December 2001

Re: Environmental Assessment - Basalt Canyon Slim Hole and Geothermal Well Exploration Projects

Dear Interested Party:

This Environmental Assessment (EA) has been prepared in conformance with the requirements of the National Environmental Policy Act (NEPA) to assess the potential environmental effects of two geothermal resource exploration drilling projects proposed by Mammoth Pacific, L. P., on portions of two federal geothermal resource leases, CA-11667 and CA-14408, each located west of U.S. Highway 395 and north of State Route 203, near the Town of Mammoth Lakes in Mono County, California. This EA provides a detailed description of the Projects, describes the environmental setting, assesses the potential environmental effects of the Projects, and present mitigation measures to reduce the potential environmental effects. The Bureau of Land Management, Bishop Field Office (BLM) is the Lead Agency for the preparation of this EA, and the Inyo National Forest (USFS) participated in the preparation of this EA as a cooperating agency. The EA will be used by the BLM in its decisions concerning the discretionary actions required to implement the Projects. The BLM decisions will be identified in a Decision Record that sets forth the basis for the decisions made. Under the regulations implementing the Geothermal Steam Act, the BLM must consult with the USFS prior to approving the Projects.

The text of this EA is available for review on the internet at the Bishop Bureau of Land Management web site (http://www.ca.blm.gov/bishop/) and the Inyo National Forest web site (http://www.r5.fs.fed.us/inyo/). Complete copies of the EA are also available for review at the offices of the BLM and USFS, as shown below:

BUREAU OF LAND MANAGEMENT
Bishop Resource Area
785 North Main Street, Suite E
Bishop, California 93514

UNITED STATES FOREST SERVICE
Mammoth Ranger District
2500 Main Street
Mammoth Lakes, California 93456

Complete copies of the EA may be obtained from the BLM Projects Coordinator, Cheryl Seath, at 760.872.4881 or from Vernon McLean of the USFS, at 760.873.2424. The EA is also available for review at the Mammoth Public Library:

Mammoth Public Library
960 Forest Trail (P.O. Box 1120)
Mammoth Lakes, CA 93546

This EA is being distributed for a 30-day review and comment period that begins on December 6, 2001 and will end on January 4, 2002. Comments received on the EA by the end of the review and comment period will be accepted by the Lead Agency, and responses will be prepared to address the issues raised. The comments and responses will be considered in the decisions made concerning approval of a Finding of No Significant Impact, as proposed, and concerning approval of the Projects. Written information or questions regarding the EA should be submitted to:

Cheryl Seath, Geologist, BLM Projects Coordinator
Basalt Canyon Slim Hole and Geothermal Well Exploration Projects
785 North Main Street, Suite E
Bishop, California 93514

ENVIRONMENTAL ASSESSMENT

BASALT CANYON
SLIM HOLE AND GEOTHERMAL WELL EXPLORATION PROJECTS

DECEMBER 2001

Long Valley KGRA
Federal Geothermal Leases CA-11667 and CA-14408
Mono County, California

EA Number: CA-170-02-15

Lead Agency:

BUREAU OF LAND MANAGEMENT
Bishop Resource Area
785 North Main Street, Suite E
Bishop, California 93514

Cooperating and Surface Management Agency:

FOREST SERVICE
Inyo National Forest
873 North Main Street
Bishop, California 93514

Projects Applicant:

MAMMOTH PACIFIC, L.P.
P.O. Box 1584
Mammoth Lakes, California 93540

BASALT CANYON
GEOTHERMAL AND SLIM HOLE EXPLORATION PROJECTS
ENVIRONMENTAL ASSESSMENT

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1 INTRODUCTION

1.1 SUMMARY OF PROPOSED ACTIONS

Mammoth Pacific, L.P., (MPLP) is proposing to conduct two geothermal resource exploration drilling projects on portions of two existing federal geothermal resource leases, CA-11667 and CA-14408, within the Mono-Long Valley Known Geothermal Resource Area ("KGRA"), in Mono County, California. The area to be explored, termed the Basalt Canyon geothermal exploration area, consists of those lands located within Section 31, Township 3 South, Range 28 East (T3S, R28E), and Section 36, T3S, R27E, Mount Diablo Baseline and Meridian (MDB&M), which are west of U.S. Highway 395 and north of California Highway 203. For the Basalt Canyon Slim Hole Exploration Project, MPLP proposes to drill and monitor up to five small diameter holes from up to five of six identified sites in the exploration area. For the Basalt Canyon Geothermal Well Exploration Project, MPLP proposes to drill, complete, and test up to two large diameter geothermal exploration wells from up to two of these same six identified sites. Both the Basalt Canyon Slim Hole Exploration Project and the Basalt Canyon Geothermal Well Exploration Project ("Projects") are located entirely on public lands within the Inyo National Forest.

1.2 RELATIONSHIP TO STATUES, REGULATIONS AND PLANS

Geothermal Steam Act and Implementing Regulations: The Projects are proposed to be conducted on lands which were leased by the United States of America to MPLP and which conveyed to MPLP the "exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources." To maintain this right, MPLP must "diligently explore the leased lands for geothermal resources until there is production in commercial quantities" applicable to each of these leases. MPLP must pay annual rentals to the federal government, and has to expend increasing amounts to have these funds qualify as diligent exploration expenditures, until the production of geothermal resources in commercial quantities is achieved.

The Geothermal Steam Act of 1970 ("Act") gives the Secretary of the Interior the responsibility and authority to manage geothermal operations on lands leased for geothermal resource development by the United States of America, and the Secretary has delegated this authority to the Bureau of Land Management ("BLM"). Pursuant to the regulations adopted to implement these portions of the Act (43 CFR 3200 *et. seq.*), the BLM will review a Plan of Operation ("Plan") submitted by a geothermal lessee and will approve the Plan if it complies with the Act, the regulations adopted pursuant to the Act, other directives issued by the BLM (Geothermal Resource Operational (GRO) Orders Nos. 1-7, Notices to Lessees, etc.), any special stipulations applicable to the leases, and any other applicable laws and regulations. All operations conducted on the geothermal lease by the geothermal lessee are subject to the approval of the BLM. The BLM must comply with the requirements of the National Environmental Policy Act (NEPA) prior to approving the Plan, and if another federal agency manages the surface lands of the geothermal lease, the BLM must also consult with that agency before approving the Plan.

The United State Forest Service ("USFS") is the federal agency responsible for managing and administering surface activities within national forests. Because the geothermal leases to be

explored are located entirely on public lands within the Inyo National Forest, the BLM will consult with the USFS as it prepares this Environmental Assessment in conformance with NEPA, and as it considers approval of the plans of operation submitted by MPLP.

Other agencies with permit authority for one or more aspects of the Projects include the Great Basin Unified Air Pollution Control District (GBUAPCD) and the California Regional Water Quality Control Board, Lahontan Region (CRWQCB).

Inyo National Forest Land and Resource Management Plan: The Projects are located entirely on publicly owned land administered by the USFS as part of the Inyo National Forest. Land uses within the Inyo National Forest are governed by the 1988 Inyo National Forest "Land and Resource Management Plan" (LRMP). The LRMP provides integrated, multiple resource management direction for all Forest resources for the plan period. The Forest wide Standards and Guidelines set the minimum resource conditions that will be maintained throughout the forest and the Management Area Direction provides general direction for the management of areas whose boundaries are defined with reference to its unique characteristics.

The LRMP includes Standards and Guidelines for the management of Leasable Minerals, which includes Geothermal Resources. These Standards and Guidelines include: 1) Following existing Memoranda of Understanding between the Bureau of Land Management and the Forest Service that relate to oil, gas, and geothermal mineral activities; 2) Follow applicable regulations, operating orders, and notices for oil, gas, and geothermal leases issued pursuant to appropriate authority; 3) Prepare environmental documents in cooperation with the Bureau of Land Management for site-specific exploration, development, and production proposals. 4) Assure that impacts to resources are appropriately analyzed; 5) assure that impacts to these resources are mitigated to the extent possible. 6) Consider the location of fluid conveyance lines and facilities for geothermal development to ensure the viability of deer migration corridors. Encourage geothermal development that utilizes air-cooling rather than evaporative cooling systems. Standards and Guidelines apply to other resources areas as well and are incorporate here by reference.

The Basalt Canyon geothermal exploration area is part of the LRMP Management Area #9 ("Mammoth"). The LRMP notes that uses in Management Area #9 are directly related to the support of nearby Mammoth Lakes including various utilities, the Mammoth Lakes/Yosemite Airport, various parks, the Hot Creek Fish Hatchery, and land owned by the City of Los Angeles. Management Area #9 also contains two important viewsheds (along U.S. 395, and State Route 203), portions of two cattle grazing allotments, and is important as a mule deer migration path and staging area in the fall and spring.

The LRMP identifies three "Management Prescriptions" for Management Area #9: Management Prescription 11 (Range Emphasis, which applies to 3,357 of the 8,414 acres in Management Area #9), Management Prescription 12 (Concentrated Recreation Area, 4,796 acres), and Management Prescription 15 (Developed Recreation Site, 261 acres). The LMRP also describes future Management Directions for Management Area #9, including guidelines to direct future uses of lands managed by the USFS. Table 1.1 identifies the LRMP Management Directions, and discusses each in terms of its relationship to the Projects. As indicated, the Projects are consistent with the Management Directions for Area #9 to the extent they apply to the Basalt Canyon geothermal exploration area.

USFS Sierra Nevada Forest Plan Amendment: In January 2001, the Regional Forester, Pacific southwest region, signed the Record of Decision (ROD) for the Sierra Nevada Forest Plan Amendment (SNFPA) Environmental Impact Statement. The ROD amended the Pacific Southwest Regional Guide, the Intermountain Regional Guide and the land and resource management plans (LRMPs) for national forests in the Sierra Nevada and Modoc Plateau,

including the Inyo National Forest. The SNFPA focused on and established new Forest LRMP Standards and Guidelines for 5 specific problem areas, including the: (a) protection of old forest ecosystems; (b) protection of aquatic, riparian and meadow ecosystems; (c) management of fire and fuel loading; (d) reduced potential for noxious weeds; and (e) enhanced hardwood forest ecosystems in the lower west side of the Sierra Nevada.

Table 1.1
INYO NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN
MANAGEMENT DIRECTIONS FOR MANAGEMENT AREA #9 (MAMMOTH)

MANAGEMENT DIRECTIONS	DISCUSSION
Cultural Resources (Conforms)	
Maintain and enhance interpretive sites such as Indian Caves.	There are no interpretive centers on or adjacent to the Basalt Canyon geothermal exploration area.
Facilities (Conforms)	
Allow new ski base areas commensurate with transportation planning.	The ski base areas are far removed from the Basalt Canyon geothermal exploration area.
Fish (Conforms)	
Maintain the productivity and resources of Hot Creek Fish Hatchery; study Laurel Pond for introduction of fish; and implement the 1986 Hot Creek Wild Trout Management Plan.	Neither the Hot Creek Fish Hatchery nor Laurel Pond will be affected by the Projects; there is little potential for impacts to Hot Creek from the Projects.
Geology (Conforms)	
Cooperate and encourage geophysical exploration and research including post-caldera formation and current and future seismic and volcanic activity.	The Projects are consistent with directions concerning geophysical exploration and geothermal resources.
Lands (Conforms)	
Enter into land exchanges where the best use of USFS land would be in the private sector, the exchange would conform to state/county/USFS planning, and the proposed use is consistent with the local General Plan. Allow no exchanges north of SR 203; solicit comment on proposed exchanges from other interested agencies; and allow development on USFS lands where infrastructure is available and the use would have benefits that outweigh adverse impacts.	The Projects do not propose any land exchanges; Project activities are consistent with prior decisions under the Geothermal Steam Act.
Recreation (Conforms)	
Provide for trail links within the community of Mammoth Lakes; maintain open space areas around the Town for passive use; prohibit dispersed camping; prohibit further development of Shady Rest Park; Allow development of Mammoth Creek Park; Identify and fund expansion potential of the Shady Rest and Sherwin Creek Campgrounds; and fund the interpretive potential of the Hot Creek geologic site.	The Projects would have minimal impact on recreational uses of the surrounding lands with implementation of the proposed measures to mitigate impacts.
Visual Resources (Conforms)	
Develop a viewshed analysis for SR 203 & US 395; mitigate visual impacts of major uses seen from these major gateway routes.	Because they are of short duration and implement measures to mitigate impacts, the Projects would have minimal impact on these visual resources.
Water (Conforms)	
Allow development where water supplies are adequate after first meeting the water requirements of natural resources; allow development of new water sources on USFS lands only when private sources have been exhausted; support state and local ordinances that mitigate adverse impacts of runoff onto USFS lands.	Water requirements would be met through use of existing, private, non-potable water resources, and best management practices would be implemented to mitigate adverse impacts of storm water runoff.
Wildlife (Conforms)	
Continue to maintain waterfowl habitat at Laurel Pond; and maintain the integrity of winter ranges, holding areas, migration routes, and fawning areas for mule deer.	Laurel Pond would not be affected by the Projects; nor would mule deer winter ranges or fawning areas. Adequate open areas would remain for deer migration through the Basalt Canyon geothermal exploration area.

Based on a review of the ROD only the provisions addressing the protection of aquatic, riparian and meadow ecosystems and the reduced potential for noxious weeds are applicable to the Basalt Canyon geothermal exploration area. The Projects have been designed to avoid all aquatic, riparian and meadow ecosystems, and the reduced potential for noxious weeds has been incorporated into the Projects and this EA. Therefore, the Projects are consistent with the general intent and specific goals of the SNFPA, to the extent they are applicable.

County of Mono General Plan: The Basalt Canyon geothermal exploration area is located in an area that the Mono County General Plan designates as "RM/INF," or "Resource Management" and "Inyo National Forest" (Mono County 2001). As noted in the General Plan, the "Resource Management" designation is intended "to recognize and maintain a wide variety of values in the lands outside existing communities," including geothermal resources. Because the land is part of the "Inyo National Forest," management responsibilities for the area fall under the jurisdiction of the USFS, as outlined in the Inyo National Forest Land and Resource Management Plan, discussed above. However, the Projects are consistent with the designations of the Mono County General Plan.

1.3 PURPOSE AND NEED FOR PROPOSED ACTIONS

The purpose of the Projects is to explore for, locate and verify the existence and characteristics of a commercially viable geothermal resource within these portions of the identified federal geothermal leases. The specific objectives of the Basalt Canyon Slim Hole Exploration Project are to drill targets identified through geologic and geophysical surveys to confirm the geologic information, measure temperature profiles, obtain samples of the geothermal fluid for water chemistry, and monitor reservoir pressures. The specific objectives of the Basalt Canyon Geothermal Well Exploration Project are to drill into and flow test the identified geothermal reservoir to confirm the characteristics of the geothermal reservoir and determine if the geothermal resource is commercially viable. Should a commercially viable geothermal resource be verified by the Projects, MPLP would be required to submit new applications and receive additional approvals before proceeding with any commercial development or production of those resources.

BLM's purpose in preparing this EA is to comply with the requirements of NEPA to evaluate the potential environmental consequences of the proposed exploration Projects. Consistent with requirements of NEPA, this EA will serve as a decision-making tool to assist BLM in its determination to approve the proposed actions. Because MPLP has not requested the approval of any commercial uses, and no commercial uses can be undertaken without the approval of the BLM, this EA does not consider or evaluate the effects of any potential commercial uses.

USFS's purpose in participating with the BLM in the preparation of this EA is to fulfill its surface management agency's responsibility to assure that impacts to surface resources and uses are appropriately analyzed and mitigated to the extent possible. This purpose is consistent with the requirements of the Geothermal Steam Act to participate in the BLM consultation process, the Inyo National Forest LRMP, and NEPA requirements to review and comment on matters which address or relate to its areas of legal jurisdiction and/or area of special expertise. Consistent with requirements of NEPA, this EA will also serve as a decision-making tool to assist the USFS in its consultation capacity with the BLM.

1.4 ADDITIONAL INFORMATION

This EA was prepared in accordance with BLM geothermal regulations (43 CFR 3200, *et. seq.*), the Council of Environmental Quality (CEQ) regulations for implementing NEPA, and BLM guidelines for implementing NEPA (USDI, 1988). This EA was prepared with the assistance of Environmental Management Associates, Inc. (EMA) and Bauer Planning and Environmental

Services Inc. using information gathered from the BLM, the USFS, other federal agencies, state agencies, local agencies, MPLP and public literature. The BLM published a notice of intent to prepare this EA on September 20, 2001 in newspapers of local circulation to solicit public comment on issues of concern with respect to the projects and the scope of this EA. In addition, a field meeting was held on October 6, 2001 to review the proposed Projects and to tour the Basalt Canyon geothermal exploration area and specifically the proposed sites. Three comment letters were received in response to the published notice. Comments included in these letters regarded recreation use, citing of power plants, and approval of geothermal resource use. The scope of this EA is based upon specific issues and concerns identified by the BLM, the USFS, and the public.

In the early 1970's the Department of Interior responded to geothermal industry interest in the Mono/Long Valley area and produced an Environmental Impact Statement (EIS) analyzing the potential impacts of geothermal development specifically on this and two other areas. This Final EIS was released in 1973. Based on that EIS, BLM and USFS made the decision to issue three leases for geothermal development in 1974 and 1975.

In 1979 the USFS completed the "Mammoth-Mono Planning Unit Land Management Plan" and associated EIS. The USFS decision provided for leasing, exploration, and possible development and utilization of geothermal resources within the Mono-Long Valley Known Geothermal Resource Area (KGRA), including portions of the Basalt Canyon geothermal exploration area. In 1981, continued industry interest in leasing lead the USFS to identify two additional lease blocks within the KGRA, and the USFS initiated the preparation of another EA to analyze the potential effects of geothermal leasing within those proposed lease blocks. The Casa Diablo geothermal area and the areas to the east, including the land that became Geothermal Lease CA-11667 of the Basalt Canyon geothermal exploration area, were called Lease Block 1. Lease Block 2 includes the Inyo Dome area to the west of Lease Block 1, including the land that became the Geothermal Lease CA-14408 portions of the Basalt Canyon geothermal exploration area. Revised Decision Notices were signed on August 1981 for leases within Lease Block 1 and on July 1984 for leases within Lease Block 2.

The Environmental Assessment for lease block 2 identified areas of concern and designated mitigating measures for seasonal occupancy; temporary surface occupancy; no surface occupancy; and no leasing. Specifically, a Special Stipulation was adopted into Geothermal Lease CA-14408 which required that "No surface disturbing activities will be permitted in the No Surface Occupancy areas shown on Map 5, attached, unless the lessee can demonstrate through an appropriate plan of operation or permit application that no unacceptable environmental impacts will occur from the proposed operations" (see Figure 2 for a map of these "No Surface Occupancy" areas). Based upon a review of the other maps provided in the lease block 2 EA, it is believed that these "No Surface Occupancy" restrictions were adopted based on the "Critical Visual Zones" mapped on "Map 3" of this EA.

The eastern portion of the Basalt Canyon geothermal exploration area was also evaluated in the Environmental Assessment prepared for BLM and USFS in July of 1992 for the "Casa Diablo Geothermal Project Exploratory Core Hole Program." This EA evaluated a proposal for drilling of up to 4 exploratory core holes on lands immediately east and west of U.S. Highway 395 in the vicinity of State Route 203, in Sections 29, 30 and 31, T3S, R28E, MDB&M. The EA concluded that the proposed exploratory program would have no unavoidable adverse effects provided that 12 mitigation measures were implemented as outlined in the EA. Two core holes were subsequently drilled under the Plan of Operation approved under this EA.

These previous EIS and EA documents are considered an integral part of this Environmental Assessment and are herein incorporated by reference.

2 DESCRIPTION OF PROPOSED ACTIONS

2.1 OVERVIEW AND LOCATION OF PROPOSED PROJECTS

MPLP has submitted two plans of operation to conduct geothermal resource exploration drilling operations on portions of two federal geothermal resource leases, CA-11667 and CA-14408, within the Mono-Long Valley KGRA, in Mono County, California. The Basalt Canyon geothermal exploration area consists of those lands located within Section 31, T3S, R28E, and Section 36, T3S, R27E, MDB&M, which are west of U.S. Highway 395 and north of California Highway 203. These lands are located entirely within the Inyo National Forest. The Basalt Canyon Slim Hole Exploration Project is a plan to drill and monitor up to five small diameter holes from up to five of six specific sites in the Basalt Canyon geothermal exploration area (see Figure 1). The Basalt Canyon Geothermal Well Exploration Project is a plan to drill, complete, and test up to two large diameter geothermal exploration wells from up to two of these same six identified sites. MPLP would make the determination as to specifically which slim hole or geothermal well to drill based on the geological, geophysical, geothermal resource and other data available at the time each decision must be made.

The name and location (by township and range, section number, and distance from the reference corner) of each of the six sites are provided in Table 2.1.

Table 2.1
GEOTHERMAL EXPLORATION SITES

Site Name (Modified Kettleman No.)	Township/ Range	Section Number	Reference Corner	East (feet)	North (feet)
31-36	3S 27E	36	SW	1,800	5,100
81-36	3S 27E	36	SW	5,200	4,900
12-31	3S 28E	31	SW	300	4,400
[illegible]	3S 28E	31	SW	[illegible]	3,800
35-31	3S 28E	31	SW	2,000	2,400
55-31	3S 28E	31	SW	3,000	2,200

Each drill site is designed to explore a specific geophysical or geologic target. These targets were identified during previously completed geophysical exploration projects and surface geologic mapping. The location of each site was then adjusted to reduce or avoid known environmental issues or constraints (Figure 3). Each of the six sites has been located outside of riparian conservation areas identified by Inyo National Forest personnel. No new access roads or temporary pipelines would be constructed in these riparian conservation areas, and only existing roads would be used to cross through any riparian conservation area.

Each of the sites has been located in an area designated by Inyo National Forest with the less sensitive "partial retention" (PR) visual quality objective, as well as being designated variety class "common" (B). Finally, each of the well sites was also selected to minimize the amount of surface disturbance required through selection of sites with low topographic slope (within the other limitations of the geothermal resource targets and environmental issues), which minimizes the amount of cut and fill which may be required to construct the pad for the drill rig.

2.2 SCHEDULE OF EXPLORATION ACTIVITIES

MPLP proposes to initiate the Projects as soon the required permits and approvals are obtained, if possible before the end of 2001. Most likely, one or more of the slim holes would be

drilled before commencing the drilling of one or both of the geothermal wells, but drilling of one or both of the geothermal wells could commence before the drilling of any of the slim holes. No more than one slim hole and one geothermal well would be drilled at any time, as only one of each type of drill rig would be utilized, and although a slim hole and geothermal well could be drilled at the same time, they would not be drilled on the same site at the same time. Drilling of the slim holes and geothermal wells is expected to be completed by the end of 2003. Drilling activities are planned to be conducted during the spring, summer and fall of each year, but could be continued through the winter months.

2.3 SITE ACCESS AND ROAD IMPROVEMENTS

Primary access to all six proposed sites is gained from Sawmill Road off of State Route 203 (see Figure1). Four of the sites (12-31, 23-31, 35-31, and 81-36) would be accessed directly from Sawmill Road. Access to Sites 55-31 and 31-36 would require the construction of short sections of new dirt road, approximately 400 feet and 650 feet in length, respectively, off of existing dirt roads off of Sawmill Road (see Figure 1).

All roads would be constructed or improved and maintained as needed to safely accommodate the traffic required for the specific exploration activity. Minimal grading and little road widening would be required for access by the truck-mounted drill rig and support trucks and other vehicles during the slim hole drilling. Because both larger, 18-wheeled trucks and greater truck traffic volume are associated with the drilling and testing of the geothermal wells, roads used to access the two geothermal well sites would require the creation or maintenance of an all-weather surface with a minimum road bed width of ten feet, a maximum grade of ten percent, and a turning radius of no less than 50feet. Sawmill Road currently meets these criteria, and minimal grading, widening, straightening or leveling is anticipated for the existing roads to Sites 55-31 and 31-36 off of Sawmill Road.

2.4 SITE PREPARATION ACTIVITIES

Site preparation would include clearing, earthwork, drainage and other improvements necessary for efficient and safe operation and for fire prevention. Each site would be cleared of organic material, stumps, brush and slash only when it was being prepared to be drilled. Each site has been designed to minimize tree loss. Where tree removal is required, marketable logs would be disposed of according to specific instructions from the Inyo National Forest, and stumps hauled to a landfill authorized to accept such waste. Other slash material would be chipped and stockpiled and returned to the drill site during reclamation.

Each site would be prepared to create a level pad for the drill rig, and a graded surface for the support equipment. Minor gradients would be incorporated in the site to direct runoff into ditches and energy dissipaters (if needed), and then onto undisturbed ground, consistent with USFS and California Regional Water Quality Control Board, Lahontan Region (CRWQCB) best management practices for storm water. All machinery, drilling platforms, and oil and fuel storage would be in areas tributary to the reserve pit (see below) in order to prevent the movement of storm water from these areas off of the well site.

Reserve pits would be constructed at each site to contain waste drilling materials. For the drilling of each slim hole, the reserve pit would measure approximately ten feet by five feet by five feet deep. Each would be lined with a 40 mil plastic liner, in accordance with requirements of the CRWQCB. For the drilling of each geothermal well, the reserve pit would be approximately 70 feet by 40 feet by 5 feet deep, and would hold roughly 50,000 gallons with a 2 foot freeboard. This reserve pit would also be lined with a 40-mil plastic liner.

2.5 WATER FOR GRADING AND DRILLING

Water required for well drilling would typically average about 50,000 gallons per day. Water requirements for slim hole drilling, site and road grading, construction, and dust control would average less. Water necessary for these activities would be obtained from one or more of three different potential water sources:

- Casa Diablo power plant service water (non-potable shallow groundwater used at the existing Casa Diablo geothermal plants for irrigation and other plant service purposes);
- Casa Diablo power plant geothermal injection fluid (obtained by diverting a small stream of the geothermal injection fluid); and
- Mammoth Community Water District (MCWD) reclaimed water (tertiary treated waste water produced by the treatment plant).

Each of these water sources would be picked up from the source and delivered to the construction location or drilling site(s) by a water truck which would be capable of carrying approximately 4,000 gallons per load. In addition, if, at the time the water was needed for drilling, the MCWD was providing reclaimed water to the existing Casa Diablo power plants via either a temporary or permanent water pipeline constructed adjacent to State Route 203, reclaimed water from this pipeline could be delivered to each site by means of a small, temporary pipeline connected to the then-existing reclaimed water pipeline. This temporary reclaimed water pipeline would be connected to the then-existing reclaimed water pipeline near the junction of State Route 203 and Sawmill Road, then would be laid on the surface (except where buried under road crossings) immediately adjacent to Sawmill Road (and the smaller access roads) to each site.

2.6 SLIM HOLE DRILLING AND MONITORING

Slim holes are data-gathering holes used to confirm preliminary information concerning the underground geology and temperatures inferred from the geophysical surveys and obtain a sample of the geothermal resource for chemical analysis. Each slim hole site would be approximately 60 feet by 60 feet (for a total surface area of about 3,600 square feet), although the actual dimensions are generally modified to best match the specific physical and environmental characteristics of the site and minimize grading (cut and fill) (see Figure 4).

Slim Hole Drilling: Each slim hole would be drilled with a small, truck-mounted rotary drill rig or coring rig similar to those used for water well drilling. The rigs would be equipped with diesel engines, storage tanks, mud pumps, and other typical auxiliary equipment. During drilling the top of the drill rig derrick would be approximately 30 to 40 feet above the ground surface. An average of about one large truck (delivering drilling supplies and equipment), and about six small trucks/service vehicles/workers vehicles, would be driven to the site each day throughout the typical 12-day drilling process. Difficulties encountered during the drilling process, including the need to redrill the hole, could double the time required to successfully complete a slim hole. Drilling is typically conducted 24-hours per day, 7-days per week by a crew of three to four workers which are typically not recruited locally. The drill rig and surrounding operation area would be lit at night.

The drilling program involves a sequence of drilling or coring a hole to a selected depth, cementing a steel casing of smaller diameter into the drilled hole, then repeating the process with progressively smaller holes and cemented casings to progressively greater depths until the design depth of 1,500 feet (or the depth selected by the project geologist) is reached (see Figure 5 for a cross-sectional profile of a representative slim hole). After cementing of the initial casing (approximately 8-5/8 inches in diameter) in the hole, blowout prevention equipment

(BOPE), inspected and approved by the BLM, would be installed and utilized at all times while drilling deeper to ensure that any geothermal fluid encountered does not flow uncontrolled to the surface.

The hole would be drilled or cored using a special, non-toxic drilling mud composed of a bentonite clay-water or polymer-water mix. The drilling mud helps to circulate the rock cuttings to the surface where they are removed by the surface equipment. The drilling mud or other drilling fluids would then be recirculated. In the unlikely event that very low pressured areas are encountered (which could cause the mud to flow into the hole, preventing circulation of the drilling mud back to the surface), compressed air may be used to reduce the weight of the drilling mud in the hole and assist in carrying the cuttings to the surface. The air, drilling mud, cuttings, and any reservoir fluids brought to the surface would then be diverted through a separator/muffler to separate and discharge the air and water vapor to the air and the drilling mud and cuttings to the reserve pit.

Once drilled to the final depth, the drilling mud in the hole would be circulated out using water and steel tubing, typically 2-3/8 inches in diameter and perforated at the bottom, would be run into and hung in the hole. The water in the hole would be "bailed" by either lifting with a mechanical bailer (basically a small diameter bucket) or by lifting the water out with air pumped into the hole so that a sample of the geothermal fluid in the reservoir can be obtained for chemical analysis.

Slim Hole Monitoring: Following completion of drilling and bailing, all of the drilling equipment would be removed from the site. The surface facilities remaining on the site would likely consist only of several valves on top of the surface casing, covered by a locked steel cannister approximately three feet in diameter and up to six feet high which provides protection for the valves. Pressure and temperature sensors may then be installed in the hole at fixed depths to monitor any changes in these parameters over time. A temperature sensor may also be slowly lowered into the tubing to measure the temperature profile of the hole with depth, which is helpful in understanding the depths where geothermal fluids may be circulating.

2.7 GEOTHERMAL WELL DRILLING, TESTING AND MONITORING

The geothermal wells are designed to drill into and flow test the geothermal reservoir to confirm the characteristics of the geothermal reservoir and determine if the geothermal resource is commercially viable. Each geothermal well site would be approximately 200 feet by 150 feet (for a total surface area of about 30,000 square feet), although the actual dimensions are modified to best match the specific physical and environmental characteristics of the site and minimize grading (cut and fill) (see Figure 6).

Geothermal Well Drilling: Each geothermal well would be drilled with a large rotary drill rig essentially identical to those used to drill oil and gas wells. During drilling the top of the drill rig derrick would be as much as 140 feet above the ground surface, and the rig floor could be 20 to 30 feet above the ground surface. The typical drill rig and associated support equipment (rig floor and stands; draw works; derrick; drill pipe; trailers; mud, fuel and water tanks; diesel generators; air compressors; etc.) would be brought to the prepared site on 20 or more large trucks. The placement of this equipment within each prepared site would depend on rig-specific requirements and site-specific conditions, but would be generally as shown on Figure 6. Additional equipment and supplies would be brought to the site during ongoing drilling and testing operations. As many as ten or more large truck trips may be generated on the busiest day, although on average about two large trucks (delivering drilling supplies and equipment), and about 12 small trucks/service vehicles/workers vehicles, would be would be driven to the site each day throughout the typical 20-day drilling process. Difficulties encountered during the drilling process, including the need to redrill the hole, could double the time required to

successfully complete a geothermal well. Drilling is typically conducted 24-hours per day, 7-days per week by a crew of four to six workers which are typically not recruited locally. During short periods, the number of workers on site during drilling may be as high as 12.

Like the slim hole drilling process, the geothermal well drilling program involves a sequence of drilling a hole to a selected depth, cementing a steel casing of smaller diameter into the drilled hole, then repeating the process with progressively smaller holes and cemented casings to progressively greater depths until the design depth of 1,500 feet (or the depth selected by the project geologist) is reached (see Figure 7 for a cross-sectional profile of a representative exploration well). However, the size of the geothermal well holes and casing are substantially larger than the slim hole and slim hole casing, typically ranging from 22-inch casing at the surface to 13-3/8-inch slotted liner at the bottom of the well. After cementing of the initial casing in the well, blowout prevention equipment (BOPE), inspected and approved by the BLM, would also be installed and utilized at all times while drilling deeper to ensure that any geothermal fluid encountered does not flow uncontrolled to the surface. During drilling operations, a minimum of 10,000 gallons of cool water and 6 tons of inert, nontoxic, non-hazardous barite (barium sulfate) would be stored at the well site for use, if required, in preventing well flow.

The hole would be drilled using special, non-toxic, temperature stable, drilling mud composed of a bentonite clay-water or polymer-water mix. Additional non-hazardous and non-toxic additives would be added to the drilling mud as needed to prevent corrosion, increase mud weight, and prevent mud loss. The drilling mud is cycled down the drill pipe, out the drill bit, up the outside of the drill pipe, through drill rig mud system, and back into the drill pipe. The drilling mud helps to cool and lubricate the drill bit, maintain the well bore, prevent the loss of drilling fluids into or out of the rock formations, and circulate the rock cuttings to the surface. The drill rig mud system acts to remove the rock cuttings produced by the drill bit from the drilling mud, and discharges them, along with any waste drilling mud, into the reserve pit. Additional drilling mud would be mixed and added to the mud system as needed to maintain the required quantities.

In the unlikely event that very low pressured areas are encountered (which could cause the mud to flow into the hole, preventing circulation of the drilling mud back to the surface), compressed air may be added to the drilling mud, or used instead of drilling mud, to reduce the weight of the drilling fluids in the hole and assist in carrying the cuttings to the surface. The air, any drilling mud, rock cuttings, and any reservoir fluids brought to the surface would then be diverted through a separator/muffler to separate and discharge the air and water vapor to the air and the drilling mud and cuttings to the reserve pit.

Geothermal Well Testing: Once the slotted liner has been set, and while the drill rig is still over the geothermal well, the residual drilling mud and cuttings would be flowed from the well bore and discharged to the reserve pit. This may be followed by one or more short-term flow tests, each lasting from two to four hours and also conducted while the drill rig is over the well. Each test would consist of flowing the geothermal well into portable steel tanks brought onto the well site while monitoring geothermal fluid temperatures, pressures, flow rates, chemistry and other parameters. An "injectivity" test may also be conducted by injecting the produced geothermal fluid from the steel tanks back into the well and the geothermal reservoir. The drill rig would likely be moved from the well site following completion of these short-term test(s).

One or more long-term flow test(s) of each geothermal well drilled would likely be conducted following the short-term flow test(s) to more accurately determine long-term well and geothermal reservoir productivity. The long-term flow test(s), each lasting approximately five days or more, would be conducted by either pumping the geothermal fluids from the well through onsite test equipment closed to the atmosphere, or allowing the well to flow naturally to the surface, where the produced steam and non-condensible gases, separated from the residual geothermal fluid, would be discharged into the atmosphere. In either case, a surface booster pump would then

pump the residual produced geothermal fluid through a temporary pipeline to the other geothermal well, where it would be injected back into the geothermal reservoir. The temporary pipeline would be laid on the surface on the disturbed shoulders of the access roads connecting the two geothermal exploration wells (as required, roads would be crossed by trenching and burying the temporary pipe in the trench). The onsite test equipment would include standard flow metering, recording, and sampling apparatus.

Geothermal Well Monitoring: Following completion of geothermal well testing, all of the drilling and testing equipment would be removed from the site. The surface facilities remaining on the site would likely consist only of several valves on top of the surface casing, which would be chained and locked and surrounded by an approximately 12-foot by 12-foot by 6-foot high fence to prevent access and vandalism. Pressure and temperature sensors may be installed in the hole at fixed depths to monitor any changes in these parameters over time. As with the slim hole, a temperature sensor may also be slowly lowered into the well to measure the temperature profile of the well with depth, which is helpful in understanding the depths where geothermal fluids may be circulating. This monitoring may be continued indefinitely.

2.8 ABANDONMENT

After drilling operations are completed, the liquids from the reserve pits would either be evaporated, pumped back down the well or hole, or disposed of in accordance with the requirements of the CRWQCB. Excess fluids that are compatible with the environment would be used as dust inhibitors on the roads, if so allowed by the CRWQCB and the BLM/USFS.

The solid contents remaining in the reserve pits, typically consisting of non-hazardous, non-toxic drilling mud and rock cuttings, would be tested as required by the CRWQCB. If inert, and as authorized by the CRWQCB and BLM/USFS, these materials would be spread and dried on the site, then buried in the on-site reserve pit in conformance with the applicable requirements of the CRWQCB and BLM/USFS. If burial on site is not authorized by the BLM/USFS, the solids would be removed and either used as construction material on private lands or disposed of in a waste disposal facility authorized by the CRWQCB to receive and dispose of these materials. After the materials buried in the reserve pit have been removed or compacted and stabilized, the reserve pit area will be reclaimed.

Upon the completion of well drilling and flow testing, a decision would be made by MPLP regarding the commercial potential of each well. If a well is judged by MPLP to have any commercial potential, well operations would likely be suspended pending application for and receipt of regulatory approvals to place the well into commercial service (either through a new pipeline to the existing Casa Diablo geothermal plants, or through a new pipeline to a new geothermal power plant). The well would likely continue to be monitored while these approvals are being processed. If a well is judged to not have commercial potential, it may continue to be monitored, or it may be abandoned in conformance with the well abandonment requirements of the BLM (Geothermal Resource Operational Order No. 7) and the USFS as to surface reclamation. Abandonment of either a slim hole or a geothermal well typically involves plugging the well bore (or hole) with cement sufficient to ensure that fluids will not move across into different aquifers. The well head (and any other equipment) is then removed, the casing cut off well below ground surface, and the well site reclaimed.

2.9 ALTERNATIVES

NEPA requires the consideration and assessment of alternatives whenever there are unresolved conflicts involving alternative uses of available resources. However, as noted above in Section 1.2, the Projects conform to the geothermal leasing requirements, the Inyo National Forest Land and Resource Management Plan, and the Sierra Nevada Forest Plan Amendment,

and no unresolved resource conflicts were identified during the scoping process. Therefore, no alternatives other than the "No Action" alternative are considered in this EA. The No Action alternative would prevent MPLP from undertaking the geothermal resource exploration activities as proposed and described in the plans of operation and this EA for the Basalt Canyon geothermal exploration area.

3 ENVIRONMENTAL SETTING, IMPACTS, MITIGATION MEASURES AND RESIDUAL IMPACTS

3.1 INTRODUCTION

BLM NEPA Handbook, as updated, (H-1790-1) identifies the 14 critical elements of the human environment that must be addressed in any document prepared pursuant to NEPA. The NEPA Handbook also stipulates that if the resource or value is not present or is not affected by the proposed action or alternatives, this may be documented in the EA as a negative declaration. The following documents the negative declarations for those five critical elements of the human environment which are not affected by the proposed action or alternatives:

- The proposed Projects are not located in or adjacent to any Area of Critical Environmental Concern, and thus this resource or value would not be affected by the Projects;
- The proposed Projects are not located in or adjacent to any unique or prime farm lands, and thus this resource or value would not be affected by the Projects;
- The proposed Projects are not located in or adjacent to any recognized floodplains, and thus this resource or value would not be affected by the Projects;
- The proposed Projects are not located in or adjacent to any wild or scenic rivers, and thus this resource or value would not be affected by the Projects;
- The proposed Projects are not located in or adjacent to any wilderness or wilderness study areas, and thus this resource or value would not be affected by the Projects; and
- The proposed Projects are not located in or adjacent to any concentrations of minority or low income populations, and thus the Projects would not create an environmental justice issue.

3.2 CULTURAL RESOURCES

Paleontological Resources

Because the surface rock materials are composed entirely of volcanic materials, the potential for any significant paleontological resources to be encountered is essentially nil, and no mitigation measures are required.

Archaeological Resources

On October 10 - 12, 2001, an intensive archaeological survey of the six sites and associated access roads from State Route 203 to Sawmill Cutoff (Forest Road 3S08), following Sawmill Road (Forest Road 3S25) was conducted by David Wilcox, Project Supervisor/Archaeologist of Pacific Legacy, Inc. Approximately 146 acres of Inyo National Forest lands were examined, including a linear survey along Sawmill Road and associated site access roads, a total of 12,540 feet in length and 200 feet in width, and an 800-foot by 800-foot area around each of the six well sites located in the Basalt Canyon geothermal exploration area. A total of 15 isolated occurrences, two prehistoric sites and one historic site were encountered and recorded during the survey. For each proposed drill site there is sufficient room within the surveyed site or road shoulder to construct a well pad or place a temporary pipeline to avoid any direct disturbance to the recorded sites (for this project a site is defined as at least three artifacts per square meter).

CULTURAL RESOURCES MITIGATION MEASURES

CUL-1: Construct drill pads and access roads in such a way so as to ensure that the recorded archaeological site materials are not disturbed. Any surface disturbing activity

conducted for the Project along Sawmill Road between State Route 203 and the access road to Site 55-31, including the laying of temporary pipeline along the side of the road, shall either utilize the north side of Sawmill Road or be located to ensure that the cultural resource materials recorded adjacent to the south side of Sawmill Road are not disturbed.

To ensure that identified cultural resource sites are not disturbed the limits of surface disturbing activities, including an adequate buffer zone, shall be clearly marked and flagged prior to the start of all grading or other surface-disturbing activities. The flagging shall be set with the assistance of a professional archaeologist, and the construction/grading contractor and each of the workers shall be trained to understand the flagging and its importance.

CUL-2: If previously unrecorded cultural resources are encountered during grading or other surface-disturbing activities, all grading or other surface-disturbing activities at the location of the discovery shall cease, and the authorized officer notified. Grading or other surface-disturbing activities shall not recommence at the location of the discovery until the identified cultural resources(s) have been assessed, any necessary mitigation actions taken, and the expressed approval of the authorized officer or his designee granted.

3.3 VISUAL RESOURCES

Impact Assessment: The visual impacts of the Projects depend upon the visibility of individual project elements from surrounding lands and scenic roads. Table 3.1 presents the distance of each site from State Route 203 and U.S. Highway 395:

Table 3.1
SITE DISTANCE FROM SCENIC ROUTES

Site	Distance from U.S. Highway 395	Distance from State Route 203
55-31	0.25 miles	0.25 miles
35-31	0.50 miles	0.25 miles
23-31	0.65 miles	0.65 miles
12-31	0.70 miles	0.60 miles
81-36	0.70 miles	0.70 miles
31-36	1.30 miles	0.40 miles

With the exception of Sites 55-31 and 35-31, all of the sites are set back quite far from State Route 203 and/or U.S. Highway 395, no closer than "middleground," and all of the sites themselves are generally screened from direct view by intervening terrain and/or vegetation. Thus, the visual impacts of the Projects depend upon the visibility of the equipment used on each site for each project and the operations conducted on each site.

During the approximate 12-day drilling period for the slim hole on Site 55-31, much of the drill rig derrick would be visible from small portions of U.S. Highway 395 and State Route 203, but would be screened from view from most of U.S. Highway 395 to the north by portions of the intervening "Rhyolite Ridge" and from State Route 203 to the west and south and the Town of Mammoth Lakes to the west by the low topographic ridge north of the ephemeral stream channel parallel to State Route 203 known locally as "Murphy Gulch." Only the top of the slim hole drill rig derrick would be visible from a small portion of State Route 203 when drilling from Site 35-31 and Site 23-31. The visible portions of the drill rig derrick would be especially visible at night when the derrick is lighted during nighttime drilling operations. Equipment operating on the other three sites during the drilling of the slim holes would be completely screened from view

from U.S. Highway 395 by the intervening "Rhyolite Ridge," and would be completely screened from view from State Route 203 and the Town of Mammoth Lakes by the low topographic ridge north of "Murphy Gulch." Once the drill rig is removed from a site following the completion of the approximately 12-day drilling process, however, the residual monitoring facilities, which would not be lighted, would not be easily visible from any site.

Much of the equipment utilized on Site 55-31 during the approximately 20-day drilling and subsequent testing of the geothermal well, including the drill rig derrick, would be visible from the portions of State Route 203 and a section of U.S. Highway 395 (as a long-distance view), but would be screened from view from most of U.S. Highway 395 to the north by portions of the intervening "Rhyolite Ridge." The upper two-thirds of the drill rig derrick would be visible from State Route 203 down to the junction with U.S. Highway 395 while operating on either Site 35-31 or Site 23-31, and the upper two-thirds of the derrick operating on Site 23-31 would also be visible from a section of U.S. Highway 395 (as a long-distance view), Both would be screened from view from most of U.S. Highway 395 to the north by portions of the intervening "Rhyolite Ridge" and from State Route 203 to the west and south and the Town of Mammoth Lakes to the west by the low topographic ridge north of "Murphy Gulch."

Equipment operating on the other three sites during the approximately 20-day drilling and subsequent testing of the geothermal wells would also be screened from view from U.S. Highway 395 by the intervening "Rhyolite Ridge," and would be screened from view from State Route 203 and the Town of Mammoth Lakes by the low topographic ridge north of "Murphy Gulch." However, the upper-most sections of the 140-foot tall geothermal well drill rig derrick would likely be visible during the approximate 20-day drilling process from certain locations along U.S. Highway 395, State Route 203, and the Town of Mammoth Lakes. During daylight hours, the drill rig derrick would not be that noticeable, as it would tend to blend in with the background, but at night, when the derrick is lighted during night-time drilling operations, the derrick would be very visible. This impact would be temporary, since the drill rig is only on a site during the drilling process, which averages approximately 20 days.

During geothermal well flow testing, condensed water vapor plumes ("steam plumes") may be created under certain atmospheric conditions. During periods of colder temperatures and higher humidity, the created water vapor plumes may be as much as several hundred feet high, although typically these plumes would be no more than a few tens of feet high. The visibility of these plumes would be dependent on the height of the plume and the time of day; plumes no more than a few tens of feet high would have no greater visibility than the top of the slim hole drill rig derrick, but taller plumes created in the daylight hours would have greater visibility, possibly as great or greater than the geothermal well drill rig derrick. Water Vapor plumes generated at night would likely not be visible. Each geothermal well flow test is expected to last an average of only five days.

Following the completion of the geothermal well drilling and testing, the residual geothermal well monitoring facilities, consisting of a small fenced area and the geothermal well-head valves, which would not be lighted and would not extend higher than ten feet. The residual geothermal well monitoring facilities would not be easily visible on any site.

Caltrans Criteria for Scenic Highways: US Highway 395 is designated by the California Department of Transportation (Caltrans) as a Scenic Highway of statewide significance (Personal Communication. R. Kizer, Caltrans District 09 Scenic Highway Coordinator, June 2000). The Scenic Highway designation reflects the presence of exceptional natural beauty unimpaired by visual intrusion. Views are rated according to visual quality, view quality, landform and regional character. *Visual Quality* is defined as the physical elements of the area, including landform, vegetation, color and diversity. *View Quality* is defined as the character of broad panoramas as seen from a distance, including ridgelines and geologic features. *Landform*

is defined as the degree of change associated with proposed landform alterations, including lot grading and road improvements. *Regional Character* is defined as loss/modification of notable landmarks, or change in the visual continuity of the region as a whole.

Caltrans has also developed a formula for assessing visual changes according to three levels of impact:

- *Minor:* Intrusions that are either complementary to the landscape or have recognized cultural or historical significance.
- *Moderate:* Intrusions that are integrated into the landscape and do not degrade or obstruct scenic views.
- *Major:* Intrusions that dominate the landscape, degrading or obstructing scenic views.

The impacts are assessed in terms of three categories of visual composition and value, including:

- *Vividness:* The extent to which the landscape is memorable, including distinctiveness, diversity and contrast.
- *Intactness:* The integrity of visual order in the landscape and freedom from visual intrusions that dominate the landscape, degrading or obstructing scenic views.
- *Unity:* The extent to which intrusions are sensitive to and in harmony with the natural landscape.

The portions of the Basalt Canyon geothermal exploration area visible from U.S. Highway 395 are considered to have high visual quality and high visual sensitivity. The following list summarizes the principal information necessary to assess the effects of the Projects on U.S. Highway as a Scenic Highway of statewide significance:

- the sites are generally removed from U.S. Highway 395 (they are no closer than 0.25 mile, and are all considered in the "middleground" of the view);
- the window of visibility from U.S. Highway 395 would be generally limited to areas south of the Basalt Canyon geothermal exploration area due to the intervening "Rhyolite Ridge;"
- sites visible from portions of U.S. Highway 395 would be partially screened by intervening vegetation;
- temporary structures, such as the drill rig derrick, would not alter the dominance of the Sierra Nevada range, the integrity of the ridge lines and geologic features, or the overall panorama; and
- lighting required for night operations for safety would be arrayed from U.S. Highway 395 against lighting in the Town of Mammoth Lakes.

The proposed projects would have a minor to moderate impact on *Visual Quality* (i.e., overall physical elements of the area), where the effect would be greatest for the short segment of U.S. Highway 395 closest to the sites. Impacts on *View Quality*, *Landform* and *Regional Character* would be minor, as the broad panoramas and landforms would remain unchanged and there would be no modification to notable landmarks. In terms of visual composition and value, it is anticipated that the project elements would have a minor impact on the *vividness* of the landscape. Because the sites would be set against the background of the Town of Mammoth Lakes, impacts of the temporary structures on the *intactness* of the scene would also be expected to be minor. Impacts on the *unity* of the setting would be moderate, due to the structural linearity of exploration facilities compared with the more fluid contours of the background. Overall, impacts from the Projects on the U.S. Highway 395 Scenic Corridor are considered to be less than significant, due both to the placement of the sites in the less sensitive locations and the temporary nature of the exploration activities. No mitigation measures are required to reduce impacts to below the level of significance, and there are no significant residual impacts.

USFS Visual Management System: Visual Quality Objectives (VQOs) have been established by the USFS for national forest lands. The four VQOs are "Preservation," the most restrictive designation, followed by "Retention," "Partial Retention," and "Modification," the least restrictive. These VQOs are further defined in terms of Distance Zones (foreground, middleground and background), Sensitivity Levels (1, 2 or 3), and Variety Class (A, B and C). This system is established in Agricultural Handbook Number 462.

The VQOs relevant to the Basalt Canyon geothermal exploration area include "Retention" and "Partial Retention;" the other two VQOs are not found within the Basalt Canyon geothermal exploration area (Figure 3). The "R-Retention" designation provides for only those management activities that are not visually evident, allowing only those activities that would repeat form, line, color and texture of the surrounding characteristic landscape. This designation does not provide for changes that would alter the existing landscape character. The "PR-Partial Retention" designation also requires that management activities be subordinate to the characteristic landscape, but allows the introduction of forms, lines, colors and textures found infrequently in the characteristic landscape as long as those elements remain subordinate to the visual strength of the characteristic landscape.

Sensitivity Levels are a measure of public concern for scenic values, where the public includes: those traveling on developed roads and trails; those using campgrounds or visitor centers; and those recreating at lakes, streams, and other water bodies. Level 1 refers to areas that are visible from primary use areas (travel routes, user areas and water bodies) where at least 25 percent of the visitors have a major concern for scenic values. Level 2 refers also to areas with exposure from primary use areas, but where fewer than 25 percent of the visitors have a major concern for scenic values. Level 3 refers to lands visible only from secondary use areas, where fewer than 25 percent of visitors have a major concern for scenic values.

Variety Classes are obtained by classifying landscapes into different degrees of variety to determine the comparative importance of landscapes. Generally, the highest values are assigned to landscapes with the most variety and diversity. Class A ("Distinctive") refers to areas with unusual or outstanding landforms, vegetation patterns, and water and rock forms. Class B ("Common") refers to areas where variety is present but which are characteristic of the region and not outstanding in visual quality. Class C ("Minimal") is assigned to areas where features exhibit little change in form, line, color or texture.

Distance Zones are divisions the divisions of a landscape as it is viewed from a particular point and are used to describe the part of a characteristic landscape being evaluated. There are three distance zones the foreground, the middleground and the background. The foreground is based on the distance at which details can be perceived. The middleground extends from the foreground to 3 to 5 miles from the observer. The background extends from the middleground to infinity.

As shown in Figure 3, portions of the Basalt Canyon geothermal exploration area are designated, from most sensitive to least sensitive, either "Rfg1A" (Retention, foreground, Sensitivity Level 1, Distinctive); "Rfg1B" (Retention, foreground, Sensitivity Level 1, Common); "Rmg1A" (Retention, middleground, Sensitivity Level 1, Distinctive); or "PRmg1B" (Partial Retention, middleground, Sensitivity Level 1, Common).

All six of the Project sites are located in "middleground" Distance Zone, a Sensitivity Level of "1," and a Variety Class of "B" (Common) with a VQO of "Partial Retention". Though all six sites are located within Sensitivity Level 1 areas, they are within middleground distance zones with fairly common vegetation patterns of open Jeffery Pine woodlands and landforms with moderate elevation changes characteristic of the area. This combination of visual elements

identifies the Partial Retention Visual Quality Objective as the appropriate goal for management activities. Under this system management activities are designed to be subordinate to the characteristic landscape. Based on this; the minimal visibility and the low degree of impact of the Projects; and the short-term, temporary nature of the greatest visual impacts; it is concluded that the Projects would not have a significant impact on visual resources or the VQOs developed for the Basalt Canyon geothermal exploration area. Several mitigations measures were identified to ensure that the impact of the Projects is minimized below a level of significance. For example, for drilling during the times when lighting is required, a mitigation measure to limit lighting to that required for safety and to direct lighting away from receptors is recommended.

To avoid potentially substantial impacts to critical visual resources, Special Stipulation No. 9 was adopted into Geothermal Lease CA-14408 ("No surface disturbing activities will be permitted in the No Surface Occupancy areas shown on Map 5, attached, unless the lessee can demonstrate through an appropriate plan of operation or permit application that no unacceptable environmental impacts will occur from the proposed operations." Two sites, Sites 31-36 and 81-36, have been proposed as part of the Projects within this "No Surface Occupancy" area (see Figure 2). The analysis of potential visual resource impacts from proposed operations from these two sites provided in this EA demonstrates that no unacceptable visual impacts would result from project implementation.

VISUAL RESOURCES MITIGATION MEASURES

VIS-1: All drill rig and well test facility lights shall be limited to those required to safely conduct the operations, and shall be shielded and/or directed in a manner which limits direct light to the immediate work area, except as may be required to comply with Federal Aviation Administration requirements. Special care shall be taken to minimize or avoid the placement or use of lights that may be directly visible from U.S. Highway 395, State Route 203, the Town of Mammoth Lakes, or other areas where substantial numbers of viewers may be present. Work lights shall only be on at times required for safety.

VIS-2: Leave a buffer of native vegetation, approximately 5 feet or greater in width, between Sawmill Road and the drilling pad sites 35-31, 23-31, 12-31, and 81-36. Access roads should be constructed at approximately 45-degree angles to Sawmill Road so the view from the road is not directly into the drill site. The reserve pits should be placed out of the direct view of travelers on Sawmill road by using the existing vegetation for screening.

VIS-3: Pipelines laid to connect the well sites should either be tucked into the overhanging vegetation along the roadside or be out of view of the road, concealed by the ample and dense vegetation found along either side of the road.

VIS-4: Wellhead monitoring equipment left on site should be painted a color that will blend with the landscape and be screened by vegetation. Locations and color choices are subject to approval by the Authorized officer in cooperation with the Forest Landscape Architect.

VIS-5: Tree removal at site 55-31 should be on the north or east sides of the drilling pad.

3.4 VEGETATION

The following discussion of environmental conditions and impacts on vegetation summarizes the results of studies conducted by Dr. James Paulus during May, June, July, and September of 2001 and reported in the documents provided as Appendix B to this EA. It also includes the conclusions presented in the Biological Evaluation for sensitive plants for this project.

The Basalt Canyon geothermal exploration area is located on the eastern flank of the Sierra Nevada Mountains at an average elevation of 7,650 feet. Precipitation in the area averages 30" with up to 80 percent falling in the form of snow. The frost-free growing season for plants is between 80 and 100 days, and is characterized by low humidity and moderate daytime temperatures. Temperatures average 30°F in winter and 70°F in summer.

The Basalt Canyon geothermal exploration area is characterized by gently rolling dry slopes except for one steep, north-south trending ridge ("Rhyolite Ridge") near U.S. Highway 395. Soils are thin-to-very-thin, comprised largely of pumice sands and loose alluvium overlying fractured basalt rock, and the majority of habitat is summer xeric. Areas that remain moist through the growing season are absent, with the exception of the few active fumaroles (which are generally devoid of vegetation).

Historical activities in the area have been influenced by proximity to the Town of Mammoth Lakes. Over the years, lands in the Basalt Canyon geothermal exploration area have been variously used for timber harvests, road-building, sediment retention dams, an abandoned landing strip, and light recreation including ongoing bicycling and off-road vehicle use. The loss of vegetation ("devegetation") is apparent in many of these areas.

Plant communities in the study area are dominated by Great Basin Mixed Scrub. Additionally, vegetation in the forested areas is classified in one community, Jeffrey Pine Forest, and there are also small patches of Tobacco Brush Chaparral near the top of "Rhyolite Ridge." There are no meadows with or without willows in the Basalt Canyon geothermal exploration area. Table 3.2 summarizes the plant communities found within the Basalt Canyon geothermal exploration area. Site 31-36 is located within the Jeffrey Pine Forest community; all other sites are located in the Great Basin Mixed Shrub plant community.

Table 3.2
PLANT COMMUNITIES IN THE BASALT CANYON GEOTHERMAL EXPLORATION AREA

Plant Community Name	Holland Number	Sawyer/Keeler-Wolf Series
Jeffrey Pine Forest	85100	Jeffrey Pine
Great Basin Mixed Shrub	35100	Big Sagebrush
Tobacco Brush Chaparral	37533	Tobacco Brush
Disturbed/Devegetated	N/A	N/A

A total of 149 plant species belonging to 35 families were identified within the Basalt Canyon geothermal exploration area. Diversity of tree species was highest near the summit of "Rhyolite Ridge," while shrub and herb diversity was highest at a naturally formed channel known locally as "Murphy Gulch." The lowest diversity of herbaceous species occurred in the Jeffrey Pine Forest community where the tree canopy cover exceeds 40 percent. Annual species diversity throughout the Basalt Canyon geothermal exploration area in 2001 included 29 native and 11 non-native species.

No occurrences of federal or state listed threatened, endangered, proposed, or rare plant species, nor Forest Service sensitive or watch list, nor unique plant communities, were found within the Basalt Canyon geothermal exploration area. Confusion of occurring species with identified species of concern is very unlikely. No low herbaceous associations of Mono Pumice Flat were found. During the transect surveys, sign of widespread use by deer was observed but there was no evidence that the area had been used for livestock, even though the area is within a sheep grazing allotment, and it is concluded that herbivore activity did not influence ability to detect sensitive plants during the survey. Based on these findings, a determination was made that this project will have no impact on federally listed threatened, endangered, or proposed plant species, or Forest Service sensitive plant species.

If all five of the proposed slim holes were drilled, and the access roads to Sites 55-31 and 31-36 constructed, then a maximum of 0.77 acres of land would be disturbed (650 feet + 400 feet of new road times 15 feet of disturbance, plus 5 pads each 3,600 square feet). If both of the proposed geothermal wells were drilled, and the access roads to Sites 55-31 and 31-36 constructed, then a maximum of 2.89 acres of land would be disturbed (650 feet + 400 feet of new road times 20 feet of disturbance, plus 2 pads each 30,000 square feet, plus temporary pipeline along a maximum of 10,000 feet of existing roads times a maximum of 5 feet of disturbance from laying the pipe on the ground). If both Projects were completed, the maximum amount of land disturbance would be less than the sum of the two Projects because of the overlap of the access roads and the one slim hole pad "consumed" by one of the well pads. Total surface disturbance would thus be a maximum of 3.30 acres. Of this total, a maximum of approximately 1.39 acres of Jeffrey Pine Forest community could be disturbed, and a maximum of 2.27 acres of Great Basin Mixed Scrub could be disturbed. These acreages are very small compared to the extensive areas in and surrounding the Basalt Canyon geothermal exploration area covered by these two plant communities, and are not considered significant. However, to ensure that adequate revegetation of the sites occurs, and to minimize the spread of noxious weeds, mitigation measures to salvage and restore topsoil, revegetate the reclaimed sites, and distribute slash material are recommended below.

Special Stipulations in both of the affected geothermal leases require the lessee to pay for timber species cut or destroyed during operations under the lease. Construction of Site 31-36 and the new access road to this site are likely to result in the removal of some small quantity of young and mature timber. No additional mitigation measures are required.

Because no federally or state listed threatened, endangered, proposed, or rare plant species, nor Forest Service sensitive or watch list species, nor unique plant communities were found within the Basalt Canyon geothermal exploration area, no mitigation measures for these species are required, and there are no residual significant impacts.

VEGETATION MITIGATION MEASURES

VEG-1: Topsoils shall be salvaged during the construction of all pads and access roads, as feasible, and stockpiled for use during subsequent reclamation of the disturbed areas, The depth of soil to be salvaged shall be determined by the authorized officer in consultation with the Forest Service. Soil stockpiles shall be placed in locations approved by the authorized officer and shall not be more than two feet high to encourage the continued viability of living organisms in the soil.

VEG-2: Upon completion of operations, all surface disturbance shall be recontoured as necessary to blend with the surrounding topography as soon as practicable. Partial, phased or concurrent reclamation may be required by the authorized officer as appropriate to minimize erosion and stabilize the disturbed areas. Salvaged and

stockpiled topsoil shall be redistributed over the recontoured disturbed area. Seeding of disturbed areas will be completed using the following seed mixture and application rate.

Big sagebrush (*Artemisia tridentata)*	0.5 PLS lb/ac
Antelope bitterbrush (*Purshia tridentata*)	4 PLS lbs/ac
Desert peach (*Prunus andersonii*)	2 PLS lbs/ac
Indian ricegrass (*Achnatherum hymenoides*)	2 PLS lbs/ac
Western needlegrass (*Achnatherum occidentalis)*	2 PLS lbs/ac
Squirreltail (*Elymus elymoides)*	3 PLS lbs/ac
Spurred lupine (*Lupinus argenteus* var. *heteranthus)*	2 PLS lbs/ac
Chicalote, prickly poppy (*Argemone munita*)	1 PLS lb/ac
TOTAL:	16.5 PLS lbs/ac

PLS = Pure Live Seed

Preferably, seeds for this project will be collected within the immediate vicinity of the project area. If this is not possible due to poor seed availability, seed from the following ecological subsections or sections the area borders on will be acceptable: 1) Eastern Slopes Subsection of the Sierra Nevada Section, and 2) Mono Section (Miles and Goudey 1997 – map available). If availability still presents a problem, the seed mix may be modified in consultation with the Forest Service.

Success standards for revegetation are as follows:

- At least 3 shrubs and 8 perennial native grasses and/or forbs per 4 square meters will be established on site.
- Perennial grasses will account for at least 10% of the relative cover.
- All non-native weed species that are already present in the area will account for no more than 5% total of the relative cover at the end of the 2 year evaluation period. New non-native species introduced as a result of the project will be eradicated, i.e. 0% cover.

The revegetated areas will be monitored for compliance with the success standards defined above, and a report provided to the Forest Service the first and second years following completion of the project. Failure to meet the success standards will require additional planting and/or weed control, as appropriate, until standards are met.

VEG-3: Slash material produced from clearing the site access roads and drill pads would be chipped and stockpiled and spread to a depth of 1 to 2 inches over the drill sites after seeding, to serve as a native mulch and to provide an additional seed source for revegetation.

3.5 NOXIOUS WEEDS

The following discussion invasive, non-native species summarizes the results of studies conducted by Dr. James Paulus during May, June, July, and September of 2001 and reported in documents provided as Appendix B to this EA. IT also incorporates mitigation measures as outlined in the Weed Risk Assessment for this project.

The overall tendency for loss of vegetation ("devegetation") from repeated disturbance to lead to invasions from weedy species is apparently high in the Basalt Canyon geothermal exploration area. Annual species diversity throughout the Basalt Canyon geothermal exploration area in 2001 included 29 native and 11 non-native species; a total of 15 non-native species were found in disturbed areas of relatively dry Jeffrey Pine Forest and Great Basin Mixed Scrub

communities. Two of these species have shown a tendency to spread into relatively undisturbed areas, and the risk is high for these two species to spread and/or increase in abundance as a result of further vegetation disturbance. Finally, a sufficient seed source for one of these two species (*Bromus tectorum)* is already in place throughout both of the major plant community types. These existing exotic populations would likely facilitate rapid post-disturbance colonization that could exclude native pioneer species in the absence of proactive management practices. Direction in the Forest Land and Resource Management Plan (Sierra Nevada Framework amendment) regarding noxious weeds includes preventing the introduction and establishment of noxious weed infestation and containing and controlling established infestations, with an emphasis on the eradication of new infestations. Mitigation measures to meet the intent of this direction are included below, and in the vegetation section, and will be incorporated into plans of operation for this project.

NOXIOUS WEED MITIGATION MEASURES

NOX-1: Prior to entering and upon exiting the Basalt Canyon geothermal exploration area, all trucks and construction equipment that will operate off of previously existing roads shall be washed to remove soil and plant parts. A central washing facility shall be provided for this purpose, either at the MPLP equipment area at Casa Diablo on private land or at a location approved by the authorized officer. Vehicles washed prior to traveling to the area shall be inspected the Forest Service prior to entering the Basalt Canyon geothermal exploration area to verify that they are soil and weed free.

NOX-2: Where appropriate, seed mixtures used to revegetate disturbed areas shall be certified as being free of noxious weed materials. IN some cases, e.g. when seed is collected locally vs. grown in a nursery setting, weed certification may not be available.

NOX-3: Forest litter located on Site 31-36 shall be salvaged during construction of this pad and access road, as feasible, and stockpiled for use during subsequent reclamation of the disturbed areas to minimize the potential invasion of noxious weeds.

NOX-4: All non-native weed species already present in the area will account for no more than 5% total of the relative cover at the end of the 2-year evaluation period, following completion of revegetation measures. New non-native species introduced as a result of the project will be eradicated, i.e. 0% cover. Where this standard is not met, appropriate weed control measures will be implemented.

3.6 WILDLIFE

The Basalt Canyon geothermal exploration area is characterized as Great Basin Mixed Scrub plant communities distinguished by big sagebrush, antelope bush, tobacco brush, and manzanita (Paulus, 2001b). Associated with these scrub species are perennial grasses. Stands of Jeffrey Pine Forest plant communities are also interspersed and provide forest canopy cover at lower elevations. "Murphy Gulch," an ephemeral stream channel, parallels State Route 203 along the southern edge of the Basalt Canyon geothermal exploration area, and a much smaller, un-named ephemeral stream may occasionally flow through Basalt Canyon along the northern edge of the Basalt Canyon geothermal exploration area. No other streams, seeps, or wet meadows were identified within the Basalt Canyon geothermal exploration area (Paulus, 2001b)

A number of wildlife species are associated with the Basalt Canyon geothermal exploration area, including jackrabbits, cottontail rabbits, ground squirrels, least chipmunks, kangaroo rats, and wood rats Bird species may include chukker, black-billed magpie, gray flycatcher, pinyon jay, sage thrasher, sparrows, and hawks (Paulus, 2001b). Complete implementation of the

Projects could result in the loss of a maximum of only 3.30 acres of habitat for these species, which is not significant, considering the abundance of this habitat in the area and the temporary nature of the impacts. No mitigation measures are necessary, and there are no significant residual effects.

No federal- or state-listed threatened or endangered species are known to occupy or frequent the Basalt Canyon geothermal exploration area (Perloff, 2001). There is potential habitat for Northern Goshawk in the Jeffrey pine vegetation type adjacent to 31-36. No nests were identified during surveys conducted during 2001; however, individuals do move around and may have nested in the area subsequent to the 2001 surveys. Except for completing a Northern goshawk survey immediately prior to initiating site preparation and drilling, no mitigation measures are necessary, and there are no residual significant effects.

Mule Deer

Individuals from two separate deer herds utilize the project area during portions of each year. Deer from the Casa Diablo herd migrate west from their winter range, located generally east of the Benton Range, along routes on the north and south sides of Glass Mountain, crossing Highway 395 at several locations, generally north of the Basalt Canyon geothermal exploration area (Taylor 1987, 1988). Selection of the routes used by this herd for migration on a year-to-year basis is apparently related to spring snow conditions and available forage (Taylor, 1988). Deer from the Round Valley herd migrate north and west along a corridor between Highway 395 and the edge of the eastern slope of the Sierra Nevada from their winter range to the Sherwin holding area (Taylor, 1996). The majority of this holding area is located south to southeast of the Basalt Canyon geothermal exploration area, south of Mammoth Creek and Highway 395, however the holding area does extend into the Basalt Canyon area. When spring snow conditions permit, most of these deer then move west and south through high passes to the summer ranges in the Sierra Nevada.

Radio telemetry information indicates that the Basalt Canyon geothermal exploration area is generally located between the major deer migratory corridors for the Casa Diablo and Round Valley mule deer herds. Tim Taylor, California Department of Fish and Game wildlife Biologist, considers the Basalt Canyon geothermal exploration area to be important as a holding area (an intermediate destination to be used while waiting to finish migration to the main summer range) for a small portion of the Round Valley mule deer herd (Taylor, 2001 and 2002 per. com.). Deer begin to arrive on the holding area in early April, and may inhabit the Basalt Canyon area by April 15 during years of "normal" precipitation. Deer generally spend several months in the area in and around the Basalt Canyon geothermal exploration area while they wait to complete their migration. Though limited in total numbers, the deer that use this area generally arrive in poor condition and rely on the succulent forage to replenish reserves depleted during winter months. In addition, habitat similar to that used elsewhere for fawning, is available in the Basalt Canyon area. No surveys have been conducted to substantiate or quantify fawning use, however it is likely that fawning occurs during the holding period and summer months.

Taylor (2001 per. com) has also characterized the Basalt Canyon geothermal exploration area as being used by deer from either herd for summer foraging. Taylor (second interim report) estimated that between 1,290 and 1,500 deer of the Casa Diablo herd summered east of the Sierra crest, although the observed locations of these deer are all north of the Basalt Canyon geothermal exploration area. During the May-July 2001 vegetation surveys conducted for MPLP, signs of deer use were observed throughout the Basalt Canyon geothermal exploration area, with deer being observed in the Murphy Gulch area on several occasions (Paulus, 2001b). Kucera (1987, 1988) estimated that around 69 deer moved through the Casa Diablo area, where the three MPLP geothermal power plants are constructed. Although this data is over

thirteen years old, and current deer densities may be different, deer are still observed around the power plants on a regular basis during the spring and summer months (Sullivan, 2001 pers. com).

Complete implementation of the Projects could result in the direct loss of approximately 3.30 acres of mule deer habitat. In addition, the construction, drilling and testing activities associated with the exploration projects would result in some additional, temporary, disturbance to the deer population due to noise, night-lighting, traffic, and other associated activities. Both primary habitat loss and secondary effects are greatest on deer during spring migration, in holding areas, and on winter ranges, as deer are usually more concentrated at these times and in overall poorer condition. Impacts during migration and holding periods would be the most significant as the deer are heavily dependent on forage and other available habitat within the migration routes and adjacent holding areas. The consequences would depend on the specific circumstances of habitat condition and deer populations at the time. An effective reduction in habitat size, either directly or indirectly, could result in additional competition for the remaining available habitat or a loss of individual animals. Implementation of a Limited Operating Period (described below as mitigation measure WLD-1) would eliminate impacts to deer during critical holding and migration periods.

Roads and associated human traffic have been shown to reduce the value of habitat to big game species (Leege 1976, Thiessen 1976, Perry and Overly 1977, Rost and Bailey 1979). Bormann (1976) reported that human activities, such as residential or recreational developments, impact the habitat beyond the actual boundary of the development. Cornett et al. (1979) reported that a meadow near cabins received only 40 percent of the deer use of a similar undisturbed meadow area. They also reported a 70-percent decline in deer use within 30 to 50 yards of hiking trails. Smith et al. (1989) looked at the distribution of winter range mule deer around residential subdivisions in Northeastern California. They found that the estimated circular area about home sites where reduced deer use could be expected was five acres (a 90-yard radius). Within this radius, deer use was 61 percent of overall mean deer use in similar undisturbed areas.

If the area of reduced deer use from the geothermal drilling and testing operations in the Basalt Canyon geothermal exploration area is assumed to be generally equivalent to that Smith found for winter deer use near residential homes, then we could expect only 61 percent usage (a reduction of 39 percent) of the area within a 90-yard radius of each of the drill sites. Thus, because no more than two sites would be drilled at any time, the total secondary avoidance would amount to approximately an additional 10 acres of ground at any time. Based on work done by Kucera (1987, 1988) and CDFG herd estimates (Taylor, 2001 pers. com.), Kerns (2001) estimated that approximately 46 deer might be utilizing the general 800-acre Basalt Canyon geothermal study area for summer range, which is an average use of 17 acres per deer. Combining this with the 39 percent reduction in usage leads to an estimated reduction of summer range forage of less than 4 additional acres, equivalent to that used by one-quarter deer. In addition, this loss of summer range by avoidance would be temporary, for a period of approximately two weeks per well (or a total of six weeks, if all wells and holes were drilled).

In the summer months deer tend to be more dispersed, and direct habitat loss and secondary avoidance impacts tend to be lessened. Because the area of these impacts is small and the impact is temporary, the impacts to summer use are considered to be minimal and less than significant. Implementing mitigation measures WLD-3 and WLD-4 would further reduce direct impacts.

WLD-1: No operations are permitted during the migration and migration-holding period from April 15 through June 15.

WLD-2: Immediately prior to occupancy at site 31-36, a Forest Service biologist will conduct a survey to determine whether new northern goshawk nests have been constructed adjacent to the drill pad or access road. If a new nest is discovered, drilling will be delayed until after the nesting season.

WLD-3: All Drivers accessing drill sites will adhere to a speed limit of 25 mph.

WLD-4: Domestic dogs will not be kept on the drill sites.

3.7 SOILS, GEOLOGY AND MINERALS

Soils

Soils in the Basalt Canyon geothermal exploration area are displayed in the Soil Survey, Inyo National Forest West Area, California. The two soil families within the project area are the Haypress family and the Calpine family. These soils are characterized as deep to very deep, well to excessively well drained, with light textures. Soil productivity is low to medium, with the lack of organic matter and low soil water retention being the primary limiting factors. The maximum erosion hazard of these soils is low to moderate. These soils also tend to have little cohesiveness and do not compact well on the surface. Construction of drill pads could result in the loss of soil productivity on up to 3.3 acres. Due to the relatively small area potentially disturbed, mitigation measures are not necessary to reduce impacts to soils below the level of significance, and there are no residual significant effects. Mitigation measures proposed to minimize of the potential for erosion and the generation of sediment and to speed up the recovery of soil productivity are provided below.

Geology

The Basalt Canyon geothermal exploration area is located on the western edge of the Long Valley caldera, a large volcanic crater formed approximately 700,000 years ago. The Basalt Canyon geothermal exploration area lies east of the ring fractures which mark the western edge of the caldera and west of the resurgent dome north of Casa Diablo near the center of the caldera. Many of the geologic features in the area, such as the 530-650 year old volcanic domes located on the northwestern boundary of the caldera, are quite young. "Rhyolite Ridge," located immediately to the west of U.S. Highway 395, appears to form a barrier to the subsurface western movement of geothermal fluid flow from its point of upwelling west of the Basalt Canyon geothermal exploration area. The geothermal fluid flow direction is thought to continue in a southeasterly direction, around the southern end of "Rhyolite Ridge," then turn to the east, toward the Casa Diablo area and the existing geothermal power plants also owned and operated by MPLP. The purpose of the Projects is to explore for, locate and verify the existence and characteristics of a commercially viable geothermal resource within the federal geothermal leases of the Basalt Canyon geothermal exploration area.

The geothermal resource exploration process would not alter subsurface geology or adversely affect the geothermal resources of the Basalt Canyon geothermal exploration area. No other locatable, salable or leaseable minerals are known to exist in the Basalt Canyon geothermal exploration area that could be adversely affected by the geothermal resource exploration process (Personal Communication. V. McLean, USFS Mineral Resource Specialist, October 6, 2001). No mitigation measures are necessary.

No areas of surface geologic hazards, such as active faults, volcanic activity, or landslide areas, exist within the Basalt Canyon geothermal exploration area. Because very little geothermal fluid

would be produced during the geothermal well testing, and all of this produced geothermal fluid would be injected back into the geothermal reservoir (except for that which would be discharged to the atmosphere as steam or water vapor), there is no potential for creating subsidence. Active fumaroles (geothermal steam vents), located in "Basalt Canyon," at the southern tip of "Rhyolite Plateau," vent geothermal steam and gases, and indicate that fractures connecting the geothermal reservoir and the surface are found in this area. Intersecting such fractures near to the surface can present a hazard to the drilling of geothermal wells, and so all of the Projects sites are located at least 500 feet away from this area. Neither is the drilling or flow testing of any of the geothermal wells anticipated to have any affect on the flow of these fumaroles because so little geothermal fluid would be produced and all of this produced geothermal fluid would be injected back into the geothermal reservoir (except for that which would be discharged to the atmosphere as steam or water vapor). No mitigation measures are necessary.

SOILS, GEOLOGY AND MINERALS MITIGATION MEASURES

SGM-1: Topsoils shall be salvaged during the construction of all pads and access roads, as feasible, and stockpiled for use during subsequent reclamation of the disturbed areas, The depth of soil to be salvaged shall be determined by the authorized officer. Soil stockpiles shall be placed in locations approved by the authorized officer and shall not be more than two feet high to encourage the continued viability of living organisms in the soil.

SGM-2: Upon completion of operations, all surface disturbance shall be recontoured as necessary to blend with the surrounding topography as soon as practicable. Partial, phased or concurrent reclamation may be required by the authorized officer as appropriate to minimize erosion and stabilize the disturbed areas. Salvaged and stockpiled topsoil shall be redistributed over the recontoured disturbed area. Seeding of disturbed areas may be required by the authorized officer if determined necessary using seed mixtures and application rates and techniques approved by the authorized officer.

3.8 HYDROLOGY

No potable ground water is known to exist in the Basalt Canyon geothermal exploration area, although shallow, cold ground water may exist and may be encountered during the drilling of the slim holes and geothermal wells. Deeper ground waters are believed to be geothermal fluids, which are not potable, both because of their elevated temperature and because of their elevated concentrations of some minerals. These geothermal fluids are the targets of the proposed drilling Projects.

Surface waters in the Basalt Canyon geothermal exploration area are all tributary to Mammoth/Hot Creek, a perennial steam that flows east from the Sierra Nevada Mountains south of State Route 203, outside of the Basalt Canyon geothermal exploration area. Only two ephemeral stream channels are found within the Basalt Canyon geothermal exploration area: "Murphy Gulch," an ephemeral stream channel which parallels State Route 203 along the southern edge of the Basalt Canyon geothermal exploration area, and a much smaller, un-named ephemeral stream channel which may occasionally flow through "Basalt Canyon" along the northern edge of the Basalt Canyon geothermal exploration area. Both have been identified as ephemeral/intermittent "riparian conservation areas" by the USFS under the "Sierra Nevada Forest Plan Amendment," and activities that are proposed within 150 feet of the channel are subject to special restrictions or may be prohibited (see Figure 3). None of the proposed Projects sites or access roads encroach on any designated "riparian conservation areas." No perennial streams, seeps, or wet meadows were identified within the Basalt Canyon geothermal exploration area. No mitigation measures are required.

Water required for well drilling would average about 50,000 gallons per day, or an average of about 3 acre-feet total for each of the two wells. Water requirements for slim hole drilling, site and road grading, construction, and dust control would average substantially less; an estimated 0.5 acre-foot per slim hole, and possibly 1 acre-foot for all of the pad construction and dust control. Thus, total water consumption for the Projects is estimated at less than 10 acre-feet. Water necessary for these activities would be obtained from one or more of three different potential water sources:

- Casa Diablo power plant service water (non-potable shallow groundwater used at the existing Casa Diablo geothermal plants for irrigation and other plant service purposes);
- Casa Diablo power plant geothermal injection fluid (obtained by diverting a small stream of the geothermal injection fluid); and
- Mammoth Community Water District (MCWD) reclaimed water (tertiary treated waste water produced by the treatment plant).

Because each of these water sources would not consume potable water, and because the amount of water to be consumed is very small, especially over the projected time period, the impacts of this water consumption for the Projects would not be significant. No mitigation measures are required to reduce impacts below the level of significance, and there are no residual significant impacts.

Impacts to surface water quality could occur from storm water runoff carrying either sediment eroded from areas disturbed by the Projects or accidentally discharged drilling materials reaching Mammoth Creek. Potential flow paths would either be through the ephemeral "Murphy Gulch," which has a relatively short connection to Mammoth Creek from the Basalt Canyon geothermal exploration area, or through the much smaller, un-named ephemeral stream channel which may occasionally flow through "Basalt Canyon," which follows a much longer path, from the Basalt Canyon geothermal exploration area through the existing Casa Diablo geothermal area, before reaching Mammoth Creek. Based upon a review of topographic maps of the Basalt Canyon geothermal exploration area, it would appear that all of the Projects sites, and most of the access roads, including most of Sawmill Road, are tributary to the small, un-named ephemeral stream channel that may occasionally flow through "Basalt Canyon."

Because there will be less than 5 acres of surface disturbance, and because geothermal exploration is not a regulated industrial activity, the Projects are not required to obtain a storm water permit nor prepare a formal storm water pollution prevention plan. However, little soil erosion is anticipated because the topography is gentle and cut and fill for construction of the pads and access roads have been minimized. MPLP has proposed that storm water generated on-site will be collected and discharged into the reserve pit, and that off-site storm water would be intercepted in ditches and channeled to energy dissipaters as necessary to minimize erosion. Only non-toxic, non-hazardous drilling mud and drilling mud additives would be utilized when drilling either the slim holes or the geothermal wells, and waste drilling mud and drill cuttings would be discharged into the lined reserve pit to prevent water quality degradation. For these reasons, the potential impacts to surface water quality from storm water runoff are considered below the level of significance. No mitigation measures are necessary to reduce impacts below the level of significance, but several measures are recommended to ensure the implementation of the mitigation proposed by MPLP.

To prevent the accidental discharge or un-controlled flow of geothermal fluids, either below ground where they might be able to contaminate some as yet unidentified shallow ground water system, or at the surface, where they could flow into an ephemeral channel which is tributary to Mammoth Creek, the slim holes and geothermal well bores will be cased (to prevent the interzonal movement of the geothermal fluids) and will utilize blow-out prevention equipment

(BOPE) to reduce the possibility of uncontrolled well flow ("blowouts"). In addition, the plans submitted by MPLP contain a "blowout contingency plan" which describes the methods for cleanup and abatement in the remote event that there were any spills or discharges from a well blowout. No mitigation measures are considered necessary, but several are recommended to ensure the implementation of the mitigation proposed by MPLP. There are no residual significant impacts.

HYDROLOGY MITIGATION MEASURES

HYD-1 The permittee shall use the following Best Management Practices (BMPs) to ensure the full containment of all sediment that may be generated by storm water runoff from the construction of each pad and access road throughout the life of the Projects. (See Appendix B for a description of each BMP)

1. Erosion Control Plan (BMP 2.2)
2. Timing of Construction (BMP 2.3)
3. Stabilization of Road slope Surface and Soil Disposal Areas (BMP 2.4)
4. Servicing and Refueling of Equipment (BMP 2-12)
5. Snow Removal Control (BMP 2-25)

This mitigation measure shall be implemented by developing a plan to prevent storm water pollution, which plan shall be prepared prior to construction of each well pad and access road. This plan shall identify structures such as sediment traps, filter fences, straw bales, or activities that will implement the intent of the BMPs. The permittee shall be responsible for ensuring that the identified BMPs are implemented immediately as required or applicable throughout the course of the exploration activities.

HYD-2: The slim holes and the geothermal well bores will be cased as appropriate and utilize the appropriate blow-out prevention equipment (BOPE) as authorized by the BLM in the drilling permits to prevent interzonal migration of geothermal or drilling fluids and reduce the possibility of uncontrolled flows.

HYD-3: To minimize the potential of any contamination of shallow ground water from drilling fluids or drilling mud, the reserve pit shall be lined, and all drilling fluids not contained in the mud mixing tanks, mud system, or down hole shall be contained in the reserve pit. Upon completion of drilling activities, the solids remaining in the mud pit shall be dried, tested in accordance with the requirements of the California Regional Water Quality Control Board and, if authorized by the California Regional Water Quality Control Board, buried in the reserve pit.

3.9 GRAZING

The Basalt Canyon geothermal exploration area is within the Sherwin/Deadman Sheep Allotment, operated by Joe F. Echenique Livestock, Bakersfield, CA (permittee). The Sherwin/Deadman Sheep Allotment includes 26,882 acres, of which 12,418 acres are considered capable acres. Capable acres are considered suitable for forage production at a level that can sustain livestock grazing.

Mr. Echenique has a term grazing permit to run 2600 ewes from July 5 to September 30 each year. The sheep typically run in two bands of ca. 1300 each. The Basalt Canyon geothermal exploration area is within the Mammoth Unit of this allotment. The Mammoth Unit is typically used during July and late September.

Clearing of the proposed drill pad locations would directly affect 2 acres of the capable area. Vegetation on these 2 acres would be removed and would be unavailable for grazing use until revegetation of the drill sites is completed.

Permanent bedgrounds have been established for years. Drilling site 35-31 is adjacent to an established bedground. Drilling site 55-31 is within .1 miles of the same bedground. Drilling site 31-36 is within .5 miles of the main staging bedground for one band of sheep. They are located in disturbed sites and tend to encourage noxious weeds such as Cheat grass, Russian thistle and Pigweed (Chenopodium spp). Depending on topography, bedgrounds can also contribute to soil erosion. It is not a range management objective to create new bedgrounds.

If drilling coincides with grazing it may be more difficult to manage the sheep both on the bedgrounds and during active grazing due to noise from the drill sites and the extra support traffic. It is possible that sheep could be lost if they are spooked from drilling activity. Consequently it may be necessary for the permittee to abandon this area of his permit during drilling activity, in which case up to 300 acres of capable forage could be lost for that grazing season.

GRAZING MITIGATION MEASURES

GRZ-1: If required by the authorized officer, the lessee shall fence active pads sufficient to prevent access by grazing animals.

GRZ-2: If the allotment permittee is unable to occupy a portion of the allotment adjacent to an active drilling operation due to the potential loss of sheep, the operator will compensate the permittee for lost forage. The authorized officer, in conjunction with the Forest Service, will determine the amount and type of compensation. In general the compensation would be equal to the amount of forage unavailable to the permittee during the time that the permittee would normally have occupied the acres lost to grazing.

GRZ-3: The Authorized Officer, in conjunction with the Forest Service, will identify alternate bedgrounds or other permittee use areas, if exploration-drilling operations displace the permittee's use. If new bedgrounds are needed to replace bedground occupied by geothermal drilling operations, the geothermal operator will be responsible for reclaiming the new bedgrounds, including revegetation and weed control, if the permittee chooses to return to the old bedgrounds after the drilling operation is completed.

3.10 TRANSPORTATION AND PUBLIC SERVICES

Regional access to the Basalt Canyon geothermal exploration area is from U.S. Highway 395, a major north-south state highway designated as a Scenic Corridor along the length of Mono County, and State Route 203, the major arterial linking U.S. Highway 395 with the Town of Mammoth Lakes. Direct access to the sites would be from Sawmill Road (Forest Road 3S25), an improved but narrow dirt road connecting State Route 203 with Sawmill Cutoff (Forest Road 3S08) through Shady Rest Park. Sawmill Cutoff provides paved access to the Town of Mammoth Lakes to the south and via an improved gravel road to U.S. Highway 395 to the north in the vicinity of Dry Creek (see Figure 1).

During the winter months, both U.S. Highway 395 and State Route 203 are plowed by Caltrans to maintain highway vehicle access (although during some periods of heavy or persistent snow these vehicles may be required to drive with chains). Sawmill Road is not plowed to remove snow.

There are no counts of traffic using Sawmill Road, but incidental observations indicate that the use is very light, no more than a few per hour. During the summer, traffic on Sawmill Road consists of a mix of passenger vehicles, small trucks, motor cycles, ATVs, bicycles, and pedestrians. During the winter months when snow is on the road bed, traffic would likely decrease, but occasional use by snowmobiles and cross-country skiers may occur.

All access roads would require the creation or maintenance of an all-weather surface with a minimum roadbed width of ten feet, a maximum grade of ten percent, and a turning radius of no less than 50 feet. Sawmill Road is adequate to accommodate construction vehicles and highway delivery trucks, although light grading would be required to maintain the all-weather road bed during construction and drilling operations. Four of the six sites are located directly adjacent to Sawmill Road, and no additional road construction would be required for access to these sites. Site 55-31 is located north of Sawmill Road, and approximately 400 feet of new road would be constructed to access this site, either directly from Sawmill Road or from a short section of unimproved road that parallels Sawmill Road to the north in this area. Site 31-36 is located south of Sawmill Road, and approximately 650 feet of new access road would be constructed off of a minor, unimproved dirt road off of Sawmill Road (see Figure 1). The existing unimproved dirt road from Sawmill Road would need minor grading and roadbed improvements to support the required delivery and construction truck traffic, and the turnoff from Sawmill Road to the unimproved dirt road would need to be widened and regraded with a larger turning radius. Together, these road improvements and new construction to access site 31-36 would require the removal of a small number of both young and mature trees.

Projects traffic volume would be highest during assembly of the geothermal well drill rig, which would be delivered to a constructed geothermal well pad by 18-wheel highway tractor-trailer trucks. A total of 20 or more truck round-trips would be required, sometimes as many as ten or more truck round-trips per day. During drilling, additional truck loads of supplies would be delivered, averaging possibly two loads per day, and an average of 12 passenger or service vehicle trips would be generated. No more than one geothermal well would be drilled at any time. On completion of well drilling and initial flow testing (requiring an estimated 20 days), the drill rig would be disassembled, loaded back on trucks, and either removed from the area or moved to the second geothermal well site where the process would be repeated. Both the drill rig and most of the drilling supplies would originate from sources located throughout the western United States.

Equipment for the slim hole sites would also be brought in by truck, with a total of approximately 5 truck round-trips per site to assemble the truck-mounted drill rig and support equipment. No more than one slim hole and one geothermal well would be drilled at any time, as only one of each type of drill rig would be utilized, and although a slim hole and geothermal well could be drilled at the same time, they would not be drilled on the same site at the same time.

The truck and smaller vehicle traffic associated with the Projects can easily be accommodated on both the regional road system (including U.S. Highway 395 and State Route 203) and Sawmill Road. However, this temporary increase in traffic, especially heavy truck traffic, may degrade the dirt road bed of Sawmill Road. Because the level of traffic increase is small and temporary, this impact is considered less than significant, and no mitigation measures are required to reduce the impacts to below the level of significance. A mitigation measure is provided to ensure the ongoing maintenance of Sawmill Road during construction, drilling and testing operations and the restoration of Sawmill Road to a condition at least equal to pre-Project conditions once construction, drilling and testing operations are complete. There are no significant residual impacts.

None of the six sites is planned to encroach onto the bed of any road or trail. However, four of the six sites are proposed to be located immediately adjacent to Sawmill Road, and repeated access to the site(s) by trucks and other vehicles could unintentionally encroach onto and eventually impede the flow of traffic on Sawmill Road. Project vehicles waiting to enter onto a site or parked on Sawmill Road could block traffic on the narrow Sawmill Road, or force vehicles to drive around the stopped Projects vehicles, creating additional disturbance and widening the road bed. Because the level of traffic on Sawmill Road is so small, and the potential for these impacts low, this impact is considered less than significant, and no mitigation measures are required to reduce the impacts to below the level of significance. A mitigation measure is provided requiring that each pad be separated from Sawmill Road by at least 25 feet of undisturbed ground or other barrier to vehicles, that vehicles not stop or park on Sawmill Road, and that an off-site local location be provided for the long-term parking of delivery vehicles not currently being used for current operations. There are no significant residual impacts.

During the winter months, both U.S. Highway 395 and State Route 203 are plowed by Caltrans to maintain highway vehicle access (although during some periods of heavy or persistent snow these vehicles may be required to drive with chains). To conduct drilling and testing operations during winter, it may be necessary to plow the snow from Sawmill Road and any access road to the site(s) being drilled, and some damage to the road may occur from this snow removal. Because the potential for damage is very slight and the potential for this impact low, this impact is considered less than significant, and no mitigation measures are required to reduce the impacts to below the level of significance. A mitigation measure is provided to require the installation of snow wands to limit incidental disturbance and require that snow removal be conducted with a loader or blower, not a bulldozer. There is no residual significant impact.

The Town of Mammoth Lakes has developed an area-wide emergency evacuation plan that identifies Mammoth Scenic Loop (3S23) and State Route 203 as the major evacuation routes for area residents. No Projects operations would adversely affect this emergency evacuation plan, and operations personnel would have easy access to either route (or Sawmill Cutoff) for their own evacuation should that be necessary. No mitigation is required.

Water required for drilling may, if available, be supplied from a reclaimed water pipeline constructed adjacent to State Route 203 by connecting a temporary pipeline near the junction of State Route 203 and Sawmill Road, then laying the temporary pipeline on the surface (except where buried under road crossings) immediately adjacent to Sawmill Road (and the smaller access roads) to each site. During geothermal well testing, the residual produced geothermal fluid would be conducted from one well to the other well for injection through a temporary pipeline laid on the surface on the disturbed shoulders of the access roads connecting the two geothermal exploration wells. As required, roads would be crossed by trenching and burying the temporary pipe in the trench. Since each temporary pipeline would be buried under existing roads, there would be no impact to the transportation system, and no mitigation would be necessary.

Public services, such as police and fire services, and public utilities, such as water supply, waste disposal, electrical supply, will either not be used by the Projects or have so little potential to be used that there would be no potential for significant impacts. Further, the number of workers involved in the operations, even if they each were staying in temporary quarters, are so small that there is no potential for adverse impacts. Because these operations are temporary, there will be not increased demand for public schools from worker's dependents. No mitigation measures are required.

Southern California Edison (SCE) owns and operates an above ground electric transmission line that roughly parallels the un-named ephemeral stream channel that runs through "Basalt Canyon" along the northern edge of the Basalt Canyon geothermal exploration area. The center

of Site 55-31 is located approximately 50 feet north of this transmission line, close enough to create the possibility of potential conflicts or hazards from the operation of equipment on the site. Although this is not a potentially significant impact, and no mitigation measures are required to reduce the impacts below the level of significance, a mitigation measure requiring consultation with SCE to minimize the potential for conflicts is recommended.

TRANSPORTATION AND PUBLIC SERVICES MITIGATION MEASURES

TPS-1: Sawmill Road shall be maintained by the permittee during construction, drilling and testing operations, and any other period of high traffic associated with the Projects, to ensure that the road bed is maintained in a condition of at least equal to pre-Projects conditions.

TPS-2: To prevent encroachment of the pads onto Sawmill Road, each of the pads located immediately adjacent to Sawmill Road shall be constructed with at least at 25-foot wide area of undisturbed ground or other low, visually unobtrusive barrier to vehicles between the pad and Sawmill Road.

TPS-3: Project vehicles shall not block Sawmill Road by either stopping for any substantial length of time or parking on Sawmill Road. To reduce the need for Project vehicles to stop for any substantial length of time or park on Sawmill Road, the permittee shall provide an off-site, local location for the long-term parking of vehicles not currently being used for current operations on that site.

TPS-4: If Project operations continue during the winter, MPLP shall erect snow stakes or wands to aid in the removal of snow from Sawmill Road, other access roads, and pads and limit incidental disturbance. Actual removal of snow shall be with a loader or blower, not a bulldozer.

TPS-5 Prior to initiating the construction of the pad on Site 55-31, MPLP shall consult with SCE to regarding adequate separation between SCE's transmission line and the pad and the equipment to be sited on the pad. To the extent feasible, the pad shall be located as necessary to avoid conflicts between the SCE transmission line and the pad location and equipment placement. Should conflicts not able to be resolved between the two parties, any dispute shall be brought to the BLM and USFS, which shall attempt to mediate the dispute.

3.11 HAZARDOUS MATERIALS

Only non-toxic and non-hazardous drilling mud additives would be used during drilling of the slim holes and the geothermal wells.

The construction equipment used to construct the pads and access roads; the engines used to operate the drill rigs; and the engines used to generate electrical energy for the drilling and testing activities, would all use diesel fuel. As much as 550 gallons of diesel fuel per day would be consumed by the drill rig during the drilling of a geothermal well, with substantially lesser amounts consumed by the slim hole drill rig and the construction equipment. During construction of the pads and access roads and drilling of the slim holes, a small, commercial diesel fuel service truck would deliver diesel fuel directly to the fuel tanks of the construction equipment and drill rig. During drilling of the wells, up to 2,000 gallons of diesel fuel would be stored on the well pad in one or more diesel fuel storage tank(s) which would be filled by the same type of commercial diesel fuel service truck. Typical of most construction projects, storage

and use of this fuel may result in minor, incidental spills of diesel fuel to the ground during fueling of equipment and the filling of fuel storage tanks. The plans submitted by MPLP contain a spill or discharge contingency plan that describes the methods for cleanup and abatement of any spills of this type. The potential impacts from these discharges would not be significant, and no mitigation is required. There are no residual significant impacts.

3.12 AIR QUALITY

Both the federal and California state governments have established ambient air quality standards (AAQSs) to protect public health and welfare. National AAQSs have been established for six pollutants, known as "criteria" pollutants because the standards satisfy "criteria" specified in the federal Clean Air Act [the six air pollutants are ozone (O_3), carbon monoxide (CO), oxides of nitrogen (NO_x) as nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than or equal to 10 microns in diameter (PM_{10}), and lead (Pb)]. California has also established ambient standards for these air pollutants, plus sulfates (SO_4) and hydrogen sulfide (H_2S).

The Basalt Canyon geothermal exploration area is located in the Great Basin Valleys air basin. Air quality in this basin, or sub-basins of this basin applicable to the Basalt Canyon geothermal exploratory area, have been designated by the federal government as "attainment/unclassified" (which means it either meets, or is assumed to meet, the applicable air quality standards) for ozone and carbon monoxide, and as "non-attainment" (but meets the applicable standard(s)) for particulate matter. The state has designated the basin (or sub-basins) "non-attainment" for ozone and particulate matter and "attainment" for carbon monoxide, sulfates and hydrogen sulfide. The Great Basin Unified Air Pollution Control District (GBUAPCD) has been delegated responsibility to regulate air pollution and emissions of air pollutants in this basin. The GBUAPCD regulates air quality in the basin through the control of emissions of air pollutants. Regulations adopted by the GBAPCD limit the emission of these criteria air pollutants and their precursors, and the Projects will be required to comply with these emission regulations, principally by applying for and complying with one or more air quality permits.

Principal air pollutant emissions from the Projects are from four types of sources: stationary "point" sources (for example, the air pollutant emissions from the combustion of diesel fuel in the drill rig engines); "fugitive" sources (principally dust generated by vehicles moving on unpaved roads or windblown dust); mobile combustion sources (that is, the "tailpipe" emissions from the construction equipment, delivery truck, etc.); and "other" sources (such as vapor emissions from the storage of diesel fuel in storage tanks).

MPLP has committed to a number of actions to limit air pollutant emissions. MPLP would obtain required permits from the GBUAPCD and comply with any requirements prescribed by the GBUAPCD concerning emissions of air pollutants from the drill rig engines and non-condensible gases from the geothermal fluid during flow tests. Based upon the estimated amount of diesel fuel which would be used by the drill rig engines during slim hole and geothermal well drilling (a maximum of 900 gallons per day), and the application of diesel engine timing retard, air pollutant emissions are calculated at less than 250 pounds per pollutant per day. This emission rate falls below the GBUAPCD's thresholds for requiring the application of best available control technology (BACT) and mitigation for net emission increases (emission offsets); thus, BACT and emissions offsets will not be required. Estimated emissions of hydrogen sulfide during geothermal well flow testing would also fall below GBUAPCD regulatory limits (Rule 424 C., 2.5 kilograms (5.5 pounds) per hour per well), and no abatement would be required. MPLP has proposed that fugitive dust, which would otherwise be generated during construction and travel over access roads and well sites, would be minimized by watering, consistent with GBUAPCD Rule 401, and vehicle speeds would be limited on unpaved roads to 15 miles per hour to further reduce dust emissions. Annual emissions (conservatively assuming that all activities are conducted in the same year) for each air pollutant are below ten tons. These low levels of air

pollution emissions ensure that the Projects' impacts on air quality are below the level of significance. No mitigation measures are necessary to reduce impacts below the level of significance, but several measures are recommended to ensure the implementation of the mitigation proposed by MPLP. There are no residual significant impacts.

Mobile vehicle combustion emissions are controlled by state and federal laws and regulations, which limit the amount of air pollution each vehicle may emit. The total number of vehicle trips (passenger vehicle, small truck, and large truck) generated by these Projects is expected to be small, likely less than 250 truck trips and 500 passenger vehicle/small truck trips, and the total air pollution emissions from these vehicles would be very small. The small size of the diesel-fuel tank(s) and the limited amount of diesel fuel used for the Projects would also limit the amount of air pollutants emitted from these sources to a very small quantity. These limits on air pollution emissions would ensure that the Projects' impacts on air quality are below the level of significance. No additional mitigation measures are required, and there are no residual significant impacts.

AIR QUALITY MITIGATION MEASURES

AIR-1: In order to limit NO_x emissions to less than 250 pounds per day, diesel engines shall have ignition timing retarded at least 2 degrees, and total consumption of diesel fuel for each drill rig shall be limited to an actual (not average) throughput of 900 gallons per day. Fuel flow shall be maintained at each drill site and shall be made available to the District staff upon request. If NO_x emissions exceed 250 pounds per day, Best Available Control Technology shall be applied to each diesel engine.

AIR-2: The permittee shall discharge into the atmosphere from any geothermal well, including well drilling, well reworking and well testing, more than 2.5 kilograms per hour per well (kg/hr/well) of hydrogen sulfide (H_2S). If the emission of H_2S from any well exceeds 2.5 kg/hr, or the State's H_2S ambient air standard for one hour is exceeded at a monitoring station located at a District approved site, further venting of that well containing H_2S will be curtailed until an H_2S abatement plan, approved by the District, is implemented to reduce H_2S well emissions below 2.5 kg/hr and ambient concentrations below the State standard of 0.03 parts per million. Such plan shall include a description of the abatement technology, the degree of control expected from such technology, and the test data indicating that such degree of control can be expected in a geothermal well application; and air quality analysis showing that the use of such abatement technology will not result in any violation of the State ambient air quality standard for H_2S.

AIR-3: If, during drilling, excessively high concentrations of H_2S are encountered, the applicant will notify the District within 24 hours and either put into operation new or additional H_2S abatement capacity as approved by the District, or cease operation and close in the well according to appropriate standards of operation. For the purpose of this condition, excessively high concentrations of H_2S will mean emissions greater than 5 lbs/hr.

AIR-4: The permittee shall apply water during the construction and utilization of pads and access roads as necessary to control dust. Dust shall not be discharged into the air for a period or periods aggregating more than three minutes in any one-hour that is as dark or darker in shade as that designated and No. 1 on the Ringelmann Chart.

3.13 NOISE

Noise is most often measured in decibels (dB), units that measure the apparent loudness of sound. Because the human ear is more sensitive to some sound frequencies than others, sound measured by a noise meter is typically adjusted so that it approximates what would be heard by

the human ear. Units of noise measurement recorded by such an adjusted noise meter are termed "A-weighted decibels" (dBA). Because noise levels in the environment fluctuate with time, a time-averaged noise level in dBA is often used to characterize the noise environment at a given location. The "day-night equivalent noise level" (L_{dn}) is a 24-hour time-averaged noise measurement to which a 10-dBA "penalty" is added between 10:00 p.m. and 7:00 a.m. to account for greater nighttime noise sensitivity.

The Noise Element of the Mono County General Plan identifies goals and policies to attain and maintain acceptable noise levels (Mono County, 1993). Mono County Code, Chapter 10.16, Noise Regulation sets noise standards for the various categories of land use, and prohibits noise levels on these lands from exceeding the applicable noise standard for a cumulative period for more than thirty minutes in any hour (or the standard plus five dB for 15 minutes, or plus ten dB for five minutes, or plus 15 dB for one minute, but not more than plus 20 dB). For the "noise zone classification" of "suburban," the exterior noise limit is 50 dBA from 10:00 p.m. to 7:00 a.m., and 55 dBA from 7:00 a.m. to 10:00 p.m., in the "receiving land use category" of "multiple dwelling residential public space," the category which most likely could be applied to areas like Shady Rest Park. The Mono County Noise Regulation also suggests that if technically and economically feasible, relatively long-term construction (periods of ten days or more) should not exceed 65 dBA during weekday daylight hours (55 dBA daily 7:00 p.m. to 7:00 a.m. and all day Saturday, Sunday and legal holidays) in "type II areas multi-family residential areas."

Chapter 8.16 of the Town of Mammoth Lakes Municipal Code also limits excessive noise. Section 8.16.070 (exterior noise limits) establishes noise levels that may not be exceeded based upon the nature of the receiving land use, the time of the day that the noise occurs and the distribution over time of the noise levels generated by the source. Section 8.16.090 of the Noise Ordinance specifically addresses noise from construction activities.

The U.S. Department of the Interior has issued Geothermal Resources Operational (GRO) Orders to regulate geothermal resource operations on federal geothermal leases. GRO Order No. 4, General Environmental Protection Requirements, requires geothermal lessees to comply with federal occupational noise exposure levels or state standards for protection of personnel, whichever are the more restrictive. Further, GRO Order No. 4 requires that the federal geothermal lessee "shall not exceed a noise level of 65 dBA for all geothermal-related activity including, but not limited to, exploration, development, or production operations, as measure at the lease boundary line or 0.8 km (one-half mile) from the source, whichever is greater."

Noise levels in the Basalt Canyon geothermal exploration area have not been measured, but are assumed to be typical of similar, rural environments, where ambient sound levels can range from below 30 to above 50 dBA. Typical sounds consist primarily of the natural forest sounds of birds, wind, and insects, punctuated by occasional vehicular noise from the very lightly traveled Sawmill Road and the sound of the infrequent low-flying aircraft approaching and departing from Mammoth/June Lakes airport, located approximately five miles to the east. Existing ambient noise levels are likely higher at Site 55-31 and Site 35-31 due to these sites proximity to the heavily traveled U.S. Highway 395 and/or State Route 203 (Site 55-31 is located approximately 1,500 feet from, and is visible from, both U.S. Highway 395 and State Route 203, while Site 35-31, located approximately 1,800 feet from State Route 203, is not directly visible from this section of the highway).

The closest noise-sensitive concentrated land use is the USFS Pine Glen group campground, located approximately 2,300 feet (approximately 0.43 miles) from Site 31-36, and Shady Rest Park, a Town of Mammoth Lakes-developed sports and recreation park located on USFS land approximately 1,600 feet (approximately 0.30 miles) from Site 31-36. No other sites are located

within 0.5 miles of any noise-sensitive concentrated land use. Pine Glen group campground is located approximately 1,000 feet (0.19 mile) from State Route 203.

Pad and access road construction activities, which would be conducted only during daylight hours and over only a few daytime periods, would likely use construction equipment that would generate a maximum noise level of as much as 83 dBA at a distance of 50 feet (BLM et. al. 1998). Using the usually conservative simple assumption of hemispherical attenuation of the sound with distance, a reduction of 6 dBA per doubling of the distance is calculated. Thus, at a distance of 1,600 feet, pad construction noise would be reduced to 53 dBA; at a distance of 2,300 feet, pad construction noise would be reduced to approximately 51 dBA. From Site 31-36, which is located within a Jeffrey Pine forest and over a slight topographic rise from either of its nearest noise-sensitive neighbors, the noise levels would likely be noticeably less. Some individual sounds may be audible at each of these locations, but the general construction noise levels would likely not be noticeable at the Pine Glen group campground because of the ambient noise levels generated by its proximity to State Route 203. Pad and access road construction noise levels of 53 dBA and 51 dBA would be well below the 65 dBA construction noise criteria, and would not be significant. Noise levels from construction activities at the other sites would be substantially less at the nearest noise-sensitive receptors. Although individual forest users of Sawmill Road within about 0.5 mile of each site would be able to hear pad and access road construction activities, the numbers of exposed persons is very small, and these sounds would be temporary, so the impacts would not be significant. No mitigation measures are needed, and there are no residual significant impacts.

Like pad and access road construction, slim hole drilling, geothermal well drilling, and geothermal well flow testing would each also be temporary "construction" activities, lasting between an estimated 12 (slim hole drilling) and 20 days (geothermal well drilling). However, unlike the pad and access road construction activities, these drilling operations would be conducted 24-hours per day. Geothermal well drilling produces more noise than the other 24-hour per day operations, as it uses more, larger engines. In addition, it produces much of its noise around the drill rig floor, located from 25 to 35 feet above the ground; and can produce occasional "impact" noises, such as the banging pipes or tools, which may be particularly noticeable. However, because geothermal well drilling engines are typically run at constant speeds and are generally well muffled, the overall noise emissions from geothermal well drill rigs is usually appreciably less than that emitted from construction equipment (BLM et. al. 1998). Conservatively assuming that the well drilling noise emissions are equivalent to the noise emissions from pad and access road construction, noise levels from geothermal well drilling from the site closest to noise-sensitive receptors, Site 31-36, would be 53 dBA at the Shady Rest Park and 51 dBA at the Pine Glen group campground. These noise levels may be audible at these locations, especially at night when the ambient noise level would be lower, but would both be below the BLM 65 dBA criterion and the Mono County nighttime construction noise criteria of 55 dBA. For these reasons, and also based upon the short duration of the activities generating noise, noise impacts would not be significant.

Noise levels from geothermal well drilling, slim hole drilling, and geothermal well testing at the other sites would be substantially less at the Shady Rest Park and Pine Glen group campground. Individual forest users of Sawmill Road within about 0.5 mile of each site would be the most affected by pad and access road construction noise. The numbers of exposed persons is very small, however, and these sounds would be temporary, so the overall impacts would not be significant. No mitigation measures are needed, and there are no residual significant impacts.

3.14 RECREATION

Recreation is considered the most significant resource of the Inyo National Forest, and will remain so in the foreseeable future (Forest Service, 1988). Presently, recreational uses characterize about 34 percent of the entire acreage in Inyo National Forest. Three types of recreation are defined: recreation at developed sites, alpine skiing, and dispersed recreation. Recreational opportunities in the Basalt Canyon geothermal exploration area fall into the "dispersed recreation" category, which also represents the dominant form of recreation in the Inyo National Forest.

Dispersed recreation activities in the Basalt Canyon geothermal exploration area are focused on and around Sawmill Road and the adjoining road/trail systems. Summer dispersed recreational activities in the Basalt Canyon geothermal exploration area include walking, dog walking, jogging, bicycling, and off-highway vehicle ("OHV") use. During the winter months, additional activities include snowmobiling, cross-country skiing, and snowshoeing. Dispersed recreational user intensity is considered to be moderate in the Basalt Canyon geothermal exploration area. Dispersed recreational activity is generally higher in spring through fall, with less intensive dispersed recreational use during the winter months, in part because the Basalt Canyon geothermal exploration area lies at a relatively lower elevation which receives less snow than other areas within Inyo National Forest used more heavily for dispersed winter recreation. Sawmill Cutoff (Forest Road 3S08), at the western end of Sawmill Road, is a main staging area for winter recreational activities that include snowmobiling, snowshoeing, cross-country skiing, and other winter sports.

Shady Rest Park, a Town of Mammoth Lakes-developed sports and recreation park, is located on USFS land between the western end of Sawmill Road (Forest Road 3S25) and Sawmill Cutoff (Forest Road 3S08). The park receives substantial use by individuals and organized groups for bicycle riding, softball, soccer and skateboarding during the late spring, summer and fall months, but is currently closed to wheeled vehicles during the winter months. However, the Town of Mammoth Lakes has recently proposed that new facilities, including an ice skating rink and winter trails, be constructed to establish Shady Rest Park as a new staging area for winter recreational activities, many of which (such as snowmobiling, showshoeing, and cross country skiing) are already concentrated along Sawmill Cutoff, which is a major winter recreational corridor (Personal Communications, Bill Taylor and Dave Wilbrecht, Town of Mammoth Lakes, October 2001; Bill Sauser, President of Snowmobile Association and Town of Mammoth Lakes Park and Recreation Commissioner, October 2001).

Impacts from the Projects on dispersed recreation would be related to the level of changes in the road and trail system resulting from the Projects and in the perceived affects of the Projects on the recreational experience, principally from traffic, visual, and noise effects. All of the roads and trails into and around the Basalt Canyon geothermal exploration area would remain open to forest users throughout all phases of the Projects, except when construction of a pad, access road, or temporary pipeline may need to close a road to traffic for a few minutes. Project traffic would not exceed the capacity of Sawmill Road, and MPLP has committed to restricting Projects vehicles to traveling at speeds no greater than 15 miles per hour over Sawmill Road (see Section 3.10). Traffic impacts to dispersed recreation would not be significant, but would be a noticeable increase during the short, temporary periods of construction, drilling, and well testing (see Section 3.10). Visual impacts might be of great concern to the individual dispersed recreational user of the Basalt Canyon geothermal exploration area, but will be of short duration and not significant to overall recreation use (see Section 3.3). Similarly, noise impacts would be noticeable to the individual dispersed recreational user of the Basalt Canyon geothermal exploration area, but would also not be significant (see Section 3.13). No mitigation measures are required, and there are no residual significant impacts.

At its southeastern edge, Shady Rest Park is located approximately 1,600 feet (approximately 0.30 miles) from Site 31-36. There should be no visual impacts to users of this park because the

surrounding trees should hide from view all of the Projects facilities and operations. Noise produced from operations conducted on Site 31-36 may be perceptible at Shady Rest Park (see Section 3.13), but will likely not be intrusive, considering the relatively intense recreational activities typically conducted at the park. None of these effects are significant, and no mitigation measures to reduce impacts to below the level of significance are required. There are no residual significant impacts.

Projects traffic entering the Basalt Canyon geothermal exploration area along Sawmill Road from State Highway 203 would not affect Shady Rest Park or the winter recreation concentrated along Sawmill Cutoff. Access from Sawmill Cutoff to Sawmill Road would travel through the short access road to, and parking areas of, Shady Rest Park, and winter access along this same route may require some snow removal, which could affect the quality of the winter recreational users of Sawmill Cutoff at this southern end of the Road. Because MPLP has indicated that primary access to Sawmill Road for all of the Projects sites would be from State Route 203 near its intersection with U.S. Highway 395, these impacts are not significant, and no mitigation measures to reduce the effects of impacts to below the level of significance are needed. However, a mitigation measures is proposed to ensure that the Projects impacts on recreational use of Shady Rest Park is minimized. Winter over-the-snow use, such as snowmobile and cross country skiing, would be eliminated between the junction with State Highway 203 and which ever drill site is occupied, if drilling activities are completed during winter months and Sawmill road is plowed.

RECREATION MITIGATION MEASURES

REC-1: To minimize impacts to the recreational uses of Shady Rest Park, access to the Basalt Canyon geothermal exploration area by Projects vehicles (whether MPLP, contractors or others) shall be on Sawmill Road from State Route 203; no Project access shall be through Shady Rest Park.

4 NO ACTION ALTERNATIVE

The No Action alternative would prevent MPLP from undertaking the geothermal resource exploration activities as proposed and described in the plans of operation and this EA for the Basalt Canyon geothermal exploration area. None of the environmental impacts described in Section 3, above, would occur, and although no mitigation measures were required to mitigate significant environmental impacts, those mitigation measures recommended to further reduce the potential impacts of the Projects would not be recommended. The geologic and production information anticipated from the proposed operations would not be developed, and no revenues from these geothermal leases would be anticipated in the future.

5 CUMULATIVE EFFECTS

Cumulative impact is the impact on the environment, which results from the incremental impact of the actions when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Potential past, present and reasonably foreseeable future actions which could be considered as potentially adding to the impacts resulting from the proposed actions include the existing Casa Diablo geothermal power plants (MP-I, MP-II, and PLES-I); the Casa Diablo 4 Geothermal (CD4) Project, proposed also for the Casa Diablo area; the proposed Mammoth Yosemite Airport Expansion Project, and the following other projects planned in the region, as listed in the Mammoth Yosemite Airport Expansion Project Draft Supplement to Subsequent Environmental Impact Report (SSEIR): Intrawest Development; Eastern Sierra College; Sherwin Bowl Ski Area; Sierra Business Park; Mammoth Lakes Airport Commercial Development Plan; Inaja Ranch Land Company; Lake Ridge Ranch; Rimrock Ranch; and Pacifica Residential Development (Town of Mammoth Lakes, 2001). However, none of these projects are located within the Basalt Canyon geothermal exploration area, and only the existing Casa Diablo geothermal projects and the proposed CD4 Project are located in the vicinity of the Projects. The Basalt Canyon Projects are within the drainage area of an unnamed ephemeral stream (section 3.8, Hydrology). The only other existing or reasonably foreseeable activities within this drainage include the vehicular use of existing roads, sheep grazing, and the continued use of the Shady Rest park and campground. The drainage includes approximately X acres of existing roads. Drilling could add up to 3.3 acres of disturbed ground as a potential sediment source. Relocation of 1 sheep bedding ground could ad an additional 1 acre of sediment source. The additional 4.3 acres of potential disturbed ground could act as additional site for the spread of noxious weeds.

The proposed actions are each and all very short-term "construction" activities, which result in, at most, minor, temporary impacts to the environment. Because of this, and the lack of proximity of the other projects to the Projects, cumulative impacts to cultural resources, visual resources, vegetation, noxious weeds, wildlife, soils, geology, minerals, hydrology, grazing, transportation, public services, hazardous materials, noise, and recreation were judged to be clearly not cumulatively considerable. Thus, no further analysis was conducted, and no mitigation measures to reduce cumulative impacts to below the level of significance were required.

Air quality in the region of the Basalt Canyon geothermal exploration area has been designated as "non-attainment" (but meets the applicable standard(s)) for particulate matter under federal standards, and "non-attainment" for ozone and particulate matter under state standards. This is interpreted to mean that a cumulatively significant impact to air quality already exists for these air pollutants. However, because the Projects' emissions are very small, are temporary, and fall well below the *de minimus* levels (100 tons per year for PM_{10} and NO_x and 50 tons per year for volatile organic compounds [VOCs - a precursor to ozone]) set by the U.S. Environmental Protection Agency (USEPS) for project conformity with the applicable air quality management plan, the Projects would have a *de minimus*, non-significant contribution to this existing cumulatively significant impact. Thus, no mitigation measures to reduce cumulative impacts to below the level of significance were required.

6 REFERENCES AND PERSONS AND AGENCIES CONSULTED

REFERENCES

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8 LIST OF ACRONYMS

AAQS	Ambient Air Quality Standards
BACT	Best Available Control Technology
BLM	Bureau of Land Management
BMP	Best Management Practices
BOPE	Blow Out Prevention Equipment
CEQ	Council of Environmental Quality
CEQA	California Environmental Quality Act
CRWQCB	California Regional Water Quality Control Board
dBA	A-Weighted Decibels
EA	Environmental Assessment
EIS	Environmental Impact Statement
GBUAPCD	Great Basin Unified Air Pollution Control District
GRO	Geothermal Resource Operational
KGRA	Known Geothermal Resource Area
LRMP	Land and Resource Management Plan
MCWD	Mammoth Community Water District
MDB&M	Mt. Diablo Baseline and Meridian
MPLP	Mammoth Pacific, L.P.
NEPA	National Environmental Policy Act
OHV	Off-Highway Vehicle
SCE	Southern California Edison
SNFPA	Sierra Nevada Forest Plan Amendments
USFS	United States Forest Service
VQO	Visual Quality Objectives

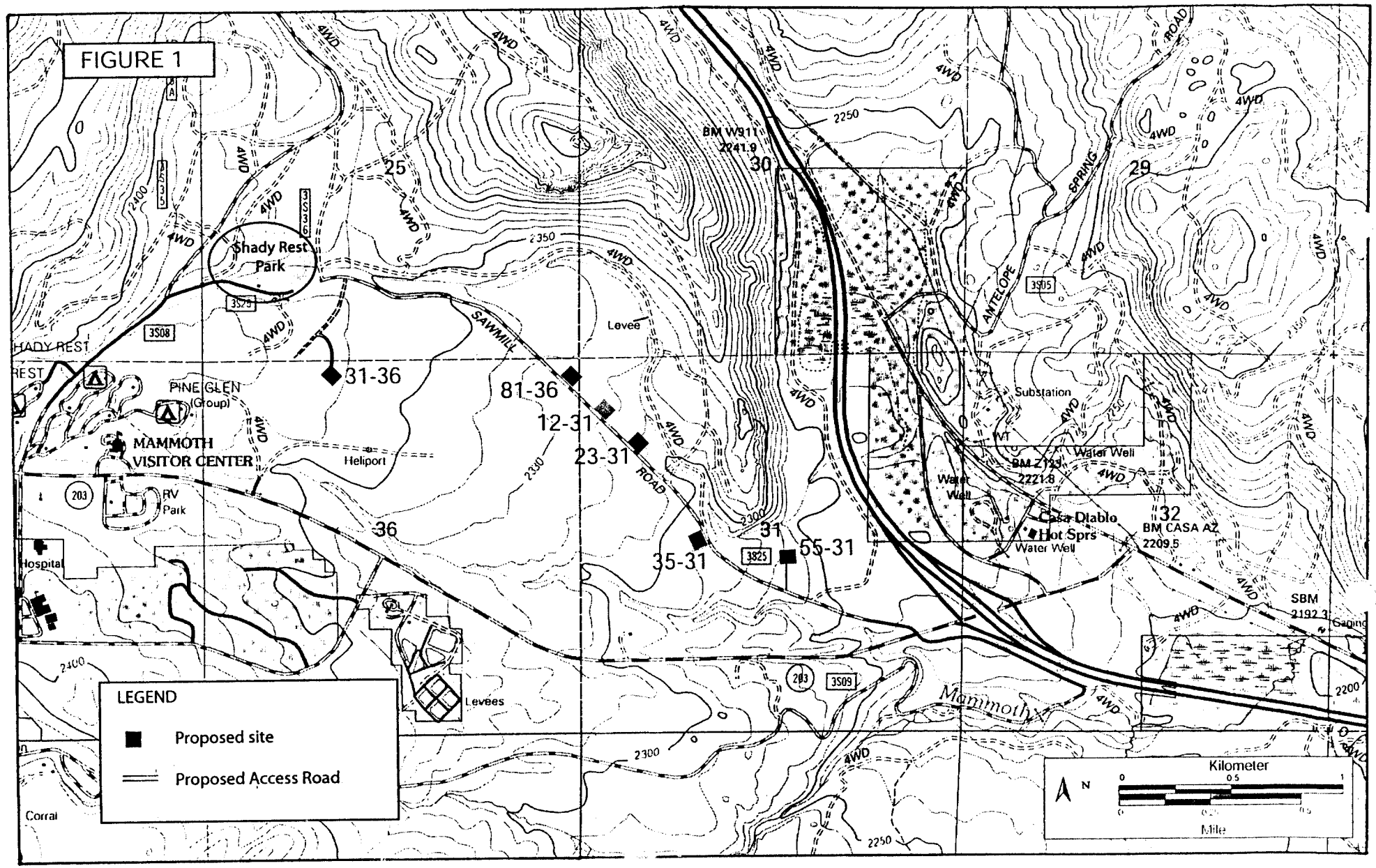
FIGURE 1
Shady Rest Park
PINE GLEN (Group)
MAMMOTH VISITOR CENTER
RV Park
Heliport
Hospital
Levee
Levees
Corral
SAWMILL
ANTELOPE
SPRING
ROAD
Substation
Water Well
Casa Diablo Hot Sprs
BM CASA AZ 2209.5
BM W911 2241.9
BM Z733 2221.8
SBM 2192.3
Mammoth
31-36
81-36
12-31
23-31
35-31
55-31
25
30
29
31
32
36
LEGEND
Proposed site
Proposed Access Road
N
Kilometer
Mile

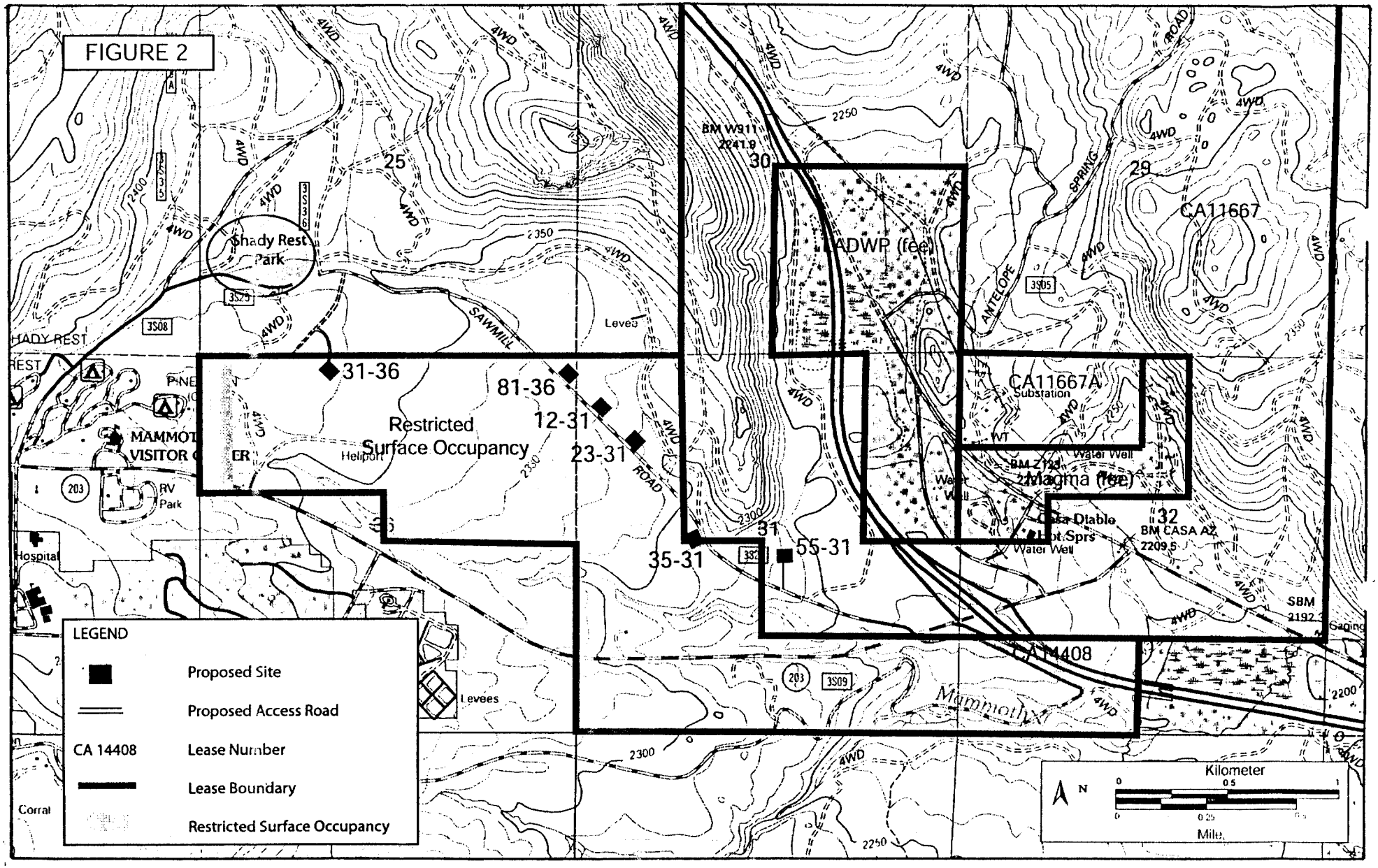
FIGURE 2
Shady Rest Park
31-36
81-36
12-31
23-31
35-31
55-31
Restricted Surface Occupancy
LADWP (fee)
CA11667
CA11667A
Substation
Magma (fee)
CA14408
Mammoth Lakes
Casa Diablo Hot Spgs
Water Well
BM CASA AZ
Z209.5
BM W911
2241.9
Levees
Heliport
Hospital
RV Park
Corral
Sawmill
Antelope
Spring
Road
LEGEND
Proposed Site
Proposed Access Road
CA 14408
Lease Number
Lease Boundary
Restricted Surface Occupancy
N
Kilometer
Mile

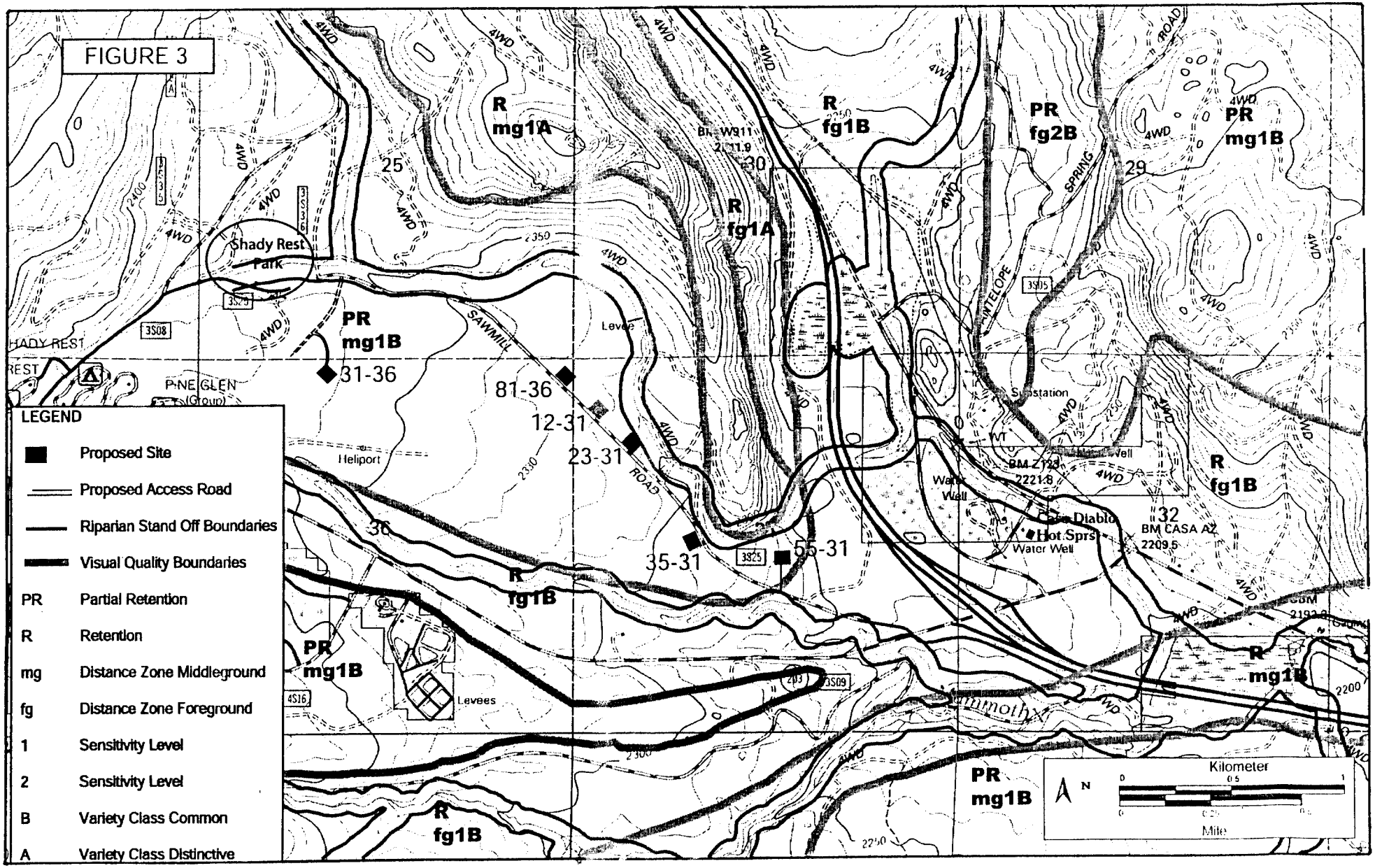
FIGURE 3
LEGEND
Proposed Site
Proposed Access Road
Riparian Stand Off Boundaries
Visual Quality Boundaries
PR Partial Retention
R Retention
mg Distance Zone Middleground
fg Distance Zone Foreground
1 Sensitivity Level
2 Sensitivity Level
B Variety Class Common
A Variety Class Distinctive
R mg1A
R fg1B
PR fg2B
PR mg1B
R fg1A
31-36
81-36
12-31
23-31
35-31
55-31
Shady Rest Park
SHADY REST
PINE GLEN (Group)
SAWMILL
ROAD
Heliport
Levees
Water Well
Hot Sprs
BM CASA AZ 2209.5
Kilometer
Mile

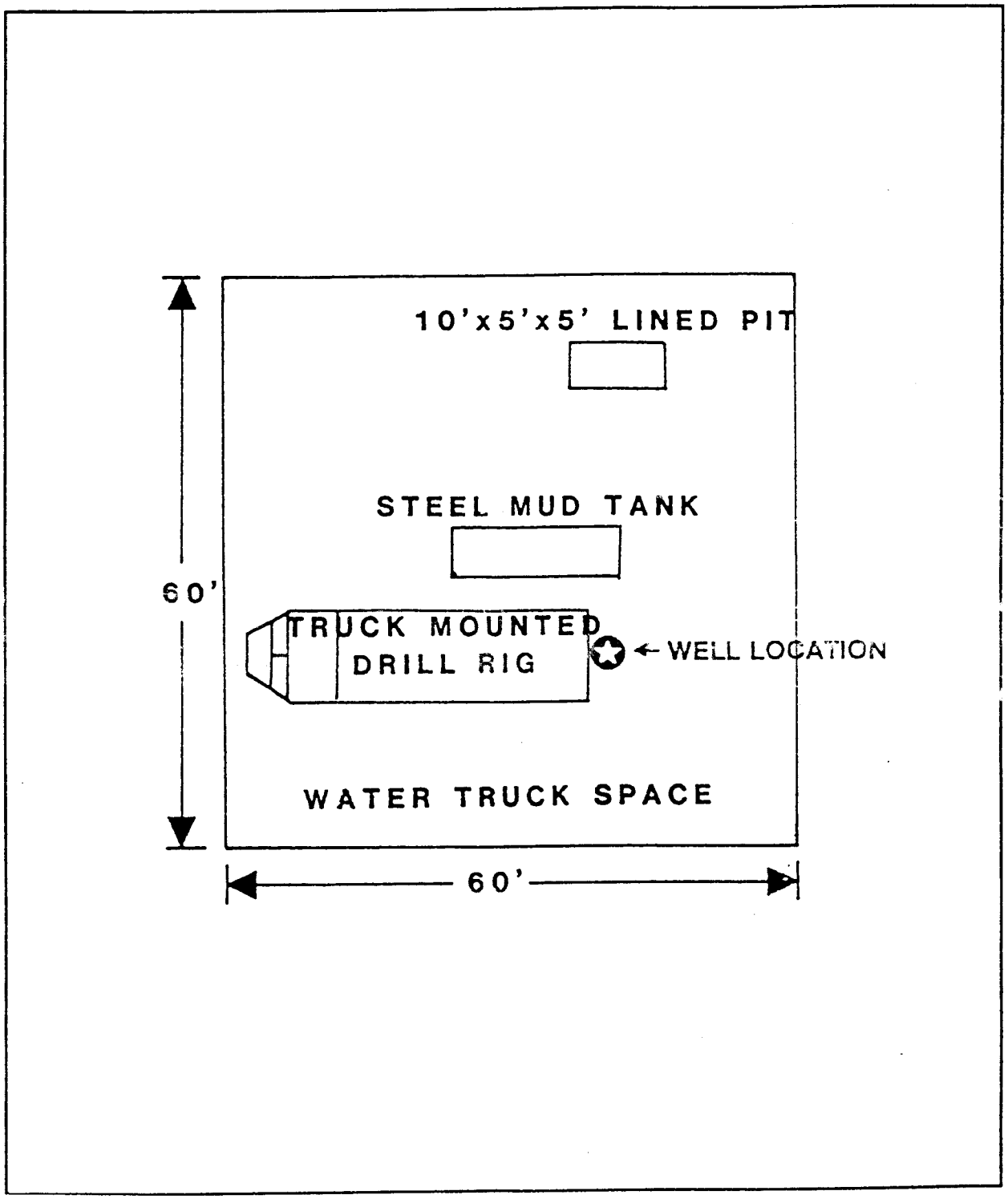

Figure 4: Typical Slim Hole Site and Equipment Layout

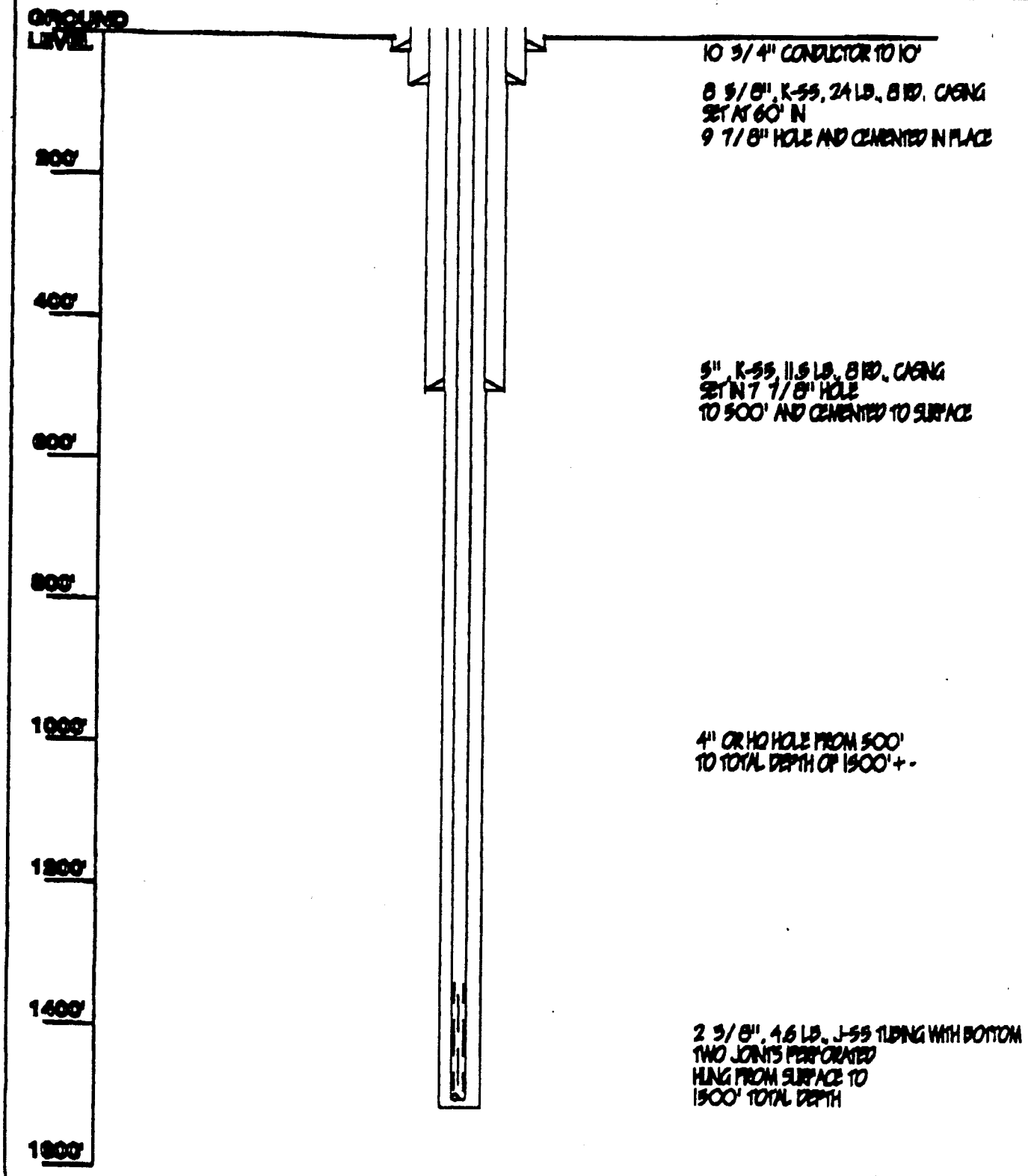

FIGURE NUMBER 5	THERMASOURCE INC.	DATE
	Mammoth Pacific Slim Hole Completion Profile	8-8-01

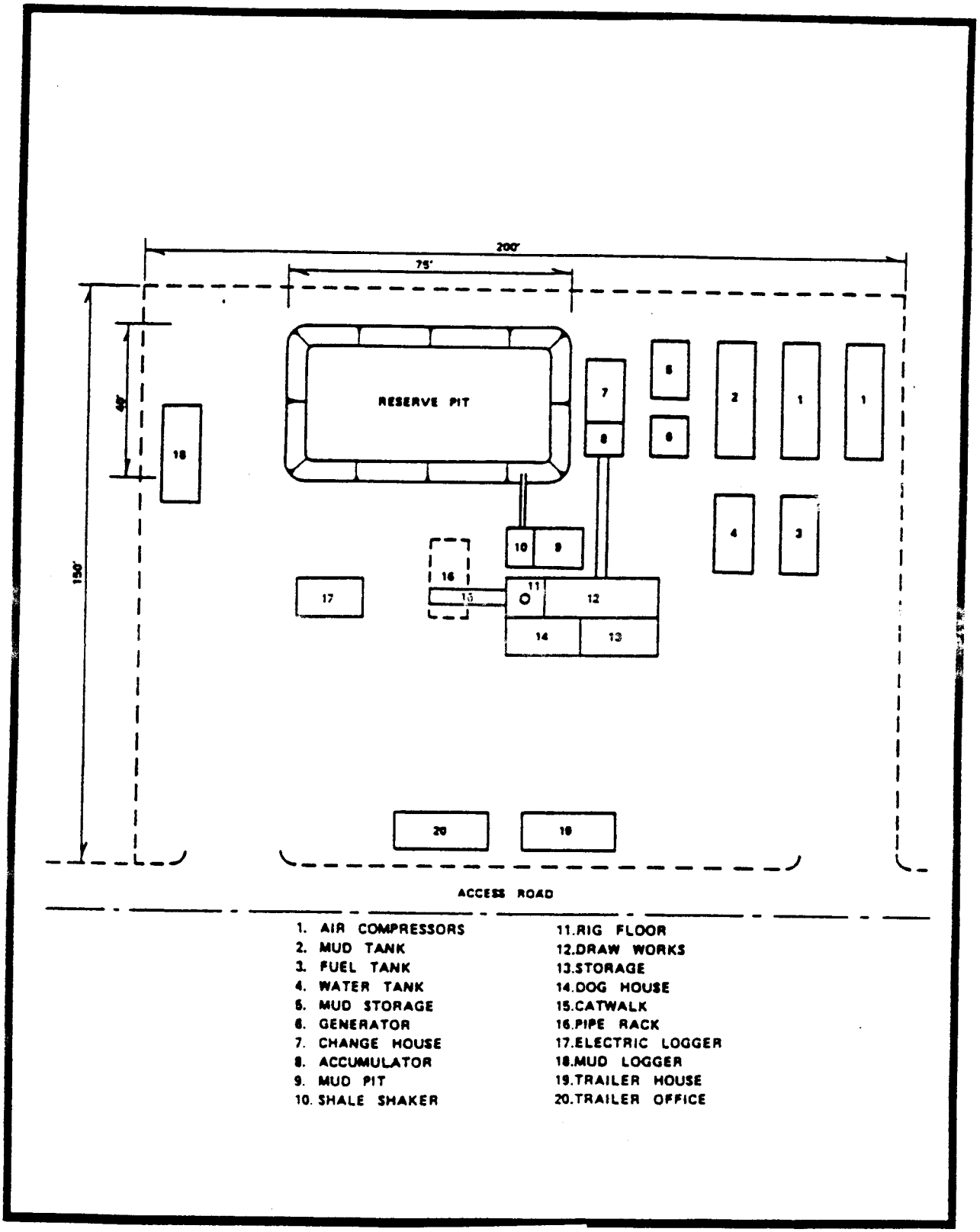

Figure 6: Typical Drill Pad and Equipment Layout

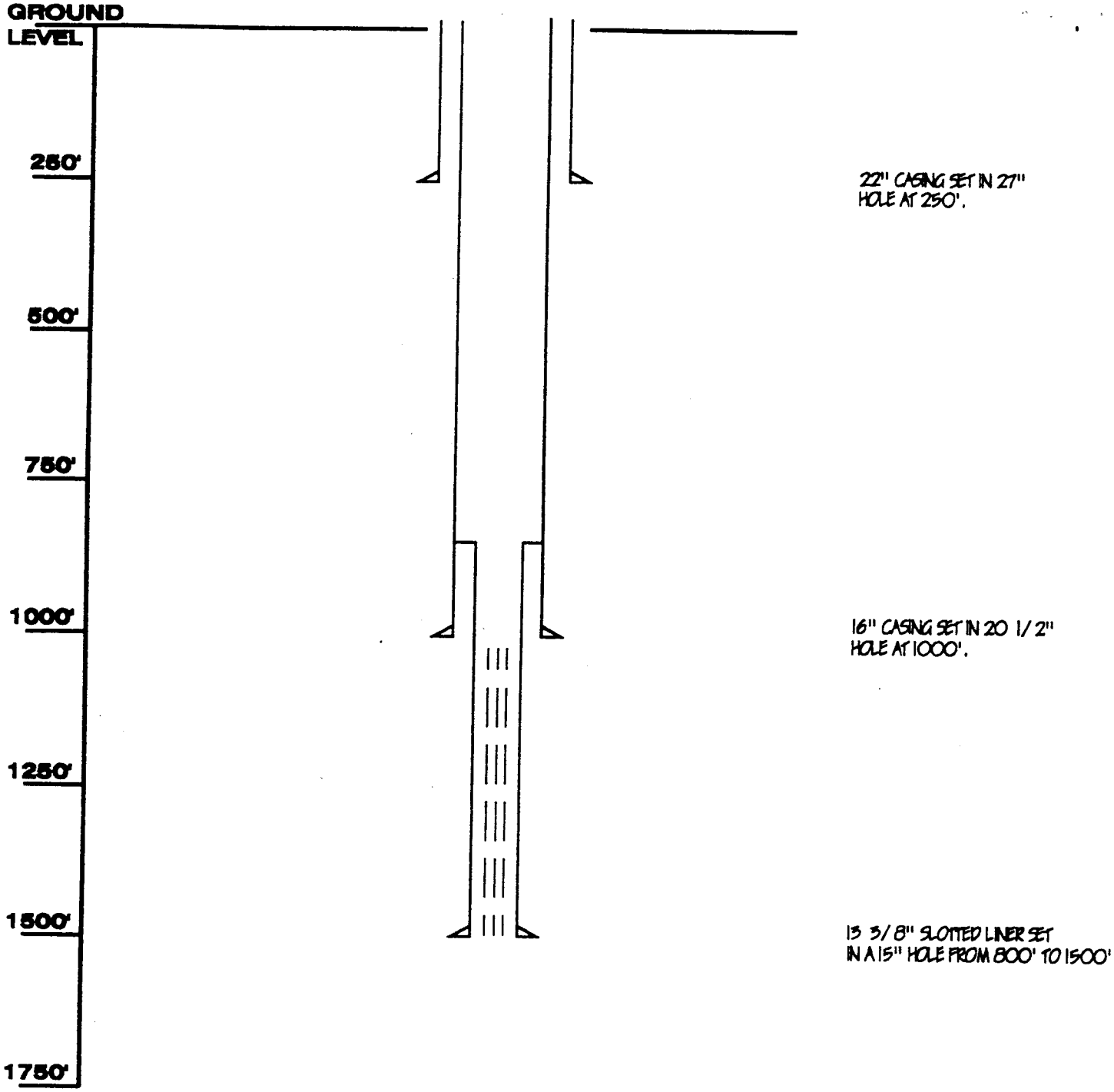

FIGURE NUMBER 7	**THERMASOURCE, INC.**	**DATE**
	MAMMOTH PACIFIC L.P. COMPLETED WELL PROFILE 1500' PRODUCTION WELL	6-1-01

APPENDIX A

BOTANICAL RESOURCE SURVEYS

Botanical Survey for the Basalt Canyon Geothermal Site, Mammoth Lakes

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June 28, 2001

Botanical Survey for the Basalt Canyon Geothermal Site, Mammoth Lakes

June 28, 2001

Introduction

This report communicates the results of botanical survey work performed at the proposed geothermal energy exploration site known as Basalt Canyon during May and June 2001. Basalt Canyon (referred to as "study area" in this report) encompasses a single parcel of 800 acres of land administered by the Inyo National Forest, and several acres of adjacent privately owned property (Figure 1). National Forest lands are situated to the north and west of the Highway 203 interchange with Highway 395, while private land is located to the north and east of the interchange. The western edge of the Basalt Canyon study area approaches to within 1 mile of the Town limits of Mammoth Lakes, Mono County, California .

The Basalt Canyon site is located on the eastern flank of the Sierra Nevada Mountains at an average elevation of 7650 ft. The montane climate is influenced by a rain shadow effect due to the close proximity of the steeply rising Sierra Nevada Mountains to the west. Winter and spring precipitation averages about 30 inches, with up to 80% falling as snow. The average winter temperature is 30° F. The frost-free growing season for plants is 80-100 days and is characterized by low humidity and moderate daytime temperatures. The average summer temperature is 70° F (NRCS, 1996).

The majority of the habitat available for plants is summer xeric. Gently rolling, dry slopes undulate across the entire study area, except for one steep north-south ridge near Highway 395 (Figure 1). Soils are thin to very thin pumice sands and loose alluvium overlying fractured basalt bedrock. In some areas, the rooting horizon that is available for plants consists mainly of pumice-filled cracks between large basaltic slabs. Active fumarole areas are relatively moist but support virtually no vegetation. Other areas that remain relatively moist throughout the growing season were not found in the study area. Consequently, none of the dominants and very few of the plant species occurring in the scrub and forest communities can be said to have a phreatophytic habit. Ephemerally flowing stormwater drainage that occurs in a naturally formed channel known as Murphy Gulch provides the only significant hydrological feature in areas of active plant growth. Flows occur here during snowmelt and after brief summer thunderstorms. Even in this channel, no springs, seeps or wet swales are present to provide wetland microhabitats.

Because of its close proximity to the Town of Mammoth Lakes, historical practices ranging from silviculture to road-building have influenced the assemblage of plant species. Disturbance associated with use of the channel for landfill, and dam-building for sediment retention purposes, have impacted plants in Murphy Gulch. Ongoing and recent human disturbance appears to be relatively light and inconsequential outside this channel, aside from occasional trampling by vehicles driven off-road. Within

lands administered by the Inyo National Forest, small forest gaps and disturbed roadsides are the only widespread microhabitat variations maintained by recent human use. Throughout the study area, the most significant habitat variation is provided by usually gradual but sometimes rapidly changing combinations of slope aspect and soil depth.

Methods

A literature search was performed in May 2001 in order to develop a list of potentially occurring rare plant species. The literature search and subsequent review by personnel from the Inyo National Forest, Bishop Office, identified six rare plant species, *Astragalus monoensis* var. *monoensis* (Mono milkvetch), *Botrichium crenulatum* (scalloped moonwort), *Epilobium howellii* (subalpine fireweed), *Lupinus duranii* (Mono Lake lupine), *Plagiobothrys glomeratus* (Mammoth popcorn flower), and *Sedum pinetorum* (Pine City sedum), which could potentially occur in the Basalt Canyon study area (Table 1). The literature search included use of regional rare plant lists (Mono County Planning Department, 1993, Halford and Fatooh, 1994, Skinner and Pavlik, 1994, USDA Forest Service, 1998a, 1998b, 2001, California Department of Fish and Game, 2001a), published floras (Cronquist, *et al.*, 1984, Hickman, 1993), and environmental documents for area projects (Bagley, 1995, 1997, Paulus, 1999, 2000). Potentially occurring plant species were considered to be "rare" if they have current state or federal status as rare, threatened or endangered (California Department of Fish and Game, 2001b), are listed in the California Natural Diversity Database (CNDDB) list of special plants (California Department of Fish and Game, 2001a), are listed by the California Native Plant Society in their inventory of sensitive California plants (Skinner and Pavlik, 1994), or are included in the most recent sensitive plant or watch lists prepared by Inyo National Forest (U.S. Forest Service, 1998a, 1998b).

A search of CNDDB occurrences within the USGS Old Mammoth 7.5 minute quadrangle was performed in May, 2001. Documented occurrences of rare plant species within the study area were not found. Search results do indicate that three rare plant species (3 occurrences of *Lupinus duranii*, one occurrence of *Plagiobothrys glomeratus*, and one occurrence of *Astragalus monoensis* var. *monoensis*) and one sensitive plant community (Mono Pumice Flats) occur within five miles of the Project Area. The milkvetch *A. monoensis* is a federal Species of Concern and has been state listed as "Rare" since July, 1982. The small perennial *L. duranii* is a federal Species of Concern. Both are typically restricted to open pumice flat habitat, either within the Mono Pumice Flat community or in relatively open pumice soil amid Great Basin Mixed Scrub habitat (Holland, 1986, Bagley, 1995). The CDFG considers Mono Pumice Flats to be a sensitive habitat. The Mono Pumice Flats community, a *Chrysothamnus parryi - Achnatherum occidentalis* ssp. *pubescens* (syn. *Stipa elmeri*) association, is distinctive in composition and height from Great Basin scrubland communities. *Plagiobothrys glomerata*, the only annual species on this list, has not been recorded in the Mammoth area by CNDDB, but potential past occurrences "in the Mammoth area" are noted by Bagley (1997). This species occurs in similar dry habitat in Nevada.

Table 1. Sensitive plant species potentially occurring within the search corridors for the Basalt Canyon geothermal exploration transects. Flowering period data is from Skinner and Pavlik (1994). A key to the rank or status symbols follows the table.

Scientific/Common Name Life Form	Rank or Status[1]				Habitat	Flowering Period
	USFWS	DFG	USFS	CNPS		
Astragalus monoensis var. *monoensis* Mono milkvetch herbaceous perennial	SC	R	S	1B	Open scrub, sand or pumice	June-August
Botrychium crenulatum scalloped moonwort herbaceous perennial	SC	SC	S	1B	Open forest, meadows, marshy	fertile June-July
Epilobium howellii subalpine fireweed herbaceous perennial			S	1B	Meadows, wet margins	July-August
Lupinus duranii Mono Lake lupine herbaceous perennial	SC	-	W	1B	Open scrub, pumice	May-July
Plagiobothrys glomeratus Mammoth popcorn flower herbaceous annual				2	Sagebrush scrub	June-July
Sedum pinetorum Pine City sedum herbaceous perennial			W		Rocky, open forest?	May-August

1. Rank or status, by agency:
USFWS = US Fish and Wildlife Service status under the Endangered Species Act
SC = Species of Concern
USFS = US Forest Service, Inyo National Forest, Bishop Office (1998a, 1998b)
S = Sensitive List, June 1998
W = Watch List, December 1998
DFG = California Department of Fish and Game listings under the Native Plant Protection Act and the California Endangered Species Act.
R = Rare
SC = Species of Concern (CDFG, 2001b)
CNPS = California Native Plant Society listings (Skinner and Pavlik, 1994)
1B = rare and endangered in Calif. and elsewhere
2 = rare, threatened or endangered in California, but more common elsewhere

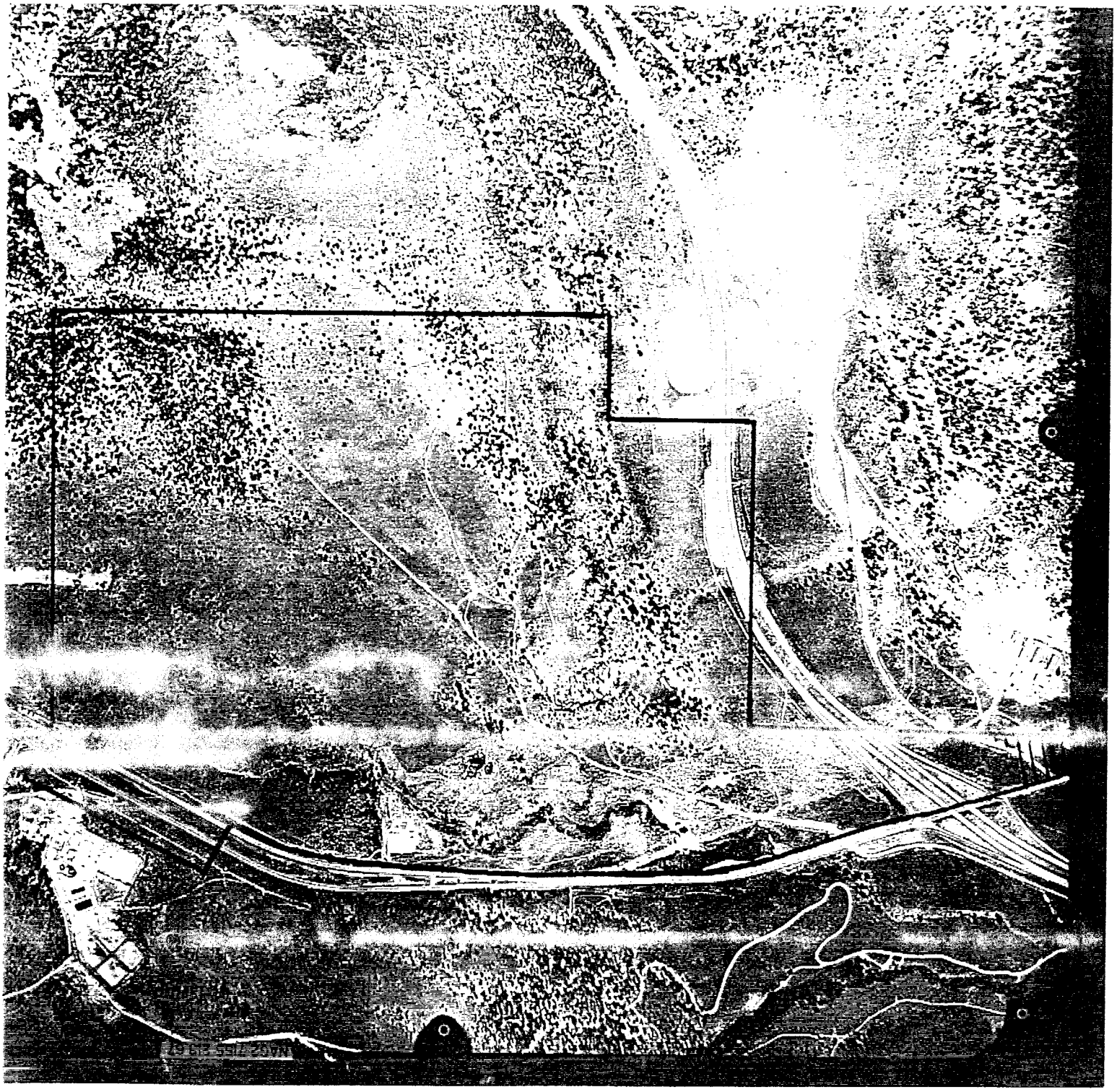

Figure 1. Boundaries of the study area are shown. Most of the study area is on lands administered by the Inyo National Forest. Hatching denotes privately owned portions of the otherwise continuous parcel known as the Basalt Canyon Geothermal Exploration Area.

N

Field surveys were guided by plant community-level interpretation of 1:15840 scale color aerial photographs dated 6-30-93 (Inyo National Forest, Bishop). Variations in the vegetation cover visible upon stereoscopic magnification (7X) were overlain with topographic contours and GPS waypoints on a map of the study area. Planned survey transects were then more closely spaced in areas with finer-grained vegetation cover variation. Areas surveyed with dense transect spacing of 25-50 ft included open flats in scrublands, steep-rocky slopes, the rocky ridge line near Highway 395, Murphy Gulch and its "banks", gaps in forest and scrub overstory, and disturbed roadsides. Areas with wider spacing and more wandering transect direction included the forest areas with continuous canopy shading and uniformly dense scrub on dry slopes.

Rare plant searches were conducted on May 25, May 31-June 3, and June 6-12, 2001. Transects were searched while walking slowly and wandering slightly from side to side. The search strategy strove to identify every species encountered along transects within the study area. In all cases identification was completed to the level necessary to draw distinction from potentially occurring rare species. A total of 168 person-hours was spent on-site searching for rare plants.

Surveys were conducted at the proper time of year for identifying potentially occurring rare plants (Table 1). Annual species were generally in flower during the survey period, and early blooming members of the *Brassicaceae* and *Boraginaceae* were exhibiting both flowers and fruit. The Mono Pumice Flat community at nearby Smokey Bear Flat was visited on June 1, observing the perennials *Lupinus duranii* in early anthesis and *Astragalus monoensis* var. *monoensis* with flowers and fruit.

At several points along search transects, the structures of forest or shrub canopy and understory communities were briefly characterized. Estimates of tree or shrub canopy closure were made visually (± 10%). Average plant community height (by stratum) was estimated. The list of all plant species encountered was grouped by community type. Plant names were recorded using the nomenclature of Hickman (1993), and plant communities assigned using the classification system proposed by Sawyer and Keeler-Wolf (1995).

Results

The majority of the study area is relatively undisturbed upland forest and scrub. Vegetation in forested areas was classified into one community, Jeffrey Pine Forest. There are small patches of Tobacco Brush Chaparral near the top of the steep ridge. The clearly dominant community is Great Basin Mixed Scrub (Table 2). Elements of Great Basin Mixed Scrub are also found in small (10^2 to 10^3 ft^2) forest gaps, or as understory amid more open tree stands at the forest edge. No meadows with (or without) willows occur within the study area.

Devegetation and sometimes early seral recovery from disturbance was found on National Forest land along abundant roads and bicycle trails, at two ponding basin and dam sites along Murphy Gulch, at a dump site west of Murphy Gulch, and at an abandoned landing strip. Devegetation has occurred at two geothermal fluid extraction wells and a ponding basin on private land east of Highway 395. Non-anthropogenic

devegetation or recent change from native forest and scrub to a weedy pioneer herb assemblage has occurred patchily at sites of active fumaroles. Fumaroles are located within the study area near the base of the steep ridge west of Highway 395 and near existing geothermal wells on private lands east of Highway 395 (Figure 2).

Table 2. Plant communities found within the Basalt Canyon study area.

Plant Community Name	Holland Number	Sawyer/Keeler-Wolf Series	Approximate Acreage
Jeffrey Pine Forest	85100	Jeffrey Pine	85
Great Basin Mixed Scrub	35100	Big Sagebrush	658
Tobacco Brush Chaparral	37533	Tobacco Brush	4
Disturbed/Devegetated			53

A total of 149 species belonging to 35 families were identified within the study area (Table 3). Diversity of trees (S=5 tree species) is highest near the summit of the steep ridge. Diversity of shrubs and herbs is highest at Murphy Gulch (S = 16 and 72, respectively). The lowest diversity of herbaceous species (S=5, all perennial) was found within the Jeffrey Pine Forest community where tree canopy cover exceeds 40%. Introduced perennial herbs (S=6) were most common in disturbed habitats, especially at roadsides and ponding basins within the area classified as Great Basin Mixed Scrub. Annual species diversity throughout the study area in 2001 included 12 native and 11 non-native species.

Jeffrey Pine Forest

Forested slopes in the northern half of the study area are 20-70% covered by canopies of mostly Jeffrey pine (*Pinus jeffreyi*). This community dominates about 10% of the study area (Table 2). Dense, nearly pure stands of Jeffrey Pine occur near the western edge of the study area. The 40-70% forest cover class (= canopy closure) is frequently attained in this portion of the Forest. Overstory composition varies to scattered, somewhat more diverse stands on east, west and south facing slopes of the steep ridge. The 0-40% forest cover class (USDA Forest Service, 2001a) best describes the average condition in stands associated with the steep ridge. Forest edges are broad, appearing as thinning Jeffrey pine with an often dense Great Basin Mixed Scrub understory.

Jeffrey Pine Forest near the western edge of the study area is at the downslope edge of a continuous forest band associated with Shady Rest and Mammoth Knolls. Within the study area, this forest grades into slopes with shallow pumice soils and scrub-dominated vegetation. Average tree height is about 30 ft and average trunk girth is < 20 inches dbh. Dense 40-70% tree cover is associated with a buildup of leaf litter and dense shading. A few shrubs, notably currant (*Ribes cereum*) and snowberry (*Symphoricarpos rotundifolius*), and sparse native perennial grasses (*Achnatherum nevadensis*, *Poa wheeleri*, and *Elymus elymoides*), weakly coexist with trees where the canopy exceeds about 40%. Small gaps in the trees increase local structural and species diversity. Typically, components of the Great Basin Mixed Scrub community are added, and higher

densities of currant and snowberry are supported. Total cover in forest gaps averages 30%, with Jeffrey pine or white fir (*Abies concolor*) seedlings and native herbs such as mountain violet (*Viola purpurea*) sometimes becoming locally abundant.

The more diverse and open Jeffrey Pine Forest mapped near the steep north-south ridge west of Highway 395 has a high proportion of edge/ecotone area. As opposed to the continuous Forest described above, stands of trees here form a complex mosaic with the surrounding scrub (Figure 2), attaining clear dominance in shaded areas and at slope bases. The deeper soils at slope bases support dense stands of Jeffrey pine that have attained heights of 40 ft. Near the summit, thin ridgeline stands include small numbers of other conifers. White fir, singleleaf pinyon (*Pinus monophylla*), lodgepole pine (*Pinus contorta* ssp. *murryana*), and Western juniper (*Juniperus occidentalis*) are present but never form dense stands or outnumber Jeffrey pine. However, western juniper frequency is high at lower ridgeline elevations on south-facing slopes. Once-dense Jeffrey pine and juniper near the active fumaroles at the southernmost slope base have been killed by recently increased heat flux. Surviving junipers just upslope from the fumaroles include one that is particularly magnificent, a windswept "beehive tree" that has attained > 100 inches dbh.

Forest gaps near the summit have developed a diverse understory of less than 1 ft in height, with a perennial species assemblage that is notably different from the understory assemblage found at slope bases. The habitat is rocky, with exposed, thin soils supporting low shrubs such cushion buckwheat (*Eriogonum ovalifolium*) and matted perennials such as Beatley's five-leaved clover (*Trifolium andersonii* var. *beatleyae*) and hairy milkvetch (*Astragalus purshii* var. *tinctus*). Total living cover along the ridge spine is less than 10%, with few trees greater than 10 ft in height. Forest/Scrub ecotones on the steep east and west facing slopes that are immediately below this ridge are often dominated by non-native cheat grass (*Bromus tectorum*). Where cheat grass is sparse, understory vegetation includes native perennials (e.g., *Arabis* and *Phlox* spp.) and native annuals (e.g., *Phacelia* spp.).

Great Basin Mixed Scrub

Typical dominants of the Great Basin Mixed Scrub have developed a dense, fairly uniform cover across lower elevation slopes. The total shrub cover is usually 40-50%. Cover is reduced to 10% or less where basaltic bedrock dominates or shallowly underlies the soil surface. Dominance by big sagebrush (*Artemisia tridentata*) is generally 50-70% of the total cover. Antelope bush or bitterbrush (*Purshia tridentata*) is a co-dominant making up 20-30% of the total cover. An assortment of native shrubs such as rabbitbrush (*Chrysothamnus* spp.), sulfur flower (*Eriogonum umbellatum*), cotton thorn (*Tetradymia canescens*), desert peach (*Prunus andersonii*), rock spirea (*Holodiscus microphyllus*), tobacco brush (*Ceanothus velutinus*), and manzanita (*Arctostaphylos nevadensis* and *A. patula*) occur at low frequencies. Areas of an acre or more where frequencies of tobacco brush and manzanita exceed 50% were mapped separately as Tobacco Brush Chaparral. The height of the Great Basin Mixed Scrub community outside of Murphy Gulch averages 3 ft.

Perennial grasses (especially *Achnatherum hymenoides, A. occidentalis, Hordeum jubatum,* and *Leymus cinereus*) sometimes make up a significant percentage of the total

Scrub cover. However, grasses never occur as distinctly non-shrubby meadows, even in Murphy Gulch. Larger openings in the shrub canopy were found to be infrequent, except where pumice soils only thinly or intermittently cover basalt bedrock. Intensive searches of these areas consistently found a species poor but sometimes dense cover of common perennial shrubs and herbs. Low, undulating ridgelines parallel to Murphy Gulch were often found to be crowned by exposed or shallowly covered basalt bedrock amid otherwise dense Scrub. Big sagebrush retains dominance in these areas, but rarely exceeds 1 ft in height and is occasionally outnumbered by equally low-growing sulfur flower. Exposed basalt stunts vegetation, and total cover (depending on degree of rockiness) is typically < 10%. Larger scrub openings (i.e, openings > 10^2 ft^2 in size) found in relatively deep pumice soil were always associated with recent soil disturbance.

Vegetation found where Murphy Gulch bisects dry slopes dominated by Great Basin Mixed Scrub was not classified as a distinct (e.g., riparian) plant community. Scattered clumps of bitter cherry (*Prunus emarginata*) and mugwort (*Artemisia douglasiana*), and an increased frequency of lodgepole pine, combine to add some riparian character to the Murphy Gulch vegetation. But flows do not occur with great enough frequency to support the development of a continuous corridors of dominants typical of Great Basin Riparian Scrub or Aspen Riparian Scrub as defined by Holland (1986). The narrowly incised channel does show evidence of recent scour and erosive damage to vegetation, and it would qualify as a "seasonally flowing stream" (USDA Forest Service, 2001). The scoured channel is 3-10 ft wide. At this time, it is sparsely colonized by a diverse set of native and non-native grasses (Table 3). Dense sagebrush and antelope bush cover most of Murphy Gulch outside the immediate areas impacted by flowing water. Shrub cover is 50-70% and averages 3.5 ft in height. Openings occur where taller shrubs give way on open, steep channel edges to sparse phlox (especially *Leptodactyon pungens*), and perennial grasses, including mat muhly (*Muhlenbergia richardsonis*) and bluegrass (*Poa pratensis*). Several other herbs (S=16, "MG" in Table 3) were restricted within the study area to Murphy Gulch. However, these species were never abundant. In summary, the overall departure from the surrounding Scrub composition was not considered great enough to map Murphy Gulch vegetation as a separate plant community.

Murphy Gulch is the only low area found to have water marks, flotsam or evidence of scour within the entire study area. Given that meadows and riparian plant assemblages are absent from all areas surveyed including Murphy Gulch, it is concluded that no areas fitting the definition of "Special Aquatic Feature" (USDA-Forest Service) currently occur in the study area.

Tobacco Brush Chaparral

Open, sunny slopes on the steep north-south ridge west of Highway 395 were sometimes found to be nearly impassable due to a thick, tangled mix of tobacco brush (*Ceanothus velutinus*) and manzanita (*Arctostaphylos* spp.). More or less continuous bands of this scrub in forest openings of greater than one acre in size were mapped as Tobacco Brush Chaparral (Figure 2).

The Chaparral assemblage is the least diverse of the communities observed within the study area. Understory herbs (S=10) were found to be virtually absent in 2001. Shrub

canopies are more continuous than found in nearby Great Basin Mixed Scrub, hence the descriptive 'nearly impassable'. Chaparral living cover averages 80% and approaches 100% in some places, and the buildup of leaf litter is thick, so there is little available habitat for low herbs. Community height averages 4 ft and so is somewhat taller than surrounding Great Basin Mixed Scrub. Ground creep is removing Chaparral plants in some locations where slope angle exceeds about 30%.

Disturbed

Historical vegetation removal for road, runway and dam building, and landfill disposal has impacted Great Basin Mixed Scrub more than other communities present on National Forest lands. Geothermal resource development (currently confined to existing roads, wells and a settling pond on private land east of Highway 395) has impacted Great Basin Mixed Scrub also. The overall acreage that due to human activities is currently devegetated or in early seral recovery is about 2 acres in Jeffrey Pine Forest (~ 2%) and 32 acres in Great Basin Mixed Scrub (~ 5%). Another 12 acres on National Forest land and 8 acres on private land have become largely devoid of living vegetation or converted from perennial Forest or Scrub to winter annual-dominated (mainly cheat grass), weedy fields due to naturally occurring thermal activity. A few weedy species (S=5) are confined to the fumarole areas ("FUM" in Table 3). Fumarole-associated weedy fields appear as dense, monospecific stands of stunted, short-lived or dead grass (*Bromus tectorum*) for most of the growing season, often amid the standing or fallen trunks of heat-killed trees.

Roadsides, the Murphy Gulch ponding basins and landfill area, and the abandoned runway are 0-5% covered with native and exotic pioneer species. The most abundant species in disturbed areas, however, are usually non-native annuals such as cheat grass and Russian thistle (*Salsola tragus*). Native perennials such as ashy wildrye (*Leymus cinereus*) and dock (*Rumex crispus*) have recently recolonized portions of the disturbed ponding basins in Murphy Gulch. A slightly more diverse, predominantly native assemblage of annuals and perennial herbs has developed on less frequently disturbed openings such as the abandoned runway and along some roads, especially where amendments and (probably) seeds have been applied by forest managers. Native annuals that are apparently restricted to disturbed habitats include common species such as annual bursage (*Ambrosia acanthicarpa*) and purple mat (*Nama* spp.). Six non-native, weedy species, including Mexican tea (*Chenopodium ambrosioides*) and knotweed (*Polygonum arenastrum*), are widespread in disturbed areas, but apparently have not invaded relatively undisturbed Forest and Scrub communities. Non-native *Bromus* were the only noxious weeds widely found in relatively less disturbed sandy/stony soil in the open areas between shrub and tree canopies.

Recent mechanical scraping, ponding and silt/debris deposition has altered vegetation within a 1-acre ponding basin on private property at the extreme eastern edge of the study area. The low, herbaceous vegetation observed in 2001 at this habitat included isolated populations of five species ("PO" in Table 2). Seven of 19 occurring species are non-native. Cover by mostly grasses and sedges approaches 100%.

Noxious Weeds

The overall propensity for devegetation and repeated disturbance to lead to weedy pioneer recruitment is apparently high. A total of 15 non-native species were found in disturbed areas of relatively xeric Forest and Scrub communities on Inyo National Forest lands. Two additional non-native species were found at the 1 acre disturbed ponding basin on private property. Only two of these species, *Bromus tectorum* and *Bromus madritensis* ssp. *rubens*, have shown a tendency to spread into relatively undisturbed areas. The risk for spread of these two species as a result of further vegetation disturbance is high. A noxious weed risk assessment for any new disturbance within the study area boundaries should note that sufficient propagule sources for especially *B. tectorum* are already in place throughout both of the major plant community types. Existing exotic populations would likely facilitate rapid post-disturbance colonization that could exclude native pioneer sere species in the absence of proactive management practices.

Sensitive plant species

No occurrences of federal, state, or locally recognized sensitive plant species, or sensitive plant communities, were found within the study area. Well developed fruits, senescing leaves, and lower plant internodes were readily available during the time of the 2001 surveys to positively differentiate the common *Astragalus* and *Lupinus* species that were found from potentially occurring *A. monoensis* var. *monoensis* and *L. duranii*. No occurrences of any members of the *Botrychium*, *Epilobium*, or *Plagiobothrys* genera were found in 2001. Confusion of occurring species with identified species of concern is very unlikely.

No low herbaceous associations typical of Mono Pumice Flat were found. As described above, openings in Jeffrey Pine Forest are vegetated by typical native shrub dominants of Great Basin Mixed Scrub. Openings in Great Basin Mixed Scrub were normally associated with stunted, scattered shrubs on shallow pumice soils overlying or surrounding bedrock. These areas are rarely dominated by herbaceous or grassy species. Deeper pumice soils that support dense sagebrush-dominated scrub across most of the study area could allow co-occurrence of the with Mono Pumice Flat community (Bagley, 1995, Kathleen Nelson, personal communication 5/19/2001). No examples of this unusual co-occurrence were found within the study area. During a comparative visit on June 17, 2001 to the example described by Bagley (1995), abundant *L. duranii* and occasional *A. monoensis* were observed among a more open, shorter Big Sagebrush stand at 7650 ft elevation. The growth of shrubs forming the uniform Great Basin Mixed Scrub within the study area is on average twice as dense and twice as tall as the off-site Big Sagebrush/Mono Pumice Flat community visited on June 17.

During the transect surveys, sign of widespread use by deer was observed. However, there was no evidence that this area had been used for livestock during the 2001 growing season, and it is concluded that herbivore activity had no influence on the ability to detect sensitive plants during this survey.

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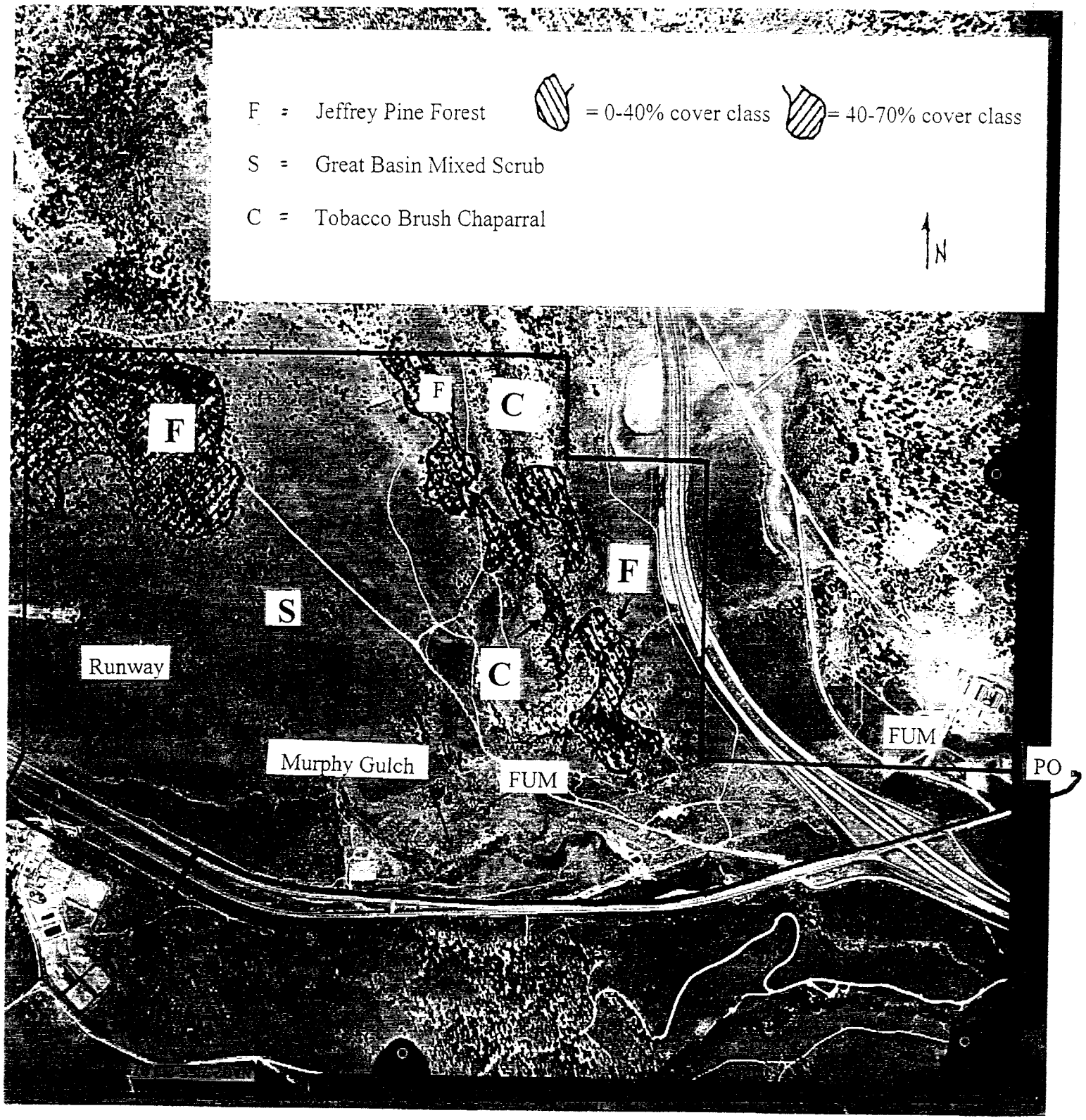

Figure 2. Map of Basalt Canyon study area, showing botanical survey boundaries and plant communities present in May-June, 2001.

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Table 3. List of plant species occurring in the area of the Basalt Canyon Geothermal Exploration. Habit summarizes the growth form of each species. Plants occurred in one of four habitats. Habit codes are defined below.

Plant Families and Species	Habit	Occurrence in Study Area: Forest	Scrub	Chaparral	Disturbed
Cupressaceae					
Juniperus occidentalis	NT	x	x		
Dryopteridaceae					
Woodsia oregana	NPH		xMG		
Pinaceae					
Abies concolor	NT	x			
Pinus contorta ssp. *murrayana*	NT	x	x		
Pinus flexilis (?, 1 ind.)	NT		xMG		
Pinus jeffreyi	NT	x	x	x	
Pinus monophylla	NT	x			
Dicots					
Amaranthaceae					
Amaranthus californicus	NAH				xFUM
Apiaceae					
Cymopterus terebinthinus var. *petraeus*	NPH		x	x	
Asteraceae					
Achillea millefolium	NPH		xM		
Agoseris glauca var. *laciniata*	NPH		x		
Agoseris retrorsa	NPH		x		
Ambrosia acanthicarpa	NAH				x
Artemisia cana ssp. *bolanderi*	NS		x		
Artemisia douglasiana	NPH		xMG		
Artemisia tridentata	NS	x	x		x
Aster ascendens	NPH	x	x		
Chaenactis stevioides	NAH		x	x	x
Chrysothamnus nauseosus	NS		x		x
Chrysothamnus parryi ssp. *nevadensis*	NS		x		
Chrysothamnus teretifolius	NS		x		
Chrysothamnus viscidiflorus ssp. *puberulus*	NS		x		
Chrysothamnus viscidiflorus ssp. *viscidiflorus*	NS		x		
Crepis acuminata	NPH		x		
Machaeranthera canescens var. *canescens*	NPH		x	x	
Rigiopappus leptocladus	NAH				xPO
Senecio aronicoides	NPH		xMG		
Senecio integerrimus var. *exaltatus*	NPH		xMG		
Stephanomeria paniculata	NAH		x		
Stephanomeria spinosa	NPH		x		
Tetradymia canescens	NS		x		
Tragopogon dubius	IBH				x
Wyethia mollis	NPH		x		

Plant Families and Species	Habit	Forest	Scrub	Chaparral	Disturbed
Boraginaceae					
Cryptantha circumscissa	NAH	X	X		X
Cryptantha confertifolia	NPH		X		
Cryptantha echinella	NAH	X	X	X	
Cryptantha micrantha	NAH	X	X		
Brassicaceae					
Arabis holboellii var. *retrofracta*	NPH	X	X	X	
Arabis inyoensis	NPH	X	X		X
Arabis platysperma var. *platysperma*	NPH		XMG		
Arabis puberula	NPH		X		
Arabis pulchra var. *pulchra*	NPH		X		
Arabis sparsiflora var. *sparsiflora*	NPH		X		
Descurainia californica	NAH		X		X
Descurainia sophia	IAH		X		X
Erysimum capitatum ssp. *capitatum*	NBH	X	X		
Lepidium desiflorum var. *macrocarpum*	NBH		XMG		
Thelypodium milleflorum	NBH		XMG		
Caprifoliaceae					
Symphoricarpos rotundifolius var. *parishii*	NS	X			
Symphoricarpos rotundifolius var. *rotundifolius*	NS	X	X	X	
Caryophyllaceae					
Stellaria borealis ssp. *sitchana*	NPH		XMG		
Chenopodiaceae					
Chenopodium ambrosioides	IAH				X
Chenopodium foliosum	IAH				XPO
Chenopodium pratericola	NAH		X		X
Grayia spinosa	NS		X		
Salsola tragus	IAH		X		X
Ericaceae					
Arctostaphylos nevadensis	NS	X	X	X	
Arctostaphylos patula	NS		X	X	
Fabaceae					
Astragalus purshii	NPH		X		X
Lupinus albicaulis	NPH		X		
Lupinus andersonii	NPH		X		
Lupinus argenteus var. *heteranthus*	NPH		X		X
Lupinus bicolor	NAH		X		
Trifolium andersonii var. beatlyae	NPH		X		
Fagaceae					
Chrysolepis sempervirens	NS		X	X	
Geraniaceae					
Erodium cicutarium	IAH				XFUM

Plant Families and Species	Habit	Forest	Scrub	Chaparral	Disturbed
Grossulariaceae					
Ribes cereum var. *cereum*	NS	x	x	x	
Hydrophyllaceae					
Nama aretioides var. *multiflorum*	NAH				x
Nama californicum	NAH				x
Nama rothrockii	NPH		x		x
Phacelia bicolor	NAH	x	x		
Phacelia vallis-mortae	NAH		x	x	x
Phacelia glandulifera	NAH	x	x		
Phacelia hastata ssp. *hastata*	NPH				x
Phacelia sp.	NAH		x		
Lamiaceae					
Monardella odoratissima ssp. *odoratissima*	NPH		x		
Loasaceae					
Mentzelia congesta	NAH		x		x
Mentzelia dispersa	NAH		x		x
Mentzelia veatchiana	NAH				x
Onagraceae					
Gayophytum diffusum ssp. *parviflorum*	NAH	x	x	x	x
Papaveraceae					
Argemone minuta	NPH		x		x
Polemoniaceae					
Allophyllum gilioides	NAH		x		x
Gilia brecciarum ssp. *brecciarum*	NAH		x		
Eriastrum sparsiflorum	NAH		x		x
Leptodactylon pungens	NPH	x	x		
Linanthus nuttallii ssp. *pubescens*	NPH	x	x		
Phlox condensata	NS	x	x		
Phlox gracilis	NAH		xMG		
Phlox stansburyi	NPH	x	x		
Polygonaceae					
Eriogonum maculatum	NAH		x		x
Eriogonum ovalifolium	NPH		x		x
Eriogonum parishii	NAH		x		
Eriogonum umbellatum var. *nevadense*	NS		x		
Polygonum arenastrum	IAH				x
Polygonum polygaloides	NAH		x		
Rumex crispus	IPH		xMG		
Portulacaceae					
Calyptridium monospermum	NPH		x		x
Calyptridium umbellatum	NPH				x

Plant Families and Species	Habit	Forest	Scrub	Chaparral	Disturbed
Rhamnaceae					
Ceanothus velutinus	NS		X	X	
Rhamnus sp.	NS		X		
Ranunculaceae					
Delphinium cf. *parishii*	NPH		X		
Rosaceae					
Amelanchier utahensis	NS	X			
Holodiscus microphyllus var. *microphyllus*	NS	X	X	X	
Prunus andersonii	NS		X		
Prunus emarginata	NS	X	X		
Rosa woodsii	NS		X		
Purshia tridentata var. *tridentata*	NS		X		
Rubiaceae					
Galium multiflorum	NPH	X	X		
Kelloggia galioides	NPH		X		
Scrophulariaceae					
Castilleja angustifolia	NPH		X		
Mimulus nanus	NAH		X		
Orthocarpus luteus	NPH		X		
Penstemon azureus var. *angustissimus*	NPH		X		
Penstemon rostriflorus	NPH	X	X		
Verbascum thapsus	IBH		XMG		
Solanaceae					
Chamaesaracha nana	NPH		X		X
Nicotiana acuminata var. *multiflora*	IAH				XFUM
Violaceae					
Viola purpurea ssp. venosa	NPH		X		
Monocots					
Cyperaceae					
Carex douglasii	NPGL		X		X
Carex microptera	NPGL		XMG		
Carex raynoldsii	NPGL	X			
Cyperus laevigatus	NPGL				XFUM
Juncaceae					
Juncus mexicanus	NPGL				XPO
Liliaceae					
Allium atrorubens var. *cristatum*	NPGL		XMG		
Calochortus leichtlinii	NPGL		X		

To: Steven Kerns
Wildlands Resource Managers
P.O. Box 102
Round Mountain, CA 96084

June 18, 2001

From: Jim Paulus
Consulting Botanist, EMA Associates
PO Box 244
Bishop, CA 93515

RE: Plant communities found at the Basalt Canyon Geothermal Exploration Survey Area

Dear Mr. Kerns,

I am writing to inform you of results of botanical survey work I have recently completed within the approximately 800 acre Basalt Canyon geothermal exploration area of the proposed Mammoth Pacific Geothermal Project. The botanical survey was performed to determine the presence or absence of sensitive plant species. All of the land surveyed is located west of Highway 395 north of the Highway 203 exit, near the Town of Mammoth Lakes, Mono County, California and is administered by the Inyo National Forest.

Great Basin Mixed Scrub and Jeffrey Pine Forest plant communities were found on currently undeveloped, rolling hills and steep slopes, crossed by many dirt roads and bicycle trails. "Murphy Gulch", an ephemeral stream channel, parallels Highway 203 near the southern edge of the survey area (Figure 1). No other hydrologic features (streams, seeps, wet meadows) were encountered. My survey strategy was floristic, striving to identify every species occurring along the transects. I have attached a list of the species found.

Typical dominants of the Great Basin Mixed Scrub were found at high frequencies at lower elevations, especially big sagebrush (*Artemisia tridentata*), antelope bush (*Purshia tridentata*), while tobacco brush (*Ceanothus velutinus*) and manzanita (*Arctostaphylos nevadensis* and *A. patula*) were restricted to patches on the steep slopes of the ridge west of Highway 395. Dominance by *A. tridentata* was usually 60-80%, and scrub height averaged 1 m. Perennial grasses (*Achnatherum hymenoides, A. occidentalis, A. nevadensis,* and *Leymus cinereus*) make up a significant percentage of the Mixed Scrub cover. Riparian vegetation was not found where Murphy Gulch (a conduit for runoff from impervious surfaces in Mammoth Lakes, upstream) bisected rolling hills dominated by Great Basin Mixed Scrub. However, a few patches of pine, and thick but small stands of shrubs such as bitter cherry (*Prunus emarginata*), were present to provide cover for animals. Deer sign was relatively profuse along the length of the Gulch.

Forest canopy cover is nearly monospecific Jeffrey pine (*Pinus jeffreyi*) at lower elevations. On steeper slopes near the ridge line west of Highway 395, white fir (*Abies concolor*), pinyon pine (*Pinus monophylla*), and juniper (*Juniperus occidentalis*) are mixed into the Forest canopy. Forest floor cover consisting of sometimes dense perennial grasses (mostly *Poa*

wheeleri) and snowberry (*Symphoricarpos rotundifolia*) was found to be widespread. Habitat quality for deer in otherwise dense Forest near the eastern edge of the survey area is probably further enhanced by the high frequency of small, shrubby forest gaps.

Larger openings in the Forest canopy occur on the steeper slopes of higher elevations in the study area. Great Basin Mixed Scrub of higher diversity, ranging from nearly impassable inclusions of Tobacco Brush Chaparral to more open, herb-dominated inclusions of low Buckwheat Scrub, was found on these dry steep slopes. The frequency of the browse species *P. tridentata* occasionally increases to > 90%, and these areas were associated with high use by mule deer. Patches of desert peach (*Prunus andersonii*) showed similar relatively high usage by deer.

I did not see a lot of sign of deer use in Scrub-covered lower slopes central to the Basalt Canyon study area. I saw about 15 deer during the 8 days I have spent on site, all in Murphy Gulch, at the forest/scrub interfaces on lower slopes, and in heavy scrub cover on higher slopes. I did not find any water sources on the study area at the time of the survey. I believe the nearest surface water is Sherwin Creek south of Highway 203. Ground squirrels are common in Murphy Gulch. I observed a pair of red-tailed hawks on several consecutive days near the rocky outcrop on the ridgeline west of Highway 395. Smaller migratory birds were the only other wildlife observed during this work.

I hope this helps with your wildlife assessment. Call me at (760) 873-8516 if you have any questions.

Yours truly,

James R. Paulus

James R. Paulus, Ph.D.

cc. Dwight Carey

Plant Families and Species	Habit	Scrub	Forest	Disturbed
Boraginaceae				
Cryptantha circumscissa	NAH	X		X
Cryptantha confertifolia	NPH	X		
Cryptantha echinella	NAH	X		
Cryptantha micrantha	NAH	X		
Brassicaceae				
Arabis holboellii var. *retrofracta*	NPH	X	X	
Arabis inyoensis	NPH	X		X
Arabis platysperma var. *platysperma*	NPH	XMG		
Arabis puberula	NPH	X		
Arabis pulchra var. *pulchra*	NPH	X		
Arabis sparsiflora var. *sparsiflora*	NPH	X		
Descurainia californica	NAH	X		X
Descurainia sophia	IAH	X		X
Erysimum capitatum ssp. *capitatum*	NBH	X		
Lepidium desiflorum var. *macrocarpum*	NBH	XMG		
Thelypodium milleflorum	NBH	X		
Caprifoliaceae				
Symphoricarpos rotundifolius var. *parishii*	NS		X	
Symphoricarpos rotundifolius var. *rotundifolius*	NS	X	X	
Caryophyllaceae				
Stellaria borealis ssp. *sitchana*	NPH	XMG		
Chenopodiaceae				
Chenopodium ambrosioides	IAH			X
Chenopodium foliosum	IAH			XPO
Chenopodium pratericola	NAH	X		X
Grayia spinosa	NS	X		
Salsola tragus	IAH	X		X
Ericaceae				
Arctostaphylos nevadensis	NS	X	X	
Arctostaphylos patula	NS	X		
Fabaceae				
Astragalus purshii	NPH	X		X
Lupinus albicaulis	NPH	X		
Lupinus andersonii	NPH	X		
Lupinus argenteus var. *heteranthus*	NPH	X		X
Lupinus bicolor	NAH	X		
Trifolium andersonii var. beatlyae	NPH	X		
Fagaceae				
Chrysolepis sempervirens	NS	X		
Geraniaceae				
Erodium cicutarium	IAH			XFU

List of plant species occurring in the area of the Basalt Canyon Geothermal Exploration. Habit summarizes the growth form of each species. Plants occurred in one of four habitats. Habit codes are defined below.

Plant Families and Species	Habit	Occurrence in Study Area: Scrub	Forest	Disturbed
Cupressaceae				
Juniperus occidentalis	NT	X	X	
Dryopteridaceae				
Woodsia oregana	NPH	XMG		
Pinaceae				
Abies concolor	NT		X	
Pinus contorta ssp. *murrayana*	NT	XMG		
Pinus flexilis (?, 1 ind.)	NT	XMG		
Pinus jeffreyi	NT	X	X	
Pinus monophylla	NT		X	
Dicots				
Amaranthaceae				
Amaranthus californicus	NAH			XFU
Apiaceae				
Cymopterus terebinthinus var. *petraeus*	NPH	X		
Asteraceae				
Achillea millefolium	NPH	XMG		
Agoseris glauca var. *laciniata*	NPH	X		
Agoseris retrorsa	NPH	X		
Ambrosia acanthicarpa	NAH			X
Artemisia cana ssp. *bolanderi*	NS	X		
Artemisia douglasiana	NPH	XMG		
Artemisia tridentata	NS	X	X	X
Aster ascendens	NPH	X		
Chaenactis stevioides	NAH	X		X
Chrysothamnus nauseosus	NS	X		X
Chrysothamnus parryi ssp. *nevadensis*	NS	X		
Chrysothamnus teretifolius	NS	X		
Chrysothamnus viscidiflorus ssp. *puberulus*	NS	X		
Chrysothamnus viscidiflorus ssp. *viscidiflorus*	NS	X		
Crepis acuminata	NPH	X		
Machaeranthera canescens var. *canescens*	NPH	X		
Rigiopappus leptocladus	NAH			XPO
Senecio aronicoides	NPH	XMG		
Senecio integerrimus var. *exaltatus*	NPH	XMG		
Stephanomeria paniculata	NAH	X		
Stephanomeria spinosa	NPH	X		
Tetradymia canescens	NS	X		
Tragopogon dubius	IBH			X
Wyethia mollis	NPH	X		

Plant Families and Species	Habit	Scrub	Forest	Disturbed
Grossulariaceae				
Ribes cereum var. *cereum*	NS	x	x	
Hydrophyllaceae				
Nama aretioides var. *multiflorum*	NAH			x
Nama californicum	NAH			x
Nama rothrockii	NPH	x		x
Phacelia bicolor	NAH	x		
Phacelia vallis-mortae	NAH	x		x
Phacelia glandulifera	NAH	x		
Phacelia hastata ssp. *hastata*	NPH			x
Phacelia sp.	NAH	x		
Lamiaceae				
Monardella odoratissima ssp. *odoratissima*	NPH	x		
Loasaceae				
Mentzelia congesta	NAH	x		x
Mentzelia dispersa	NAH	x		x
Mentzelia veatchiana	NAH			x
Onagraceae				
Gayophytum diffusum ssp. *parviflorum*	NAH	x		x
Papaveraceae				
Argemone minuta	NPH	x		x
Polemoniaceae				
Allophyllum gilioides	NAH	x		x
Gilia brecciarum ssp. *brecciarum*	NAH	x		
Eriastrum sparsiflorum	NAH	x		x
Leptodactylon pungens	NPH	x		
Linanthus nuttallii ssp. *pubescens*	NPH	x	x	
Phlox condensata	NS	x		
Phlox gracilis	NAH	xMG		
Phlox stansburyi	NPH	x		
Polygonaceae				
Eriogonum maculatum	NAH	x		x
Eriogonum ovalifolium	NPH	x		x
Eriogonum parishii	NAH	x		
Eriogonum umbellatum	NS	x		
Eriogonum umbellatum var. *nevadense*	NS	x		
Polygonum arenastrum	IAH			x
Polygonum polygaloides	NAH	x		
Rumex crispus	IPH	xMG		
Portulacaceae				
Calyptridium monospermum	NPH	x		x
Calyptridium umbellatum	NPH			x

Plant Families and Species	Habit	Scrub	Forest	Disturbed
Rhamnaceae				
Ceanothus velutinus	NS	X		
Rhamnus sp.	NS	X		
Ranunculaceae				
Delphinium cf. *parishii*	NPH	X		
Rosaceae				
Amelanchier utahensis	NS		X	
Holodiscus microphyllus var. *microphyllus*	NS	X	X	
Prunus andersonii	NS	X		
Prunus emarginata	NS	X	X	
Rosa woodsii	NS	X		
Purshia tridentata var. *tridentata*	NS	X		
Rubiaceae				
Galium multiflorum	NPH	X	X	
Kelloggia galioides	NPH	X		
Scrophulariaceae				
Castilleja angustifolia	NPH	X		
Mimulus nanus	NAH	X		
Orthocarpus luteus	NPH	X		
Penstemon azureus var. *angustissimus*	NPH	X		
Penstemon rostriflorus	NPH	X	X	
Verbascum thapsus	IBH	XMG		
Solanaceae				
Chamaesaracha nana	NPH	X		X
Nicotiana acuminata var. *multiflora*	IAH			XFU
Violaceae				
Viola purpurea ssp. venosa	NPH	X		
Monocots				
Cyperaceae				
Carex douglasii	NPGL	X		X
Carex microptera	NPGL	XMG		
Carex raynoldsii	NPGL		X	
Cyperus laevigatus	NPGL			XFU
Juncaceae				
Juncus mexicanus	NPGL			XPO
Liliaceae				
Allium atrorubens var. *cristatum*	NPGL	XMG		
Calochortus leichtlinii	NPGL	X		

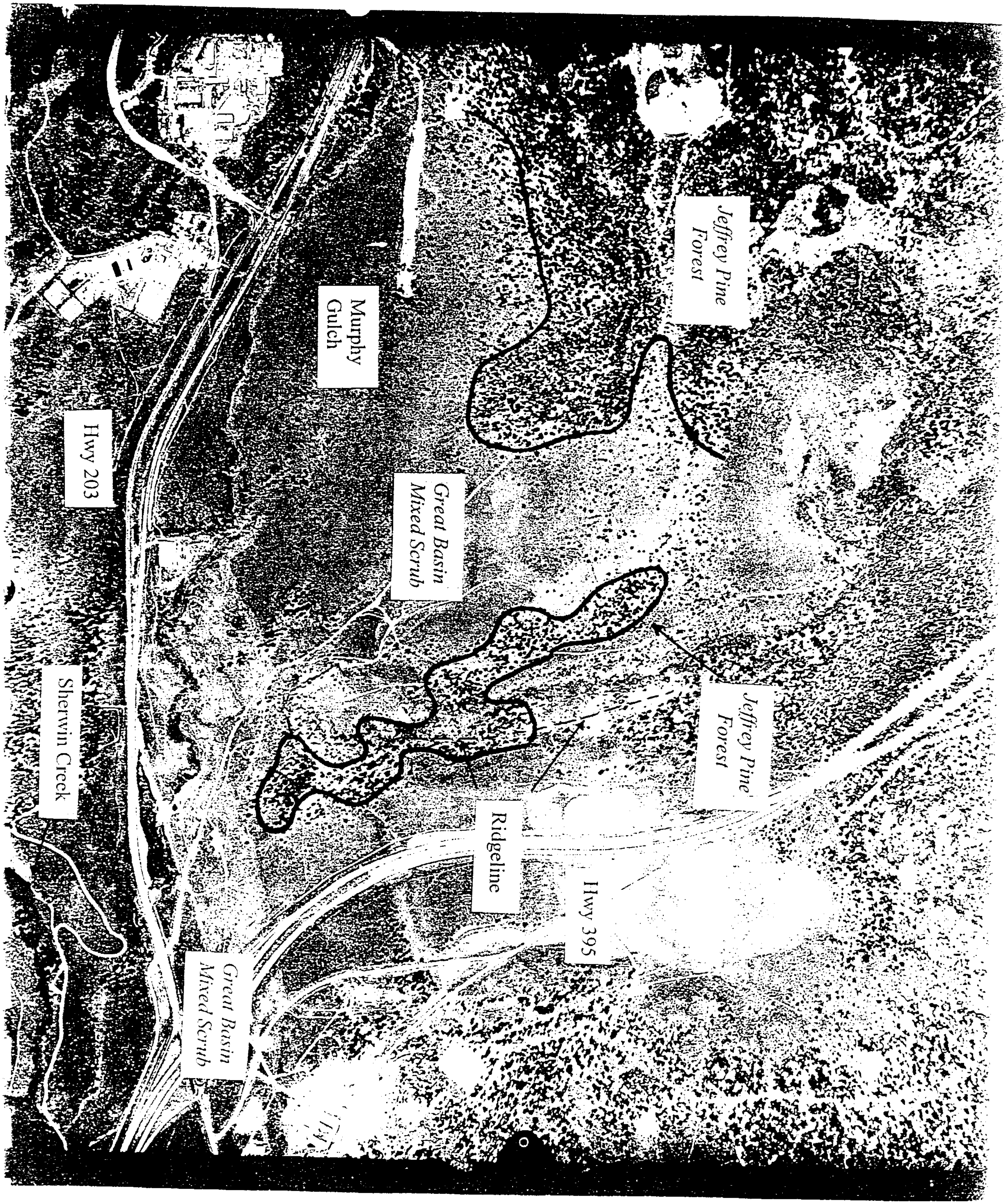
Plant Families and Species	Habit	Scrub	Forest	Disturbed
Poaceae				
Achnatherum hymenoides	NPG	X		X
Achnatherum nevadensis	NPG	X	X	X
Achnatherum occidentalis ssp. *californicum*	NPG	X		
Achnatherum occidentalis ssp. *pubescens*	NPG	X		
Agropyron desertorum	IPG			X
Bromus laevipes	NPG	X		
Bromus madritensis ssp. *rubens*	IAG	X	X	X
Bromus suksdorfii	NPG	X		
Bromus tectorum	IAG	X	X	X
Cynodon dactylon	IPG			XPO
Dactylis glomerata	IPG	XMG		
Elymus elymoides ssp. *elymoides*	NPG	X		X
Hesperostipa comata ssp. *comata*	NPG	X		
Hordeum brachyantherum ssp. *brachyantherum*	NPG	X		
Hordeum jubatum	NPG	X		
Leymus cinereus	NPG	X	X	
Leymus triticoides	NPG			XPO
Melica stricta	NPG	X	X	
Muhlenbergia richardsonis	NPG			
Poa fendleriana ssp. *longiligula*	NPG	X		
Poa palustris	IPG	XMG		
Poa pratensis	IPG	X	X	
Poa wheeleri	NPG		X	
Pseudoroegneria spicata ssp. *spicata*	NPG	XMG		

key to growth habit codes:

A	annual
B	biennial
G	grass
GL	grass-like
H	herb
HS	half-shrub
I	introduced
N	native
P	perennial
S	shrub

key to occurrence codes:

MG	restricted to channel at Murphy Gulch
FU	restricted to disturbed fumarole areas
PO	restricted to disturbed ponding basin at extreme eastern tip of survey area



Plant community boundaries are broadly depicted at the Basalt Canyon Geothermal Exploration Area. Aerial photo taken June, 1993.

NORTH

Basalt Canyon Geothermal Surveys
Sensitive Species Search

To: Kathleen Nelson
Forest Botanist, Inyo National Forest
873 N. Main Street
Bishop, CA 93514

October 29, 2001

From: Jim Paulus
Consulting Botanist, EMA Associates
PO Box 244
Bishop, CA 93515

RE: Plant Communities Observed at the Proposed Well 31-36 and Access Route

Dear Ms. Nelson,

Botanical survey work has been recently completed across 800 acres known as the Basalt Canyon Geothermal Exploration Area and along several miles of exploration transects adjacent to this area (Paulus, J., (1) "Botanical Survey for the Basalt Canyon Geothermal Site, Mammoth Lakes", (2) "Botanical Report for the Basalt Canyon Geothermal Exploration Survey Transects", (3) "Second Botanical Report for the Basalt Canyon Geothermal Exploration Survey Transects"). On September 28 2001, I visited the proposed site of Well 31-36 and its associated access route along an existing logging road located in this same area. The flagged well pad site and access route is located about .25 miles outside the western edge of the survey area reported in (1), and between transects 12 and 13 of the survey area reported in (2), and between points 90 and 62 of parallel transects that were surveyed and reported in (3). I am writing to inform you about my findings during the September 28 site visit.

Great Basin Mixed Scrub and Jeffrey Pine Forest were found on currently undeveloped, gently sloping terrain. The proposed access route follows a well-used unimproved road, then follows a recently harvested logging road. No ephemeral stream channels are crossed by this route, which was checked along its entire length from Sawmill Road. Also, a circular area with a 300 ft radius was walked in order to describe the vegetation in the area of proposed drilling (Figure 1). About 2 hours was spent in this effort. It was not possible to determine the presence or absence of sensitive plant species due to the lateness of the season. However, this visit showed that vegetation within the affected habitat would be largely identical to the Great Basin Mixed Scrub and Jeffrey Pine Forest communities described in (1). Specifically, the entire length of the access route will cross through Jeffrey Pine Forest with about 40% canopy cover and a nearly non-existent understory. But at the well site, and to the south and east, the forest canopy opens and Great Basin Mixed Scrub species (30-50% cover) become more important than pines (10% cover). The only tree is Jeffrey pine, which recently has been selectively harvested ("thinned") along the access route and in the area immediately north and west of the well site. All the species observed during this short visit were recognized as previously documented in the above reports for this general area.

The forest understory is sparse, and in 2001 seems to be composed almost exclusively of *Achnatherum* grass where canopy closure reaches or exceeds the 40% average. Tree seedlings are absent from the access route, as are standing snags, but stumps are common. The main feature of the forest floor is a dense accumulation of needles, cones, and fallen wood. When the forest trees abruptly (and apparently, naturally) thin to 10% closure at the well site, shrubs such as *Artemisia tridentata*, *Purshia tridentata* (10% of total shrub cover), and *Chrysothamnus viscidiflorus* are dominant. These shrubs are 2-3 ft tall. No non-native species were observed, but again the late season disallows absolute determination of their presence or absence. Scattered annual cheat grass (*Bromus tectorum*) was commonly found in the adjacent Forest and Scrub communities described in (1) – (3). Perennial grasses such as *Achnatherum* and *Elymus elymoides* are common between the mature shrub clumps, but no large grassy openings or anything resembling a Mono Pumice Flat habitat were seen within the 300 ft radius circle.

Yours truly,

James R. Paulus, Ph.D.

APPENDIX B

BEST MANAGEMENT PRACTICES

Erosion Control Plan (PRACTICE: 2-2)

a. Objective: To limit and mitigate erosion and sedimentation through effective planning prior to initiation of construction activities and through effective contract administration during construction.

b. Explanation: Land disturbing activities can result in short term erosion. By effectively planning for erosion control, sedimentation can be controlled or prevented. Within a specified period after award of a contract (presently 60 days prior to the first operating season in Timber Sale Contracts, per C6.3) the purchaser will submit a general plan which, among other things, sets forth erosion control measures. Operations cannot begin until the Forest Service has given written approval of the plan. The plan recognizes the mitigation required in the contract. A similar plan is required of miners and special use permittees.

c. Implementation: Design engineers develop detailed mitigation using an IDT. The detailed mitigations are reflected in the contract specifications and provisions. The intent of mitigation is to prevent construction-generated erosion, as well as that generated from the completed road, from entering watercourses. Contracted projects are implemented by the contractor or operator. Compliance with contract specifications and operating plans is ensured by the **COR, ER, or FSR through** inspection.

This practice is commonly applied to all road construction through contract clauses and specifications and will apply to road construction for timber sales, mining, recreation, special uses and other roadwork on NFS lands.

Timing of Construction Activities (PRACTICE: 2-3)

a. Objective To minimize erosion by conducting operations during minimal runoff periods.

b. Explanation: The amount of erosion and sedimentation from road construction are affected by the magnitude of water runoff. An essential element of effective erosion control is to schedule operations during the dry season or when rain and runoff are unlikely. Purchasers will be required to schedule and conduct operations during the dry season or when rain and runoff are unlikely. Purchasers will be required to schedule and conduct operations to minimize erosion and sedimentation. Equipment will not be allowed to operate when ground conditions are such that excessive rutting and soil compaction could result. Such conditions will be identified by the COR or ER with the assistance of an earth scientist or other specialists as needed.

   Erosion control work will be kept as current as practicable on active road construction projects. Construction of drainage facilities and performance of other contract work to control erosion and sedimentation will be required in conjunction with earthwork projects. The operator should limit the amount of area being graded at a site at any one time, and should minimize the time that an area is laid bare. Erosion control work must be kept current when road construction occurs outside of the normal operating season.

c. Implementation: Detailed mitigations developed by design engineers and an IDT will be included in the environmental analysis and in subsequent project plans and contracts.

   Project crew leaders and supervisors will be responsible for implementing force account projects to construction specifications and as specified in the project plan. Contracted projects are implemented by the contractor, or operator. Compliance with plans, specifications, and the operating plan will be achieved by the COR or ER through inspection.

Stabilization of Road Slope Surfaces and Spoil Disposal Areas (PRACTICE: 2-4)

a. Objective: To minimize erosion from exposed cut slopes, fill slopes, and spoil disposal areas.

b. Explanation: This is a preventive practice using bioengineering and other techniques to prevent or minimize erosion. Depending on site factors such as slope angle, soil type, climate, and proximity to waterways, many fill slopes, some cut slopes, and some spoil disposal areas will require vegetative and/or mechanical measures to provide surface soil stability. The level of stabilization effort needed is determined on a case-by-case basis by trained and qualified employees.

   Revegetation includes the seeding of plant species grass, legumes, or browse species--or the planting of brush, or trees. Revegetation may also include fertilizer, soil amendments, and mulching or even watering to ensure success. A combination of plant types with both woody root systems and fibrous root systems usually produce better results than a single plant type such as grass. Native species are preferred and used wherever feasible. Where local native seed is not available, not economically feasible or native plants would be ineffective in controlling erosion sterilized grass or cereal grain seed is applied.

   Mechanical measures may include, but are not limited to: wattles, erosion nets, terraces, side drains, blankets, mats, riprapping, mulch, tackifiers, pavement, soil seals, and windrowing construction slash at the toe of fill slopes.

c. Implementation: Vegetative measures are generally a supplementary device, used to improve the effectiveness of mechanical measures, but can be effective and complete by themselves. They may not take effect for several seasons, depending on the timing of project completion in relation to the growing season.

   Mechanical and vegetative surface stabilization measures will be periodically inspected to determine effectiveness. In some cases, additional work will be needed to ensure that the vegetative and/or mechanical surface stabilization measures continue to function as intended.

   Initial project location, mitigation measures and management requirements are developed during the environmental analysis process. These are translated into project plans, contract provisions and specifications.

   Project road inspectors, and their supervisors monitor work accomplishment and effectiveness, to ensure that design standards, project plan management requirements, and mitigation measures are met.

Servicing and Refueling of Equipment (PRACTICE: 2-12)

a. Objective To prevent pollutants such as fuels, lubricants, bitumens and other harmful materials from being discharged into or near rivers, streams and impoundments, or into natural or man-made channels.

b. Explanation: During servicing and refueling of logging and road construction equipment, any spilled pollutants can be transported by runoff to surface waters. If the volume of fuel exceeds 660 gallons in a single container, or if total storage at a site exceeds 1,320 gallons, project Spill Prevention, Containment and Counter Measures (Spec) plans are required. Contaminated upland soils can be a long-term threat to surface and ground water quality. This threat must be managed by disposing of waste material properly, selecting service and refueling areas well away from wet areas and surface water; by using berms around such sites and by utilizing impermeable liners or other techniques to contain spills according to the Forest SPCC plan.

c. Implementation: The COR, ER, CI, or TSA are authorized to designate the location, size and allowable uses of service and refueling areas. Operators are required to remove service residues, waste oil and other materials from National Forest land. They must also be prepared to take responsive actions in case of a hazardous substance spill, according to the Forest SPCC plan.

Snow Removal Controls Io Avoid Resource Damage (PRACTICE: 2-25)

a. Objective: To minimize the impact of snowmelt runoff on road surfaces and embankments and to consequently reduce the probability of sediment production resulting from snow removal operations.

b. Explanation: This is a preventive measure used to protect resources and indirectly to protect water quality. Forest roads are sometimes used throughout the winter for a variety of reasons. For such roads, the following measures are employed to meet the objectives of this practice:

1. The contractor will be responsible for snow removal in a manner, which will protect roads and adjacent resources.

2. Rocking or other special surfacing and drainage measures will be necessary, before the operator is allowed to use the roads.

3. Snow berms will be removed where they result in accumulation or concentration of snowmelt runoff on the road and erosive fill slopes.

4. Snow berms will be installed where such placement will preclude concentration of snowmelt runoff and serve to rapidly dissipate melt water. If the road surface is damaged during snow removal, the purchaser, or contractor will be required to replace lost surface material with similar quality material and repair structures damaged in removal operations as soon as practicable, or unless otherwise agreed to in writing

c. Implementation: Project location and detailed mitigation will be developed by the IDT during the environmental analysis and incorporate into the project plan and/or contracts. Project crew leaders and supervisors will be responsible for implementing force account projects to construction specifications and project criteria. (See also Practice 2-24)

Contracted projects are implemented by the contractor, or operator. Compliance with criteria in the project plan specifications, and the operating plan is ensured by the COR, ER and FSR.