance

Impact: Accidents could occur during facilities maintenance operations, (particularly a welding ignited fire.)

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties).

Facts Supporting the Finding:

At a national level, welding activities associated with maintenance and repair are one of the leading causes of industrial fires. In the geothermal field, maintenance welding may be conducted at virtually any location in the vicinity of well heads, pipelines, or power plant equipment. Maintenance welding could ignite a fire due to the sparks and hot material generated.

The potential for a welding initiated fire resulting from maintenance activities will be reduced to an insignificant level by implementing measures to inspect welding areas prior to initiation of work as follows:

- During field operation, all maintenance and repair welding locations will be inspected prior to the start of work, and all combustible materials will be removed to a distance well beyond which any sparks or flames could travel. In addition, a large ABC class fire extinguisher will be close at hand during all maintenance and repair work (FEIR Mitigation Measure #7).

SYSTEMS SAFETY: Operation and Maintenance

Impact: Handling hazardous materials and hazardous waste could result in a significant accident causing significant adverse environmental impact.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should ~~be adopted by other such~~

agencies (Lake, Sonoma and Mendocino Counties; California Regional Water Quality Control Board; and Caltrans).

Facts Supporting the Finding:

Gases surfacing with the geothermal steam can include hydrogen sulfide and ammonia, both extremely hazardous at relatively low concentrations. NIOSH/OSHA (1985) defines the concentration of hazardous chemicals that is "Immediately Dangerous to Life and Health" (IDLH) as that maximum level from which a person can escape within 30 minutes without experiencing any escape-impairing or irreversible health effects. For hydrogen sulfide the IDLH concentration is 300 parts per million, and for ammonia is 500 parts per million. Hydrogen sulfide may be lethal at concentrations of approximately 1,000 ppm. Therefore, even in the event of a low concentration of either of these gases in the geothermal well production, a release or leak could pose significant risk to persons in the area of the leak or release.

Designated hazardous materials are utilized in various portions of the drilling and operation of geothermal resource recovery operations. During well flow-testing, it is frequently necessary to inject two hazardous materials, sodium hydroxide and hydrogen peroxide, to scrub the H_2S from the produced steam. The nonhazardous by-products, Na_2SO_4 and $NaHSO_4$, are separated from the produced steam and deposited in the mud sump.

Hazardous and designated wastes generated during geothermal development have the potential for contaminating surface and ground waters if not handled properly in the following manner; on-site accidental waste spills, leaking on-site containment basins or vessels, accidents during transport of waste to off-site facilities, spills and leaking containment basins at off-site county disposal facilities, and illegal disposal of the waste.

The following measures requiring worker training, mutual aid for emergency response, and establishment of standards for worker exposure to hazards have been adopted by State Lands Commission to mitigate the impacts of geothermal development relative to systems safety. It is recommended that local agencies adopt these measures during the site development permit process.

- All personnel working on or near the gas abatement system equipment or components will be instructed in the hazards of the toxic gases and trained in the observation (by odor) of the gases and in the proper steps to be taken in the event of gas detection. The prime action to be taken in the event of gas odor is generally evacuation, with return only when equipped with proper respirator equipment. In addition, an H_2S monitor should be provided, capable of issuing an alarm H_2S at a concentration greater than 10 ppm is detected (FEIR Mitigation Measure #8).

- Developers of geothermal resources will be required to participate in an area of mutual benefit agreement for the purpose of development of a unified emergency notification and communication system linking the geothermal facilities, the California Department of Forestry, the Lake, Mendocino, and Sonoma County Sheriffs' Offices, and possibly other

agencies. This system may be integrated with the Lake County Sheriff Department central dispatch service (FEIR Mitigation Measure #9).

- Hazardous wastes generated will be packaged, manifested, and transported according to applicable state and federal regulations, and disposed of at a Waste Management Unit properly permitted by the applicable Regional Water Quality Control Board for acceptance of the specific type and composition of waste (FEIR Mitigation Measure #10).

- On-site minimization of hazardous wastes, such as dehydration or other physical phase separation, and the use of well-drilling and other process techniques which eliminate or reduce the volume of hazardous wastes produced will be employed to the maximum extent practicable (FEIR Mitigation Measure #11).

- Personnel responsible for handling lubrication oils and diesel fuel will be schooled in proper care and handling (FEIR Mitigation Measure #12).

- The operator of any leasehold will ensure that any hazardous waste hauler employed has a certificate of registration from the California Department of Health Services (CDHS), Hazardous Materials Management Section (FEIR Mitigation Measure #13).

- Standards for occupational exposure, ambient air and water quality exist for certain geothermal contaminants. Threshold Limit Values (TLVs) for other contaminants have been adopted by the American Conference of Governmental Industrial Hygienists. EPA has developed "Multimedia Environmental Goals" (MEGs) for a large number of pollutants. Potential impacts from exposure to or accidental discharge of geothermal related chemicals can be mitigated by strict enforcement of applicable standards, compliance with emission limitations and discharge prohibitions, and compliance with federal, state, and local laws which regulate the safe handling, transport, and disposal to toxic/hazardous materials. A compliance monitoring program will be formulated for approval by SLC for each leasehold (FEIR Mitigation Measure #14).

- Drilling activities shall occur in a manner that minimizes the generation of hazardous materials and waste, allows for their recycling whenever practical, and is in compliance with all waste management policies and regulations. The use of BAKER tanks and sumpless drilling shall be encouraged, particularly when located within 500 ft of blue line water features (FEIR Mitigation Measure #15).

- Project operators shall ensure that the transport of hazardous material or waste is minimized whenever possible and is accomplished in a safe manner (FEIR Mitigation Measure #16).

- Each operator shall prepare a viable contingency plan for emergencies due to breaks or unexpected deformation of pipelines or its supports. The plan shall show who is responsible and what equipment and manpower is available to respond to such an emergency (FEIR Mitigation Measure #17).

- The transportation of hazardous and toxic material can be reduced through support of research and development of alternative methods for handling and minimizing wastes on-site (FEIR Mitigation Measure #18).

- An inspection will be conducted on each truck hauling toxic or hazardous materials prior to leaving the leasehold. The inspection will include brakes, vehicle connection, wheels/tires, valves, tanks, etc. After loading, a material inspection for leaks in the system will be conducted. All inspections will be logged for later verification if necessary, by CHP, CDHS, or other appropriate agencies (FEIR Mitigation Measure #19).

- Participation in driver safety programs for all drivers of waste transport vehicles will reduce the potential for accidents and spills (FEIR Mitigation Measure #20).

- Hazardous and designated wastes generated from geothermal activities in the leaseholds will be collected, contained, transported, and disposed of in accordance with all regulations as specified and enforced by the California Regional Water Quality Control Board and the CDHS under RCRA (FEIR Mitigation Measure #21).

- Emergency response procedures shall be developed to contain hazardous waste spills which occur during transport on and off of the proposed leaseholds (FEIR Mitigation Measure #22).

The mitigation measures described above will reduce the significant adverse impacts to levels considered acceptable and therefore insignificant, with the exceptions of the following two impacts:

- The potential for significant adverse impact associated with accidental release of hazardous materials during Exploratory drilling, Field Development, and Operation and Maintenance cannot be fully mitigated to insignificance.

- The potential for significant adverse impact associated with an accidental release or improper disposal of hazardous wastes during Exploratory Drilling, Field Development, and Operation and Maintenance cannot be fully mitigated.

Unlike other environmental resource areas, impacts related to system safety cannot be associated with a specific significance threshold in every sense. System safety impacts, significant or not, occur only in the event of abnormal system operation. If the system operates normally and as designed, there are no direct system safety impacts. However, the potential for an accident, upset, or release of hazardous or toxic material always exists, despite mitigation measures designed to minimize this potential. Here, the potential, however small, for adverse impacts due to the use of hazardous materials or the generation of hazardous wastes, occurring as a result of abnormal or improper system operation, is identified as an unavoidable and significant adverse impact. Such impact may, in fact, never occur.

The EIR evaluated several alternatives which could have the potential to reduce or eliminate the identified environmental impacts.

No Project Alternative

Implementation of the No Project Alternative would mean that the State Lands Commission would not offer any of the lands within the study area for leasing for geothermal resources. These resources would remain undeveloped for the foreseeable future. From the standpoint of the unavoidable adverse impacts listed above, adoption of this alternative would eliminate the impacts.

It is noted however, that the No Project Alternative would deny the State of California revenues from the leasing program. Also since the steam resource of The Geysers area is diminishing, the resources on the site may diminish over time so that development may not be cost feasible in the future. The energy lost by the No Project Alternative would need to be made up from some other source, most probably fossil fuels.

Leasing Portions of the Project Areas

This alternative involves leasing one or two of the three project areas identified for prospective leasing. The reasons for omitting any particular leasing area could be numerous; however, this analysis assumes that the reason would be to avoid emissions of hazardous gases and hazardous wastes. Emissions of hazardous substances has a potential for occurrence with aspects of geothermal activity involving exploratory drilling, and field development and operations. Since this alternative does eliminate such activity, the unavoidable adverse impacts could still occur.

Prohibiting Construction of Power Plants

This alternative would allow construction of steam fields in the area, but not development of new power plants. Emissions of hazardous substances has a potential for occurrence with aspects of geothermal activity involving exploratory drilling, and field development and operations. Since this alternative does eliminate such activity, the unavoidable adverse impacts could still occur.

Alternative Land Uses

This alternative is based on the assumption that the State Lands Commission could encourage alternative land uses, other than geothermal uses, to be established on the leasehold areas. The State Lands Commission is limited in its ability to establish or encourage land uses beyond its jurisdiction to lease lands for resource and mineral development. Local land use approvals for any use subsequent to leasing are under the purview of the local county governments with jurisdiction. The state does own the lands on Cobb Mountain within the designated lease area and would have some land use authority there. Uses other than geothermal development would not involve hazards from geothermal gases and fluids.

Alternative Technology

This alternative assumes that alternative technologies could be implemented to exploit the geothermal resources of the project areas. The need for implementation of alternative technologies has several purposes, including the reduction in the physical environmental impacts of more traditional geothermal development, and the extension of the life of The Geysers steam field through conservation and more efficient use of the resources. However, this alternative does not eliminate the need for drilling and extraction of geothermal resources nor the associated hazards involved with toxic materials.

In conclusion, only the No Project and Alternative Land Use Alternatives have been shown to reduce the unavoidable systems safety impacts. Neither of these alternatives allow the State Lands Commission to fulfill its obligations under the Geothermal Resources Act and are not considered feasible, not withstanding efforts by State Lands Commission to minimize to the extent practicable, the significant adverse impacts relative to systems safety associated the proposed action.

SYSTEMS SAFETY: Abandonment

Impact: Demolition activities may ignite a wildland or forest fire.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; County Air Pollution Control Districts; California Division of Oil and Gas; California Regional Water Quality Control Board; Caltrans; California Energy Commission; California Public Utilities Commission).

Facts Supporting the Finding:

The abandonment process will include activities similar to those described for the construction phase of the project. Thus, there is an analogous potential for demolition activities to ignite a wildland or forest fire. Sparks and hot material generated by cutting torches pose a particular fire threat during demolition.

Mitigation measures described for the construction and operational phases of the project will continue to be implemented during the abandonment process. Specifically, demolition areas will be inspected and cleared of all combustible material prior to the initiation of all work, and a large ABC class fire extinguisher will be close at hand at all times.

SYSTEMS SAFETY: Abandonment

Impact: Abandonment may result in the accumulation of hazardous waste as equipment, pumps, sumps, pipelines, etc. are dismantled.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; California Division of Oil and Gas; and California Regional Water Quality Control Board).

Facts Supporting the Finding:

During the abandonment process, hazardous waste could accumulate as equipment, pumps, sumps, pipelines, etc. are dismantled. The potential for adverse impacts resulting from the accumulation of hazardous waste during the dismantling and abandonment phase of the project will be reduced to an insignificant level by implementing the following mitigation measures:

- Mitigation measures as imposed during construction and operations shall be imposed (FEIR Mitigation Measure # 23).

- A reclamation plan will be submitted to the applicable local planning agency prior to abandonment of the project. All wells will be abandoned in accordance with Division of Oil and Gas and SLC guidelines and regulations for leased lands (FEIR Mitigation Measure # 24).

- As part of any approved operating plan, testing of inactive or abandoned sumps shall be required and, if necessary, long-term monitoring for ground and surface water contamination shall be implemented. All sumps shall be fenced or otherwise protected to prevent access by persons or animals (FEIR Mitigation Measure #25).

The mitigation measures described above will reduce the significant adverse impacts to levels considered acceptable and therefore insignificant

SYSTEMS SAFETY: Cumulative Impacts

Impact: Cumulatively, geothermal projects considered will lead to an increase in the incidence of wildland brush or forest fires.

Finding: A) Changes or alteration have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

Facts Supporting the Finding:

All phases of geothermal development involve some risk of igniting a wildland fire due to the incursion of humans and machinery into wildland areas. Particular hazards are associated with the operation of motor vehicles in brushy areas, as well as the use of welding equipment, generators, etc.

Fire suppression mitigation measures described for other construction and operational phases of the project will be implemented during the abandonment process.

SYSTEMS SAFETY: Cumulative Impacts

Impact: The cumulative geothermal projects will increase the amount of hazardous gases released to the atmosphere and will generate significant quantities of hazardous waste which must be contained, handled, and disposed of.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; County Air Pollution Control Districts; and California Regional Water Quality Control Board.

C) Specific economic, social and or other considerations make infeasible the mitigation measures or project alternatives identified in the Final EIR.

Facts Supporting the Finding:

The cumulative geothermal developments will increase the amount of hazardous gases, such as hydrogen sulfide and ammonia, released to the atmosphere during drilling, testing, and operation phases. Such releases would have significant adverse impact on employees and could seriously affect nearby vegetation. Abatement measures as described for project-specific impacts could be applied to reduce the likelihood of a significant impact from such discharges.

Geothermal operations resulting from cumulative development levels will generate significant quantities of known hazardous wastes which must be contained, handled, and disposed of in accordance with state and federal law. Significant adverse impacts can occur from waste disposal due to accidental waste spills on-site, leaking on-site containment basins or vessels,

accidents during transport of waste to off-site disposal facilities, spills and leaking containment basins at off-site county disposal facilities, and illegal disposal of wastes. Presently, there are no hazardous waste disposal sites in Lake County, and the two sites that were accepting nonhazardous geothermal wastes have been closed since 1985 due to regulatory violations (County of Lake, 1989). Most hazardous waste must be transported to the Chemical Waste Management disposal facility near Kettleman Hills, California, with minor amounts going to other sites in Utah and Idaho.

The following measures supporting establishment of geothermal waste facilities in the area, advanced technology with respect to drilling and production, and development of Risk Management and Prevention Plans have been adopted by State Lands Commission to mitigate the cumulative impacts of geothermal development relative to systems safety. It is recommended that local agencies adopt these measures during the site development permit process and implement site-specific impact measures discussed above.

- State Lands Commission should support the establishment of geothermal waste facilities in The Geysers area. This will reduce waste vehicle miles travelled and correspondingly reduce accident potential (FEIR Mitigation Measure # 26).

- State Lands Commission should support and implement to the extent possible technological changes in operations, such as incorporation of mechanical water/drilling mud separation technologies, and chemical processes, such as the conversion of hydrogen sulfide to a water soluble sulfur compound (by burning or other chemical reaction) allowing the compound to be injected back into the reservoir with steam condensate. These have great potential to reduce hazardous waste disposal requirements (FEIR Mitigation Measure #27).

- The proposed project will involve acutely hazardous materials (AHMs) such as ammonia and hydrogen sulfide. California law (Health and Safety Code Section 25531 et seq.) requires preparation of a Risk Management and Prevention Program (RMPP) for all facilities involving AHMs in amounts greater than the threshold planning quantities listed in Part 335, Appendix A, Title 40 of the Code of Federal Regulations. The requirements for a RMPP and the procedures for its certification are established by regulation. A RMPP includes a formalized hazardous operations study (HAZOPS). A HAZOPS is designed to identify system safety deficiencies which may result from equipment failure, improper operation, or outside influences, and to provide corrective actions (mitigation) as necessary. The proposed project must cause a RMPP to be prepared and submitted prior to start-up, as required by law (FEIR Mitigation Measure #28).

As was the case with hazardous materials impacts on a site-specific basis, the cumulative impacts from hazardous materials associated with geothermal development are also significant and unavoidable. Specifically, the following impacts are not mitigated to insignificance by the stated mitigation measures:

- The potential for significant adverse impact associated with accidental release of hazardous materials during Exploratory drilling, Field Development, and Operation and Maintenance cannot be fully mitigated to insignificance.

- The potential for significant adverse impact associated with an accidental release or improper disposal of hazardous wastes during Exploratory Drilling, Field Development, and Operation and Maintenance cannot be fully mitigated.

Findings regarding the potential for alternatives to be implemented lead to the same conclusions as stated previously for site-specific systems safety impacts. Only the No Project and Alternative Land Use Alternatives have been shown to reduce the unavoidable systems safety impacts. Neither of these alternatives allow the State Lands Commission to fulfill its obligations under the Geothermal Resources Act and are not considered feasible, not withstanding efforts by State Lands Commission to minimize to the extent practicable, the significant adverse impacts relative to systems safety associated the proposed action.

LAND USE: Exploratory Drilling

Impact: Land transformation will occur as a result of access roadway construction and pad development for exploratory drilling. This includes cut and fill activity which will alter existing topography and landform.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

Facts Supporting Finding:

In its undeveloped state, the project site sustains a variety of functions. It serves as protective watershed and habitat lands, allows for private landowner recreation and hunting, and results in a general open space ambience. The intrusion of geothermal development will significantly disrupt these values by removal of vegetative cover and increase in erosion potential.

Mendocino, Sonoma, and Lake Counties have policies which guide the development of project activities related to industrial development. Facility siting is subject to certain setback requirements under these policies. For example, buffer zones are to be established around sensitive biological/vegetation resource areas (such as near streams). There are various common restrictions such as those for construction on steep slopes due to landslide potential, restrictions on facility placement at set distances from residences and sensitive receptors for noise buffering, and avoidance to the extent possible of siting facilities on ridgelines or within sensitive viewsheds. These requirements are normally made a condition of approval at the permitting phase of a particular facility and are assessed on an individual project basis.

In addition to these typical policies and regulations, the following additional mitigation measures limiting land area disturbance will be implemented;

- o Exploratory drilling activities shall disturb the minimum amount of land area possible (FEIR Mitigation Measure #1). To ensure that land disturbance is minimized, the project development proceed will be conducted in accordance with all state and local permit requirements. Mitigation monitoring programs should provide the necessary control to assure compliance with the permit requirements. Measures to minimize land disturbance and amount of land surface will be implemented including limitations on cut and fill activity, sharing of roadways and certain facilities (possibly maintenance areas) where applicable, directional drilling, and locating well sites as close as possible to plants. All disturbed areas will be revegetated as soon as possible and all debris and excess material and equipment will be removed.

Upon implementation of the mitigation measures described above, the significant adverse impacts will be reduced to levels considered acceptable and therefore insignificant.

LAND USE: **Lease Development, Operation and Maintenance**

Impact: Impact of development of geothermal resources on the leaseholds and geothermal operations and maintenance activities will result in significant land use compatibility impacts, including; disruption of vegetative cover and wildlife carrying capacity, increased erosion potential from grading and site development, and development of industrial facilities (roads, pipelines and transmission facilities) which could divide the areas into isolated parcels disturbing the natural habitat.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties).

Facts Supporting Finding:

If deemed commercially viable, lease development will occur including the construction and operation of the power plant. Construction activity will include additional access roads, transmission and pipeline corridors, and pads for plants, maintenance facilities, and other related structures. A land use transformation occurs in the form of a previously undisturbed rural area being transformed to an industrial use area. While generally maintaining the same basic landform, alterations from cut and fill work and construction of these structures will criss-cross the terrain.

Mendocino, Sonoma, and Lake Counties all have General Plans which guide the development of project activities related to industrial development. In addition, Lake County has an adopted

geothermal element which is designed to provide planning guidance for geothermal projects and is meant to work with the General Plan. Sonoma County has such an element in draft form. Because the various county policies regarding land use are designed to allow for geothermal leasing and development within the proposed project boundary, no impacts to land use from a regulatory standpoint are anticipated. The proposed leasing program is in compliance with these local goals and objectives to encourage geothermal energy development.

These planning elements define to varying degrees the policies that pertain to geothermal development for all resource areas. Facility siting is subject to certain setback requirements which are indirectly related to land use. For example, these requirements are directly related to establishing buffer zones around sensitive biological/vegetation resource areas (such as near streams), restrictions on construction on steep slopes due to landslide potential, restrictions on facility placement at set distances from residences and sensitive receptors for noise buffering, and avoidance to the extent possible of siting facilities on ridgelines or within sensitive viewsheds. These requirements are normally made a condition of the permit requirements for a particular facility and are assessed on an individual project basis.

In order to mitigate the impacts of geothermal development on land use, the measures involving viewpoint/interpretive displays, resident education, minimizing land area disturbed and consolidation of facilities have been adopted by State Lands Commission. It is recommended that local agencies adopt these measures during the site development permit process.

- Some local residents are not aware of the geothermal activity in the area, nor of the various potential uses of the geothermal resources. The respective counties should require the establishment of a viewpoint/interpretive display to help educate local residents and visitors regarding the proposed project and the beneficial uses of geothermal energy (FEIR Mitigation Measure #2).

- Mitigation measures to ensure that land disturbance is minimized include that project development proceed in accordance with all state and local permit requirements. Mitigation monitoring programs should provide the necessary control to assure compliance with the permit requirements (FEIR Mitigation Measure #3).

- Measures to minimize land disturbance and amount of land surface will be implemented including limitations on cut and fill activity, sharing of roadways and certain facilities (possibly maintenance areas) where applicable, directional drilling, and locating well sites as close as possible to plants. All disturbed areas will be revegetated as soon as possible and all debris and excess material and equipment will be removed. Transmission line construction will be in adherence with CEC criteria and will be consolidated when possible with the existing PG&E system (FEIR Mitigation Measure #4).

- Space-consuming towers and diagonal alignments of transmission lines and facilities through agricultural fields will be avoided. Where possible, transmission lines will follow property lines or routes with the least environmental and land use impacts (FEIR Mitigation Measure #5).

- o Long spans between transmission towers may be utilized at stream crossings to prevent disturbance to stream banks and riparian vegetation (FEIR Mitigation Measure #6).

- o Landscaping around periphery of well islands or power plant facilities will assist in shielding residences and casual observers from any undesirable or incompatible views of the facilities (FEIR Mitigation Measure #7).

- o Revegetation during construction requires careful plant species selection. Revegetation with many species is, in the long run, the most successful. Often immediate erosion problems can be checked by hydromulching of various grasses. Instead of using fast-growing non-native grasses, an alternative would be to cover bare soil with a coating straw. Straw would absorb raindrop impact and act as a mulch for viable seed buried in the soil (FEIR Mitigation Measure #8).

- o Measures to mitigate potential impacts to residential users include adherence to buffering requirements set forth through county guidelines for noise, visual affects, air quality, and other areas (FEIR Mitigation Measure #9).

- o Hunting activities and issues related to both hunter safety and plant personnel safety from stray shots may require the restriction of recreational or hunting with areas proximate to energy-generating facilities (FEIR Mitigation Measure #10).

Upon implementation of the mitigation measures described above, the significant adverse impacts will be reduced to levels considered acceptable and therefore insignificant.

LAND USE: Abandonment

Impact: Abandonment of operations has the potential to create long-term degradation from site development grading.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties; California Division of Oil and Gas; and California Regional Water Quality Control Board).

Facts Supporting Finding:

When properly conducted, abandonment activities including proper site restoration and revegetation, will over time allow areas to substantially recover from geothermal development. As with operational requirements, there are standard requirements ~~in local agency plans and~~

regulations regarding abandonment that are normally made a condition of the permitting for abandonment activities on an individual project basis.

The proposed mitigation for abandonment includes a number of measures for specific resource impacts (for instance, grading, runoff, aesthetics, etc.) which are discussed under each resource topic in these findings and are not repeated here. However, the following measure has been adopted relative to impacts of abandonment on land use;

- Revegetation during construction requires careful plant species selection. Revegetation with many species is, in the long run, the most successful. Often immediate erosion problems can be checked by hydromulching of various grasses. Instead of using fast-growing non-native grasses, an alternative would be to cover bare soil with a coating straw. Straw would absorb raindrop impact and act as a mulch for viable seed buried in the soil (FEIR Mitigation Measure #11).

Upon implementation of the mitigation measure described above, the significant adverse impacts will be reduced to levels considered acceptable and therefore insignificant.

PHYSIOGRAPHY AND GEOLOGY: Non-Drilling Exploration

Impact: Non-Drilling related exploratory activities have potentially significant impacts from use of seismic sounding vehicles, potential use of explosives and shallow drilling activities.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; County Air Pollution Control Districts; and California Division of Oil and Gas).

Facts Supporting the Finding:

Gravity, magnetometer, resistivity, and geochemical surveys along with field mapping and surveying would have little impact on the study area. All of these operations require one or two field people and all of the vehicular traffic can be confined to existing roadways. The only potential impact that can be attributable to this type of field activity is the potential for an accidental forest fire due to the negligence of field personnel.

Seismic studies would involve the use of a vibrating energy source or small explosive charges. Under normal circumstances, the study points are located along existing roadways. While the instrumentation of seismic studies causes no environmental impacts~~, the energy source presents~~

potential environmental impacts. If a vibratory source is used, roads are required to move the truck carrying the source. If explosives are used, hand auger holes are used for small explosive charges. The larger charges required for deeper prospecting do require drilling 15- to 30-km (50- to 100-foot) blast holes drilled with a portable drill rig.

Thermal gradient wells require the drilling of small diameter shallow test holes. This drilling requires the use of small self-contained truck mounted drill rigs. Where existing roads do not serve the areas where exploration is needed, paths will need to be cut.

These impacts can be reduced to a level of insignificance through implementation of measures requiring truck mounted drill rigs for geophysical exploration and preparation of plans of exploration, as follows:

- o The use of truck mounted and/or core type drill rigs for temperature gradient or deep geophysical investigations shall be encouraged (FEIR Mitigation Measure #1).

- o A plan of exploration shall be prepared and submitted to SLC prior to commencement of any exploratory activities. Said plan shall delineate the proposed site access, exploratory methods, equipment used, and required land form on subsurface modification. Based upon the plan, SLC may place conditions and or other restrictions on exploratory activities (FEIR Mitigation Measure #2).

PHYSIOGRAPHY AND GEOLOGY: Exploratory Drilling

Impact: Exploratory drilling operations will have significant adverse impacts due to drill pad and road grading, devegetation, and potential erosion hazards.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; and California Regional Water Quality Control Board).

Facts Supporting the Finding:

The primary concern of exploration drilling operations that will impact the area are:

- Drill sites or pads
- Access roadways
- Drilling operations
- Well testing

The most acceptable locations for drill pads are on the ridges and moderately sloping hillsides. Placement of drill pads in these locations will almost eliminate the potential for landslide hazards by keeping the pads off of the steep slopes and valley floors.

The least desirable locations for drilling pads are the steep slopes of the area and the valley floors. Steep slopes all have a potential for developing into landslides or being damaged from landslides developed higher on the same slopes. Much more construction is needed for this type of pad with the resulting increase in damage and impact to the natural surroundings. Pads positioned in the valley floors have the potential of being damaged from landslide debris and flooding during times of heavy rainfall.

Measures to mitigate exploratory drilling impacts include a requirement for geotechnical investigations, hazard mapping, and grading performance standards as listed below:

- Geotechnical investigations for design of facilities should be done for the following purposes: 1) to explore and evaluate soil, groundwater, and subsurface geologic conditions; 2) to evaluate site stability under static and earthquake conditions; 3) to assess the potential for reserve pit leakage; and 4) to provide soil engineering criteria for proposed grading. The investigation would be based on adequate surface and subsurface exportation, laboratory testing, and engineering analyses (FEIR Mitigation Measure #3).

- Updated mapping of existing and potential landslide areas and other geological hazards in the project area should be encouraged and supported (FEIR Mitigation Measure #4).

- Site-specific topographic maps should be prepared of site facilities for project design purposes. The maps may be prepared by either photogrammetric methods and/or by ground survey. The maps should be of sufficient scale and detail to allow the preparation of accurate design drawings (FEIR Mitigation Measure #5).

- Copies of finalized design plans, construction specifications, and geotechnical reports should be submitted to the local Public Works and Planning Departments for review and approval prior to construction activity (FEIR Mitigation Measure #6).

- Civil engineering and geotechnical studies should be undertaken for the design of new road alignments and, as needed, for improving existing road (FEIR Mitigation Measure #7).

- The mitigation measures suggested for pad construction and design are (FEIR Mitigation Measure #8):

  - Have each pad and/or fill designed by a licensed civil engineer with all design based on adequate exploration, testing, and analysis.
  - Pads shall be compacted to a minimum of 90 percent relative compaction.
  - Filled slope banks should not exceed a gradient of 1.5:1. Toes of fills should be stabilized with rock and gravel or keyed into stable soil.
  - Pads should be designed on the basis of balanced cut and fill, whenever possible.

- Hillside storage of spoilage should be avoided whenever possible.
- Provisions must be made for adequate surface drainage from pad surfaces into the nearest stream course.
- Subdrains should be provided under fills where natural drainage courses and seepage are evident.
- Fill and cut slopes should be seeded, mulched, and fertilized as soon as possible.
- If the pad is for drilling, the actual location of the well(s) (if possible) should be in that portion of the pad where the cut was made.

o The mitigation measures suggested for construction of road alignments are in general the same as those for pad construction (see above) plus the following (FEIR Mitigation Measure #9):

- To gain access to the project areas, use should be made of the existing road network in order to minimize the amount of new access roads that would have to be constructed.
- Keep road width to a minimum.
- On hillsides the road surface should slope into the hillside.
- Culverts and drainage ditches should be installed as necessary. They should be of adequate size, properly lined, and regularly inspected to be sure the are functioning.

o Particular restriction should be placed on operating tractors and vehicles up and down hills, where hill and gully erosion can result. Construction zones should be shown on plans, flagged on the ground, and compliance made a part of all agreements (FEIR Mitigation Measure #10).

o Energy dissipators should be installed at all outfalls in weathered rock (FEIR Mitigation Measure #11).

o Roads should not be placed where slopes exceed 33.5 percent. Road base should be graded, compacted, and surfaced (FEIR Mitigation Measure #12).

o All grading activity shall be completed and all drainage structure shall be in place and operational prior to October 1 of any year when possible (FEIR Mitigation Measure #13).

o To be on the safe side, lost circulation problems should be anticipated during the thermal gradient phase by the lessee and a program to minimize such problems should be developed beforehand for implementation. Only non-toxic, biodegradable drilling fluids should be used (FEIR Mitigation Measure #14).

o Prior to the filling of sumps, sump fluids (both mud and supernatant liquids) shall be chemically analyzed, upon request from the Planning Department, for type and quantity of biologically sensitive materials, especially hazardous materials, heavy metals, and acids (FEIR Mitigation Measure #15).

- o If analysis does not indicate quantities in excess of allowable limits for either human or other important biological elements, especially those of the aquatic ecosystem, then sump materials shall be solidified, dried, mixed with native soil and buried. Hazardous or biologically sensitive materials found will be disposed of properly. Sump pits shall be refilled to a stable grade and be revegetated as required (FEIR Mitigation Measure #16).

Upon implementation of the mitigation measure described above, the significant adverse impacts will be reduced to levels considered acceptable and therefore insignificant.

PHYSIOGRAPHY AND GEOLOGY: Lease Development

Impact: The significant impacts that will result to the geology and physiography as a result of lease development as it pertains to well field development, steam conveyance, power generation facility construction, and transmission facility construction are:

- Considerable alteration of the topography in the development area This alteration will include slopes and vegetation.
- Modification of the drainage in the area of the development areas and change in water run off patterns.
- Construction activities will expose bare ground which will result in increased erosion in the development areas.
- Local sloughing, slumping, and sliding of steep hill side grades.
- Increased potential for landslide due to exposed cuts and porous fills.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties and California Division of Oil and Gas).

Facts Supporting the Finding:

The extent of geothermal development which will occur within the project areas cannot be predicted until results from the exploratory wells are known. The primary concerns of development drilling operations that will impact the area are the same as those listed above for exploratory drilling, including the impacts of development additional access roads, drill pads, and hazards during well drilling and testing.

Lease development also includes construction of a steam gathering system, and possible additional power generation and transmission facilities. This aspect of operations will have potentially significant impacts on the physiography of the area.

The significant impacts that will result to the geology and physiography as a result of lease development can be mitigated to insignificance by implementing many of the grading performance standards as described previously as well as additional measures as follows:

- All measures included under Exploratory Drilling would apply to the Lease Development phase (FEIR Mitigation Measure #17).

- If a well pad and reserve pit are to be reactivated following the drilling of the initial exploratory well, they should first be inspected by a geotechnical and civil engineer to assess threat condition and suitability for reuse. Particular care should be given to reserve pit inspection to identify possible damage or deterioration to the impermeable liner material (FEIR Mitigation Measure #18).

- It is the County of Sonoma's policy to encourage power plant design that is appropriate for the resource. The design should provide for conservation of the resource and minimize plant emissions (FEIR Mitigation Measure #19).

- Viability of side casting of soil and rock spoilage depends upon volume, type of material, slope composition, slope stability, and riparian drainage. Where casting is to be prohibited, an acceptable debris disposed areas shall be identified (FEIR Mitigation Measure #20).

- Structures should not be sited on, across or adjacent to unstable landslides unless complete landslide repair is feasible (FEIR Mitigation Measure #21).

- In all areas, but especially those with high soil erodibility, minimum removal of vegetation is advisable (FEIR Mitigation Measure #22).

- Cut and fill slope ratios exceeding 33.5 percent should be avoided. Projects on steeper areas can proceed only after substantial evidence of safety prepared by a registered engineering geologist (FEIR Mitigation Measure #23).

- Large sliver fills shall be avoided (FEIR Mitigation Measure #24).

- Where engineered fills and culverts are to be placed across gullies and streams, it is preferable to use material with a high rock content in order to reduce siltation problems. Less desirable, but acceptable, would be the careful riprapping of compacted soil. Hydrologic studies should be done for culvert sizing purposes (FEIR Mitigation Measure #25).

- Those segments of the road alignments where casting is to be so prohibited should be identified for the applicant's maintenance crews, and acceptable areas for the debris disposal located (FEIR Mitigation Measure #26).

- A retaining levee of not less than 18 inches in height and three feet in base thickness shall be placed on the perimeter of all fill areas including access road fills, pad sites, and waste sumps, to prevent storm runoff accumulation from random discharge (FEIR Mitigation Measure #27).

- Anchor points for stream crossings should be located as far from the active channel as feasible (i.e., on the order of 100 feet). This will reduce the potential for soil and rock generated from pipeline corridor to intercept runoff and reduce soil erosion (FEIR Mitigation Measure #28).

- Cuttings from the bore hole and associated drilling fluids should be disposed of according to state and county requirements (FEIR Mitigation Measure #29).

- The operator shall comply with all federal, state, and local standards with respect to the control of all forms of air, land, water and noise pollution, including, but not limited to, the control of erosion and disposal of liquid, solid, and gaseous wastes (FEIR Mitigation Measure #30).

- In the event of development of a hot water resource, an inventory and analyses of fresh water wells within 1/2-mile of the project shall be made prior to the reinjection of any geothermal effluent from testing or production. At the property owner's option, the developer shall annually test such wells for compliance with state water quality control standards (FEIR Mitigation Measure #31).

PHYSIOGRAPHY AND GEOLOGY: Operations and Maintenance

Impact: The potential significant impacts that are associated with operation and maintenance include damaging settlements and/or failure of the earthwork, failure or leakage of surface pits constructed, surface rupture damage through the site, liquefaction of the site, damage due to settlement or subsidence as a result of steam withdrawal, damage from volcanic ash fall or lava flows, and collapse of facilities into natural or manmade caverns.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such

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agencies (Lake, Sonoma and Mendocino Counties; California Division of Oil and Gas; and California Regional Water Quality Control Board).

Facts Supporting the Finding:

During the operations and maintenance phase, little additional surface disturbance will occur. Impacts are limited to possible occurrences ranging from failure of previous work to regional geotechnical or seismic events. The likelihood of these events occurring ranges from minor to remote.

The following measures incorporating specific site maintenance requirements are proposed to reduce the impacts to insignificance as follows:

- Culverts, ditches, trash racks, and other facilities of development sites shall be regularly cleaned and maintained, particularly just before and during the wet season. Such maintenance is necessary to reduce damage to these facilities and subsequent erosion/siltation problems (FEIR Mitigation Measure #32).

- A program of long-term site project maintenance should be developed and implemented by the applicant to ensure continued performance of project components (FEIR Mitigation Measure #33).

- If a drill pad is to be used following a period of deactivation, it should first be inspected by a civil engineer and engineering geologist to evaluate its conditions and to recommend repairs as necessary. Particular care should be given to the waste sump liner to ensure that it is repaired or replaced as necessary (FEIR Mitigation Measure #34).

PHYSIOGRAPHY AND GEOLOGY: Abandonment

Impact: During the abandonment and restoration process, the significant environmental impacts that can be expected are similar to those encountered during the development phase except that generally less effort is required to recontour sites than to initially clear and grade them.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; County Air Pollution Control Districts; California Division of Oil and Gas; California Regional Water Quality Control Board).

Facts Supporting the Finding:

Once the resource has been depleted or the practicality of using the resource has passed, the project must be abandoned and the sites restored to a shape as near the original as possible. Abandonment will include dismantling and removal of equipment, plugging of the wells, removal of pipelines and regrading the sites and roads to their near original condition.

Impacts of abandonment will be mitigated to levels of insignificance by implementing measures requiring restoration, revegetation, and erosion control, as follows:

- In the event that steam in commercial quantities is not discovered or the field is completely utilized, the pads should be abandoned according to all existing federal, state, and local requirements and regulations, including scarifying the pad surface, placing stockpiled topsoil on the pad, fertilizing as required, and planting with suitable grasses and/or shrubs (FEIR Mitigation Measure #35).

- If, upon completion of drilling, an access road is to be abandoned, it should be done according to good engineering practice with permanent drainage facilities installed (FEIR Mitigation Measure #36).

PHYSIOGRAPHY AND GEOLOGY: Geothermal Resource Utilization-Resource Depletion

Impact: The primary significant adverse impact caused by utilization of the geothermal resource is the lack of future benefits caused by depletion.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; California Division of Oil and Gas; California Regional Water Quality Control Board; and California Energy Commission).

C) Specific economic, social and or other considerations make infeasible the mitigation measures or project alternatives identified in the Final EIR.

Facts Supporting the Finding:

As discussed in Section 3.3.6.2 of the FEIR, recent study has concluded that a properly planned injection project can extract additional heat from the formation and positively impact both the reservoir pressure and flowrate while minimizing thermal breakthrough to the offset wells. The estimated field life using volumetric analysis is 108 years and using heat recovery analysis is

60 years. In addition, installation of energy conserving features within the geothermal energy production process will have the benefit of improving power generation efficiency.

Without injection, Shook and Faulder (1991) have projected (at the current rate of production) the reservoir would be depleted within 15 years. In 12 years, over 95 percent of the mass initially present would be produced and only about 4 percent of the energy recovered. The model indicated that by injecting 30 percent of the mass produced, energy recovery would increase by 35 percent, to a total of 5.4 percent of the energy in place.

When Shook and Faulder (1991) modeled the reservoir using 60 percent injection, quenching had an appreciable immediate negative impact on energy production as indicated by the delay in heat extracted. However, this large amount of injection increased the life of the reservoir. When model was terminated at 40 year duration, approximately 40 percent of the recoverable mass still remained. This amount was on the order of the mass initially in place, thus they concluded that the energy extraction could nearly be doubled with a reservoir fluid injection program. Unfortunately, to attain an injected mass exceeding the amount of condensate water available from the energy generation will impact other very limited water sources in the region. It is noted that these data are estimates and that the actual benefits of injection are not precisely known.

Because reservoir injection is believed to improve energy recovery, the following measures to conserve the resource have been adopted to address resource depletion:

- The most effective mitigation measure is conservation of the resource during energy production. However, since The Geysers energy production is an alternate energy source for fossil fuels the premiss of using a substitute energy source is non-viable (FEIR Mitigation Measure #37).

- By using operational measures such as cycling, load following, and puffing (shut down and then reopening) increased conservation of the resource is achieved by delivering loads in a cyclic manner consistent with demand. In that each source is somewhat unique, each of these measures would need to be reviewed in depth prior to large scale implementation (FEIR Mitigation Measure #38).

- By installing binary recovery equipment the lower-pressure lower-temperature steam exhausted from the typical six stage turbines systems used can capture additional energy. This would increase overall plant efficiency and conserve the resource (FEIR Mitigation Measure #39).

- In order to mitigate fluid loss from the reservoir, current injection of process water from the plants could be supplemented with additional process water, impoundment water, municipal water, or sewage effluent. Extra process water could be derived if more efficient cooling towers are constructed. Water from impoundments would require the construction of such, as well as collection and distribution systems. This is undesirable for it would be land intensive. Municipal water, if used, would draw upon the domestic and agricultural water supply and would create other impacts. ~~Using effluent from a~~

nearby public works facility would require construction of a delivery system. With any of these efforts there remains the unknown consequences of artificially recharging the reservoir in higher quantities (FEIR Mitigation Measure #40).

Though some effort to develop surface water resources for geothermal purposes has occurred in The Geysers, it is recognized that sources of water for reinjection are very limited. Groundwater is not abundant enough nor adequately recharged to supply a secondary source of injection water. For this reason the operators do not use it, except wells are maintained on some leases for fire fighting purposes and potable water.

The construction of impoundments on any of the local water course, of a size adequate enough to contribute a substantial amount of water for reinjection, would have significant negative impacts. There have been proposals to transport water from several locations south of the project area via pipeline to The Geysers area, including up to 4 million gallons of treated wastewater per day initially. Constraints to wastewater injection include costs and cooperation of geothermal companies for implementation. Complete analysis of short-term and long-term impacts of wastewater injection warrants further study.

Consequently, it is not known whether any reinjection program (as mitigation) is feasible. Also, before any injection program could be implemented, additional research on the steam reservoir and its mechanics must be completed. A study is presently underway. Based on the uncertainties of research results and water availability, any additional development of the steam resource at The Geysers is considered to exacerbate the resource depletion in locations where the steam production rates are declining.

The EIR evaluated several alternatives which could have the potential to reduce or eliminate the identified environmental impacts of resource depletion.

No Project Alternative

Implementation of the No Project Alternative would mean that the State Lands Commission would not offer any of the lands within the study area for leasing for geothermal resources. These resources would remain undeveloped for the foreseeable future. From the standpoint of the unavoidable adverse impact of depletion of the geothermal resource, adoption of this alternative would reduce but not eliminate the impact. Existing operations have had major impact on resource depletion and may or may not cooperate in conservation if it negative affects existing resource production.

Leasing Portions of the Project Areas

This alternative involves leasing one or two of the three project areas identified for prospective leasing. The reasons for omitting any particular leasing area could be numerous; however, this analysis assumes that the reason would be lessen demand for reinjection fluids. While this alternative could perhaps accomplish that purpose, it would not have any effect of reversing resource decline relative to existing operations.

Prohibiting Construction of Power Plants

This alternative would allow construction of steam fields in the area, but not development of new power plants. Since this alternative does eliminate such activity, the unavoidable adverse impacts of resource depletion would still occur.

Alternative Land Uses

This alternative is based on the assumption that the State Lands Commission could encourage alternative land uses, other than geothermal uses, to be established on the leasehold areas. The State Lands Commission is limited in its ability to establish or encourage land uses beyond its jurisdiction to lease lands for resource and mineral development. Local land use approvals for any use subsequent to leasing are under the purview of the local county governments with jurisdiction. The state does own the lands on Cobb Mountain within the designated lease area and would have some land use authority there. Uses other than geothermal development do not affect the problem of resource depletion from existing operations.

Alternative Technology

This alternative assumes that alternative technologies could be implemented to exploit the geothermal resources of the project areas. The need for implementation of alternative technologies has several purposes, including the reduction in the physical environmental impacts of more traditional geothermal development, and the extension of the life of The Geysers steam field through conservation and more efficient use of the resources. However, this alternative does not eliminate the need for drilling and extraction of geothermal resources, but by better use of thermal conversion technology, it is possible to reinject a larger portion of the fluids originally extracted.

In conclusion, the No Project, Alternative Technology and Alternative Land Use Alternatives could lessen, but not eliminate the unavoidable impacts of resource depletion at The Geysers. None of these alternatives allow the State Lands Commission to fulfill its obligations under the Geothermal Resources Act and are not considered feasible. The issue of resource depletion must be addressed on an industry-wide basis at the Geysers and the State Lands Commission definitely encourages geothermal operators to implement resource conservation measures at The Geysers.

It is possible that potential new resource locations, however, may be separate pockets of steam resource which are not interrelated to adjacent formations and, as such, development would not contribute to overall resource depletion. An example of this is the Aidlin Field in the northwest area of The Geysers. If development of these individual pockets is postponed, the opportunity might be lost to connect these wells into existing plant delivery networks and/or plants. Since the existing networks and plants might become obsolete or need retirement, the remaining reservoir pockets would not be economically viable to pursue later. This is one major reason for pursuing the proposed leasing at this time rather than reserving options for leasing at some future date.

PHYSIOGRAPHY AND GEOLOGY: Geothermal Resource Utilization-Debilitation of Resource

Impact: Significant adverse impacts will potentially occur from injecting too much water back into the formation or in the wrong location or depth resulting in drowning or thermal breakthrough.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; County Air Pollution Control Districts; California Division of Oil and Gas; and California Regional Water Quality Control Board).

Facts Supporting the Finding:

Drowning causes a phase change reducing the steam to water or making it "wetter". This term would be associated with a pronounced effect on a large area. Thermal breakthrough is associated with injecting too close or shallow relative to a producing well and affecting its production rate. A remote or improbable form of debilitation can also occur from the injection of water that may contaminate (i.e., high in total dissolved solids) the reservoir with material which would adversely effect steam extraction, the generation process equipment, air quality emissions, or process waste water discharge quality.

The significant impacts of resource debilitation can be mitigated to insignificance by incorporating voluntary control measures as follows:

- Geothermal developments occurring on SLC leasing areas shall be conducted in a manner that is consistent with the Interim Coordinated Resource Management Plan for The Geysers, including compliance with future finalization or modifications of the plan that is necessary to conserve the steam resource (FEIR Mitigation Measure #41).

PHYSIOGRAPHY AND GEOLOGY: Geothermal Resource Utilization-Induced Ground Displacement

Impact: A secondary impact of drawing off the resource is surface displacement caused by relief of subsurface pressure. The settlement may then induce seismicity, or seismicity may occur alone. Observed effects of induced ground displacement have been relatively minor at The Geysers, however, the impact is considered potentially significant.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; California Division of Oil and Gas; and California Regional Water Quality Control Board).

C) Specific economic, social and or other considerations make infeasible the mitigation measures or project alternatives identified in the Final EIR.

Facts Supporting the Finding:

Localized ground subsidence from reduction of fluid pressure in The Geysers has been addressed by Lofgren (1981). Reported was a maximum vertical compression of the reservoir rock of 14 cm (5-1/2 in.) over a 4-1/2 year period. This study was done from 1972-1977.

The data suggest that declines in deep reservoir pressure and rates of horizontal and vertical displacement are greatest soon after new sources of steam are put on line, and diminish as recharge gradients reach a steady state.

The adopted mitigation for induced ground displacement is recharging the reservoir as stated in the following measure:

- Subsidence and induced seismic activities are mitigable by recharging the reservoir by injection. However, for lack of better knowledge on the reservoir the effectiveness in quantifying control of displacement is hardly predictable. Localized displacement has little impact and requires little mitigation (FEIR Mitigation Measure #42).

This impact is considered unavoidable and not mitigated by measures that can be implemented by operators. Ground subsidence has been attributed to geothermal resource extraction and can be reduced by fluid injection. The degree of fluid injection required to offset subsidence is not presently known, therefore, no effective mitigation measure is available.

The EIR evaluated several alternatives which could have the potential to reduce or eliminate the identified environmental impacts of ground subsidence. Of the alternatives considered, and identified previously, the No Project, Alternative Technology and Alternative Land Use Alternatives could lessen, but not eliminate the unavoidable impacts of ground subsidence at The Geysers. The impacts would be reduced by minimizing or eliminating the need for extraction of additional quantities of steam from the area. None of these alternatives allow the State Lands Commission to fulfill its obligations under the Geothermal Resources Act and are not considered feasible.

PHYSIOGRAPHY AND GEOLOGY: Geothermal Resource Utilization-Induced Seismicity

Impact: Micro earthquake activity in The Geysers area has been directly attributed to the withdrawal of the steam resource and is considered a potential significant adverse impact.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; California Division of Oil and Gas; and California Regional Water Quality Control Board).

C) Specific economic, social and or other considerations make infeasible the mitigation measures or project alternatives identified in the Final EIR.

Facts Supporting the Finding:

Eberhardt-Phillips and Oppenheimer (1984) have attributed seismic activity to steam withdrawal. Lipman, Strobel, and Gulati (1978) identified two main clusters of microearthquakes with two independent pressure sinks resulting from steam production. Micro earthquakes are defined as those up to a Richter scale magnitude of 3, due to movement in limited fault lengths of less than 1.6 km (1 mile). Contraction of the reservoir rock causes micro faulting when existing stresses in the formation are relieved.

Current seismicity is of low magnitude and has unmeasurable effects on the production facilities which are designed for significantly higher ground accelerations. However, tremors propagating through the neighboring communities are a concern to residents.

The adopted mitigation for induced seismicity involves implementation of a program to monitoring horizontal and vertical displacement as follows:

- Before controlled mitigation of seismic activity can be implemented, a sustained monitoring program is needed to measure vertical and horizontal displacements in order to assess the seismic risks in the region. Further research about the dynamics and makeup of the reservoir is needed from production data, geophysical data, and well logs. Without thorough information, the long range effects of steam withdrawal and injection on the geothermal resource cannot be weighed against the benefits of controlling subsidence and seismic activity (FEIR Mitigation Measure #43).

This impact is considered unavoidable and not mitigated by measures that can be implemented by operators. Induced seismicity will continue to occur in association with geothermal

production. Though seismic events and magnitudes associated with geothermal extraction have heretofore been insignificant, this trend cannot be reliably predicted into the future.

The EIR evaluated several alternatives which could have the potential to reduce or eliminate the identified environmental impacts of ground subsidence. Of the alternatives considered, and identified previously, the No Project, Alternative Technology and Alternative Land Use Alternatives could lessen, but not eliminate the unavoidable impacts of induced seismicity at The Geysers. The impacts would be reduced by minimizing or eliminating the need for extraction of additional quantities of steam from the area. None of these alternatives allow the State Lands Commission to fulfill its obligations under the Geothermal Resources Act and are not considered feasible.

PHYSIOGRAPHY AND GEOLOGY: Cumulative Impacts - Resource Depletion

Impact: Cumulative developments may diminish the long-term viability of the geothermal resource. As existing operations have seen a decline in the steam resource, additional development including makeup wells, generically, increases the rate at which the available quantity of heat is extracted from the reservoir. It is not known at this time whether this level of development is actually significant over the expected 60 year life of the field, however, the impact is assumed to be a significant adverse impact.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; California Division of Oil and Gas; and California Regional Water Quality Control Board).

C) Specific economic, social and or other considerations make infeasible the mitigation measures or project alternatives identified in the Final EIR.

Facts Supporting the Finding:

Of importance from a cumulative standpoint is the overall decline in geothermal resource potential in The Geysers which is presently theorized to be accelerated due to lack of reinjection of sufficient quantities of fluids to offset depletion. The only measure available to mitigate this occurrence is to implement area-wide injection to conserve the resource (similar to FEIR Mitigation Measure No. 40). However, because of the lack of sufficient sources of water to support such an injection program and the need for such a program to be adopted industry-wide at The Geysers, this measure is considered to have low feasibility.

The EIR evaluated several alternatives which could have the potential to reduce or eliminate the identified cumulative environmental impacts of resource depletion. Of the alternatives considered, and identified previously under site-specific impacts, the No Project, Alternative Technology and Alternative Land Use Alternatives could lessen, but not eliminate the unavoidable impacts of induced seismicity at The Geysers. The impacts would be reduced by minimizing or eliminating the need for extraction of additional quantities of steam from the area. None of these alternatives allow the State Lands Commission to fulfill its obligations under the Geothermal Resources Act and are not considered feasible.

PHYSIOGRAPHY AND GEOLOGY: Cumulative Impacts - Induced Seismicity

Impact: Induced subsidence is considered a significant adverse cumulative impact, even though substantial impacts from this phenomenon have not occurred previously.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; and California Division of Oil and Gas).

C) Specific economic, social and or other considerations make infeasible the mitigation measures or project alternatives identified in the Final EIR.

Facts Supporting the Finding:

Geotechnical and seismic hazards present a risk to cumulative geothermal development. Seismic hazards include principally groundshaking, but could also involve fault rupture, seismically-induced liquefaction, and surface subsidence. Any of these potential hazards could have significant short-term adverse impact on geothermal operations, structures, pipelines, and power plant facilities. Of these effects, subsidence can be considered a significant adverse cumulative impact. This phenomenon has thus far not caused accumulated damage to the region because of the low level of developed uses of the area. However, subsidence is believed to be affected (slowed) by injection, and this measure would beneficially apply to cumulative development. Injection is expected to be increased by the operators over time to mitigate the ever increasing decline in steam productivity.

The mitigation measure discussed under site-specific impact is the only one available to mitigate the occurrence of induced seismicity FEIR Mitigation Measure No. 43). However, induced seismicity will continue to occur in association with geothermal production. Though seismic events and magnitudes associated with geothermal extraction have heretofore been insignificant, this trend cannot be reliably predicted into the future.

The EIR evaluated several alternatives which could have the potential to reduce or eliminate the identified environmental impacts of ground subsidence. Of the alternatives considered, and identified previously under site-specific impacts, the No Project, Alternative Technology and Alternative Land Use Alternatives could lessen, but not eliminate the unavoidable impacts of induced seismicity at The Geysers. The impacts would be reduced by minimizing or eliminating the need for extraction of additional quantities of steam from the area. None of these alternatives allow the State Lands Commission to fulfill its obligations under the Geothermal Resources Act and are not considered feasible.

SURFACE WATER HYDROLOGY: Non-Drilling Exploratory Activities

Impact: Short-term impacts caused by non-drilling exploratory activities involve the potential for a significant increase in sedimentation and erosion, including the increase in potential sediment load in nearby streams as a result of erosion from newly constructed roadways, drill pads, and other construction.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties and California Regional Water Quality Control Board).

Facts Supporting Finding:

Non-Drilling Exploratory activities are, by their nature, very focused and localized activities, result in minimal ground disturbance and/or road building, and consequently pose only a minor threat to the surface water or groundwater. The effects of these activities can be mitigated to insignificance through the following mitigation measures:

- The impacts on the surface waters can be reduced or eliminated by proper planning and siting. All available mapping, aerial photography, and available geotechnical reports should be reviewed prior to any exploration, drilling, or construction (FEIR Mitigation Measure #1).

- Plans of exploration shall detail methods to prevent erosion into creeks and streams (FEIR Mitigation Measure #2).

SURFACE WATER HYDROLOGY: Exploratory Drilling

Impact: Exploratory drilling will have significant adverse impact on surface as a result of potential for increased sediment load in streams due to newly constructed roadways, drill pads, and other construction.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties; and California Regional Water Quality Control Board).

Facts Supporting Finding:

Construction activities such as building pads, constructing road alignments, building sumps, and general drilling operations will all cause impacts that will be more short-term in nature rather than permanent. It should be pointed out that there are many site-specific impacts that cannot be included in this discussion due the lack of details as to specific locations for drill pads and operational facilities.

Mitigation measures requiring erosion and sedimentation control have been adopted to mitigate the impact as follows:

- The mitigation measures to reduce erosion and sedimentation for pad construction and design are as follows (FEIR Mitigation Measure #3):
  - During construction, cut and fill areas should be dammed with hay bales to prevent transport of sediment from construction site.
  - Pads shall be compacted to a minimum of 90 percent relative compaction.
  - Filled slope banks should not exceed a gradient of 1.5:1. Toes of fills should be stabilized with rock and gravel or keyed into stable soil.
  - Hill storage of spoilage should be avoided whenever possible.
  - Fill and cut slopes should be seeded, mulched, and fertilized as soon as possible.
- The additional mitigation measures suggested for construction of road alignments are in general the same as those for pad construction plus the following (FEIR Mitigation Measure #4):
  - Keep road width to a minimum.
  - On hillsides the road surface should slope into the hillside.
  - Culverts, drainage ditches and adequate energy dissipaters at transition to natural drainage channels should be installed as necessary.

Upon implementation of the mitigation measure described above, the significant adverse impacts will be reduced to levels considered acceptable and therefore insignificant.

SURFACE WATER HYDROLOGY: Exploratory Drilling

Impact: Exploratory drilling will have significant adverse impact on surface from as a result of potential for spillage of drilling fluids and/or fluids discharged from blowouts.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties; California Division of Oil and Gas; and California Regional Water Quality Control Board).

Facts Supporting Finding:

If oil, grease, or drilling fluid spills occur during the drilling and/or construction operations, these fluids can migrate down slope and into the water courses. The greatest concern is of course for the spillage of drilling fluids during drilling operations. Uncontrolled blowouts of drilling fluids or formation waters can result in overtopping the sumps and loss of fluids into the water courses. Additionally, ground compaction will result from the stripping of vegetation during the construction of drilling and operations pads. This compaction will cause a greater runoff than that normally encountered during rainfall on an area with vegetation and normal soil aeration.

Drilling wastes and test fluids could be produced in fairly large quantities during exploratory well drilling. The accidental deposition of drilling fluids into nearby waters could create significant adverse water quality conditions deleterious to most aquatic organisms. Increased turbidity would reduce visual feeding activity and increase biological and chemical oxygen demand.

The following mitigation measures requiring proper design of sumps, dikes, and berms, as well as preparation of contingency plans for emergency spills have been adopted as follows:

- During drilling operations, in addition to the above listed measures, the following additional measures should be taken (FEIR Mitigation Measures #5):
  - Sumps should always be maintained with at least 3 feet of freeboard to accommodate blowouts, excess formation fluids, or heavy rains.

- Proper berms and dikes should be strategically placed to guard against the accidental release of oils, grease, and cleaning solvents during drilling operations.
- Lessee/operator shall prepare a viable contingency plan for spills and emergency pumping of the sump in the event of a heavy, unexpected rainfall or if excessive geothermal fluids are encountered. The plan shall show who is responsible and what equipment and manpower is available to respond to such an emergency (FEIR Mitigation Measure #6).
- The primary protection of the groundwater is accomplished by proper lining of all sumps and monitoring sumps on a monthly basis (FEIR Mitigation Measure #7).
- Everyone on the drilling pad or facility pad must be constantly aware of any leaks, spills, or disposal of any liquid wastes directly onto the ground (FEIR Mitigation Measure # 8).

Upon implementation of the mitigation measure described above, the significant adverse impacts will be reduced to levels considered acceptable and therefore insignificant.

SURFACE WATER HYDROLOGY: Lease Development

Impact: The significant impacts to surface waters resulting from full scale development of the resources are the same as those resulting from exploratory drilling except that the magnitude of potential construction projects is much greater which increases the potential or frequency of impacts.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties; California Division of Oil and Gas; and California Regional Water Quality Control Board).

Facts Supporting Finding:

The development of the lease into production status may involve one or more of the following: drilling additional wells, building a generation plant, constructing pipelines, feeder transmission lines, and providing required access. Measures to protect surface waters which require consideration of flood flows and proper setback from active streams have been adopted as follows:

o All measures listed for Exploratory Drilling above also apply to field development drilling (FEIR Mitigation Measure #9).

- o Roads and pipelines crossing riparian areas shall be minimum safe widths and constructed for maximum erosion control (FEIR Mitigation Measure #10).

- o Proposed development projects that involve riparian areas, wetlands, and wet meadows subject to possible local flooding or seasonal inundation shall include appropriate setbacks from such wet areas (FEIR Mitigation Measure #11).

- o Floodplain management practice shall be applied in all designated 100-year floodplains (FEIR Mitigation Measure #12).

- o The development of generating technologies that have the potential for using less water or increasing the use of recycled water and wastewater shall be encouraged (FEIR Mitigation Measure #13).

- o The foundation design for the power plant facilities should take into account the potential for high seasonal groundwater levels (FEIR Mitigation Measure #14).

- o It is advisable to monitor the spring(s) in proximity to a thermal gradient boring during and for some period following completion of the boring. Such monitoring shall be accomplished by a certified groundwater hydrologist (FEIR Mitigation Measure #15).

- o In order to preserve the hydrologic integrity of the project area, the applicant shall obtain by right or purchase all water used in the drilling process or dust control. The equipment service and fuel transfer area and the area occupied by the drilling rig shall drain into the sump (FEIR Mitigation Measure #16).

Upon implementation of the mitigation measure described above, the significant adverse impacts will be reduced to levels considered acceptable and therefore insignificant.

SURFACE WATER HYDROLOGY: Operation and Maintenance

Impact: The potential of contamination of surface water via liquid wastes is a potential significant adverse impact.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties; and California Regional Water Quality Control Board).

Facts Supporting Finding:

Deleterious liquid wastes occur as formation liquids produced during utilization of the steam and/or condensate from well heads and valve locations. Constituents found in geothermal condensate around valves and wellheads at other locations may show high concentrations of boron, arsenic, and mercury. While most liquids produced are expected to be re-injected into the formation, there is always the potential for the liquids to be released into the surface waters of the area.

The extent of degradation of natural waters resulting from accidental spills depends on the quantity and composition of the initial spill, pH of spilled materials, the intensity and duration any rainfall which may occur during the spill, the flow and quality of receiving waters which determine the dilution factor, and chemical reactions influencing the ultimate deposition of waste materials. An increase in salinity could result in toxic responses from organisms in the waterway. Trace metals and other minor components could accumulate in food chains, causing sublethal and/or lethal effects, depending upon concentrations and component.

The following measures requiring proper waste disposal are proposed to minimize this potential adverse impact:

- All waste, whether liquid, solid, or gaseous must be disposed of in compliance with existing federal, state and county regulations. No waste shall be allowed to enter any streams, creeks or other body of water. Disposal of well effluents must take into account effects on surface and subsurface waters, plants, fish, and wildlife and their habitats, atmosphere, or any other effects which may cause or contribute to pollution (FEIR Mitigation Measure # 17).

- In no event shall the contents of a pit, sump, or test pond be allowed to : a) contaminate streams, artificial canals or waterways, groundwaters, lakes or rivers; b) adversely affect the environment, persons, plants, fish and wildlife and their habitats; or c) damage the aesthetic values of the property or adjacent properties (FEIR Mitigation Measure # 18).

- During suspension of operation, sumps and test ponds are to be filled and covered and the premises restored to a near natural state as prescribed by the agencies of jurisdiction (FEIR Mitigation Measure # 19).

- Culverts and ditches shall be regularly cleaned and maintained to reduce the possibility of overflow and resultant erosion and siltation (FEIR Mitigation Measure # 20).

- Adequate energy dissipaters shall be installed at transitions from culverts and drainage ditches into natural water courses to prevent erosion of the natural water course (FEIR Mitigation Measure #20a).

- As an added precaution, a vacuum truck should be available at all times to remove spilled condensate, or to remove excessive waste water from the condensate pond and drill sump in case heavy rains cause overflow (FEIR Mitigation Measure # 21).

- Drainage into natural waterways should not increase water head to the point of unnatural channel abrasion, nor carry excessive siltation which might adversely impact water quality (FEIR Mitigation Measure # 22).

Upon implementation of the mitigation measure described above, the significant adverse impacts will be reduced to levels considered acceptable and therefore insignificant.

SURFACE WATER HYDROLOGY: Operation and Maintenance

Impact: A potentially significant adverse impact is the over-use of the surface waters in the geothermal operations. Additionally, the impact of development of water resources in area watersheds is seen as a significant adverse impact due to the extremely limited nature of the resource.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties; County Air Pollution Control Districts; and California Regional Water Quality Control Board).

Facts Supporting Finding:

While most operators indicate that they intend to use condensate waters for routine plant operations, some operators in the area are using large volumes of water from the surface streams for general operations and for additional injection to create a better return potential of steam. Since the area does not have a large watershed and high rainfall, water resources are very limited. The development of water resources on area streams represent a significant adverse impact.

Mitigation measures implementing surface water protection and monitoring programs have been adopted as follows:

- Encourage use of alternative sources of water for injection which are both technically feasible and environmentally acceptable (FEIR Mitigation Measure # 23).

- Water resources are to be protected for existing and future beneficial uses, including for residential, commercial, and agricultural needs. Water rights are to be protected to accommodate projected long-term water needs. Geothermal water use and reservoir management practices shall be conducted in a comprehensive manner which do not adversely affect existing beneficial uses (FEIR Mitigation Measure # 24).

- The lessee/operator should compile a list of residents who obtain water from the creeks involved in each project. These residents should be promptly notified in the event of any spill or discharge which would impact water quality and which requires notification of the Regional Water Quality Control Board. Addresses and phone numbers of these residents should be part of a spill contingency plan (FEIR Mitigation Measure # 25).

- Water quality monitoring programs shall begin at least 1 month prior to the onset of pad construction if the water course is subject to an ongoing sampling program (FEIR Mitigation Measure # 26).

- If the lessee/operator elects to conduct or participate in a larger and more comprehensive water quality program, such a proposal must be submitted to and accepted by the County Planning Department and begun prior to the commencement of construction activities (FEIR Mitigation Measure # 27).

- Information concerning chemical and isotopic makeup of geothermal fluids encountered in the course of development of any well on a pad located within 3,960 feet of a natural thermal spring developed and maintained for current use, shall be provided to the county for use in determining the relationship, if any, between the geothermal resource and the natural spring waters. Such information shall be considered confidential between parties with a "need to know" and shall not be public knowledge (FEIR Mitigation Measure # 28).

Upon implementation of the mitigation measure described above, the significant adverse impacts will be reduced to levels considered acceptable and therefore insignificant.

SURFACE WATER HYDROLOGY: Abandonment

Impact: Impacts to surface waters are potentially significant for the short-term period and are similar in nature to the impacts for the exploratory wells, particularly soil erosion and sedimentation impacts.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties; County Air Pollution Control Districts; California Division of Oil and Gas; California Regional Water Quality Control Board).

Facts Supporting Finding:

When the project has reached its useful life, the facilities, the pipelines and the wells must be abandoned and removed, causing impacts very similar to that of construction of well pads and roads. The impacts will be transitory in nature and very short-lived. Measures to mitigate such impact, including proper abandonment according to agency regulations, are as follows:

- Upon completion of any phase of the project, the site shall be cleared of all unnecessary materials and restored insofar as practical, in accordance with the requirements of the California Division of Oil and Gas, California Regional Water Quality Control Board, SLC, and county use permit conditions (FEIR Mitigation Measure # 29).

- When no longer needed, sumps and test ponds are to be filled and covered and the premises restored to a near natural state as prescribed by the agencies of jurisdiction (FEIR Mitigation Measure # 30).

- Within 15 days of the removal of drilling equipment, sump fluids (both mud and supernatant liquids) shall be chemically analyzed for hazardous materials, biologically sensitive materials, heavy metals, and acids, unless waived in writing by the County Planning Director (FEIR Mitigation Measure # 31).

Upon implementation of the mitigation measure described above, the significant adverse impacts will be reduced to levels considered acceptable and therefore insignificant.

GROUNDWATER HYDROLOGY: Exploratory and Operations Phases

Impact: There is potential for significant impact to the limited ground water resources during the drilling and operations phases as a result of, 1) accidental seepage of drilling fluids and other stored fluids through the liners of the sumps on the drilling pads, 2) accidental seepage into the ground of oils, grease, and/or cleaning solvents, and 3) migration of formation fluids up and into the groundwater zones as a result of faulty cement jobs and completion practices.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties; California Division of Oil and Gas; and California Regional Water Quality Control Board).

Facts Supporting Finding:

Groundwater occurrence and usage in the area is minimal. In general, the resource is very limited. The migration of drilling fluids into surrounding groundwater sources would have an effect quite similar to that caused by the drilling of regular domestic water wells in the area. Most of the wells are drilled using drilling muds and are developed into potable water sources. Should the drilling fluids of the geothermal test, or production wells be introduced accidentally into the groundwater, the principal problem created would be a short-term increase in finely disseminated sediment, assuming the drilling muds used were a biodegradable, non-toxic type mud. Mitigation in the form of sump lining and monitoring has been adopted as follows:

o The primary protection of the groundwater is to be accomplished by proper lining of all sumps and monitoring same on a monthly basis (FEIR Mitigation Measures # 32).

Upon implementation of the mitigation measure described above, the significant adverse impacts will be reduced to levels considered acceptable and therefore insignificant.

SURFACE AND GROUNDWATER HYDROLOGY: Cumulative Impacts

Impact: The potential for significant, hydrologic impacts from increased sedimentation is high for a short duration during and shortly after construction of future geothermal development sites.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties; County Air Pollution Control Districts; California Division of Oil and Gas; and California Regional Water Quality Control Board).

Facts Supporting Finding:

Potential sources of surface water degradation include increased sedimentation from the clearing and grading of land for access roads, drill pads, and power facilities for the cumulative development projects. However, these significant cumulative impacts can be mitigated by designing and constructing settling basins for the localized man-made drainage courses which drain into the natural watercourses and by implementing the measures described above for site-specific impacts on a case-by-case basis. No additional mitigation measures are necessary to address cumulative surface water impacts from sedimentation.

SURFACE AND GROUNDWATER HYDROLOGY: Cumulative Impacts

Impact: With cumulative developments, the probability of accidental spills or discharge of toxins into the environment by release with steam will incrementally increase and is potentially significant. These impacts will add to the subtle long-term water quality impacts experienced in the area which are attributed to geothermal development.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties; California Division of Oil and Gas; and California Regional Water Quality Control Board).

Facts Supporting Finding:

With cumulative projects, potential spills of hazardous waste materials, and the condensation of vented steam which contains toxic constituents such as H_2S and ammonia could increase. Mitigation to prevent such occurrences includes the development and implementation of operational plans for the collection, handling, and disposal of these materials within the established framework of the existing regulatory agencies. Such measures have been discussed under site specific impacts and are applicable to the cumulative impact. Additionally, monitoring of water quality has been done at times at the Geysers and presents a beneficial way to quantify the incremental water quality effects which may occur. It is proposed to expand the monitoring program to the proposed project areas as follows:

- Cumulative impacts relative to incremental water quality effects are monitored on an area-wide basis. Applicants in proposed project areas shall participate in the area-wide monitoring programs (FEIR Mitigation Measure #33).

Upon implementation of the mitigation measure described above, the significant adverse impacts will be reduced to levels considered acceptable and therefore insignificant.

SURFACE AND GROUNDWATER HYDROLOGY: Cumulative Impacts

Impact: Any significant diversion of surface water for reservoir injection will significantly diminish water quality and aquatic habitats, as well as significantly reduce the amount of water available for domestic, agricultural, and other needs.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency (Lake, Sonoma and Mendocino Counties; California Division of Oil and Gas; and California Regional Water Quality Control Board).

C) Specific economic, social and or other considerations make infeasible the mitigation measures or project alternatives identified in the Final EIR.

Facts Supporting Finding:

A potential long-term water quality and supply impact involves use of surface water sources for reservoir injection. The implementation of an area-wide reservoir injection program to conserve the geothermal resource has been discussed as a means of extending the life of The Geysers steam resource. One source of water for the reinjection program would be the development of local surface and/or groundwater sources.

A possible alternative to the use of surface water runoff and/or local groundwater to augment injection is the use of effluent from publically-owned treatment works (POTW). To provide effluent to The Geysers would require a piping and pumping system from the POTW to the power plants. The plants would then utilize the existing distribution system to the injection wells. Upon review of the amount of effluent that could conceivably be made available, there may be sufficient quantity optimize energy extraction. As the steam field ages, a secondary source of injectate will be essential to maintain a certain level of steam output. In order to mitigate an adverse cumulative impact on surface water supply, a reservoir injection program is proposed as follows:

- The implementation of an area-wide reservoir injection program to conserve the geothermal resource as discussed under cumulative geologic mitigation measures would require a corresponding program to develop local surface and/or groundwater sources to support reinjection. While such a program could provide some disposable water supplies, coupled with advances in technology which produce greater steam efficiency and greater condensate for reinjection, the amount of freshwater available for this use is limited. Rather than developing water resources on a case-by-case basis, an industry effort should be made to assess reinjection needs on reservoir basis, and to develop comprehensive measures to meet reinjection needs.

The mitigation measures described above will reduce the significant adverse impacts to levels considered acceptable and therefore insignificant. However, before any resource conservation/injection program could be implemented, a program for development of sufficient fluid injection sources needs to be implemented. The uncertainties of the availability of sufficient fluids is a major factor affecting conservation of the steam resource at The Geysers. Due to these

uncertainties, the potential demand for surface water sources with the increase in geothermal production remains a significant unmitigated impact.

The EIR evaluated several alternatives which could have the potential to reduce or eliminate the identified environmental impacts.

No Project Alternative

Implementation of the No Project Alternative would mean that the State Lands Commission would not offer any of the lands within the study area for leasing for geothermal resources. These resources would remain undeveloped for the foreseeable future. From the standpoint of the unavoidable adverse impact on surface and groundwater resources, adoption of this alternative would reduce but not eliminate the impact. Impetus to develop surface water sources for injection presently exists with current operations, and will occur with future operations.

Leasing Portions of the Project Areas

This alternative involves leasing one or two of the three project areas identified for prospective leasing. The reasons for omitting any particular leasing area could be numerous; however, this analysis assumes that the reason would be lessen demand for reinjection fluids. While this alternative could perhaps accomplish that purpose, it would not have any effect of reducing demand for reinjectate relative to existing operations.

Prohibiting Construction of Power Plants

This alternative would allow construction of steam fields in the area, but not development of new power plants. Since this alternative does eliminate such activity, the unavoidable adverse impacts of surface and groundwater resources could still occur.

Alternative Land Uses

This alternative is based on the assumption that the State Lands Commission could encourage alternative land uses, other than geothermal uses, to be established on the leasehold areas. The State Lands Commission is limited in its ability to establish or encourage land uses beyond its jurisdiction to lease lands for resource and mineral development. Local land use approvals for any use subsequent to leasing are under the purview of the local county governments with jurisdiction. The state does own the lands on Cobb Mountain within the designated lease area and would have some land use authority there. Uses other than geothermal development may or may not involve demand for surface water and groundwater resources.

Alternative Technology

This alternative assumes that alternative technologies could be implemented to exploit the geothermal resources of the project areas. The need for implementation of alternative technologies has several purposes, including the reduction in the physical environmental impacts of more traditional geothermal development, and the extension of the life of The Geysers steam

field through conservation and more efficient use of the resources. However, this alternative does not eliminate the need for drilling and extraction of geothermal resources, but by better use of thermal conversion technology, it is possible to reinject a larger portion of the fluids originally extracted.

In conclusion, the No Project, Alternative Technology and Alternative Land Use Alternatives could lessen, but not eliminate the unavoidable impacts on demand for surface and groundwater supplies. None of these alternatives allow the State Lands Commission to fulfill its obligations under the Geothermal Resources Act and are not considered feasible, not withstanding efforts by State Lands Commission to encourage geothermal operators to implement resource conservation measures at The Geysers.

BIOLOGICAL RESOURCES: Non-Drilling Exploration Activities - Vegetation

Impact: Trampling and removal of vegetation during exploration may be potentially significant if rare or sensitive plants are impacted.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

Facts Supporting the Finding:

Surface and shallow geochemical and geophysical testing will require the removal of vegetation to gain vehicular access to some test locations. Workers may also cause localized trampling of vegetation in the test areas. Though these impacts would not be significant in terms of a substantial vegetation disturbance, they could be potentially significant if suitable habitat for rare or sensitive plant species is affected.

The potential for significant adverse impacts to rare and sensitive plant species will be reduced to insignificant levels through implementation of measures requiring site-specific rare plant surveys as follows:

- A site-specific plant survey and rare plant survey shall be conducted by a qualified biologist in accordance with guidelines developed by the California Native Plant Society as recommended by the California Department of Fish and Game (FEIR Mitigation Measure #1).

BIOLOGICAL RESOURCES: Non-Drilling Exploration Activities - Wildlife

Impact: Access road construction could negatively impact active large mammal (such as coyote) den sites.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

Facts Supporting the Finding:

Due to the minor amount of habitat alteration and relatively short duration of exploration activities in any given area, overall wildlife impacts would be minimal during the exploration phase of the project. However, construction of new access roads could impact any active large mammal dens located along the routes.

Implementation of the following mitigation measure requiring survey for carnivore dens will reduce adverse impacts to insignificant levels:

- o A survey shall be conducted by a qualified wildlife biologist to assure no active carnivore dens are present. If an occupied den is found, appropriate procedures shall be taken to assure the safety of occupants. Such actions may include relocation of the occupants by a qualified wildlife biologist (FEIR Mitigation Measure #2).

BIOLOGICAL RESOURCES: Exploratory Drilling - Vegetation

Impact: Exploratory drilling activities could potentially remove or damage rare or sensitive plant populations.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies. (Lake, Sonoma and Mendocino Counties).

Facts Supporting the Finding:

Exploratory drilling will require brush clearing for road construction, road widening, clearing of drilling pad sites, and other exploration activities. These operations could inadvertently damage or remove rare or sensitive plant species.

Rare or sensitive plants could also be damaged in the event of an accidental spillage of hot liquids. (Mitigation measures to prevent such spills are discussed in all phases of the surface water and groundwater hydrology sections of these Findings.)

The potential for significant adverse impacts to sensitive plant life resulting from exploratory activities will be reduced to insignificant levels through implementation of measures to avoid sensitive plant populations as follows:

- o The construction period should avoid seasons of the year in which erosion potential is high (generally November through May) (FEIR Mitigation Measure #3).

- o Removal of or injury to sensitive plant species shall be avoided. To minimize the possibility of accidental damage to sensitive plant populations by machinery or human activity, locations of such populations should be flagged or fenced prior to exploration or construction. During construction, periodic monitoring by a qualified botanist shall be conducted in order to ensure the integrity of the population (FEIR Mitigation Measure #4).

- o If removal or injury to a sensitive plant population cannot be avoided, partial mitigation is possible through the development and implementation of [illegible]

species affected, prior to such removal or injury. Such a plan shall include, at minimum: 1) research into the reproductive ecology of the species, so as to evaluate the potential success of various management options (e.g., transplantation, seeding); 2) assessment of the surrounding habitat in terms of its potential to support the species; 3) research into the genetics of the species, sufficient to determine the minimum population size required for long-term existence of the population; 4) monitoring of the management area for three years or more, depending on the life span of the plant and the success of management efforts (FEIR Mitigation Measure #5).

- o Stepped benches shall be used where appropriate and as considered necessary by a revegetation specialist (FEIR Mitigation Measure #6).

- o Woody vegetation, stumps, and brush should not be buried on site but preferably chipped and spread as mulch over project cut and fill or incinerated in a safe manner (FEIR Mitigation Measure #7).

- o Mechanical stabilization without reseeding should be permitted on areas where construction is not complete or scheduled for continuation the following year. Mechanical stabilization is defined as measures to prevent or reduce to small amounts soil loss over the rainy season (FEIR Mitigation Measure #8).

- o Road construction, exploratory drilling, and power plant development in riparian areas shall be avoided (FEIR Mitigation Measure #9).

BIOLOGICAL RESOURCES: Exploratory Drilling - Wildlife

Impact: Modification of the existing wildlife habitat could result in the significant loss of den sites for larger carnivores (such as coyotes).

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies. (Lake, Sonoma and Mendocino Counties).

Facts Supporting the Finding:

Exploratory drilling will result in considerable local modification of wildlife habitat. Construction of the drilling pad and sump will result in 100 percent removal of native vegetation in areas encompassing approximately 2.5 acres per pad, that would otherwise serve as food, shelter, and nesting sites for wildlife. This impact will be greatest in Project Area No. 3, where drill pad construction will likely require the removal of portions of yellow pine forest.

Important den sites for larger carnivores including gray fox and coyote may be lost constituting a significant adverse impact.

Auditory and visual disturbance during exploration drilling will modify wildlife behavior in the vicinity. Negative impacts could include a reduction in foraging success, predator avoidance, and courtship. Wildlife response to ongoing disturbances is highly variable. Some species (such as deer and coyotes) habituate quickly, while more secretive species (such as gray fox and bobcat) do not, and may be displaced. These impacts are considered temporary.

Implementation of the following mitigation measures requiring survey for carnivore dens and erecting fences avoiding wildlife corridors will reduce adverse wildlife impacts to insignificant levels:

- As with non-drilling exploration, a survey shall be conducted by a qualified wildlife biologist to determine if active carnivore dens are present prior to exploration activity. Fence lines shall be positioned as to not block movement corridors of grazing animals or wildlife (FEIR Mitigation Measure #10).

BIOLOGICAL RESOURCES: Exploratory Drilling - Aquatic Resources

Impact: Exploratory drilling could increase sedimentation rates, and accidentally spilled toxic materials could wash into streams.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; Regional Water Quality Control Board).

Facts Supporting the Finding:

Access road construction and/or widening, clearing of the drill pad sites, disposal of soils, and construction of the drilling pad sumps would have a similar but greater potential to cause erosion and increase sedimentation than the non-drilling exploratory phase of the project. As discussed in the previous section, excess sedimentation could have adverse impacts on fish and invertebrate populations.

There is also a chance for potentially toxic materials to be spilled and eventually flow or be washed into streams during exploratory drilling. A spill of drilling fluid could have acute adverse impacts on aquatic life. An uncontrolled blowout could also expel drilling fluids or formation waters could also result in these fluids entering into streams.

The potentially significant adverse impacts resulting from increased sedimentation into streams can be reduced to insignificant levels by implementing measures to prevent such runoff from reaching surface waters as follows:

- o Cut and fill areas shall be dammed with sandbags during construction to prevent transport of sediment from the construction site (FEIR Mitigation Measure #11).

- o Proper grading measures shall be taken to minimize the amount of soil runoff entering natural drainages. Sedimentation rates and turbidity levels should be monitored prior to and during all phases of drilling exploration and facility construction (FEIR Mitigation Measure #12).

BIOLOGICAL RESOURCES: Full Field Development - Vegetation

Impact: Removal of a significant amount of vegetation for field development and power plant construction and or impact from accidental spill is a potentially significant adverse impact.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies (Lake, Sonoma and Mendocino Counties; Regional Water Quality Control Board).

Facts Supporting the Finding:

The removal of substantial acreage of natural vegetation communities for power plant construction and construction of new roadways is considered a significant impact, and highly significant if such removal occurred in a sensitive habitat such as serpentine grassland or chaparral, riparian community, or freshwater wetland. Removal of vegetation for power transmission facilities, and possible injury of adjacent vegetation due to erosion from unvegetated soils, would result in potentially significant impacts. The extent of these impacts would depend on the number of transmission towers and other facilities required by individual power plants, and on whether or not such facilities were located in a sensitive habitat. Mitigation measures requiring revegetation plans and avoidance of sensitive resources have been adopted to reduce field development impacts to insignificant levels as follows:

- o All mitigation measures applicable to Exploratory Drilling - Vegetation shall also apply to Field Development (FEIR Mitigation Measure #13).

- A revegetation and landscaping plan shall be developed which utilizes native plant species of the area. Source material for revegetation should be local in order to minimize disruption of the genetic structure of adjacent, undisturbed plant populations. The plan should include provisions for monitoring and care of the vegetation until the plants are established, so as to ensure that the revegetation is successful (FEIR Mitigation Measure #14).

- Revegetation of the power plant site shall be accomplished in two phases. First, the site shall be hydroseeded following application of straw. Second, woody species will be planted one year following construction (FEIR Mitigation Measure #15).

- Topsoil shall be stockpiled for later respreading over the disturbed areas prior to revegetating as recommended by a revegetation specialist (FEIR Mitigation Measure #16).

- In areas requiring removal of vegetation but no grading, root crowns shall be left intact so as to retard soil erosion (FEIR Mitigation Measure #17).

- Where technically possible, roadways shall be aligned with existing dirt roads and jeep trails to decrease habitat disturbance. Portions of old jeep trails and dirt roads that closely parallel newly constructed roads, and are to be abandoned, shall be scarified and seeded to reestablish vegetation cover (FEIR Mitigation Measure #18).

- Tree removal shall be minimized, particularly larger oaks. When large oaks are cut down; they should be trimmed (leaving major side branches), nest holes should be bored (various diameters from 1 to 6 inches), and the trees mounted upright in chaparral area to function as hard snags. Selection of trees and precise placement of artificial snags should be determined by on-site consultation with a qualified wildlife specialist (FEIR Mitigation Measure #19).

- Jute netting or hydromulch shall be installed on cut and fill slopes. Longer slopes shall be terraced. When disposing of drainage on a long fill, an apron or discharge pipe will be placed at the bottom of the fill to avoid gullying. Energy dissipators shall be installed at the point of discharge (FEIR Mitigation Measure #20).

- To consolidate the soil and provide forage at chaparral and open woodland sites, such areas shall be seeded with forage grasses and other suitable native herbs (FEIR Mitigation Measure #21).

BIOLOGICAL RESOURCES: Full Field Development - Wildlife

Impact: Considerable local modification of wildlife habitat will result, particularly at power plant sites.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR (Lake, Sonoma and Mendocino Counties; California Department of Fish and Game).

Facts Supporting the Finding:

Wildlife impacts associated with full development of the lease properties are similar to those described for the non-drilling exploration, and drilling exploration phases of the project, but on a substantially greater scale, involving approximately 50 to 100 ha (110 to 220 ac) per power plant site. The extent of the impacts is dependent on the specific location of development relative to key wildlife resources such as perennial drainages. Fossorial mammals and reptiles will be displaced or killed with the full-scale construction of the plant facilities, and den sites for larger carnivores will be removed. Loss of occupied maternal dens will have the greatest impact on the carnivore populations.

Implementation of the following mitigation measure requiring avoidance of critical habitat and consideration of threatened and endangered species will reduce adverse wildlife impacts during the full field development phase to insignificant levels:

- All wildlife mitigation measures applicable to Exploratory Drilling shall also apply to Field Development (FEIR Mitigation Measure #22).

- New high voltage electrical transmission lines shall not be located in a manner that may potentially harm the critical habitat of any rare, endangered, threatened or protected animal or plant species. Species that are under consideration for the inclusion in either the state or federal rare and endangered species lists are included in this policy (FEIR Mitigation Measure #23).

- Large snags and old trees with cavities shall be preserved to provide wildlife habitat (FEIR Mitigation Measure #24).

BIOLOGICAL RESOURCES: Full Field Development - Aquatic Resources

Impact: Exploratory drilling could increase sedimentation rates, and accidentally spilled toxic materials could wash into streams.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR (Lake, Sonoma and Mendocino Counties; California Regional Water Quality Control Board).

Facts Supporting the Finding:

The impacts of development would be similar to those of exploratory drilling except that the much more extensive construction and drilling of a greater number of wells might increase the potential and the scale of impacts. Vegetation removal and road and facilities construction for geothermal development within the project areas, again, would have the potential to increase sedimentation in streams resulting in possible sedimentation impacts on aquatic communities. Spills or accidents involving drilling fluids, formation waters, oil and grease or other materials might introduce toxic chemicals to the streams and cause lethal or sublethal effects on aquatic organisms.

Implementation of the following mitigation measure establishing a streamside conservation area will reduce adverse aquatic resource impacts during the full field development phase to insignificant levels:

- A permanent streamside conservation area of 100 feet, from the top of the bank, shall be established along Squaw Creek and other designated steelhead resource streams. On discretionary permits subject to environmental review, the conservation area may be expanded to include all riparian vegetation and a buffer zone of 10 feet from the outside drip line of the riparian canopy. However, in no instance shall the corridor, inclusive of the buffer zone, exceed 200 feet from the top of the bank (FEIR Mitigation Measure #25).

BIOLOGICAL RESOURCES: Operation and Maintenance - Vegetation

Impact: As in earlier phases of the project, there is a potential for a significant adverse impacts to vegetation resulting from steam emissions, and from accidental spills.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies.(Lake, Sonoma and Mendocino Counties; California Regional Water Quality Control Board).

Facts Supporting the Finding:

Other than continued potential for impacts from toxic constituents of the steam emissions to impact nearby vegetation, and the potential for an accidental spill of material which is toxic to plant life, operation and maintenance of the steam field and associated facilities is not expected to result in impacts beyond those described for earlier phases of the project.

Previous mitigation for aquatic impacts are applicable. Implementation of the following mitigation measure will reduce adverse vegetation impacts during the operation and maintenance phase of the project to insignificant levels:

- Monitoring of the health of vegetation which is potentially impacted by steam emissions shall be conducted for proposed facilities. The results of this study shall be incorporated into future site-specific environmental assessments (FEIR Mitigation Measure #26).

- Appropriate substrate, (i.e. soil), should be present and properly prepared for a seed bed for revegetation. Application of seed should occur at optimum times of the year for rapid germination and vigorous growth. Applications of surface stabilizing mulches should be applied before or immediately after seeding to control sheet erosion. Long-term establishment of vegetation should have precedence over short-term expediency; however, the first objective should be paramount (FEIR Mitigation Measure #27).

- The entire revegetation program shall be assessed during the spring following initial planting and an evaluation statement prepared by the revegetation specialist. If the original effort is deemed unsuccessful by the County Planning Department or State Land Commission, additional revegetation will be required before the next fall (FEIR Mitigation Measure #28).

- If any well is bled to the atmosphere while awaiting connection to a power plant, H^2S emissions will be abated if potential for substantial damage to vegetation exists (FEIR Mitigation Measure #29).

- Vegetation beyond the construction perimeter should not be disturbed. The clearing limits for pads and roads should be specified in the plans and specifications to be submitted for approval to the County Planning Department of jurisdiction and may not be changed without Planning Director approval. (Depending upon permit requirements, other agencies such as California Department of Fish and Game may need to oppose such plans) (FEIR Mitigation Measure #30).

- Vegetation within fall-out range of bleeding wells should be assessed for damage or growth impedance by a qualified person annually and a report submitted to the County Planning Director of jurisdiction. If damage to the ecosystem is present, mitigation measures should be enacted according to direction from the Planning Department and ultimately State Lands Commission (FEIR Mitigation Measure #31).

- Wildlife habitat shall be periodically studied and evaluated to monitor potential impacts from geothermal development (FEIR Mitigation Measure #32).

- Some downed logs should be left around the perimeter of pads and roads to provide den sites, escape, and thermal cover, as well as perching and courtship sites for wildlife. As they decay, downed logs also return valuable nutrients to the soil (FEIR Mitigation Measure #33).

BIOLOGICAL RESOURCES: Operation and Maintenance - Wildlife

Impact: Additional impact on wildlife species is not expected during this phase of development. However, barriers to reestablishment of wildlife could result in lost opportunities for rehabitation.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies.(Lake, Sonoma and Mendocino Counties).

Facts Supporting the Finding:

The continued operation of the steam plant facilities will not impact additional habitat beyond that lost in the development. Some species, initially displaced by construction may return to the vicinity of power plants. In order to encourage this monitor and enhance this return, the following measures have been adopted:

- Wildlife habitat shall be periodically studied and evaluated to monitor potential impacts from geothermal development (FEIR Mitigation Measure #32).

- Some downed logs should be left around the perimeter of pads and roads to provide den sites, escape, and thermal cover, as well as perching and courtship sites for wildlife. As they decay, downed logs also return valuable nutrients to the soil (FEIR Mitigation Measure #33).

BIOLOGICAL RESOURCES: Abandonment

Impact: Improper well abandonment could result in contamination and mortality of surrounding vegetation due to the migration of toxic fluids and could continue to create erosion impacts.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.
B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies.(Lake, Sonoma and Mendocino Counties; Division of Oil and Gas; State Lands Commission)

Facts Supporting the Finding:

The potential for migration of contaminates affecting vegetation mortality as a result of improperly abandoned wells will not be significant providing well abandonment regulations of the State Division of Oil and Gas, and the State Lands Commission are complied with. Overall, impacts on vegetation, sensitive plant species, and wildlife following structure abandonment and site restoration are expected to be positive, providing that replanting of the site utilizes species native to the area.

All potentially significant adverse impacts to vegetation and wildlife resulting from the abandonment phase of the project can be mitigated to levels of insignificance by implementing measures to restore the project sites as follows:

- Prior to abandonment of any geothermal facilities a revegetation and landscaping plan shall be developed which utilizes native plant species of the area. Source material for revegetation shall be local in order to minimize disruption of the genetic structure of adjacent, undisturbed plant populations. The plan shall specify finished grades and shall include provisions for monitoring and care of the vegetation until the plants are established, so as to ensure that the revegetation is successful (FEIR Mitigation Measure #34).

- All project pipelines, wellheads, equipment, and structures shall be removed prior to project abandonment (FEIR Mitigation Measure #35).

BIOLOGICAL RESOURCES: Cumulative Impacts

Impact: Removal of additional acreages of habitat within The Geysers area would have a significant cumulative impact on plant communities and wildlife habitat.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies.(Lake, Sonoma and Mendocino Counties; Division of Oil and Gas; State Lands Commission; Regional Water Quality Control Board).

Facts Supporting the Finding:

The Geysers-Calistoga KGRA contains an extensive array of plant communities and wildlife habitat, most of which are well represented by sizeable acreages within the project areas. These include serpentine chaparral, mixed chaparral, mixed evergreen forest, yellow pine woodland and forest, oak woodland, and riparian habitat. Removal of additional acreages of these habitats

within The Geysers area, up to 283 ha (700 ac) according to the cumulative scenario, would have a significant cumulative impact on plant and wildlife communities. In addition, there would be significant cumulative impacts on sensitive habitats, particularly serpentine chaparral, old-growth yellow pine woodland, and riparian communities. This is due to representation in the leaseholds of sizeable portions of the Mayacmas Mountains and Cobb Mountain, which are notable within the KGRA in terms of their high frequency of rare plant occurrences and large extent of riparian (Mayacmas Mountains) and old-growth yellow pine woodland (Cobb Mountain).

Cumulative impacts on breeding habitat for sensitive wildlife species which are known to reside or nest in the KGRA, including peregrine falcon, southern bald eagle, golden eagle, osprey, and yellow-billed cuckoo, would not be significant because these species do not nest or reside in the project areas. However, development in the project areas would result in a potentially significant cumulative loss of foraging habitat for raptors, including red-tailed hawk and possibly golden eagle, that may reside outside of the leaseholds. Cumulative loss of wildlife habitat in general, including breeding and foraging habitat for passerine birds and mammals, would be significant. In that siting considerations for cumulative projects can take into account biological habitats, the actual impact is dependent upon the care in which individual projects are designed and undertaken.

No additional mitigation measures are proposed for cumulative vegetation and wildlife impacts. Implementation of the vegetation and wildlife mitigation measures described for the various phases of the project are feasible and will reduce the cumulative significant adverse impacts to insignificant levels.

BIOLOGICAL RESOURCES: Cumulative Impacts

Impact: Cumulative effects of siltation, introduction of spilled toxic substances, and lowering of the water levels in streams could significantly degrade aquatic resource habitat.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies.(Lake, Sonoma and Mendocino Counties; Division of Oil and Gas; State Lands Commission; Regional Water Quality Control Board).

Facts Supporting the Finding:

Major geothermal development siltation events and material spills have had at most short-term detectable impacts. However, measurements of increased siltation in the vicinity of geothermal operations and corresponding declines in trout have suggested that [illegible]

cumulative effects. The potential for cumulative impacts to aquatic resources from geothermal development in The Geysers-Calistoga KGRA was recognized by the staff of the CEC as well as by public planning and regulatory agencies. In response to this concern the KGRA Aquatic Resources Monitoring Program was established in 1981 to monitor water quality, sediments, benthic macroinvertebrates and fish populations (McMillan, 1985). Similarly, to address both short-term and long-term impacts of geothermal development in the Squaw Creek Watershed, the Squaw Creek Aquatic Monitoring Program was established in 1984 (Jordan et al., 1990). To date, it has been very difficult to separate long-term cumulative impacts of stream degradation due to geothermal operations from natural perturbations in The Geysers area.

Because the rate of future development will be less than in previous decades, it is unlikely that there will be significant cumulative impacts on aquatic resources. Because many of the roads and other infrastructure are already in place and because environmental regulations are more stringent than they were prior to the 1980s, each future project should have less impact in terms of siltation, potential for accident and inputs of toxic materials than previous projects, especially those prior to 1980.

Strict adherence to the mitigation measures proposed to control siltation, accidents, and inputs of toxic chemicals as stated previously will help to ensure that cumulative impacts in The Geysers area on aquatic resources are insignificant. As discussed previously, diversion of surface water sources has been considered as a source of reservoir reinjection fluid. Such activities could have significance impact on aquatic resources in downstream watersheds.

CULTURAL RESOURCES: Exploratory Drilling, Field Development, Operation and Maintenance Activities, and Abandonment Phases

Impact: Significant adverse impacts to cultural resources could occur during any phase of the project where ground disturbance will occur.

Finding: A) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effect as identified in the Final EIR.

B) Such changes or alterations are within the responsibility or jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by other such agencies or can or should be adopted by other such agencies. (Lake, Sonoma and Mendocino Counties).

Facts Supporting the Finding:

Road widening and cutting/filling activities will further disturb known sites which have already been impacted by existing roads and trails. Drill pad and sump construction will involve fairly level areas where cultural sites are likely to be encountered and/or will require extensive clearing and cutting and filling which will disturb relatively large amounts of land, making significant cultural resources impacts highly probable.

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