CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

ORDER NO. R5-2006-0115

WASTE DISCHARGE REQUIREMENTS
FOR
CALPINE SISKIYOU GEOTHERMAL PARTNERS, L.P., AND
CPN TELEPHONE FLAT, INC., AND
U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE AND
U.S. DEPARTMENT OF INTERIOR, BUREAU OF LAND MANAGEMENT
GLASS MOUNTAIN UNIT GEOTHERMAL
EXPLORATION AND DEVELOPMENT PROJECTS
SISKIYOU COUNTY

The California Regional Water Quality Control Board, Central Valley Region, (hereafter Central Valley Water Board) finds that:

1. On 28 March 2003 Calpine Corporation and CPN Telephone Flat, Inc., submitted a Report of Waste Discharge requesting a revision of waste discharge requirements (WDRs), Order No. 95-199 adopted on 17 August 1995 by the Central Valley Water Board. Order No. 95-199 prescribed requirements for a discharge from the drilling and flow testing of geothermal exploration wells, specifically soil, rock cuttings, drilling mud with additives, oil and associated wastewaters to lined sumps. Order No. 95-199 was issued to California Energy General Corporation (hereafter CEGC), and U.S. Department of Agriculture, Forest Service, (hereafter USFS), and covered activities in the entire Glass Mountain Geothermal Unit Lease Area* including Fourmile Hill Exploration Project which is entirely within the North Coast Regional Water Quality Control Board (hereafter North Coast Water Board) boundary and Telephone Flat Project which is within the Central Valley Region. Calpine Corporation purchased CEGC in October 2001, and changed the name to CPN Telephone Flat, Inc. Other leases owned by Calpine Corporation were moved to their wholly owned subsidiary Calpine Siskiyou Geothermal Partners, L.P., in May 2003. The Report of Waste Discharge was deemed complete on 11 April 2003.

2. The Glass Mountain Geothermal Unit Lease Area is in Siskiyou County on public land in the Modoc, Shasta-Trinity, and Klamath National Forests as shown in Attachment A, a part of this Order. The National Forests are administered by the USFS. The U.S. Department of Interior, Bureau of Land Management (hereafter BLM), has authority to issue leases for, and make determinations on all geothermal activities to be conducted on federal lands. The USFS, as administrator of the property at which the discharge is to occur, and the BLM as administrator of the geothermal resource, are named as dischargers in the WDRs. Calpine Siskiyou Geothermal Partners, L.P., and CPN Telephone Flat, Inc., now own all Glass Mountain geothermal leases. Calpine Siskiyou Geothermal Partners, L.P., and CPN Telephone Flat, Inc., USFS and BLM are hereafter

designated as Discharger. The Glass Mountain Geothermal Unit Lease Area encompasses Sections 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36, T44N, R3E; Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, and 27, T43N, R3E; Sections 19, 30, 31, 32, 33, 34, 35, T44N, R4E; and Sections 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, and 20, T43N, R4E, MDB&M as shown on Attachment A.

3. The proposed Telephone Flat Geothermal Development Project is approximately 1.5 miles east of Medicine Lake, within the Medicine Lake Basin, which is part of the Pit River drainage basin and within the watershed boundary of the Central Valley Water Board. The Fourmile Hill Exploration and Development Project is approximately 3 miles northwest of Medicine Lake, outside the Medicine Lake Basin, in the Klamath River drainage basin within the watershed boundary of the North Coast Water Board.

4. This Order regulates only the transfer of geothermal fluid from geothermal fluids sump to well head for re-injection, storage of geothermal fluid prior to re-injection, storage of drilling mud and cuttings, storage of hazardous materials used in the drilling operation and the monitoring of surface and groundwater quality. Re-injection from the well head to the geothermal aquifer, including but not limited to approval of wells for re-injection, flow rate and volume of geothermal fluids injected, well location, casing design, casing leak detection, additives, leak detection and inspection is regulated by BLM and the U.S. Environmental Protection Agency (USEPA).

5. This Order includes terminology specific to geothermal well drilling and the regulation of geothermal exploration and development. As these terms may not be familiar to those outside the industry, a Glossary of Terms has been included in the Information Sheet, a part of this Order by reference. Terms appearing in the glossary are marked with an asterisk the first time they are introduced. A list of the Environmental Documents pertinent to this Order with a brief description for each is also included in the Information Sheet.

6. A Memorandum of Agreement (MOA), among Calpine Corporation, CPN Telephone Flat, Inc., North Coast Water Board, and the Central Valley Water Board, was signed and became effective on 30 August 2002. The MOA states that each regional water board shall regulate the geothermal "exploration" activities within their respective regions. However, the Central Valley Water Board shall regulate the entire Glass Mountain Exploratory Project until the North Coast Water Board is able to adopt WDRs for the parts of the Glass Mountain Exploratory Project that lie within their region. On 27 June 2002, the North Coast Water Board adopted waste discharge requirements

Order No. R1-2002-0030 for a discharge of geothermal fluid and associated wastes from geothermal exploration operations by the Discharger in the Fourmile Hill area, an area previously covered under the Central Valley Water Board waste discharge requirements Order No. 95-199. Order No. R1-2002-0030 named Calpine Corporation, the USFS, and BLM as Dischargers. On 26 September 2002 the North Coast Water Board adopted Order No R-1-2002-0089, which revised Order No. R1-2002-0030 to allow Calpine Corporation to transfer geothermal fluids to geothermal wells within the Central Valley Region for re-injection.

GEOTHERMAL OPERATIONS

7. The Report of Waste Discharge and supplemental information submitted by the Discharger presented a list of proposed new wells and temperature gradient holes* that may be drilled and/or tested. All of these new wells and temperature gradient holes have been referenced in environmental documents. The listing is as follows:

   Temperature Gradient Hole Nos. 34-8, 42-13, 11-24, 15-15, and 63-20. Geothermal Well Nos. 18-32, 46-32, 56-18, 58-6 and 13-18. The location of these wells is shown on Attachment B, a part of this Order by reference. *(Glass Mountain Unit Geothermal Exploration Project, Environmental Assessment/Initial Study, EA#CA027-EA95-06, April 1995).* The Government will not authorize Well Nos. 18-32 and 46-32, both of which are in the USDA Forest Service Mt. Hoffman Inventoried Roadless Area until a National Environmental Policy Act (NEPA) review is completed. The original Environmental Assessment (EA) did not discuss or disclose the potential effects of the loss of roadless characteristics due to constructing and utilizing these wells and associated facilities.

   Geothermal Well Nos. 26-7, 84-7, 46-8 (existing pad with no well), 64-8, 68-8 (existing well on pad with sump), 73-13, 87-13 (existing well on pad with sump), 15-16, 26-17, 31-17 (existing well on pad with sump), 72-17, 13-18, 16-18, 25-18, 51-18, 52-18, 56-18 and 83-18. The location of these wells is shown on Attachment C, a part of this Order by reference. *(Telephone Flat Geothermal Development Project Environmental Impact Statement/Environmental Impact Report (EIS/EIR), February 1999, and Update Assessment for the Telephone Flat Geothermal Development Project EIS/EIR, November 2002)*

   During drilling of temperature gradient holes the Discharger proposes to truck all drill cuttings to an approved offsite disposal site. Alternatively the Discharger may discharge cuttings from temperature gradient holes to unlined cuttings sumps, provided that the cuttings are confirmed to be non-hazardous. Drill cuttings from wells and temperature

gradient holes may not be discharged to geothermal fluids sumps. In addition to the drilling of new geothermal wells and temperature gradient holes, the Discharger proposes to flow test existing geothermal wells, including Wells Nos. 68-8, 31-17 and 87-13 in the Telephone Flat Area as shown on Attachment D a part of this Order by reference. The Discharger is required to re-inject these geothermal fluids to existing wells within the Glass Mountain Known Geothermal Resource Area (KGRA)* provided that such activity has been approved by BLM and USEPA for that purpose. *(Glass Mountain Exploration, E A/I S, CPN Telephone Flat, Inc., May 2002).*

8. The Discharger proposes in the Report of Waste Discharge to use acid for "formation stimulation*" in the production zone of existing Well Nos. 68-8, 31-17 and 87-13 or any new well in the Telephone Flat Area. BLM issued a sundry notice [approval] in April 2003 for the formation stimulation of Well No. 31-17 by injection of hydrofluoric/hydrochloric acid. This is the only well in the KGRA presently approved by BLM for formation stimulation. BLM has determined that formation stimulation will not be permitted on any additional wells until the completion of additional environmental review. This Order limits formation stimulation only to Well No. 31-17 and does not authorize formation stimulation on any other well within Telephone Flat or Fourmile Hill Unit Lease Areas, until BLM has approved such actions and additional NEPA and CEQA review has been completed.

   To insure re-injection remains uninterrupted, the Discharger will maintain two re-injection pumps, one primary and one spare, at each geothermal fluid sump being used for formation stimulation. Spare pumps will be tested on a regular basis to insure they remain in operating condition. A spill plan for the materials to be used in the stimulation has been prepared as required by BLM.

9. This Order covers the entire Glass Mountain Geothermal Unit Lease Area with the exception of Section 28, T44N, R3E, MDB&M, which is in the Fourmile Hill Exploration Project and is regulated by the North Coast Water Board. This Order includes Well Nos. 64-27 and 85-33 both of which lie within the North Coast Region. These wells are referenced in the Glass Mountain Exploration EA/IS of May 2002, not the Fourmile Hill Exploration EA/IS of December 1995. If the North Coast Water Board adopts additional WDRs for geothermal activities, they will take precedence over this Order for the portions of the Glass Mountain Geothermal Unit Lease Area they regulate.

10. This Order regulates discharges associated with the drilling and testing of geothermal wells including land clearing, well pad construction, sump construction, fluids discharged to sumps, geothermal fluid transfer, and the fluids from chemical addition of acid to the wells. These activities are referenced in the environmental documents referenced in

Finding No. 5 which appear in the Information Sheet. Well locations associated with these environmental documents are shown on Attachments B, C, and D. "Exploration" in this Order means land clearing, well drilling, well pad construction, formation stimulation ("well workovers"), sump construction, well testing, installation of sumps, geothermal fluid transfer, re-injection of geothermal fluid, temporary storage of petroleum fuels and other activities that are referenced in environmental documents entitled "Exploration Project" or "Exploration."

"Development" in this Order means all the elements of Exploration referenced in documents entitled "Telephone Flat Geothermal Development Project." In addition Development includes plant construction, and transmission line construction, which are also referenced in environmental documents entitled "Telephone Flat Geothermal Development Project." Construction and operation of a power plant including disposal of sanitary and industrial wastes from the power plant are not regulated by this Order, but will be addressed in a new Order to be adopted if appropriate prior to commencement of plant construction. Prior to plant operation, sanitary waste disposal will be by means of portable chemical toilets.

11. Wastes produced during drilling operations include soil, drill (rock) cuttings, drilling muds with additives, oil and associated wastewater. Drilling mud is inert mineral clay such as bentonite clay. Drilling mud additives may include sodium bicarbonate, soda ash, drilling soap, organic polymers, wood fibers, graphite, cottonseed hulls, walnut shells and cement. Drilling mud additives do not render the drilling mud hazardous when used according to manufacturer's specifications. During drilling operations, drilling mud, aerated mud and/or air will be used to transport drill cuttings to the surface. Drilling mud will be treated and contained in a closed system for continuous circulation using metal tanks. Drilling mud may be re-used in the drilling of additional wells, provided it is stored in leak-free tanks constructed of steel or some other durable impervious material capable of withstanding the degree of mechanical shock likely to occur at the site. At the conclusion of drilling, drilling muds may be mechanically de-watered and discharged to a lined cuttings sump or transported offsite for disposal at a regulated drilling mud disposal facility. Liquid from the de-watering will be discharged to a geothermal fluids sump. Auxiliary tanks meeting the same specifications as the drilling mud tanks will be used to collect any extraneous rig runoff and wash water used for separating solid drill cuttings.

    a. Temperature Gradient Holes: Drill cutting solids from temperature gradient holes will be mechanically separated, and deposited in un-lined "temperature gradient hole* cuttings sumps" (approximately 5,000 to 25,000 gallon capacity) located adjacent to drilling pads. Excess cement slurry from temperature gradient holes will also be discharged to the temperature gradient hole cuttings sumps. A representative

composite sample of temperature gradient hole drill cuttings will be taken at the completion of drilling. If sample analysis confirms that the cuttings are non hazardous and non designated wastes, the sump may remain open for future use. Wastes confirmed, "designated", as defined in Section 13173 of the California Water (CWC), or "hazardous" as defined in Article 1, Chapter 11, Division 4.5 of Title 22 California Code of Regulations (CCR), shall be removed and transported to an appropriate disposal site within 30 days after completion of test. Any temperature gradient hole* cuttings subsequently discharged to the sump must be sampled as required for the initial discharge. When the cuttings sumps have been filled to within two feet of the top, the Discharger may backfill with clean native soil, provided that all analysis have confirmed the contents of the sump to be neither hazardous nor designated.

b. Geothermal Wells: Drill cutting solids from geothermal wells will be mechanically separated, and deposited in lined "geothermal well cuttings sumps" (approximately 187,000 gallon capacity) located adjacent to drilling pads. These cuttings sumps are required to be constructed with a certified minimum two-foot thick clay liner, or equivalent synthetic liner, and tested to ensure a permeability of less than $1x10^{-6}$ centimeters per second (cm/sec). Excess cement slurry from the wells will also be discharged to the cuttings sumps. A representative composite sample of geothermal well drill cuttings will be taken at the completion of drilling. If sample analysis confirms that the cuttings are non hazardous and non designated waste materials, the sump may remain open for future use. Wastes confirmed, "designated", as defined in Section 13173 of the California Water Code (CWC), or "hazardous" as defined in Article 1, Chapter 11, Division 4.5 of Title 22 California Code of Regulations (CCR), shall be removed and transported to an appropriate disposal site within 30 days after completion of test. Any well cuttings subsequently discharged to the sump must be sampled as required for the initial discharge. When the geothermal well cuttings sumps have been filled to within two feet of the top, the Discharger may backfill with clean native soil, provided that all analysis have confirmed the contents of the sump to be neither hazardous nor designated waste.

12. Bore cleanout and flow tests will be performed at the completion of drilling to remove drilling cuttings and mud and evaluate the well for geothermal production. Fluids produced from these operations will be confined to lined "geothermal fluid sumps" with an approximate capacity of 750,000 gallons each. These sumps are required to be constructed with a certified minimum two-foot thick clay liner, or equivalent synthetic liner, and tested to ensure a permeability of less than $1x10^{-6}$ cm/sec. All fluid contents of the sump must be re-injected to an existing BLM approved and USEPA compliant geothermal well within 60 days of the completion of testing for the current season or in

no case later than **1 November** in any calendar year. Small quantities of residual fluids and/or accumulated solids in the sumps will be sampled and analyzed to confirm that they are neither hazardous nor designated waste. If residual material is non designated and non hazardous, the sumps may be left open until it is determined that there will be no further geothermal fluid discharge to the sump, or the sumps are full. At this point the sumps will be back-filled and capped with a soil layer capable of supporting vegetative growth. The USFS has requested that one or more of the geothermal fluids sumps be left unfilled after closure in order that they may fill with rainwater and snowmelt and provide wildlife habitat.

13. Exploration and Development include the flow testing of new and existing wells. The Discharger proposes to flow test Well Nos. 68-8, 31-17 and 87-13, existing geothermal wells in the Telephone Flat area as shown on Attachment D. Geothermal fluid pumped from wells will be pumped to geothermal fluid sumps before re-injection. The Discharger may also drill and test a well at well pad site 46-8. There is a sump approximately 10 years old at this site, which the Discharger intends to use if and when the well is drilled. In this case, the Discharger would be required to test the sump liner in order to demonstrate the existence of a two-foot compacted clay liner having a permeability of less than $1x10^{-6}$ cm/sec. The geothermal fluids from Well Nos. 68-8, 31-17 and 87-13 will be discharged to existing geothermal fluid sumps adjacent to the wells. Each of these sumps was originally constructed with a two-foot compacted clay liner and is required by this Order to have a permeability of less than $1x10^{-6}$ cm/sec. Because the geothermal fluid sumps have been unused for over ten years, re-compaction, and permeability testing will be required. Permeability testing must be conducted by, or under the direct supervision of a licensed professional Civil Engineer or certified Engineering Geologist, registered in the State of California. At the completion of each well test, any remaining fluids in the adjacent geothermal fluids sump will be re-injected to a geothermal well approved by BLM and USEPA. The lines from the sumps to the re-injection wells will be approximately six-inch diameter steel with grooved clamped joints tested at twice the operating pressure. .

14. Well Nos. 68-8, 31-17 and 87-13 have not been tested since 1989-91. Chemical analysis of fluid from these three wells is presented in the attached Information Sheet. The existing analytical data suggests that the geothermal fluid from these wells may contain arsenic and mercury. In previous analyses, the Discharger analyzed for mercury using an inductively coupled plasma - mass spectrometry (ICP/MS) method. This Order requires the Discharger to use the ultra clean sampling protocol and analysis by cold vapor atomic absorption (CVAA) (USEPA Method 1631) for all future sampling events.

15. The actual number and location of production and injection well sites to be used during the Telephone Flat Development Project will depend on the results of drilling, testing, and the response of the geothermal reservoir. The expected startup production well sites are: 16-18, 13-18, 52-18 (or 51-18), and 56-18; and the expected startup injection well sites are: 68-8 (existing), 72-17, and 15-16. Well sites 46-8 (existing well pad with no well), 84-7 and 31-17 (existing) could be either production or injection will sites depending on project needs. The other identified well pad locations: 26-7, 64-8,73-13, 25-18 and 83-18, would be used if supplemental production or injection is required as "make-up" over the life of the project.

16. The proposed exploration and development includes construction of two new well pads for drilling, completion and flow testing of two deep production size wells, 85-33 and 64-27. These two sites are immediately south and east of Fourmile Hill and are in the North Coast Region. The wells will be drilled to a depth of approximately 9,000 feet and flow tested for up to 30 days. Prior to drilling the well at 64-27, the Discharger plans to drill a temperature gradient hole to 6,000 feet or 500° F, whichever comes first. The Discharger proposes to re-inject geothermal fluid from flow tests in the Fourmile Hill Area including Well Nos. 85-33 and 64-27 to one or more wells in Telephone Flat. The geothermal fluids to be re-injected will be conveyed in aboveground steel pipe approximately 6 inches in diameter with grooved clamped joints. The Discharger no longer intends to replace these aboveground transfer lines with underground lines. The approximate pipeline routes are shown in Attachments A and D. Potable water for use in the Telephone Flat exploration programs will be supplied from a CPN Telephone Flat, Inc., supply well or the USFS wells which are adjacent to geothermal Well No. 17A-6 in the Arnica Sink area, in Section 1, T43N, R3E and Section 6, T43N, R4E respectively.

APPLICABLE REGULATIONS, POLICIES AND PLANS

17. The Central Valley Water Board adopted a Water Quality Control Plan, Fourth Edition, for the Sacramento and San Joaquin River Basins (hereafter Basin Plan). The Basin Plan designates beneficial uses, establishes water quality objectives, and describes an implementation program and policies to achieve water quality objectives for all waters of the Basin. These requirements implement the Basin Plan.

18. Medicine Lake Crater is a Hydrologic Subarea of the Pit River Hydrologic Unit, which is part of the Central Valley Basin. Beneficial uses of surface waters in the Medicine Lake Basin (Medicine Lake, Little Medicine Lake, Bullseye Lake, Blanche Lake, Payne's Springs I, II, III and Payne's Creek, Schonchin Spring, Crystal Spring, and an unnamed spring) are not specifically listed in the Basin Plan and there are no direct surface tributary streams to the Pit River. The Basin Plan states that for unidentified water bodies, the

beneficial uses will be evaluated on a case-by-case basis. The USFS and BLM have listed the uses of surface waters within the Medicine Lake Highlands as domestic, recreation, and fish habitat.

19. The beneficial uses of the underlying groundwater are municipal and domestic supply, agricultural supply, and industrial supply.

20. State Water Resources Control Board (State Water Board) Resolution No. 88-63, a policy entitled "Sources of Drinking Water," adopted May 19, 1988, provides that all surface and groundwaters of the State are considered to be suitable, or potentially suitable, for municipal or domestic water supply and should be so designated by the Regional Water Quality Control Boards, with certain exceptions. Among other exceptions, State Water Board Resolution No. 88-63 provides for exceptions where the aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 CFR Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR Section 261.3.

21. The Safe Drinking Water Act, (SDWA), authorizes USEPA to regulate "underground injection" which is defined in 40 U.S.C. Section 1421 (d) (1) as the "subsurface emplacement of fluids by well injection." The regulation of all injection wells is covered in Part 144 of the Code of Federal Regulations under the underground injection control (UIC) program. The regulations in this part establish minimum requirements for the UIC Program. Class V injection wells on federal land in California are administered by USEPA under the SDWA. Geothermal production wells on federal land are regulated by the BLM. The proposed Order requires Calpine Siskiyou Geothermal Partners, L.P. and CPN Telephone Flat, Inc. to comply with BLM and USEPA standards for injection wells. The Central Valley Water Board considers these standards to be protective of water quality.

22. The USEPA, on 16 November 1990, promulgated storm water regulations (40 CFR Parts 122, 123, and 124) which require specific categories of industrial facilities which discharge storm water to obtain NPDES permits and to implement Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT) to reduce or eliminate industrial storm water pollution.

23. The State Water Board adopted Order No. 97-03-DWQ (General Permit No. CAS000001), on 17 April 1997, specifying waste discharge requirements for discharge of storm water associated with industrial activities, excluding construction requirements, and requiring submittal of a Notice of Intent (NOI) by industries covered

under the permit. All storm water at the existing Telephone Flat well sites will be contained on-site as well pads are bermed and all runoff is directed to the geothermal fluids sumps. Consequently these facilities will not be required to obtain coverage under the General Industrial Storm Water Permit. However, land clearing, well pad construction, and road construction for new wells require coverage under the General Construction Storm Water Permit. The Discharger has obtained coverage under the General Construction Storm Water Permit (WDID No. 5R476320945) for those activities.

SITE DESCRIPTION
SURFACE AND GROUNDWATER CONSIDERATIONS

24. Medicine Lake Highlands is a shield volcano* on the Modoc Plateau east of Mt. Shasta covering a 750-square-mile area with approximately 140 cubic miles of surficial volcanic rocks. Medicine Lake Highlands stands above the general landscape and is generally perceived as a water source for streams, regional aquifers, springs, and wells. Two hydrologic units have been identified within the Medicine Lake Highlands; the shallow groundwater system that occurs only within the highlands, and the geothermal reservoir. The shallow system is a perched system that occurs at an elevation of approximately 3,300 feet higher than the regional groundwater system of the Modoc Plateau. The water source for the shallow system is infiltration of precipitation, primarily snowmelt. The shallow groundwater is separated from the geothermal reservoir by a thick sequence of non-porous highly altered volcanic rocks, which form a thick impermeable cap. Groundwater elevations are highest in the center of Medicine Lake Highlands with flow moving radially away from the center.

25. Within the Medicine Lake Basin there are four lakes, including Medicine Lake, Little Medicine Lake, Blanche Lake, and Bullseye Lake. Surface drainage in the Telephone Flat area and the sections outside that area covered in this Order, is tributary to either Medicine Lake or Arnica Sink. A number of springs and intermittent streams exist within and adjacent to Telephone Flat, including Paynes Springs I, II and III Crystal Springs, Schonchin Spring, and an unnamed spring, as shown on Attachments A and B. The almost total absence of perennial stream flow in the Medicine Lake Highlands results from the combination of relatively low precipitation (largely snowfall in the winter) and highly permeable volcanic soils and lava flows.

26. Soils in the project area are described as well drained to excessively well drained sandy loams formed in materials weathered from extrusive igneous rocks overlain by young pumice and ash deposits.

27. The groundwater table on the flanks of the Medicine Lake caldera is described as erratic, varying from about 300 ft to over 1000 ft below ground surface. Within the caldera of the Medicine Lake Highlands the depth to the first major aquifer is generally about 200 ft.

28. The groundwater hydrology of Medicine Lake Highlands is controlled by a number of factors including:

    a. Thick and highly permeable surficial deposits of lava flows, cinders, and pumice, which readily allow infiltration of precipitation.
    b. A saturated thickness (groundwater interval) that generally ranges from a few hundred feet to about 2000 feet.
    c. An impermeable, high temperature gradient zone that underlies the groundwater saturated zone and forms a thick (1500 feet to several thousand feet) obstruction to flow between the groundwater aquifer and the geothermal system.
    d. Radial outflow of groundwater away from the caldera rim of the Medicine Lake Highlands (i.e. down the regional hydrologic gradient).

    As a result of (c.) above and the casing design imposed by BLM, the impacts to groundwater will be insignificant, provided the Discharger complies with the requirements of BLM and USEPA and the prohibitions, specifications, provisions, and mitigations measures prescribed in this Order and the attached Monitoring and Reporting Program.

29. Annual precipitation for the Medicine Lake area is estimated to be 35 to 45 inches, with an average of approximately 43 inches. Precipitation occurs primarily as snow. The mean evaporation for the area is approximately 50 inches per year (California Department of Water Resources).

30. Fresh water within the project area, primarily for dust suppression use and drilling activities, will be either trucked in or supplied from an existing water supply well within the Arnica Sink area. Fresh water may be pumped from the supply wells to other sites within the project area.

CEQA AND LEGAL CONSIDERATIONS

31. In 1996, Calpine Corporation submitted a Plan of Operation to BLM for construction and operation of a 49.9 MW geothermal power plant in the Fourmile Hill area in the North Coast Region. A Draft EIS/EIR for the project was distributed to the public for review and comment in July 1997. In February 1997 CEGC submitted a Plan of Operation (POO)* to the BLM for construction and operation of a 48 MW geothermal power plant in the Telephone Flat area in the Central Valley Region. In May 1998 a Draft EIS/EIR

for the project was distributed to the public for review and comment. On 31 May 2000 separate Records of Decision (RODs) were issued by the USFS and BLM for the two power plant projects described above. The Fourmile Hill Plan of Operation was approved as amended. The Telephone Flat Plan of Operation was denied on the basis of its effect on American Indian use of Medicine Lake and on American Indians as a minority population. CEGC did not present the EIR to the CEQA lead agency, Siskiyou County Air Pollution Control District (SCAPCD), for approval. However, in a letter dated 17 April 2002, Calpine Corporation, the new owner of CECG, requested the SCAPCD to certify the EIR.

On 4 April 2002, the United States Department of Justice and CPN Telephone Flat, Inc., reached an agreement to resolve breach of contract and litigation concerning the denial of the Telephone Flat Geothermal Development Project. As part of the settlement agreement, the BLM and USFS were to reconsider the May 2000 ROD, which denied the project. In turn CPN Telephone Flat, Inc., agreed to suspend litigation against the United States until the reconsideration was complete. The reconsideration took into account the President's National Energy Policy and other changes in the renewable energy field, which had occurred since the May 2000 decision. The settlement directed both BLM and USFS to complete reconsideration by November 2002.

On 26 November 2002 the BLM and USFS approved development of the 48 MW geothermal power plant at Telephone Flat by CPN Telephone Flat, Inc. The BLM and USFS determined that the environmental analysis conducted under provisions of NEPA was still valid, but that the increased national and state focus on renewable energy, along with the further mitigation measures required, including realignment of the transmission line to reduce visual and Native American concerns, justified approval of the project. A determination of NEPA adequacy and a Biological Opinion (no jeopardy) accompanied the decision.

32. An Update Assessment to the *Telephone Flat Geothermal Development Project EIS/EIR, February 1999,* was prepared for the SCAPCD, in November 2002, to provide information to determine if recirculation of the EIR would be required prior to certification. The Update Assessment found there to be no new circumstances or information relevant to environmental concerns and bearing on the project. Further, the Update Assessment found no additional feasible mitigation measures, that are considerably different from others previously analyzed in the final EIR/EIS, which would clearly lessen or reduce the previously identified environmental impacts to a level of insignificance and which were declined to be adopted by the project sponsor. The SCAPCD by and through the Air Pollution Control Officer (APCO) concluded in its Findings of Fact and Statement of Overriding Considerations that the economic, social,

and other benefits of the project would override any significant environmental impacts. The APCO certified the Telephone Flat Geothermal Development Project EIR (State Clearinghouse No. 97052078) on 14 February 2003. An administrative appeal of the APCO's decision to certify the EIR was denied by the SCAPCD by and through its Board of Directors on 25 March 2003, at which time the SCAPCD Board took the following actions affirming the APCO's conclusions:

- Certification of an EIR for the Telephone Flat Geothermal Development Project (State Clearinghouse No. 97052078); and
- Adoption of a Mitigation Monitoring and Reporting Program (Statement of Decision 03-01); and
- Adoption of Findings of Fact and Statement of Overriding Considerations for the Telephone Flat Geothermal Development Project (Statement of Decision No. 03-01); and
- Adoption of the Second EIR Errata (Statement of Decision 03-01).

The Central Valley Water Board is a responsible agency for the purposes of CEQA. The Central Valley Water Board has considered the CEQA and NEPA documents prepared for this project and finds that the CEQA and NEPA documents are suitable for purposes of its use as set forth in 14 California Code of Regulations (CCR) section 15231 and that no subsequent EIR is required pursuant to 14 CCR section 15162. The CEQA and NEPA documents evaluated the potential impacts to waters of the state and the Central Valley Water Board has included mitigation and monitoring to address identified impacts as described below.

COMPREHENSIVE HYDROLOGY MONITORING PLAN

33. The environmental documents certified for the exploration and development projects require the Discharger to perform mitigations related to water quality as follows:

    1. Glass Mountain Unit Geothermal Exploration Project (EA # CA027-EA95-06). The Mitigated Negative Declaration for this project contained the following mitigation measures:

        a. *"In order to verify that no effects are occurring at Paynes Springs from implementation of wells at well pads 56-18 and 13-18, CEGC,[1] will collect*

[1] "CEGC" and "Calpine" were the predecessors in interest to Calpine Siskiyou Geothermal Partners, L.P., and CPN Telephone Flat, Inc. As successors in interest, Calpine Siskiyou Geothermal Partners, L.P., and CPN Telephone Flat, Inc., have assumed the responsibility to implement mitigation measures assigned to predecessors "CEGC" and "Calpine."

water samples from the springs before drilling, during initial drilling, after drilling to 500 feet (the equivalent elevation to the springs), and after completion of these wells. If effects are identified after analysis of the samples, drilling at these wells will be halted until the hydrologic connection to the springs is better understood. BLM and the USFS will compare the samples after they are analyzed." (Mitigation Measure 4.3.1)

2. Glass Mountain Exploration (EA# CA320-NEPA02-23). The mitigated negative declaration for this project contained the following water quality related mitigation measures:

   a. *"Calpine shall inspect and promptly repair each sump, and pipeline after a seismic event of magnitude 5.0 or greater."* (Mitigation Measure 4.3-1)
   b. *"Inspect integrity of sumps at well sites 68-8, 31-17, and 87-13 and repair as necessary."* (Mitigation Measure 4.3-2)

   c. *"Remove geothermal fluid in sumps within 60 days of discharge."* (Mitigation Measure 4.5-10)

3. Telephone Flat Geothermal Development Project (SCH # 97052078). The EIR for this project contained the following water quality related mitigation measures:
   a. *"The Project Applicant, CEGC, has submitted a proposed hydrology monitoring plan to the BLM. The Project Applicant shall implement the approved monitoring plan in coordination with hydrologic monitoring which may be required for the Fourmile Hill Geothermal Project and in conformance with the monitoring requirements of the BLM and USFS. The proposed hydrology monitoring plan includes, but is not limited to the following*

      - *Collection of baseline water level and water quality data*
      - *Monitoring of water level in wells*
      - *Monitoring lake stages; and*
      - *Monitoring well, spring, and lake water quality"*
        (Other Measure 3.2.3.3-3a)

   b. *"If hydrologic monitoring detects adverse effects that can be reasonably demonstrated to have been caused by project production or injection of geothermal fluids, the Project Applicant shall make appropriate changes to the wellfield production and injection to remedy the observed adverse effects."* (Other Measure 3.2.3.3-8)

c. *"The Project Applicant shall prepare an Emergency Release Contingency Plan which defines the control and restoration measures to be implemented in the event of a well blowout, sump overflow, or pipeline rupture."* (Other Measure 3.2.3.4-13)

34. Compliance with these water quality related mitigation measures are included as requirements in these WDRs and attached Monitoring and Reporting Program. The updated Medicine Lake Basin Comprehensive Hydrology Monitoring Plan submitted by the Discharger appears in Attachment E of these WDRs and is incorporated as part of Monitoring and Reporting Program No.R5-2006-0115. The Monitoring Plan is perceived by BLM and the USFS as a dynamic document that will change as project requirements change. The Central Valley Water Board, BLM and the Telephone Flat Development Project Oversight Committee have reviewed the updated version of the Comprehensive Hydrology Monitoring Plan. The Discharger proposes a combination of groundwater monitoring adjacent to each development project site and area wide baseline data collection/water quality monitoring. The Discharger proposes a monitoring frequency of twice annually, unless otherwise specified in the individual project WDRs. Prior to start-up of the either the Telephone Flat Development Project or the Fourmile Hill Development Project, Calpine Siskiyou Geothermal Partners, L.P., and CPN Telephone Flat, INC. will complete installation of a minimum of three shallow groundwater monitoring wells and one deep groundwater monitoring well at the respective project site. In addition to these project specific monitoring wells, several domestic water wells, natural springs and lakes within the Basin will also be monitored. The surface springs, lakes, and domestic wells that will be monitored were identified in USGS Open-File Report 95-750. The EIR/EIS does not require the mitigation measures for the Telephone Flat Development Project to take effect until the development project begins; however, CPN Telephone Flat, Inc., has voluntarily begun monitoring many of the sites in the Monitoring Plan. CPN Telephone Flat, Inc., has submitted a report presenting data gathered on the water quality of lakes and wells sampled twice during 2002.

PROCEDURAL REQUIREMENTS

35. State Water Board Resolution No. 68-16, *Statement of Policy with Respect to Maintaining High Quality of Waters in California*, (hereafter Resolution 68-16) requires the Central Valley Water Board, in regulating the discharge of waste, to maintain high quality waters of the State until it is demonstrated that any change in quality will be consistent with the maximum benefit to the people of the State, will not unreasonably

affect beneficial uses, and will not result in water quality less than that described in the Central Valley Water Board's policies (e.g., quality that exceeds water quality objectives). Threats to water quality resulting from the project include sediment discharge from soil disturbance, discharge of geothermal fluid to ground surface as a result of transfer pipe leakage, spills and leaks of hazardous materials used during drilling operations. Soils at the project site are highly permeable and drainage courses are relatively few and widely separated. Additionally the exploration and development takes place during the summer months after snowmelt has ceased. As a result it is very unlikely that any spill or disturbed soil would be conveyed to a stream, spring, lake or other water course. Furthermore the Discharger is required to obtain coverage under the NPDES General Construction Storm Water Permit and implement appropriate erosion control measures. Geothermal fluids and cuttings from geothermal wells are required by this Order to be held in sumps with a two-foot compacted clay liner having a permeability of less than $1x10^{-6}$ cm/sec. Geothermal fluid may not be held in sumps for more than 60 days and in no case later than **November 1** of any calendar year. The Discharger is also required to conduct regular inspections of geothermal fluid transfer lines and to prepare a spill prevention plan for the hazardous materials used in well acidification (formation stimulation). A minimum of three shallow and one deep groundwater monitoring well is required at each project site. The conditional discharge as permitted herein is consistent with the provisions of State Water Board Resolution No. 68-16 because the impact on water quality will be insignificant.

36. The Discharger is required to document that the existing sumps as originally constructed had a compacted clay liner of minimum two-foot thickness and a minimum permeability of $1x10^{-6}$ cm/sec. Because the sumps in Telephone Flat have not been used for more than 10 years and may have developed cracks due to periods in which the liners were desiccated, the Discharger will be required to re-compact these liners and retest them to confirm that the permeability requirement is being met. Tests for all sump liners must be conducted by, or under the supervision of, a licensed professional Civil Engineer or Certified Engineering Geologist registered in the State of California. The Discharger is required in Provision D.12. to retain snow melt water in geothermal fluids sumps and to accurately measure the level of water in the sumps daily over a period of at least one week for any sump that will receive geothermal fluid within twelve months. The purpose of this requirement is to determine if there are leaks in the sumps. Discharge of geothermal fluid to a sump which has not been leak tested within twelve months of the discharge is prohibited by this Order. The flow testing of geothermal wells will proceed for approximately 30 days and the Discharger is required to empty the sumps of geothermal fluids within 60 days of testing. This means that geothermal fluid will be in the sumps for a maximum of 90 days, minimizing the opportunity for percolation of geothermal fluids to groundwater. Spent acid is flowed back to the surface, discharged to

the well site sump, and immediately injected back into the geothermal reservoir minimizing the opportunity for percolation of spent acid to groundwater.

37. The Discharger has submitted an updated Comprehensive Hydrology Monitoring Plan to BLM for approval, and is required to implement the plan as part of the mitigation in the Telephone Flat Development EIR/EIS. The installation of three shallow and one deep groundwater monitoring well is proposed in the Comprehensive Hydrology Monitoring Plan. Implementation of the Plan is not required by the EIR/EIS until the Discharger has initiated the Development Project. However the Discharger has voluntarily begun some of the monitoring contained in the Comprehensive Hydrology Monitoring Plan. In response to a request by staff, the Discharger submitted a report prepared by Earth Systems Southwest dated 5 May 2006 that discussed the rationale for groundwater monitoring and specified the monitoring well locations. Staff reviewed the report and identified deficiencies. Provision D.11 of these WDRs requires the Discharger to submit an additional report that proposes the location of the three shallow and one deep monitoring well for Executive Officer approval after consideration of comments by interested parties. Provision D.11 also provides requirements for the timing of installation of monitoring wells. Installation of the wells must be completed prior to the injection of acids or other Enhanced Geothermal System (EGS) materials and/or the testing of additional geothermal wells, and in no case later than **1 November** of the year in which development is initiated.

38. The discharge of drilling mud and cuttings from well drilling operations to an on-site sump is exempt from the requirements of Title 27, of the California Code of Regulations (CCR), as set forth in Section 21565 of Title 27. The exemption, pursuant to Section 20090(g) of Title 27, applies to operations where:

    a. Discharges of wastes are to on-site sumps and do not contain halogenated solvents, and

    b. The Discharger removes all wastes from the sump or

    c. The Discharger removes all free liquid from the sump and covers residual solid and semi-solid wastes, provided that representative sampling of the sump contents after liquid removal shows residual solid wastes to be nonhazardous. If the sump has appropriate containment features, it may be reused.

39. The Central Valley Water Board has considered the information in the attached Information Sheet in developing the Findings of this Order.

40. Section 13267(b) of the California Water Code (CWC) states, in part, that:

"In conducting an investigation specified in subdivision (a), the Regional Board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging or who proposes to discharge within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste outside of its region that could affect the quality of waters of the state within its region shall furnish under penalty of perjury, technical or monitoring program reports which the regional board requires. The burden, including costs of these reports shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports. In requiring those reports, the regional board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports." Monitoring and Reporting Program No. R5-2006-0115 is necessary to assure compliance with these waste discharge requirements and is established pursuant to CWC Section 13267.

41. The Central Valley Water Board has notified the Discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for this discharge, and has provided them with an opportunity for a public hearing and an opportunity to submit written comments.

42. The Central Valley Water Board, in a public meeting, heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED that Order No. 95-199 be rescinded and that Calpine Siskiyou Geothermal Partners, L.P., and CPN Telephone Flat, Inc., and U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior, Bureau of Land Management, their agents, successors, and assigns, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, shall comply with the following:

A. Discharge Prohibitions

1. The discharge of any waste not authorized nor disclosed by the Discharger is prohibited.

2. The discharge of geothermal injection fluids, drilling mud, spent acids used for formation stimulation, drill cuttings, petroleum products, or other waste streams associated with exploration and development of geothermal resources in a manner

contrary to that described in Finding Nos.7, 8, 10, 11, 12, 13, 15 and 16 is prohibited.

3. The discharge of wastes, other than storm water (in compliance with the General Construction Storm Water Permit), to surface waters, or surface water drainage courses is prohibited**.**

4. The use of geothermal fluids generated during drilling/testing activities, for purposes other than specified herein, is prohibited. This includes but is not limited to the use of these fluids for dust control on access roads, well pads, or other developed project locations.

5. The injection of geothermal fluids from wells that have recently undergone acidification or EGS treatment to Well Nos. 85-33 or 64-27 is prohibited unless approved by BLM and/or USEPA and the North Coast Water Board.

6. The discharge of geothermal fluids to a sump which has not been monitored for leaks within twelve months as described in Provision D.12 and the Monitoring and Reporting Program is prohibited.

B. Discharge Specifications

1. The discharge, including geothermal fluid extraction and re-injection shall not cause a pollution or nuisance as defined by the CWC Section 13050.

2. Waste produced during the drilling pad site preparation, road construction, and road maintenance shall be placed where it will not enter waters of the State.

3. Waste confinement barriers shall be protected and maintained to ensure their effectiveness. All construction spoils shall be adequately protected from erosion using applicable best management practices at all times and shall be maintained continuously. Appropriate best management practices for run-on controls shall be implemented on all construction spoils at all times and shall be maintained continuously.

4. All spent acid waste and geothermal fluids produced during drilling or well testing shall be contained in tanks, lined geothermal fluids sumps, or other appropriate containment structures as approved by the Executive Officer. The Discharger shall re-inject spent acid waste immediately and maintain two re-injection pumps, one primary and one spare, at each fluid sump being used for formation stimulation. The Discharger shall re-inject all other geothermal fluid within the sumps as soon as possible and not more than 60 days after the completion of testing into any

existing geothermal well covered in this Order provided such action is in compliance with applicable USEPA guidelines (see 40 CFR Part 144) and BLM's geothermal resource Orders and approved by BLM and USEPA. In no case shall the geothermal fluid remain in the geothermal fluids sumps later than **1 November** in any calendar year.

5. All geothermal well cutting sumps and geothermal fluid sumps shall be lined with a minimum thickness of two feet compacted clay, or an equivalent geosynthetic liner, certified and tested to ensure the permeability is no more than $1x10^{-6}$ cm/sec. If a geosysthetic liner is used, a suitable underliner shall be used to prevent liner damage. In order to prevent perforation of the sump liner by root growth, sumps and sump berms shall be kept free of vegetative growth.

6. The Discharger shall maintain a minimum of two feet of freeboard (measured vertically to the lowest point of overflow) in all sumps containing fluid liquid wastes to accommodate seasonal precipitation and to prevent overtopping from wind and wave action.

7. When it is determined that there will be no further discharge to temperature gradient hole cuttings sumps, geothermal well cuttings sumps or geothermal fluid sumps, or when the sumps are full, and samples demonstrate that in-place wastes are neither designated nor hazardous, all cuttings sumps and fluid sumps, except those left open to provide wildlife habitat as requested by the USFS, shall be backfilled and ground graded to contour. The cutting sumps and fluid sumps shall be capped with one foot of clay having a permeability of no greater than $1x10^{-6}$ cm/sec. A minimum of one foot of soil capable of supporting vegetative growth shall be placed over the clay cap.

8. All petroleum products, acids, hydraulic fluids, drilling mud additives or other liquid materials shall be stored and used in such a manner that all spills are contained.

9. All geothermal wells shall be drilled and constructed in accordance with BLM guidelines to prevent degradation of groundwater or intermixing of groundwater from different aquifers.

10. In the event of seismic activity of magnitude 5.0 or greater, the Discharger shall inspect each of the sumps and pipelines and promptly repair any leaks or other damage that has occurred.

11. Appropriate self-contained sanitary facilities shall be provided at each testing site while the site is in use.

C. Financial Assurance

1. BLM has required the Discharger to post financial assurance for cessation of exploration activities, or closure of a power plant if one is constructed, which includes the following activities: Plug and abandon 18 geothermal wells, reclaim 18 wellpads, reclaim the sumps on each of the 18 wellpads, remove 1.8 miles of water lines from Arnica Sink, remove 7.9 miles of production and injection pipelines, plug 3 water monitoring wells, abandon 11.5 miles of roads within wellfield, reclaim powerplant pad site, tear down and remove powerplant, cooling tower, ancillary buildings, and foundations within plant site and tear down and remove 23 miles of 230 KV transmission line. If these financial assurance funds become encumbered for some purpose other than site closure, or become unavailable for site closure for any reason, the Discharger shall immediately notify the Central Valley Water Board, and the Discharger shall, **within 30 days of such notification and by 30 April of each year thereafter**, prepare and submit, plans with detailed cost estimates and a demonstration of assurances of financial responsibility for closure and post closure as described above. Under such circumstances, the Discharger shall provide the assurances of financial responsibility to the Executive Officer as required by Title 27 CCR, Division 2, Subdivision 1, Chapter 6. The assurances of financial responsibility shall name the Central Valley Water Board as beneficiary. The Discharger shall adjust the cost annually to account for inflation and any changes in facility design, construction, or operation.

2. The Discharger shall, **by 30 April of each year (beginning 30 April 2007)**, prepare and submit, plans with detailed cost estimates and a demonstration of assurances of financial responsibility for initiating and completing corrective action for all known or reasonably foreseeable releases arising from the exploration and/or development of geothermal resources within the areas covered by this Order. The Discharger shall provide the assurances of financial responsibility to the Central Valley Water Board as required by Title 27 CCR, Division 2, Subdivision 1, Chapter 6. The assurances of financial responsibility shall provide that funds for corrective action shall be available to the Central Valley Water Board upon the issuance of any order under California Water Code, Division 7, Chapter 5. The Discharger shall adjust the cost annually to account for inflation and any changes in facility design, construction or operation. The financial assurance fund for corrective action shall be established and approved by the Executive Officer **prior to any of the following actions (but no later than 30 April 2007)**: the discharge

of geothermal fluid, cuttings from geothermal wells or temperature gradient holes to sumps, or the performance of formation stimulation.

D. Provisions

1. The Discharger shall comply with Monitoring and Reporting Program R5-2006-0115, which is part of this Order, and any revisions thereto as ordered by the Executive Officer.

2. The Discharger shall comply with all the items of the "Standard Provisions and Reporting Requirements for Waste Discharge Requirements," dated 1 March 1991, which are a part of this Order. This attachment and its individual paragraphs are referred to as "Standard Provision(s)."

3. The Discharger shall limit use of formation stimulation by acids to Well No. 31-17 until use of formation stimulation by acids is approved by BLM for other wells and this Order is revised if necessary following additional NEPA and CEQA review. The revised Order may require additional monitoring well installation.

4. The Discharger shall provide for the transfer of geothermal fluids between geothermal fluids sumps and injection wells by means of an aboveground piping system.

5. The Discharger shall comply with the standards contained in the Health and Safety Code, Chapter 6.67, Aboveground Storage of Petroleum. As required by the act, the Discharger shall submit a Spill Prevention Control and Countermeasure, (SPCC), Plan prepared by a licensed professional Engineer registered in the State of California. The SPCC Plan shall be updated a minimum of every three years or within 30 days of any significant process change. All updates shall be certified by a licensed professional Engineer registered in the State of California and submitted to the Central Valley Water Board. In addition to the SPCC Plan for storage of petroleum, the Discharger shall prepare a hazardous material spill/release contingency plan and provide appropriate training to all project employees on the proper response to potential releases of other chemicals such as hydrochloric acid and hydrofluoric acids. The hazardous material spill/release contingency plan shall be submitted to the Central Valley Water Board prior to the storage or use of hazardous materials on site.

6. The Discharger shall develop and implement a plan for immediate detection of leaks or failures in the aboveground pipelines carrying geothermal fluid for re-injection. An alarm or shutoff device shall be installed on the pump used in the

geothermal fluid transfer pipeline. Pumping of geothermal fluids shall be suspended immediately following major pipeline failure. The plan shall include daily inspection of the entire length of aboveground line in operation at the time, and the maintenance of a daily log. Minor leaks shall be repaired immediately upon being identified. Lines should be sign posted or marked to identify the fluid being pumped and alerting the public of the potential danger.

7. Prior to their use for the containment of geothermal fluids, the Discharger shall submit evidence that new geothermal fluids sumps were constructed with liners having a minimum thickness of two foot and permeabilities no greater than $1x10^{-6}$ cm/sec. Prior to their use, the Discharger shall re-compact the liners in the four existing geothermal fluid sumps, (68-8, 31-17, 87-13 and 46-8) in the Telephone Flat area and retest the liners to confirm that permeabilities are no greater than $1x10^{-6}$ cm/sec. Alternatively the Discharger may install equivalent synthetic liners as approved by the Executive Officer. All tests must be conducted under the direct supervision of a licensed professional Civil Engineer or Certified Engineering Geologist, registered in the State of California. Permeability test results shall be submitted to the Executive Officer prior to discharging waste to each sump. The Discharger shall install splash pans or other protective devices to insure that erosion from the incoming geothermal fluid does not compromise the liner.

8. Upon completion of drilling operations, samples of accumulated solids shall be obtained from geothermal well and temperature gradient hole cuttings sumps. Analyses of the solids shall be submitted to the Executive Officer to demonstrate that the solids are neither hazardous nor designated and if so confirmed may be buried in place as described in Finding No. 10. Wastes confirmed to be "designated" as defined in Section 13173 of the (CWC), or "hazardous" as defined in Article 1, Chapter 11, Division 4.5 of Title 22 (CCR), shall be removed and transported to an appropriate disposal site within 30 days after completion of testing, weather permitting. All cuttings sumps shall be backfilled and the ground graded to contour natural conditions within 90 days following completion of drilling. If the cutting sumps cannot be closed within the time period, the Discharger shall provide a report to the Executive Officer within 90 days of completion of drilling demonstrating why the sump cannot be closed and how the sumps will be protected. The report shall include a time schedule for sump closure. In no case shall cutting sumps remain open more than one year after completion of drilling operations unless they meet the requirement to remain open for future use.

9. Upon completion of the well tests and when residual liquids have been removed, samples of residual accumulated solids shall be obtained from all cuttings and

geothermal fluid sumps. Analyses of the residue shall be submitted to the Executive Officer to demonstrate that it is compatible with on-site disposal and sump closure as described in Finding Nos. 10 and 11 and Discharge Specification D. 7. Wastes confirmed to be designated as defined in Section 13173 of the (CWC), or hazardous as defined in Article 1, Chapter 11, Division 4.5 of Title 22 (CCR), shall be removed and transported to an appropriate disposal site within 30 days after completion of testing. A time schedule for sump closure shall be provided by the Discharger and shall be approved by the Executive Officer.

10. A licensed professional Civil Engineer or Certified Engineering Geologist, registered in the State of California, shall be responsible for the design and construction of cuttings and geothermal fluid sumps, including material testing, construction, inspection, maintenance, and closure.

11. The Discharger has submitted a report prepared by Earth Systems Southwest dated 5 May 2006 which discusses the rationale for groundwater monitoring and specifies the monitoring well locations, which has been reviewed by Water Board staff. After consultation with Water Board staff and interested parties, including BLM, USFS, United States Geological Survey (USGS), the Pit River Tribes and the Mt. Shasta Bioregional Ecology Center, the Discharger shall submit for approval a revised report prepared by, or under the supervision of, and signed by a licensed professional Civil Engineer, Certified Engineering Geologist or Registered Geologist to the Executive Officer by **1 June 2007** which presents a rationale for monitoring well placement and specifies the location of the three shallow and one deep monitoring well as required in the "Medicine Lake Basin Comprehensive Hydrology Monitoring Plan" (Attachment E). After the location is approved by the Executive Officer, at least three shallow and one deep monitoring wells shall be installed prior to the performance of well acidification. The monitoring well installation shall commence prior to **15 August** and shall be completed no later than **1 November** in the year in which development or the testing of geothermal wells is initiated. After review of monitoring data these WDRs may be revised to include additional monitoring well installation. If hydrologic monitoring detects adverse impacts to water quality and these effects can be reasonably demonstrated to have been caused by testing of geothermal wells, or transfer or injection of geothermal fluids, BLM and Calpine Siskiyou Geothermal Partners, L.P. shall make appropriate changes to wellfield production and injection operations to cease the release of geothermal fluids causing adverse impacts to water quality.

12. During sump testing the Discharger shall install a level sensing device and pan evaporation equipment having an accuracy of within plus or minus 0.125 inches in any geothermal fluids sump intended for containment of geothermal fluids. Prior

to a season when geothermal fluids will be discharged to a particular sump, that sump shall be allowed to accumulate snow melt, and the level of water in the sump and the pan evaporation device monitored daily for a period of at least one week. A hydraulic balance shall be performed on each sump taking into account rainfall and evaporation. The level measurements described in this Provision are for the purpose of leak detection, and should be recorded separately from the measurements taken to demonstrate two foot of freeboard. At the completion of monitoring, the Discharger shall submit the monitoring results to Central Valley Water Board staff and repair or re-install the liner as directed by the Executive Officer.

13. In the event of any change in control or ownership of land or waste discharge facilities presently owned or controlled by the Discharger, the Discharger shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be immediately forwarded to this office.

14. The Discharger must comply with all conditions of this Order, including timely submittal of technical and monitoring reports as directed by the Executive Officer. Violations may result in enforcement action, including Central Valley Water Board or court orders requiring corrective action or imposing civil monetary liability, or in revision or rescission of this Order.

15. A copy of this Order shall, at all times, be kept at the discharge facility for reference by operating personnel. Key operating personnel shall be familiar with its contents.

16. The USFS as administrator of the property at which the discharge is to occur, is ultimately responsible for ensuring compliance with these requirements. The BLM has authority to issue leases for, and make determinations on all geothermal activities to be conducted on federal lands. Calpine Siskiyou Geothermal Partners, L.P., and CPN Telephone Flat, Inc., are responsible for compliance with these requirements including day-to-day operations and monitoring. Enforcement actions will be taken against the USFS and BLM only in the event that enforcement actions against Calpine Siskiyou Geothermal Partners, L.P., and CPN Telephone Flat, Inc., are ineffective or would be futile, or that enforcement is necessary to protect public health or the environment. In addition, since the USFS and BLM are public agencies, enforcement actions will only be taken against them only after they are given the opportunity to use their governmental powers to remedy the waste discharge.

17. The Board will review this Order periodically and may revise requirements when necessary.

I, PAMELA C. CREEDON, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region, on 27 October 2006.

original signed by
PAMELA C. CREEDON, Executive Officer

JFR: sae

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

MONITORING AND REPORTING PROGRAM NO. R5-2006-0115
FOR
CALPINE SISKIYOU GEOTHERMAL PARTNERS, L.P., AND
CPN TELEPHONE FLAT, INC., AND
U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE AND
U.S. DEPARTMENT OF INTERIOR, BUREAU OF LAND MANAGEMENT
GLASS MOUNTAIN UNIT GEOTHERMAL
EXPLORATION AND DEVELOPMENT PROJECTS
SISKIYOU COUNTY

This Monitoring and Reporting Program describes requirements for notification of construction activities, geothermal fluid monitoring, sump monitoring, surface and ground water monitoring. This Monitoring and Reporting Program is issued pursuant to Water Code Section 13267. The Discharger shall not implement any changes to this Monitoring and Reporting Program unless revised by the Executive Officer.

NOTIFICATION

PRIOR TO CONSTRUCTION

The Discharger shall submit a notice, in writing, to the Central Valley Regional Water Quality Control Board (Central Valley Water Board) at least seven days prior to any construction associated with drilling site preparation, well drilling, and road construction. The notice shall include:

1. Proposed construction dates
2. Location of the facilities
3. Description of the facilities
4. Method of construction
5. Proposed location of ultimate disposal of drill cuttings and geothermal fluids

CERTIFICATION PRIOR TO DISCHARGE

The Discharger shall submit a written certification to the Regional Board after construction or reconstruction of a cuttings sump or geothermal fluid sump and prior to any discharge. The certification shall include the following information:

1. Permeability of the disposal sump liner
2. Thickness of the disposal sump liner

PROGRESS REPORTS

The Discharger shall notify the Central Valley Water Board, in writing no later than five days after the following events:

1. First waste discharge to a cuttings or geothermal fluid sump
2. Completion of each well drilled within the lease area
3. Completion of waste discharge to a cuttings or geothermal fluid sump
4. Completion of cuttings or geothermal fluid sump closing activities

WASTE TRANSFERS

The Discharger shall record all transfers of waste from cuttings or geothermal fluid sumps. The record shall include the type and amount of waste removed and the location of the new disposal site. This information shall be submitted to the Central Valley Water Board monthly.

CIRCULATION LOSS*[1]

The Discharger shall immediately notify the Central Valley Board of any circulation loss during the construction of a well at depths less than 1300 feet. The notice shall include:

1. Location of the well
2. Well depth at the circulation loss
3. Amount of drilling fluid lost
4. Method of correction

GEOTHERMAL FLUID MONITORING

The Discharger shall record the volume of geothermal fluids produced and discharged to the lined geothermal fluid sumps. A representative sample of geothermal fluids shall be obtained from each well flowed. The well sample should be taken immediately after separation of the steam has taken place. The sample should be taken toward the end of the testing period so as to give as representative a sample as possible. Fluid purged from geothermal wells, which have had materials such as hydrochloric and hydroflouric acids injected for the purpose of formation stimulation, shall be sampled within eight hours of being pumped from the well, and analyzed for the constituents listed in the table. The sample results shall be reported monthly during discharge to the sumps. The samples shall be analyzed for the following:

[1] Terms indicated with an asterisk (*) are defined in the Glossary of Terms in the Information Sheet.

Constituents	**Units**
pH	pH Units
Specific Conductivity	µmhos/cm
Total Dissolved Solids	mg/L
Sulfide	mg/L
General Minerals[1]	mg/L
Boron	µg/L
Cobalt	µg/L
Iron	µg/L
Molybdenum	µg/L
Manganese	µg/L
Vanadium	µg/L
Priority Pollutant Metals[2]	µg/L
Mercury[3]	ng/L

[1] General Minerals shall include: Anions – F, Cl, NO_2, NO_3, PO_4, and SO_4 Cations – NH_4, K, Ca, Mg, Na, HCO_3, CO_3, and Al.

[2] Priority pollutant metals include: Antimony, arsenic, beryllium, cadmium, total chromium, chromium VI, copper, lead, nickel, selenium, silver, thallium, and zinc.

[3] Mercury analyses shall be conducted using the ultraclean protocol, CVAA-EPA Method 1631.

GEOTHERMAL FLUID AND CUTTINGS SUMPS MONITORING

The Discharger shall record the volume of waste (liquid for geothermal fluids sumps, solid for cuttings sumps) discharged to the lined and unlined cuttings sumps and geothermal fluid sumps. If spills of petroleum, acids or other hazardous materials occur which have been contained in the sumps, the material contained and the volume of the spill shall be recorded. Any such spill shall be reported to the Central Valley Water Board within 24 hours. As stated in Provision D. 11 of the waste discharge requirements, the Discharger is required to allow snow melt to remain in any geothermal fluid sumps intended for use within six months, and to monitor the level of the liquid in the sumps and the pan evaporation devices daily for a period of at least one week as soon as possible after melting in the geothermal fluid sumps is complete. Measurements are required to be accurate to within plus or minus 0.125 inches. Monitoring of rainfall to an accuracy of plus or minus 0.125 inches is also required. The purpose of these measurements is to determine if there are leaks within the geothermal fluids sumps. The Discharger is also required to measure freeboard for geothermal fluid sumps containing geothermal fluid. (Discharge Specification B.6. requires the discharger to maintain a minimum of two feet of freeboard in all sumps containing fluid containing wastes.) However, because these two measurements are unrelated and may be

based on a different datum, the Discharger is required to present them separately. Level monitoring for individual geothermal fluids sumps shall include the following:

Constituent	Units	Type of Sample	Sampling Frequency
Level	feet/decimal inches	Visual	Daily
Rainfall	decimal inches	Visual	Daily
Evaporation	decimal inches	Visual	Daily
Sump Temperature	Degrees F	Visual	Daily

Freeboard monitoring conducted for the purpose of demonstrating adequate freeboard shall include the following:

Constituent	Units	Type of Sample	Sampling Frequency
Freeboard	feet	Visual	Daily

Within 30 days after completion of well testing at each site, the Discharger shall collect a representative sample of the solids which have collected in the bottom of the geothermal fluids sump and analyze for priority pollutant metals as listed in the table above for geothermal fluid monitoring. Mercury shall be collected and analyzed by the ultraclean protocol, (CVAA-EPA Method 1631). A representative composite sample of drill cuttings from well drilling will be taken from the lined cuttings sumps when drilling is complete or before **1 November** in any year in which cuttings have been added to the sump, and analyzed to confirm they are non hazardous and non designated. A representative composite sample of drill cuttings from temperature gradient hole* drilling will be taken from the unlined cuttings sumps when drilling is complete or before **1 November** in any year in which cuttings have been added to the sump, and analyzed to confirm they are non hazardous and non designated. a representative composite sample of solids from the bottom of lined geothermal fluid sumps will be taken at the cessation of geothermal fluid additions to the sump or before **1 November** in any year in which geothermal fluid has been added to the sump, and analyzed to confirm they are non hazardous and non designated.

SURFACE WATER MONITORING

The Discharger shall continue to sample surface waters as specified in the "Medicine Lake Comprehensive Hydrology Monitoring Plan" as shown in Attachment E, which is incorporated into this Monitoring and Reporting Program by reference. Results of the monitoring shall be submitted twice annually as specified in the Monitoring Plan. Any changes in the Monitoring Plan as specified by the Bureau of Land Management (BLM) shall be reported.

GROUNDWATER MONITORING

The Discharger shall continue to sample groundwaters as specified in the Comprehensive Hydrology Monitoring Plan as shown in Attachment E. In addition, this monitoring shall include the semi-annual sampling and analysis of the three monitoring wells referenced in Provision D.10. of Order No. R5-2006-0115. Groundwater monitoring shall include the following:

Constituent	Units	Type of Sample	Sampling Frequency
Elevation	Feet (nearest .01)	Visual	Twice per year[1]
pH	pH Units	Grab	Twice per year[1]
General Minerals[2]	mg/L	Grab	Twice per year[1]
Priority Pollutant metals[3]	µg/L	Grab	Twice per year[1]
Mercury[4]	ng/L	Grab	Twice per year[1]

[1] Sampling shall be conducted in June and November of each year, weather permitting.

[2] General Minerals shall include: Anions – F, Cl, NO_2, NO_3, PO_4, and SO_4 Cations – NH_4, K, Ca, Mg, Na, HCO_3, CO_3, and Al.

[3] Priority pollutant metals include: Antimony, arsenic, beryllium, cadmium, total chromium, chromium VI, copper, lead, nickel, selenium, silver, thallium, and zinc.

[4] Mercury analyses shall be conducted using the ultraclean protocol, CVAA-EPA Method 1631.

ABOVEGROUND PIPELINE MONITORING

The Discharger shall develop and implement a leak detection program as specified in Provision D.5. of Order No. R5-2006-0115. The Discharger shall inspect the aboveground pipeline daily and maintain a log of the daily inspections including all leaks and spills. Any leak or spill of geothermal fluid in excess of 55 gallons shall be reported the Central Valley Water Board within 24-hours and included in the monthly monitoring report along with the actions taken to repair or eliminate the leaks.

REPORTING

Monitoring reports shall be submitted to the Regional Board by the **first day of the second month** following data collection. Semi-annual monitoring results shall be submitted by the **first day of the second month** following each semi-annual sampling event.

In reporting the monitoring data, the Discharger shall arrange the data in tabular form so that the date, the constituents, and the concentrations are readily discernible. The data shall be summarized in such a manner to illustrate clearly whether the discharge complies with waste discharge requirements.

If the Discharger monitors any pollutant at the locations designated herein more frequently than is required by this Order, the results of such monitoring shall be included in the calculation and reporting of the values required in the discharge monitoring report form. Such increased frequency shall be indicated on the discharge monitoring report form.

The Discharger may also be requested to submit an annual report to the Board with both tabular and graphical summaries of the monitoring data obtained during the previous year. Any such request shall be made in writing. The report shall discuss the compliance record. If violations have occurred, the report shall also discuss the corrective actions taken and planned to bring the discharge into full compliance with the waste discharge requirements.

All reports submitted in response to this Order shall comply with the signatory requirements of Standard Provisions D.6.

Ordered by: _____original signed by_____
PAMELA C. CREEDON, Executive Officer

_____27 October 2006_____
(Date)

JFR: sae

INFORMATION SHEET

ORDER NO. R5-2006-0115
CALPINE SISKIYOU GEOTHERMAL PARTNERS, L.P., AND
CPN TELEPHONE FLAT, INC., AND
U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE AND
U.S. DEPARTMENT OF INTERIOR, BUREAU OF LAND MANAGEMENT
GLASS MOUNTAIN UNIT GEOTHERMAL EXPLORATION AND DEVELOPMENT PROJECTS
SISKIYOU COUNTY

GLOSSARY OF TERMS

The following is a glossary of terms used in this Order, which are specific to geothermal well drilling and regulation of geothermal exploration:

Circulation Loss The loss of drilling fluid to a formation, usually caused when the hydrostatic head pressure of the column of drilling fluid exceeds the formation pressure. This loss of fluid may be loosely classified as seepage losses, partial losses or catastrophic losses, each of which is handled differently depending on the risk to the rig and personnel, the economics of the drilling fluid and the environmental implications. An example of a catastrophic loss would be break through to a lava tube, which could potentially allow pollutants to enter aquifers containing potable water.

Enhanced Geothermal Systems See Formation Stimulation

Formation Stimulation Formation stimulation is a general term which includes a number of techniques used to increase the production of a well. However in this Order, formation stimulation refers only to the injection of hydrochloric and/or hydrofluoric acids into a well's production formation. Small quantities of other materials, such as corrosion inhibitors, could also be added. The quantity of acid used would vary from well to well and could range from 1,000 to 60,000 gallons per well. Under favorable conditions, the chemical action of the acids on the adjacent strata opens up the formation, thereby increasing the production rate of geothermal fluids. More specifically, the acid dissolves the calcium carbonate and silica-based minerals which may have been deposited or precipitated in the natural geothermal reservoir fractures, and which reduce or prevent the flow of geothermal fluid from the reservoir through fractures into the well bore. Clearly, the effectiveness of formation stimulation is dependent on the composition and physical properties of the adjacent strata. After allowing the acid sufficient time to dissolve the precipitated minerals in the geothermal reservoir, the spent acid is flowed back to the surface, discharged to the well site geothermal fluids sump, and immediately injected back into the geothermal reservoir. To insure re-injection remains uninterrupted, the Discharger will maintain two re-injection pumps, one primary and one spare, at each geothermal fluid sump being used for formation stimulation. Spare pumps will be tested on a regular basis to insure they remain in operating condition. A spill plan for the materials to be used in the stimulation has been prepared as required by U.S. Department of Interior, Bureau of Land Management (BLM).

Terms used synonymously with formation stimulation in this Order are "well work over" and "enhanced geothermal systems" (EGS). In a wider context, EGS is defined by the US Department

of Energy (DOE) as, "engineered reservoirs created to produce energy from geothermal resources deficient in economical amounts of water and/or permeability." The term "work over" is defined in the Schlumberger oilfield glossary as "the repair or stimulation of an existing production well for the purpose of restoring, prolonging or enhancing production."

Geothermal Unit Lease Area Holders of federal geothermal leases and their representatives who wish to unite with each other, or jointly or separately with others, in collectively adopting and operating under a cooperative or unit plan for the development of any geothermal resources pool, field or like area, or any part thereof, may enter into a unit agreement. A geothermal unit lease area is the area described in a unit agreement as constituting the land logically subject to development under such agreement.

Known Geothermal Resource Area (KGRA) KGRA is defined in 43 Code of Federal Regulations (CFR) Part 3200 as "an area where BLM determines that persons knowledgeable in geothermal development would spend money to develop geothermal resources." They are: (1) areas of obvious geothermal activity such as hot springs designated by the US Geological Survey (USGS); and (2) areas where applications to lease overlap to such a degree as to indicate strong geothermal potential. The Geothermal Steam Act of 1970 (Act), as amended, (84 Stat, 1566; 30 U.S.C. 1001-1025) provides the Secretary of the Interior with the authority to lease public lands and other federal lands, including National Forest lands, for geothermal exploration and development in an environmentally sound manner. This authority has been delegated to the BLM. BLM implements the Act through the regulations contained in 43 CFR Part 3200. Geothermal leases are issued through competitive bidding for federal lands within a KGRA, or noncompetitively for federal lands outside of a KGRA. There are 18 KGRAs in California.

Plan of Operations (POO) A POO is a plan which fully describes the location of proposed drill pads, access roads and other facilities related to the drilling and testing of federal geothermal resources, and includes measures for environmental and other resources protection and mitigation.

Shield Volcano A volcano with broad, gentle slopes built by the eruption of fluid basalt lava.

Stipulation A stipulation means additional conditions BLM attaches to a lease or permit.

Sundry Notice A sundry notice is a written request to perform work not covered by another type of permit, or to change operations in a previously approved permit.

Temperature Gradient Hole A temperature gradient hole is a small diameter cased "well" drilled for the sole purpose of determining the temperature gradient profile below the ground surface. The temperature gradient is the natural increase of temperature with depth in the earth. Temperature gradients vary widely over the earth, sometimes increasing dramatically around volcanic areas. Determining the temperature gradient profile over an area suspected of having potential as a source of geothermal energy is a means of determining the most attractive drill sites

for exploration and production wells. The term "temperature core hole" is used synonymously with temperature gradient hole.

Unit Agreement Unit agreement means an agreement to explore for, produce and utilize separately owned interests in geothermal resources as a single consolidated unit. A Unit agreement defines how costs and benefits will be allocated among the holders of interest in the unit area.

Unit Area Unit Area means all tracts committed to an approved unit agreement.

Unit Operator Unit operator means the person who stated in writing to BLM that the interest owners of the committed leases have designated it as operator of the unit area.

Utilization Plan Utilization plan means a plan that fully describes the utilization facility (power plant), including measures for environmental protection and mitigation.

Work Over See Formation Stimulation

PERTINENT ENVIRONMENTAL DOCUMENTS

Environmental Documents pertinent to this Order are as follows:

a. Glass Mountain Geothermal Exploration Project, Environmental Assessment/Initial Study, (EA/IS) (Draft) EA # CA027-EA95-06 April 1995 National Environmental Policy Act (NEPA) Lead Agency -BLM, California Environmental Quality Act (CEQA) Lead Agency - Siskiyou County Air Pollution Control District (SCAPCD) *Summary – California Energy General Company submitted a Plan of Operation (POO) for the drilling of up to five temperature core hole (TCH) wells (34-8TCH, 42-13TCH, 11-24TCH, 15-15TCH and 63-20TCH) and the drilling, completion and testing of production size exploration wells (18-32, 46-32, 58-6, 56-18 and 13-18) at five well pads within the Glass Mountain Known Geothermal Resource Area (KGRA). At least two wells were to be drilled at each of the five exploration well pads.*

b. Fourmile Hill Area Geothermal Exploration Project, EA/IS, (Draft) EA # CA027-EA95-11 December 1995 NEPA Lead Agency BLM, CEQA Lead Agency SCAPCD *Summary – Calpine Corporation submitted a POO for geothermal exploration activities consisting of the drilling and testing of two deep geothermal exploration wells and access road construction in the Fourmile Hill Area located in sections 21, 22, 23, 28, 29 and 30 T44N, R3E MDB&M in Siskiyou County*.

c. Glass Mountain Exploration, EA/IS, (Draft) EA # CA320-NEPA02-23 May 2002 NEPA Lead Agency BLM, CEQA Lead Agency SCAPCD *Summary – Calpine Corporation and CPN Telephone Flat, Inc. submitted a POO for the construction of two new well pads (64-27and 85-33), the drilling and completion and flow testing of two deep production size exploration wells (64-27and 85-33) and the drilling of a temperature gradient hole (TGH) on one of these well pads (64-27) The POO also proposed to test three existing exploration wells located within the Unit(68-8, 31-17 and 87-13).*

d. Telephone Flat Geothermal Development Project EIS/EIR, (Draft), SCH #97052078 May 1998, NEPA Lead Agency BLM and U.S. Department of Agriculture, Forest Service (USFS), CEQA Lead Agency SCAPCD *Summary – California Energy General Corporation (CEGC) submitted POOs to the BLM in*

February 1997 to construct and operate a 48 MW geothermal Power plant and wellfield within the Glass Mountain KGRA. The power plant would be fueled by geothermal resources beneath the leases. An approximately 21-mile interconnection transmission line would be constructed to transport the electrical energy to the existing Bonneville Power Administration (BPA) Malin-Warner transmission line. The total estimated area of surface disturbance required for the power plant site, well pads, pipeline corridors, and access toads would be approximately 173 acres. Up to 15 acres per mile of additional surface disturbance would be associated with the proposed transmission line. Surface disturbance for the geothermal fluid production and spent fluid injection activities would be conducted within an approximately 8.41 square mile Participating Area.

e. Telephone Flat Geothermal Development Project EIS/EIR, (Final), SCH #97052078 February 1999, NEPA Lead Agency BLM and USFS, CEQA Lead Agency SCAPCD

f. Update Assessment for the Telephone Flat Geothermal Development Project Final EIS/EIR, California State Clearinghouse Number 97052078, November 2002 Prepared for SCAPCD *Summary – In 1997 applications for approvals to construct and operate the Telephone Flat Geothermal Development Project, (Project) a 48 megawatt (MW) geothermal power plant and wellfield to be built on federal geothermal leases in Siskiyou County, California were filed with BLM. USFS and SCAPCD. These agencies, together with the BPA of the U.S. Department of Energy, prepared and distributed to the public a joint Draft Environmental Impact Statement (EIS)/Draft Environmental Impact Report (EIR) for the Project in May 1998, and a Final EIS/Final EIR in February 1999.*

In May 2000 the BLM and the USFS issued a joint Record of Decision that denied the federal approvals for the project. Subsequently, the SCAPCD took no actions to complete the processing of the Final EIR. The denial of the required federal approvals for the Project was appealed and, and in April 2002, the parties entered into a settlement agreement to stay the litigation and have the BLM and USFS reconsider their earlier decision to deny. The SCAPCD had also been requested to complete its processing of the Final EIR .

The update assessment was prepared to provide the information needed for the state lead agency to determine whether recirculation of the EIR was required prior to certification. It was prepared by contacting the original information sources for the Project EIS/EIR regarding any substantial changes in the Project, the regulatory framework and/or the affected environment which may have occurred for each resource topic since distribution of the Final EIS/EIR; evaluating and identifying any potential substantial project specific or cumulative environmental impacts which could now result, which were not disclosed in the Final EIS/EIR; and identifying and disclosing any new or modified mitigation measures or project alternatives which could substantially reduce the severity of an identified environmental impact.

The Update Assessment found there to be no significant new circumstances or information relevant to environmental concerns and bearing on the Project. Findings of Fact and Statement of Overriding Considerations for the Telephone Flat Geothermal Development Project were issued and the EIR for the Telephone Flat Geothermal Development Project was certified by the SCAPCD on 14 February 2003. A Notice of Issuance for the Authority to Construct for the Project was issued by the SCAPCD on the same day.

BACKGROUND INFORMATION (REGULATORY)

The Medicine Lake Highlands has been a source of interest for possible geothermal development since the mid-1960's. In 1970, the Geothermal Steam Act was adopted and subsequent regulations provided a mechanism for leasing of public lands for exploration, development and utilization of geothermal resources. The U.S. Geological Survey (USGS) recognized the geothermal development potential in the Medicine Lake Highlands and designated 15,371 acres of this area as the Glass Mountain Known Geothermal Resource Area, (KGRA), in 1970. The Glass Mountain KGRA has subsequently been expanded in area and currently encompasses 134,254 acres.

An Environmental Assessment (EA) for the geothermal exploration leasing in the Glass Mountain KGRA was initially prepared by the USFS, in 1981 and a Supplemental EA for geothermal development leasing was prepared by the USFS and BLM in 1984. Geothermal leases in the Glass Mountain KGRA were first issued in the 1980's after competitive lease sales by BLM. The Glass Mountain Unit Lease area encompasses Sections 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, and 36, T44N, R3E; Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, and 27, T43N, R3E; Sections 19, 30, 31, 32, 33, 34, 35, T44N, R4E; and Sections 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, and 20, T43N, R4E, MDB&M as shown on Attachment A.

Exploratory geothermal drilling and testing activities in the KGRA began in 1981. Based on the findings of these early exploration activities, the Glass Mountain Federal Geothermal Unit was formed in May 1982. The Unit Agreement provides for a cooperative plan among holders of geothermal leases committed to the Unit to explore and develop the geothermal resources within the Unit. CPN Telephone Flat, Inc. is the current Unit Operator and owns all leases within the KGRA. Past lease holders have included Union Oil Company, Phillips Petroleum, Occidental Petroleum, Anadarko Petroleum and California Energy General Corporation.

The Central Valley Water Board first issued waste discharge requirements for geothermal exploration activities in the Glass Mountain KGRA to Union Oil Company in 1983, (Order No. 83-083). In September 1984 waste discharge requirements Order No. 84-109 was issued to Union Oil Company and USFS for a discharge of drilling waste to clay lined sumps from the drilling of six geothermal wells located in both the Central Valley and North Coast Regions. Both Order No. 83-083 and Order No. 84-109 were for discharges from specific wells. These two Orders were updated in 1988 with the issuance of Order No. 88-095 to Union Oil Company and USFS. Order No. 88-095 did not regulate discharges from the drilling of specific wells and covered the entire geothermal lease area, including both the Central Valley and the North Coast Regions. Waste discharge requirements were again updated in 1991 (Order No. 91-080) to change the name to Unocal Corporation.

In 1995, the Central Valley Water Board adopted Order No. 95-199, to reflect that California Energy General Corporation (CEGC) had acquired the leases from Unocal Corporation. Order No. 95-199 was issued to CEGC, and the USFS, and covered activities in the entire Glass Mountain Geothermal Unit Lease Area, including Fourmile Hill, which is entirely within the North Coast Region, and Telephone Flat, which is within the Central Valley Region. Calpine Corporation purchased California Energy General Corporation in October 2001, and changed the name of the corporation to CPN Telephone Flat, Inc.

On 27 June 2002 the North Coast Water Board adopted waste discharge requirements Order No. R1-2002-0030 for a discharge of geothermal fluid and associated wastes from geothermal exploration operations by Calpine Corporation in the Fourmile Hill area, an area previously covered under waste discharge requirements Order No. 95-199. Order No. R1-2002-0030 named Calpine Corporation, USFS and BLM as Dischargers. Order No. R1-2002-0030 only regulated a portion of the activities occurring in the North Coast Region, as there were still other Calpine activities in the North Coast Region that continued to be regulated by the Central Valley Water Board under Order No. 95-199.

A Memorandum of Agreement, (MOA), among Calpine Corporation, CPN Telephone Flat, Inc., North Coast Water Board, and the Central Valley Water Board, was signed and became effective on 30 August 2002. The MOA states that each regional board shall regulate the geothermal "exploration" activities within their respective regions. However, the Central Valley Water Board shall regulate the entire Glass Mountain Exploratory Project until the North Coast Water Board is able to adopt waste discharge requirements for the parts of the Glass Mountain Exploratory Project that lie within their region.

On 26 September 2002 the North Coast Water Board adopted Order No R-1-2002-0089, which revised Order No. R1-2002-0030 to allow Calpine Corporation to transfer geothermal fluids to geothermal wells within the Central Valley Region for re-injection.

On 28 March 2003, Calpine Corporation and CPN Telephone Flat, Inc., submitted a Report of Waste Discharge requesting a revision of waste discharge requirements, Order No. 95-199. The Report of Waste Discharge and supplemental information submitted by the Discharger presented a list of proposed new wells and temperature gradient holes that may be drilled and/or tested. In addition to the drilling of new geothermal wells and temperature gradient holes, the Discharger proposes to flow test existing wells in the Telephone Flat area. The Discharger proposes in the Report of Waste Discharge to use acid for *"formation stimulation"* in the production zone of exploration wells, Well Nos. 68-8, 31-17 and 87-13. A sundry notice for the injection of hydrochloric/hydrofluoric acid to Well No. 31-17 was issued by BLM and signed by Rebecca Watson, the Assistant Secretary, on 30 April 2003. Formation stimulation is used routinely in the oil and gas industry to increase production, and BLM is confident that it poses a minimal threat to water quality provided that standard protocol is observed. (Formation stimulation through acid injection was actually conducted on Well No. 31-17 by Unocal in 1989.) Nevertheless BLM

determined that the pertinent environmental documents have failed to adequately address formation stimulation. The BLM has stated that no well other than No. 31-17 may be treated until additional NEPA and CEQA review have been completed. The Central Valley Water Board concurs with BLM's decision, and initially prohibits the use of formation stimulation on any well except No. 31-17 in this Order. At such time as NEPA and CEQA review of formation stimulation have been completed, this Order will be reopened, if necessary, to include additional wells and conditions to address any additional mitigation measures relevant to water quality.

In May 2003 the leases owned by Calpine Corporation were moved to their wholly owned subsidiary, Calpine Siskiyou Geothermal Partners, L.P. Calpine Siskiyou Geothermal Partners L.P. was formed on 26 August 1994. The limited partners are Modoc Power Inc. (44.34%) and Mt. Hoffman Geothermal Company, L.P. (55.66%).

It had been intended to place the revised waste discharge requirements on the agenda for the April 2004 Board Meeting, however it became apparent prior to the meeting that the geothermal well tests planned for the summer of 2005 would not take place, and it was decided to postpone adoption. Calpine Corporation submitted a letter to the Central Valley Water Board dated 10 January 2006 stating that construction was planned for the Telephone Flat Development Project in 2006, and requesting that tentative waste discharge requirements be placed on the Central Valley Water Board agenda as soon as possible.

BACKGROUND INFORMATION (TECHNICAL)

To extract geothermal energy for electrical power generation the resource must meet certain conditions. The trapped heated water, present in the faults, fractures and pores of the high temperature rock, should ideally be in excess of 300° F and not excessively deep, i.e. no more than 10,000 feet below ground surface. To locate and evaluate such resources it is necessary to implement an exploration program. For power plant design purposes it is necessary to characterize the enthalpy properties of the hot water/steam mix as it exits at the well head. Enthalpy is a thermodynamic property that can most easily be thought of in the context of geothermal power generation as "energy content." The purpose of the exploration process is to locate and identify wells that are capable of delivering geothermal fluids of sufficiently high enthalpy to be suitable for the generation of electrical power. The geothermal fluids will be transported via surface pipelines from the wells to a dual-flash geothermal power plant, where steam will be directed to a steam turbine-driven generator. The turbine exhaust steam will be condensed and pumped to a cooling tower. Spent brine and condensate (geothermal fluid) will initially be pumped through surface pipelines to injection wells for injection back to the subsurface geothermal reservoir.

A typical Glass Mountain geothermal well has the following specifications:

Casing Size	9.625 In.
Casing Depth	4000 Ft.
Slotted Liner Size	7 In.
Slotted Liner Depth	9,000 Ft.
Open Hole Size	8.5 In.
Bore Hole Temp.	475º F

PROPOSED GEOTHERMAL OPERATIONS

The Report of Waste Discharge and supplemental information submitted by the Discharger presented a list of proposed new wells and temperature gradient holes that may be drilled and/or tested. All of these new wells and temperature gradient holes have been referenced in environmental documents. The listing is as follows:

Temperature Gradient Hole Nos. 34-8, 42-13, 11-24, 15-15, and 63-20.
Geothermal Well Nos. 18-32, 46-32, 56-18, 58-6 and 13-18. The location of these wells is shown on Attachment B, a part of this Order by reference. *(Glass Mountain Unit Geothermal Exploration Project, Environmental Assessment/Initial Study, EA#CA027-EA95-06, April 1995).* The Government will not authorize Well Nos. 18-32 and 46-32, both of which are in the USFS Mt. Hoffman Inventoried Roadless Area until a NEPA review is completed. The original EA did not discuss or disclose the potential effects of the loss of roadless characteristics due to constructing and utilizing these wells and associated facilities.

Geothermal Well Nos. 26-7, 84-7, 46-8 (existing pad with no well), 64-8, 68-8 (existing well on pad with sump), 73-13, 87-13 (existing well on pad with sump), 15-16, 26-17, 31-17 (existing well on pad with sump), 72-17, 13-18, 16-18, 25-18, 51-18, 52-18, 56-18 and 83-18. The location of these wells is shown on Attachment C a part of this Order by reference. *(Telephone Flat Geothermal Development Project EIS/EIR, February 1999, and Update Assessment for the Telephone Flat Geothermal Development Project EIS/EIR, November 2002)*

In addition to the drilling of new geothermal wells and temperature gradient holes, the Discharger proposes to flow test existing Wells Nos. 68-8, 31-17 and 87-13 in the Telephone Flat area as shown on Attachment D a part of this Order by reference. The Discharger proposes to re-inject these geothermal fluids to existing wells within the KGRA provided that such activity has been approved by BLM and U. S. Environmental Protection Agency (USEPA) for that purpose. *(Glass Mountain Exploration, Environmental Assessment/Initial Study, CPN Telephone Flat, Inc., May 2002)*

The three existing wells to be flow tested have not been pumped since 1989-91, over 15 years ago. Chemical analysis of fluid from the three wells is presented in the table below:

Parameter	Well No. 68-8 (11/02/89) (mg/L)	Well No. 31-17 (11/06/89) (mg/L)	Well No. 87-13, (12/11/89) (mg/L)
Antimony	0.52	<0.49	< 0.2
Arsenic	5.87	5.47	1.9
Beryllium	-	-	<0.02
Boron	14.95	13.83	10
Cadmium	<0.05	<0.05	<0.02
Calcium	184.22	16.60	6.5
Chromium, Total	<0.12	<0.12	<0.05
Cobalt	< 0.2	< 0.2	<0.02
Iron	0.21	0.07	0.2
Lead	<0.24	<0.24	<0.2
Magnesium	0.21	0.24	<0.5
Manganese	<0.24	<0.24	<0.2
Mercury	-	-	0.0006 (600 ng/L)
Molybdenum	<0.61	<0.61	<0.1
Nickel	<0.12	<0.12	0.04
Potassium	184.22	165.19	78
Selenium	-	-	<0.005
Sodium	1,087.17	995.52	560
Thallium	<2.44	<2.44	<0.3
Vanadium	<1.22	<1.22	<0.5
Zinc	-	-	<0.02
Bicarbonate ($HCO_{3)}$	14.00	27.00	-
Chloride (Cl)	1910	1690	-
Fluoride (F)	5.90	3.10	-
Sulfate (SO_4)	43.0	42.0	-
Total Dissolved Solids	4,000	3,600	-
Electrical Conductivity (µS/cm)	-	5,400	-
pH	7.07	-	-

The analytical data presented above, suggests that the geothermal fluid may be high in arsenic and may contain mercury. Mercury has not been analyzed for Well Nos. 68-8 and 31-17. In the analysis for Well No. 87-13 the Discharger analyzed for mercury using an inductively coupled plasma-mass spectrometry, (ICP/MS) method. The Discharger will now be required to use the ultra clean sampling protocol and analysis by cold vapor atomic absorption (CVAA) (USEPA

Method 1631) for all future mercury monitoring including ground and surface water monitoring as well as geothermal fluid monitoring.

Wastes produced during drilling operations include soil, drill (rock) cuttings, drilling muds with additives, oil and associated wastewater. Drilling mud is inert mineral clay such as bentonite clay. Drilling mud additives may include sodium bicarbonate, soda ash, drilling soap, organic polymers, wood fibers, graphite, cottonseed hulls, walnut shells and cement. Drilling mud additives do not render the drilling mud hazardous when used according to manufacturer's specifications. During drilling operations, drilling mud, aerated mud and/or air will be used to transport drill cuttings to the surface. Drilling mud will be treated and contained in a closed system for continuous circulation using metal tanks. Drilling mud may be re-used in the drilling of additional wells, provided it is stored in impervious tanks. At the conclusion of drilling, drilling muds may be mechanically de-watered and discharged to a lined cuttings sump or transported offsite for disposal at a regulated drilling mud disposal facility. Liquid from the de-watering will be discharged to a geothermal fluids sump. Auxiliary tanks will be used to collect any extraneous rig runoff and wash water used for separating solid drill cuttings.

a. Temperature Gradient Holes: Drill cutting solids from temperature gradient holes will be mechanically separated, and deposited in un-lined "temperature gradient hole cutting sumps" (approximately 5,000 to 25,000 gallon capacity) located adjacent to drilling pads. Excess cement slurry from temperature gradient holes will also be discharged to the temperature gradient hole cuttings sumps. A representative composite sample of drill cuttings will be taken at the completion of drilling. If sample analysis confirms that the cuttings are non hazardous and non designated wastes, the sump may remain open for future use. Wastes confirmed "designated" as defined in Section 13173 of the California Water (CWC), or "hazardous" as defined in Article 1, Chapter 11, Division 4.5 of Title 22 California Code of Regulations (CCR), shall be removed and transported to an appropriate disposal site within 30 days after completion of test. Any temperature gradient hole cuttings subsequently discharged to the sump must be sampled as for the initial discharge. When the cutting sumps have been filled to within two feet of the top, the Discharger may backfill with clean native soil, provided that all analysis have confirmed the contents of the sump to be neither hazardous nor designated.

b. Geothermal Wells: Drill cutting solids from geothermal wells will be mechanically separated, and deposited in lined "geothermal well cutting sumps" (approximately 187,000 gallon capacity) located adjacent to drilling pads. These cutting sumps will be constructed with a certified minimum two-foot thick clay liner, or equivalent synthetic liner, and tested to ensure a permeability of less than $1x10^{-6}$ centimeters per second (cm/sec). Excess cement slurry from the wells will also be discharged to the cuttings sumps. A representative composite sample of drill cuttings will be taken at the completion of drilling. If sample analysis confirms that the cuttings are non

hazardous and non designated wastes, the sump may remain open for future use. Wastes confirmed, "designated" as defined in CWC Section 13173., or "hazardous" as defined in Article 1, Chapter 11, Division 4.5 of Title 22 CCR, shall be removed and transported to an appropriate disposal site within 30 days after completion of test. Any well cuttings subsequently discharged to the sump must be sampled as for the initial discharge. When the cutting sumps have been filled to within two feet of the top, the Discharger may backfill with clean native soil, provided that all analysis have confirmed the contents of the sump to be neither hazardous nor designated.

Bore cleanout and flow tests will be performed at completion of drilling to remove drill cuttings and mud and evaluate the well for geothermal production. The liquid phase geothermal fluid from the test will be discharged to either a new or existing "geothermal fluid sumps" having a liner with a minimum two-foot thickness of compacted clay with a permeability of less than $1x10^{-6}$ cm/sec. The rate of discharge will be approximately 500-600 gallons per minute. The sumps have a volume of approximately 750,000 gallons and an area of approximately 10,000 square feet. Since some of the existing sumps have not been used for over ten years and may have gone through a number of freeze-thaw and hydration cycles, the Discharger will be required to re-compact the liners to ensure a permeability of less than $1x10^{-6}$ cm/sec. The re-compacted liners will be required to be permeability tested under the supervision of a licensed professional Civil Engineer registered in the State of California. Alternatively, an equivalent synthetic liner meeting the permeability specifications and approved by the Executive Officer could be used.

Re-injection to a geothermal well will take place concurrently with the well test, and will be to a well approved for this purpose by BLM and USEPA. At the completion of each well test, any remaining fluids in the discharge sump will be re-injected within 60 days or in no case later than **1 November** in any calendar year The lines from the sumps to the re-injection wells will be approximately six inch diameter steel with grooved clamped joints tested at twice the operating pressure.
Residual fluids and/or accumulated solids in the sumps will be sampled and analyzed to confirm that they are nonhazardous. If residual material is nonhazardous, the sumps will be left open until it is determined that there will be no further testing or the sumps are full. At this time the sumps will be back-filled and capped with a soil layer capable of supporting vegetative growth. The USFS has requested that one or more of the geothermal fluid sumps be left unfilled after closure in order that they may fill with rainwater and snowmelt and provide wildlife habitat

The actual number and location of production and injection well sites to be used during the Telephone Flat Development Project will depend on the results of drilling, testing, and the response of the geothermal reservoir. The expected startup production well sites would be: 16-18, 13-18, 52-18 (or 51-18), and 56-18; and the expected startup injection well sites are:
68-8 (existing), 72-17, and 15-16. Well sites 46-8 (existing well pad with no well), 84-7 and 31-17 (existing) could be either production or injection will sites depending on project needs. The

other identified well pad locations including: 26-7, 64-8, 73-17, 16-18, 25-18 and 83-18 would be used if supplemental production or injection is required as "make-up" over the life of the project.

The proposed exploration and development would include construction of two new well pads, for drilling, completion and flow testing of two deep production size wells, 85-33 and 64-27. These two sites are immediately south and east of Fourmile Hill and are in the North Coast Region. The wells will be drilled to a depth of approximately 9,000 feet and flow tested for up to 30 days. Prior to drilling the well at 64-27 the Discharger plans to drill a temperature gradient hole to 6,000 feet or 500° F whichever comes first. Additionally a temperature gradient hole cuttings sump and geothermal fluid sump would be constructed.

As stated earlier, exploration activities in the Fourmile Hill Area are covered under waste discharge requirements Order No. R1-2002-0030 adopted by the North Coast Water Board on 27 June 2002 and revised on 26 September 2002 by Order No. R1-2002-0089. The Discharger is prohibited from injecting acid at wells 85-33 and 64-27, and is also prohibited from injecting geothermal fluid to these wells from other wells, which have recently been acidified. The Discharger proposes to re-inject geothermal fluid from flow tests in the Fourmile Hill Area to approved well(s) in the Telephone Flat area. The geothermal fluids to be re-injected will initially be conveyed in four to six inch diameter steel pipe with grooved clamed joints. The approximate pipeline routes are shown in Attachments A and D. The Discharger is required to develop and implement a leak detection program, which shall include inspection of the pipelines at least once per day.

Numerous geothermal reservoirs contain zones of low permeability, which limit the development potential and the efficient recovery of heat from these reservoirs. The cause of the low permeability may be the natural condition of the reservoir or formation damage incurred during drilling. The Discharger intends to use acid for *"formation stimulation"* in the production zone of Well Nos. 68-8, 31-17 and 87-13 or any new well in the Telephone Flat project area. Formation stimulation is covered in the, *Update Assessment for the Telephone Flat Geothermal Development Project EIS/EIR, November 2002*, which states that BLM would review any proposal for formation stimulation by well acid operations or injection under a *"sundry notice"* pursuant to 43 CFR 3261.22 and would adopt stipulations as necessary. Formation stimulation consists of injecting hydrochloric and or hydrofluoric acids into the production formation of each well. The chemical action of the acids on the adjacent strata may open up the formation and increase the production rate of geothermal fluids. The acid dissolves the calcium carbonate and silica-based minerals which may have been deposited or precipitated in the natural geothermal reservoir fractures and which reduce or prevent the flow of geothermal fluid from the reservoir through fractures into the well bore. After allowing the acid sufficient time to dissolve the precipitated minerals in the geothermal reservoir, the spent acid is flowed back to the surface and discharged first to the adjacent geothermal fluid sump before being injected immediately back into the geothermal reservoir. Immediate re-injection is required since the spent acid waste may contain high concentrations of dissolved minerals and metals. To insure re-injection remains

uninterrupted, the Discharger will maintain two re-injection pumps, one primary and one spare, at each fluid sump being used for formation stimulation. Spare pumps will be tested on a regular basis to insure they are in operating condition. Before acid injection can be performed, Provision D.9. of this Order requires the Discharger to: (1) submit a report prepared by a registered geologist or engineering geologist making recommendations for the placement of monitoring wells and providing a rationale for the placement and (2) install the wells recommended in the report.

Water for use in both the Telephone Flat and Fourmile Hill exploration programs will be supplied from the CPN Telephone Flat Inc., supply well or the USFS wells which are adjacent to geothermal Well No. 17A-6 in the Arnica Sink area, in Section 1, T43N, R3E and Section 6, T43N, R4E respectively.

SITE DESCRIPTION, SURFACE AND GROUNDWATER CONSIDERATIONS

The project is within an area identified as the Medicine Lake Highlands, which is approximately 30 miles northeast of Mt. Shasta. The Medicine Lake Highlands is composed primarily of volcanic formations, including cinder cones, caldera basins, craters, lava flows and domes, and a basalt capped plateau. Medicine Lake Valcano is a shield volcano covering a 750 square mile area with approximately 140 cubic miles of surficial volcanic rocks. The Medicine Lake Highlands have undergone very recent volcanic activity including the eruption of basalt flows, obsidian flows and domes, and pyroclastic pumice. The more recent basalt flows are thought to be as young as 500 years. Erupted materials that now form the rocks and soils in the vicinity of the project include: andesite, dacite, rhyolite, basalt, cinders, pumice, obsidian, and ash. The project is not situated in an area of high seismic activity; however, there are numerous active and inactive faults in the region. The Likely Fault and the Surprise Valley Fault, located 50 miles and 75 miles respectively from the project area, have the potential to produce a seismic event of magnitude 5.0 or greater.

The Medicine Lake Highlands area is notable for its lack of permanent surface water drainages. The surface materials in the project area are very permeable, causing water to infiltrate the surface. Soils in the project area are described as well drained to excessively well drained sandy loams formed in materials weathered from extrusive igneous rocks overlain by young pumice and ash deposits. Medicine Lake Highlands stands above the general landscape and is generally perceived as a water source for streams, regional aquifers, springs, and wells. Two hydrologic units have been identified within the Medicine Lake Highlands, the shallow groundwater system that occurs only within the highlands, and the geothermal reservoir. The shallow system is a perched system that occurs at an elevation of approximately 3,300 feet higher than the regional groundwater systems of the Modoc Plateau. The water source for the shallow system is infiltration of precipitation, primarily snowmelt. The shallow groundwater is separated from the geothermal reservoir by a thick sequence of non-porous highly altered volcanic rocks, which form a thick

impermeable cap. Shallow groundwater elevations are highest in the center of Medicine Lake Highlands with flow moving radially away from the center.

The groundwater table on the flanks of the Medicine Lake caldera is described as erratic, varying from about 300 ft to over 1000 ft below ground surface. Within the caldera of the Medicine Lake Highlands, the depth to the first major aquifer is generally about 200 ft. The groundwater hydrology of Medicine Lake Highlands is controlled by a number of factors including:

a. Thick and highly permeable surficial deposits of lava flows, cinders, and pumice that readily allow infiltration of precipitation.
b. A saturated thickness (groundwater interval) that generally ranges from a few hundred feet to about 2000 feet.
c. An impermeable, high temperature gradient zone that underlies the groundwater saturated zone and forms a thick (1500 feet to several thousand feet) obstruction to flow between the groundwater aquifer and the geothermal system.
d. Radial outflow of groundwater away from the caldera rim of the Medicine Lake Highland (i.e. down the regional hydrologic gradient).

As a result of (c.) above and the casing design imposed by BLM, the impacts to groundwater will be insignificant, provided the Discharger complies with the requirements of BLM and USEPA and the requirements, provisions, and mitigations measures prescribed in this Order and Monitoring and Reporting Program No. R5-2006-0115.

Medicine Lake is the largest body of water in the basin and represents the lowest elevation within the volcanic basin. Other surface water bodies within the basin include, Little Medicine Lake, Blanche Lake, and Bullseye Lake. There is also a large dry lakebed, Arnica Sink, located 1.5 miles east of Medicine Lake. Surface drainage in the Telephone Flat area and the sections outside that area covered in these waste discharge requirements, is tributary to either Medicine Lake or Arnica Sink. A number of springs and intermittent streams exist including Paynes Spring I, Paynes Spring II, Paynes Spring III, Crystal Spring, Schonchin Spring, and an unnamed spring. The Paynes Springs are the source of Paynes Creek, a perennial creek approximately two miles long. A perennial stream associated with Crystal Springs flows into Medicine Lake. Other streams in the project area are intermittent, only flowing after snowmelt and intense storm runoff. The almost total absence of perennial stream flow in the Medicine Lake Highlands results from the combination of relatively low precipitation (largely snowfall in the winter) and highly permeable volcanic soils and lava flows. Annual precipitation for the Medicine Lake area is estimated to be 35 to 45 inches, with an average of approximately 43 inches.

APPLICABLE REGULATIONS, POLICIES AND PLANS

The Central Valley Water Board adopted a Water Quality Control Plan, Fourth Edition, for the Sacramento and San Joaquin River Basins (hereafter Basin Plan). The Basin Plan designates

beneficial uses, establishes water quality objectives, and describes an implementation program and policies to achieve water quality objectives for all waters of the Basin.

Medicine Lake Crater is a Hydrologic Subarea of the Pit River Hydrologic Unit, which is part of the Central Valley Basin. Beneficial uses of surface waters in the Medicine Lake Basin are not specifically listed in the Basin Plan and there are no direct surface tributary streams to the Pit River. The USFS and BLM have listed the uses of surface waters within the Medicine Lake Highlands as follows:

Surface Water Feature	Surface Water Uses
Medicine Lake	Domestic Use, Recreation, Fish Habitat
Little Medicine Lake	Recreation, Fish Habitat
Bullseye Lake	Recreation, Fish Habitat
Blanche Lake	Recreation
Paynes Spring I	Paynes Creek, Recreation, Fish Habitat
Paynes Spring II	Paynes Creek, Recreation, Fish Habitat
Paynes Spring III	Seep Only—No Identified Use
Schonchin Spring	Domestic Use
Crystal Spring	Crystal Spring Creek, Domestic Use, Recreation, Fish Habitat

The beneficial uses of the underlying groundwater are municipal and domestic supply, agricultural supply, and industrial supply. Fresh water for use within the project area, primarily dust suppression and drilling activities, will be either trucked in or supplied from an existing water supply well within the Arnica Sink area. Fresh water may be pumped from the supply wells to other sites within the project area.

State Water Resources Control Board (State Water Board) Resolution No. 88-63, a policy entitled "Sources of Drinking Water," adopted May 19, 1988, provides that all surface and groundwaters of the State are considered to be suitable, or potentially suitable, for municipal or domestic water supply and should be so designated by the Regional Water Boards, with certain exceptions. Among other exceptions, State Water Board Resolution No. 88-63 provides for exceptions where the aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 CFR Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR Section 261.3.

The Safe Drinking Water Act, (SDWA), authorizes USEPA to regulate "underground injection" which Section 1421 (d) (1) defines as the "subsurface emplacement of fluids by well injection." The regulation of all injection wells is covered in Part 144 CFR under the underground injection control (UIC) program. The regulations in this part establish minimum requirements for the UIC Programs. Each state must meet these requirements in order to obtain primary enforcement

authority for the UIC Program in that state. Class V injection wells in California are administered by USEPA, however in the special case of geothermal injection wells the California Division of Oil, Gas and Geothermal Resources assumes responsibility under a Memorandum of Agreement with USEPA. Geothermal production wells are also regulated by the California Division of Oil, Gas and Geothermal Resources, except for projects on federal lands in which case BLM assumes responsibility under a Memorandum of Understanding with the California Division of Oil, Gas and Geothermal Resources.

Re-injection from the well head to the geothermal aquifer, including but not limited to approval of wells for re-injection, well location, casing design, flow rate and volume of geothermal fluids injected, casing leak detection, additives, leak detection and inspection is regulated by BLM and USEPA. The Regional Water Boards regulate, through waste discharge requirements, the transfer of geothermal fluid from well head to well head, storage of geothermal fluid prior to re-injection, the monitoring of water quality in groundwater aquifers.

CEQA AND LEGAL CONSIDERATIONS

In 1996, Calpine Corporation submitted a Plan of Operation (POO) to the BLM for construction and operation of a 49.9 megawatt (MW) geothermal power plant in the Fourmile Hill area in the North Coast Region. A Draft EIS/EIR for the project was distributed to the public for review and comment in July 1997. In February 1997 CEGC submitted a Plan of Operation to the BLM for construction and operation of a 48 MW geothermal power plant in the Telephone Flat area in the Central Valley Region. In May 1998 a Draft EIS/EIR for the project was distributed to the public for review and comment. On 31 May 2000 separate Records of Decision (RODs) were issued by the USFS and BLM for the two power plant projects described above. The Fourmile Hill Plan of Operation was approved as amended. The Telephone Flat Plan of Operation was denied on the basis of its effect on American Indian use of Medicine Lake and on American Indians as a minority population. CEGC did not present the EIR to the CEQA lead agency, Siskiyou County Air Pollution Control District, (SCAPCD), for approval. However, in a letter dated 17 April 2002, Calpine Corporation, the new owner of CECG, requested the SCAPCD to certify the EIR.

On 4 April 2002, the United States Department of Justice and CPN Telephone Flat Inc. reached an agreement to resolve breach of contract and litigation concerning the denial of the Telephone Flat Geothermal Development Project. As part of the settlement agreement, the BLM and USFS were to reconsider the May 2000 ROD, which denied the project. In turn CPN Telephone Flat Inc., agreed to suspend litigation against the United States until the reconsideration was complete. The reconsideration took into account the President's National Energy Policy and other changes in the renewable energy field, which had occurred since the May 2000 decision. The settlement directed both BLM and USFS to complete reconsideration by November 2002.

On 26 November 2002 the BLM and USFS approved development of the 48 MW geothermal power plant at Telephone Flat by CPN Telephone Flat Inc. BLM and USFS determined that the

environmental analysis conducted under provisions of the NEPA was still valid, but that the increased national and state focus on renewable energy, along with the further mitigation measures required, including realignment of the power line to reduce visual and environmental impacts, justified approval of the project. A determination of NEPA adequacy and a Biological Opinion (no jeopardy) accompanied the decision.

An Update Assessment to the *Telephone Flat Geothermal Development Project EIS/EIR, February 1999,* was prepared for the SCAPCD, in November 2002 to provide information to determine if recirculation of the EIR would be required prior to certification. The Update Assessment found there to be no new circumstances or information relevant to environmental concerns and bearing on the project. Further the Update Assessment found no additional feasible mitigation measures, that are considerably different from others previously analyzed in the final EIR/EIS, which would clearly lessen or reduce the previously identified environmental impacts to a level of insignificance and which were declined to be adopted by the project sponsor. The SCAPCD by and through the Air Pollution Control Officer (APCO) concluded in its Findings of Fact and Statement of Overriding Considerations that the economic, social, and other benefits of the project would override any significant environmental impacts. The APCO certified the Telephone Flat Geothermal Development Project EIR (State Clearinghouse No. 97052078) on 14 February 2003. An administrative appeal of the APCO's decision to certify the EIR was denied by the SCAPCD by and through its Board of Directors on 25 March 2003, at which time the SCAPCD Board took the following actions affirming the APCO's conclusions:

- Certification of an EIR for the Telephone Flat Geothermal Development Project (State Clearinghouse No. 97052078); and
- Adoption of a Mitigation Monitoring and Reporting Program (Statement of Decision 03-01); and
- Adoption of Findings of Fact and Statement of Overriding Considerations for the Telephone Flat Geothermal Development Project (Statement of Decision No. 03-01); and
- Adoption of the Second EIR Errata (Statement of Decision 03-01).

Two additional EA/ISs for geothermal exploration projects were prepared for the Siskiyou County Air Pollution Control District, (SCAPCD); "Glass Mountain Unit Geothermal Exploration Project", (EA# CA027-EA95-06), April 1995, and "Glass Mountain Exploration", (EA# CA320-NEPA02-23), May 2002.

FINANCIAL ASSURANCE

BLM has required the Discharger to post financial assurance for closure, including the following activities: Plug and abandon 18 geothermal wells, reclaim 18 wellpads, reclaim the sumps on each of the 18 wellpads, remove 1.8 miles of water lines from Arnica Sink, remove 7.9 miles of production and injection pipelines, plug 3 water monitoring wells, abandon 11.5 miles of roads

within wellfield, reclaim powerplant pad site, tear down and remove powerplant, cooling tower, ancillary buildings, and foundations within plant site and tear down and remove 23 miles of 230 KV transmission line. If these financial assurance funds become encumbered for some purpose other than site closure, or become unavailable for site closure for any reason, the Discharger shall immediately notify the Central Valley Water Board, and the Discharger shall, **within 30 days of such notification and by 30 April of each year thereafter**, prepare and submit, plans with detailed cost estimates and a demonstration of assurances of financial responsibility to ensure closure and post-closure maintenance of sumps, wells and temperature gradient holes. The assurances of financial responsibility shall provide that funds for corrective action shall be available to the Central Valley Water Board upon the issuance of any order under California Water Code, Division 7, Chapter 5. The Discharger shall adjust the cost annually to account for inflation and any changes in facility design, construction or operation.

In addition, the Discharger shall prepare and submit plans with detailed cost estimates and a demonstration of assurances of financial responsibility for initiating and completing corrective action for all known or reasonably foreseeable releases arising from the exploration and/or development of geothermal resources within the Telephone Flat project area or those areas of the Fourmile Hill project area under the jurisdiction of the Central Valley Water Board. The financial assurance fund for such corrective action shall be established **prior to any of the following actions (but no later than 30 April 2007):** the discharge of geothermal fluid, cuttings from geothermal wells or temperature gradient holes to sumps, or the performance of formation stimulation. The Discharger proposes to issue the financial assurance in the form of a Certificate of Deposit (CD) in the name of the State Water Board. The amount of the CD will be based on the sum of costs arising from two "worst case scenarios" as follows: 1. Calpine is in the process of testing a well and has filled a geothermal fluids sump with geothermal fluid. At this point they abandon the project and a contractor must be hired to come to the site and pump the geothermal fluid in the sump to an injection well. 2. A leak develops in a geothermal fluids sump liner and must be repaired immediately.

BASIS FOR PERMIT CONDITIONS

This Order regulates discharges associated with the drilling and testing of geothermal wells including land clearing, well pad construction, sump construction, fluids discharged to sumps, geothermal fluid transfer, and the fluids from chemical addition of acid to the wells. These activities are referenced in the environmental documents referred to in Finding No. 5 and listed under "Pertinent Environmental Documents" in this Information Sheet. Well locations associated with these environmental documents are shown on Attachments B, C, and D. "Exploration" in these waste discharge requirements means land clearing, well drilling, well pad construction, sump construction, well testing, installation of sumps, geothermal fluid transfer, re-injection of geothermal fluid, temporary storage of petroleum fuels and other activities that are referenced in

environmental documents entitled "Exploration Project" or "Exploration." "Development" in these waste discharge requirements means all the elements of Exploration as well as formation stimulation, which are referenced in environmental documents entitled "Telephone Flat Geothermal Development Project." Plant construction and operation, activities associated with transmission line construction and construction of sanitary waste disposal facilities are also part of "Development," but are not covered in these waste discharge requirements.

The discharge of drilling mud and cuttings from well drilling operations to an on-site sump is exempt from the requirements of Title 27, of the CCR, as set forth in Section 21565 in Title 27. The exemption, pursuant to Section 20090(g), applies to operations where:

a. Discharges are to on-site sumps and do not contain halogenated solvents, and

b. The Discharger removes all wastes from the sump, or

c. The Discharger removes all free liquid from the sump and covers residual solid and semi-solid wastes, provided that representative sampling of the sump contents after liquid removal shows residual solid wastes to be nonhazardous. If the sump has appropriate containment features, it may be reused.

At the conclusion of drilling, drilling muds will be transported offsite to a regulated drilling mud disposal facility.

Prohibitions:

The discharge of geothermal injection fluids, drilling mud, spent acids used for permeability enhancement, drill cuttings, petroleum products, or other waste streams associated with exploration and development of geothermal resources in a manner contrary to that described in Finding Nos. 6, 7, 10, 11, 12 and 15, or to surface waters, or surface water drainage courses is prohibited.

Discharge Specifications and Provisions:

The requirements cover the design, construction, and operation of the sumps (temperature gradient hole cuttings sumps, geothermal well cuttings sumps and geothermal fluid sumps) including specifications for closure at the completion of the exploration activities. All petroleum products, acids, hydraulic fluids, drilling mud additives or other liquid materials shall be stored and used in such a manner that all spills are contained. The Discharger will be required to submit a storage statement and obtain coverage under the Aboveground Petroleum Storage Tank Act (APST Act). The APST Act requires preparation of a Spill Prevention Control and Countermeasure (SPCC) Plan. These waste discharge requirements require the Discharger to include all hazardous materials including acids and other materials in the SPCC Plan.

The Discharger is required to develop and implement a plan for immediate detection of leaks or

failures in the pipelines carrying hot pressurized geothermal fluid for re-injection. The Discharger is also required to install at least three shallow monitoring wells and one deep monitoring well as referenced in the "Medicine Lake Basin Comprehensive Hydrology Monitoring Plan."

Antidegradation Considerations:

The conditional discharge as permitted herein is consistent with the provisions of the State Water Board Resolution No. 68-16. Geothermal wells are cased to prevent loss of geothermal fluids. The Discharger is required to document that new and existing geothermal fluid sumps as originally constructed have a compacted clay liner of minimum two-foot thickness and a minimum permeability of $1x10^{-6}$ cm/sec. Because the sumps in the Telephone Flat area have not been used for over 10 years and may have developed cracks due to periods in which the liners were desiccated, the Discharger will be required to re-compact these liners and retest the them to confirm that the permeability requirement is being met. Tests for all sump liners will be conducted under the supervision of a licensed Professional Civil Engineer or Certified Engineering Geologist, registered in the State of California. The flow testing of geothermal wells will proceed for approximately 30 days and the Discharger is required to empty the sumps of geothermal fluids within 60 days of testing. This means that geothermal fluid will be in the sumps for a maximum of 90 days, minimizing the opportunity for percolation of geothermal fluids to groundwater. Following formation stimulation, immediate re-injection of spent acid is required since the spent acid waste may contain high concentrations of dissolved metals. To insure re-injection remains uninterrupted, the Discharger will maintain two re-injection pumps, one primary and one spare, at each fluid sump being used for formation stimulation. Spare pumps will be tested on a regular basis to insure they are in operating condition.

The extent of degradation allowed by this Order will not unreasonably affect present and anticipated beneficial use of such water or result in water quality less than that described in the Basin Plan.

MONITORING AND REPORTING PROGRAM AND COMPREHENSIVE HYDROLOGY MONITOIRNG PLAN

The Monitoring and Reporting Program for this Order includes requirements for notification prior to construction activities and certification that construction of the sumps complies with the specifications in Order No R5-2006-0115. The Monitoring and Reporting Program also includes monitoring for geothermal fluids discharged to the sumps and waste remaining in the sumps prior to closure or removal, surface and groundwater quality and the aboveground pipeline. Measurements of fluid level in the geothermal fluids sumps is required for both leak detection and demonstration of adequate freeboard. The Discharger is required to leak test any sump within twelve months of discharging geothermal fluid to that sump. Details of leak test monitoring are presented in the monitoring and reporting program.

The updated Medicine Lake Basin Comprehensive Hydrology Monitoring Plan submitted by the Discharger appears in Attachment E of these WDRs and is incorporated as part of Monitoring and Reporting Program No. R5-2006-0115. The Medicine Lake Basin Comprehensive Hydrology Monitoring Plan is perceived by BLM and the USFS as a dynamic document that will change as project requirements change. The updated version of the Comprehensive Hydrology Monitoring Plan has been reviewed by the Central Valley Water Board, BLM and the Telephone Flat Development Project Oversight Committee. The Discharger proposes a combination of groundwater monitoring adjacent to each development project site and area wide baseline data collection/water quality monitoring. The Discharger proposes a monitoring frequency of twice annually, unless otherwise specified in the individual project WDRs. Prior to start-up of the either the Telephone Flat Development Project or the Fourmile Hill Development Project, Calpine Siskiyou Geothermal Partners, L.P., and CPN Telephone Flat, Inc. will complete installation of a minimum of three shallow groundwater monitoring wells and one deep groundwater monitoring well at the respective project site. In addition to these project specific monitoring wells, several domestic water wells, natural springs and lakes within the Basin will also be monitored. The surface springs, lakes, and domestic wells that will be monitored were identified in USGS Open-File Report 95-750. The EIR/EIS does not require the mitigation measures for the Telephone Flat Development Project to take effect until the development project begins; however, CPN Telephone Flat, Inc., has voluntarily begun monitoring many of the sites in the Monitoring Plan. CPN Telephone Flat, Inc., has submitted a report presenting data gathered on the water quality of lakes and wells sampled twice during 2002.

Surface and groundwater monitoring in the Monitoring and Reporting Program incorporates the revised Comprehensive Hydrology Monitoring Plan submitted by the Discharger (Attachment E). Additional sampling is required for the three shallow groundwater monitoring wells for the first year.

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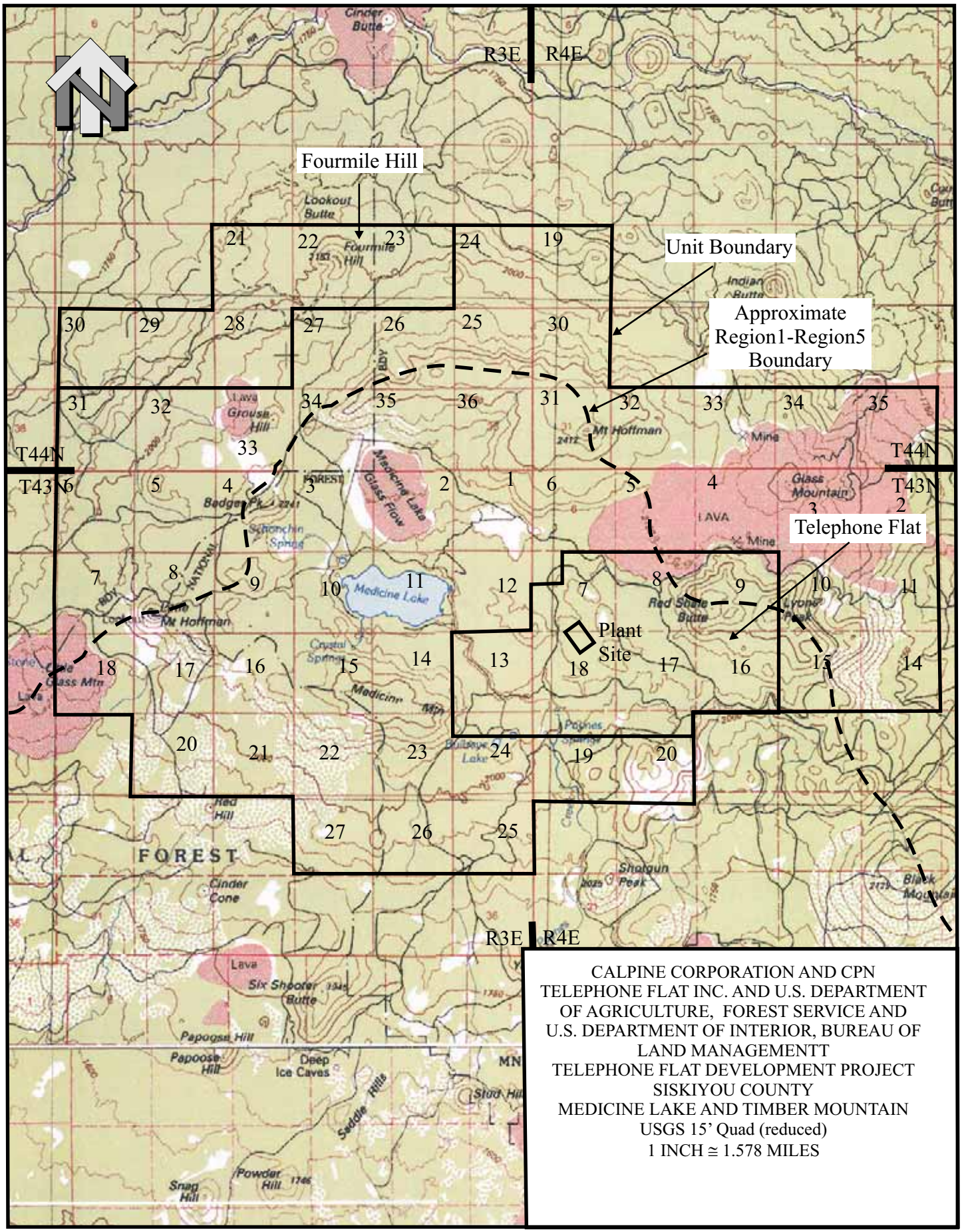
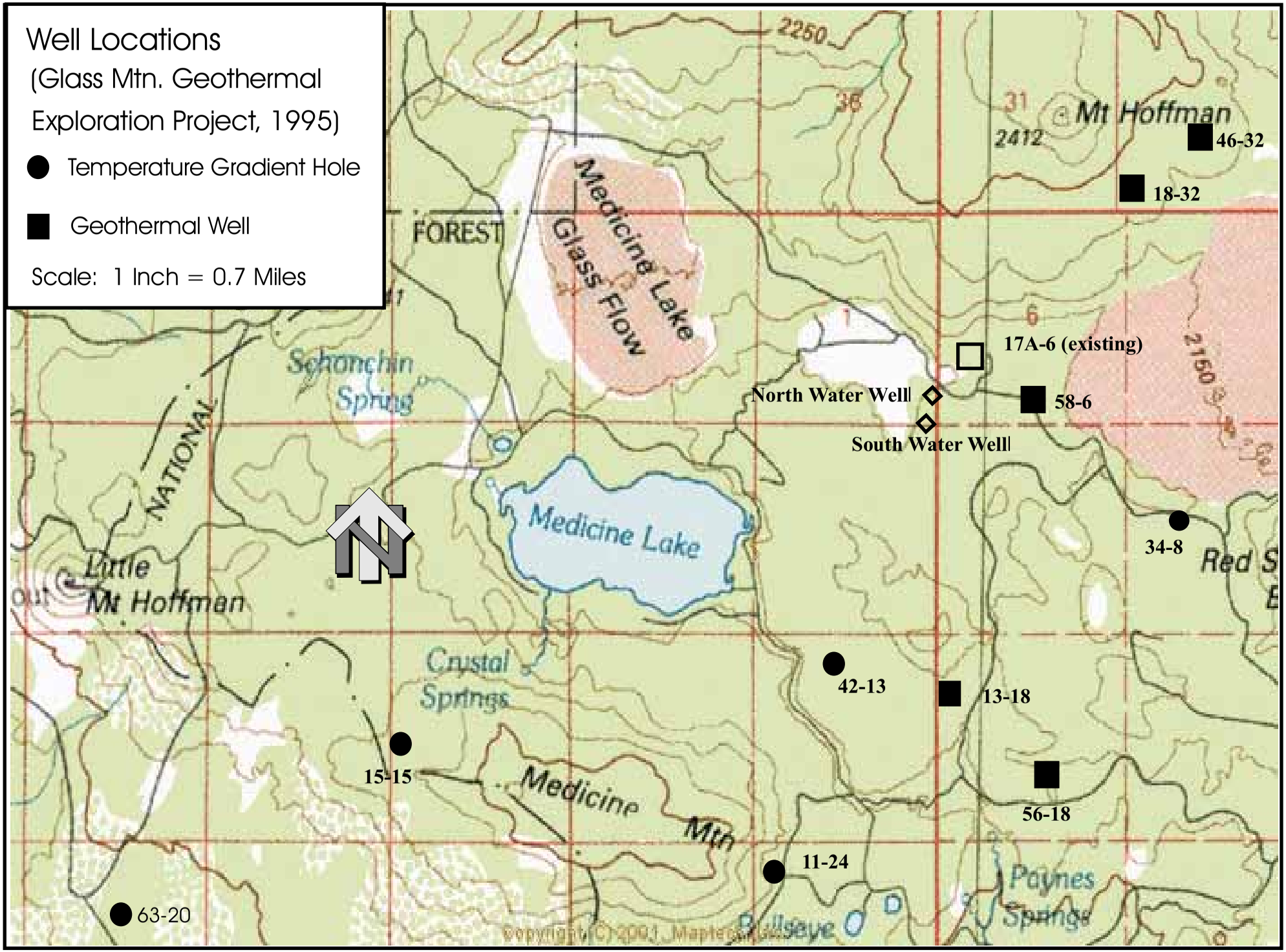


CALPINE CORPORATION AND CPN TELEPHONE FLAT INC. AND U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE AND U.S. DEPARTMENT OF INTERIOR, BUREAU OF LAND MANAGEMENTT
TELEPHONE FLAT DEVELOPMENT PROJECT
SISKIYOU COUNTY
MEDICINE LAKE AND TIMBER MOUNTAIN
USGS 15' Quad (reduced)
1 INCH ≅ 1.578 MILES


Well Locations
(Glass Mtn. Geothermal
Exploration Project, 1995)
Temperature Gradient Hole
Geothermal Well
Scale: 1 Inch = 0.7 Miles
2250
2412
Mt Hoffman
46-32
18-32
FOREST
Medicine Lake
Glass Flow
17A-6 (existing)
2150
North Water Well
South Water Well
58-6
Schonchin
Spring
NATIONAL
Medicine Lake
34-8
Red S
Little
Mt Hoffman
Crystal
Springs
42-13
13-18
15-15
Medicine
Mtn
56-18
11-24
Paynes
Spring
63-20
Bullseye
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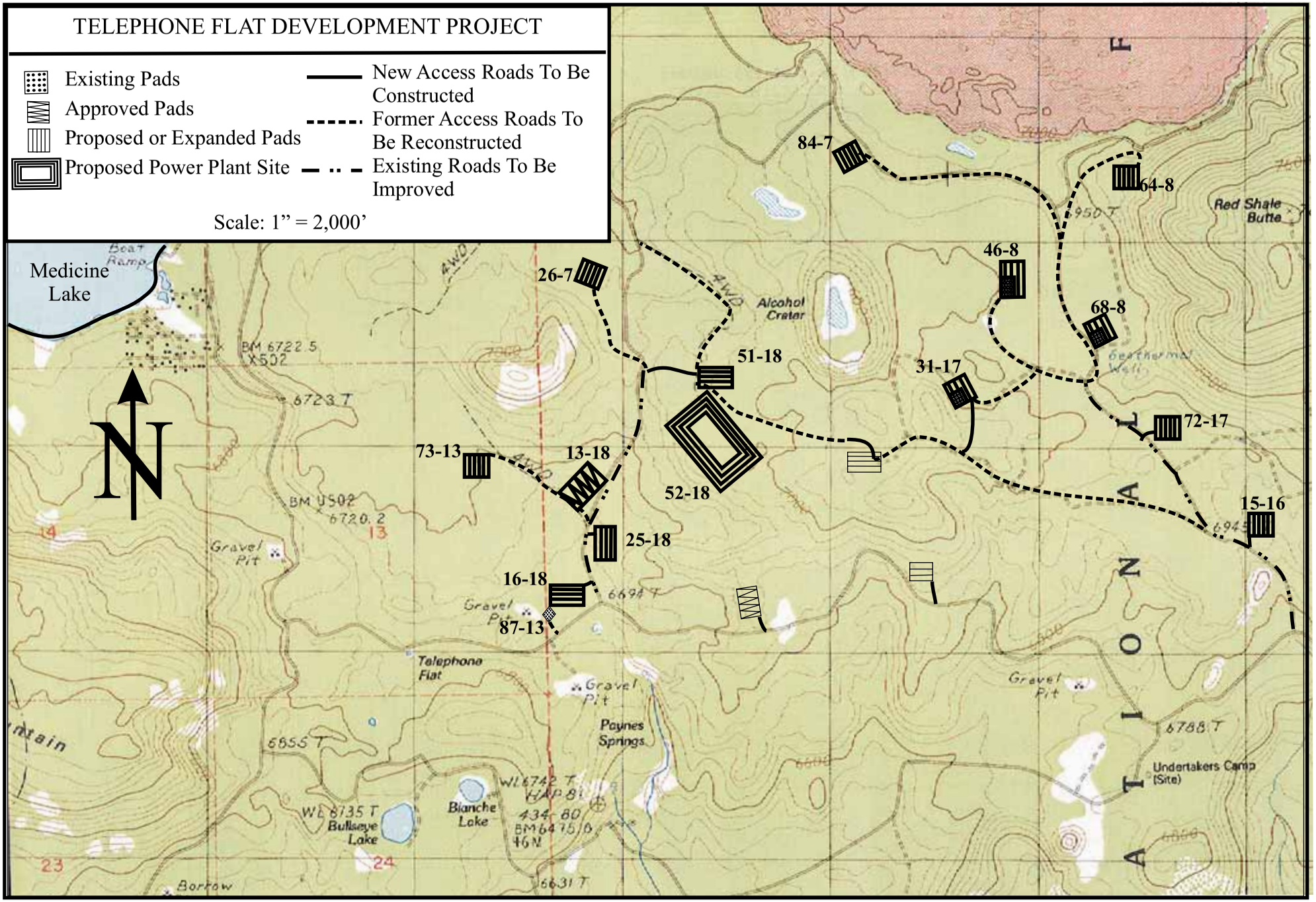
TELEPHONE FLAT DEVELOPMENT PROJECT
Existing Pads
Approved Pads
Proposed or Expanded Pads
Proposed Power Plant Site
New Access Roads To Be Constructed
Former Access Roads To Be Reconstructed
Existing Roads To Be Improved
Scale: 1" = 2,000'
Medicine Lake
Boat Ramp
4WD
Alcohol Crater
Red Shale Butte
Geothermal Well
Gravel Pit
Telephone Flat
Paynes Springs
Bianche Lake
Bullseye Lake
Undertakers Camp (Site)
Borrow
84-7
64-8
46-8
68-8
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31-17
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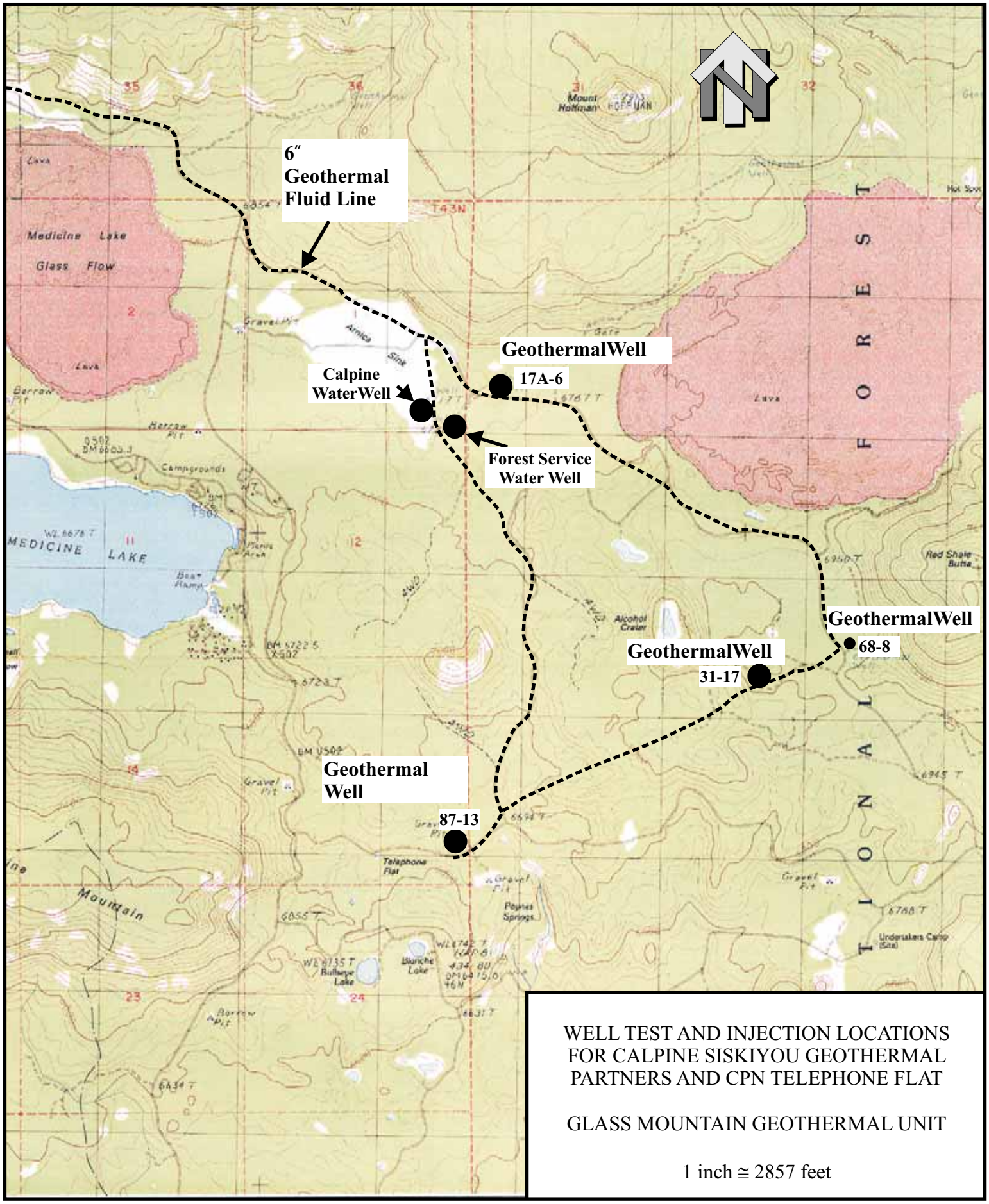
13-18
52-18
15-16
25-18
16-18
87-13



WELL TEST AND INJECTION LOCATIONS FOR CALPINE SISKIYOU GEOTHERMAL PARTNERS AND CPN TELEPHONE FLAT

GLASS MOUNTAIN GEOTHERMAL UNIT

1 inch ≅ 2857 feet

GLASS MOUNTAIN ENERGY CENTER
Hydrology Monitoring Plan

There are two geothermal development projects permitted in the Glass Mountain Known Geothermal Resource Area. The Telephone Flat Geothermal Project is located approximately 1.5 miles east of Medicine Lake, within the Medicine Lake Basin which is part of the Pit River Drainage Basin and within the district boundary of the Central Valley Regional Water Quality Control Board (CVRWQCB). The Fourmile Hill Project is located approximately 3 miles northwest of Medicine Lake, just outside of the Medicine Lake Basin, in the Klamath River drainage basin and within district boundary of the North Coast Regional Water Quality Control Board.

The intent of this Hydrology Monitoring Plan is to present a comprehensive monitoring plan that incorporates the findings of the Final Environmental Impact Statement/Environmental Impact Reports for the Telephone Flat and Fourmile Projects. This Joint Plan of Operations specifies the proposed program for monitoring ground water, surface water, and water quality in the Medicine Lake Basin and surrounding area. Each project will receive separate Waste Discharge Requirements from the respective California Regional Water Quality Control Boards. This monitoring plan will be modified to incorporate any additional requirements that may be specified in the individual projects Waste Discharge Requirements, or as appropriate to respond to any other applicable agency requirements or as data is collected on the basin's hydrology.

1.0 Introduction

The Telephone Flat Geothermal Project is a 48 MW flash geothermal power plant and Fourmile Hill is a 49.9 MW flash geothermal power plant, both with production wells, injection wells, a steam power plant, cooling tower and emission control system. Both projects are in the Glass Mountain Known Geothermal Resource Area ("Glass Mountain KGRA"), a federally designated geothermal lease area. Medicine Lake, the largest body of water within 10 miles of the project areas, is located at 1.5 miles west of the Telephone Flat Project and 3 miles southeast of the Fourmile Hill Project (Figure 1). The two geothermal projects are located on separate federal geothermal leases issued by the Bureau of Land Management ("BLM"). The leases for the Telephone Flat Project are within the Modoc National Forest and those for Fourmile Hill are within the Klamath and Modoc National Forests ("USFS").

The references used to develop the monitoring plant include:

- CalEnergy Plan of Operations: May 1997 and August 1996.
- Calpine Plan of Operations, 1997
- Fourmile Hill Geothermal Development Project Final Environmental Impact Statement, October, 1998.
- Telephone Flat Geothermal Development Project Final Environmental Impact Statement, January 1999.
- California Regional Water Quality Control Board, Central Valley Region, Waste Discharge Requirements for California Energy General Corporation, Board Order 95-199, August 1995
- California Regional Water Quality Control Board, Central Valley Region, Tentative Waste Discharge Requirements for Calpine Siskiyou Geothermal

Partners, L.P., and CPN Telephone flat, Inc., and USFS and BLM Exploration and Development Projects, February 2004

- California Regional Water Quality Control Board, North Coast Region, Waste Discharge Requirements for Calpine Corporation, Order No. R1-2002-0030, WDID no. 1A99019RSIS
- USGS Open File Report 95-750, Hydrologic Data and Description of a Hydrologic Monitoring Plan for Medicine Lake Volcano, California. 1995.
- USGS Open File Report 98-777, 3-Dimensional Visualization of the Medicine Lake Highlands, CA: Topography, Geology, Geophysics and Hydrology
- Mariner, R.H., and Lowenstern, J.B., 1999, The geochemistry of waters from springs, wells and snowpack on and adjacent to Medicine Lake volcano, northern California: Transactions Geothermal Resources Council, v. 23, p. 319-326.
- Weiss Associates, Baseline Hydrogeology Evaluation Report for Telephone Flat Geothermal Project. Medicine Lake, California, August 1997.
- Glass Mountain Unit Geothermal Exploration Project EA/IS, August 1995.

The Medicine Lake Highlands is a shield volcano on the Modoc Plateau east of Mt. Shasta Covering a 750 square mile area with approximately 140 cubic miles of superficial volcanic rocks. Medicine Lake Highlands stands above the general landscape and is generally perceived as a water source for streams, regional aquifers, springs and wells. This monitoring plan is designed to monitor the surface and groundwater near both the Telephone Flat Project and Fourmile Hill Project sites in potentially impacted areas identified by the Environmental Impact Statements ("EIS")/Environmental Impact Reports ("EIR") for each project.

The US Geological Survey ("USGS") developed a monitoring plan for the Medicine Lake area titled, Hydrologic Date and Description of a Hydrologic Monitoring Plan for Medicine Lake Volcano, CA, (Schneider and McFarland, USGS Open-File Report 95-750). The USGS suggested monitoring plan included measurements of water levels in wells, discharge rate from springs, and lake stage, as well as chemical analysis of well, spring, and lake water quality.

It is the Lessees intention to follow the general guidelines of a USGS regional groundwater hydrology monitoring program along with the input from the CVRWQCB. The monitoring plan will use a subset of the USGS suggested features that are within the collective air shed and ground water basins that reasonably might be impacted by combined developments. Additionally the Lessees intend to complete shallow groundwater monitoring wells close to the project sites to monitor groundwater chemistry for potential contamination from operations, spills, and air-born deposition. The number of shallow monitoring wells at each project will be specified in each project's Waste Discharge Requirements (3 proposed). Each project will also complete a deep groundwater monitoring well to monitor for influence between the geothermal reservoir and the regional groundwater system. This monitoring program is designed to monitor the geothermal project operations at the Telephone Flat and Fourmile Hill Projects and address the environmental concerns regarding hydrology. The primary emphasis of the hydrology monitoring program is to validate the conclusions of the environmental

analysis and to monitor not only each geothermal Project's impact on the surface and shallow groundwater system but the potential collective effect on the groundwater system of the Medicine Lake Highlands.

1.1 Medicine Lake Highlands Hydrogeologic System

Data presented in the EIR/EIS for both the Fourmile Hill and Telephone Flat projects indicate that, in its broader aspects, the groundwater hydrology of the Medicine Lake Highlands is controlled by the following:

1. Thick and highly permeable surficial deposits of lava flows, cinders and pumice which readily allow infiltration of precipitation (primarily as snow melt).
2. A saturated thickness (groundwater interval) that generally ranges from a few hundred feet to about 2000 feet.
3. An impermeable, high temperature gradient zone which underlies the groundwater saturated zone and forms a thick (1500 feet to several thousand feet) obstruction to flow between the groundwater aquifer and the geothermal system.
4. Radial outflow of groundwater away from the caldera rim of the Medicine Lake Highlands (i.e., down the regional hydrologic gradient).

On a smaller scale the movement of water in this volcanic setting is somewhat more complex and the result is a three-dimensional mosaic of aquifers, aquitards and other structures within a volcano that are overlain by soils and surface lava flows of highly variable permeability. These permeability variations affect both the surface and subsurface hydrogeology.

Within the Medicine Lake Basin, there are four lakes including Medicine, Little Medicine, Blanche and Bullseye, and six cold water springs including Schonchin, Crystal, Latunich, Payne and two un-named springs. The almost total absence of stream flow in the Medicine Lake Highlands results from the combination of relatively low precipitation (largely snow fall in the winter) and highly permeable volcanic soils and lava flows.

1.2 Regional Studies

The USGS has responsibility for regional groundwater supply studies. The Lessees will cooperate with and contribute to the USGS's baseline hydrologic data collections for the Modoc Plateau region by supplying existing and related geological, geochemical and meteorological data for the two Project areas. The USGS update to the 1995 Report, Open File Report 98-777, discusses the 3-Dimensional Visualization of the Medicine Lake Highlands (URL http://pubs.usgs.gov/of/1998/of98-777/).

The EIS/EIR documents for the approved Telephone Flat and Fourmile Hill Projects identified four ways that these projects could potentially impact surface and ground waters in the Medicine Lake Highlands.

2.0 Potential For Hydrologic and Water Quality Impacts

1) During the construction phase as a result of drilling of geothermal wells through shallow ground water formations, and from the production of ground water from the water well in the Arnica Sink area;
2) From plant operations resulting in cooling tower emissions, steam venting and during the processing of fluids at the power plant resulting in accidental fluids releases to the surface and shallow groundwater system;
3) During drilling, production of geothermal fluids from the subsurface as a consequence of well bore leakage into groundwater;
4) During the injection of fluids back into the geothermal reservoir resulting in well bore leakage to groundwater.

These potential impacts from each individual project and the potential for cumulative impacts were assessed in the referenced EIS/EIR documents for both Projects.

3.0 Monitoring Program

The monitoring plan envisions a combination of groundwater monitoring adjacent to each Project site and area wide baseline data collection/water quality monitoring which will occur twice annually, in the late spring and early fall, unless otherwise specified in the individual project Waste Discharge Requirements. Prior to startup, the Telephone Flat Project will complete a minimum of three shallow groundwater monitoring wells and the Fourmile Hill Project will complete up to three shallow groundwater monitoring wells (Figures 2 and 3). Also a deep groundwater monitoring well will be completed at each power plant site to monitor groundwater above the geothermal reservoir cap rock.

In addition to these project specific monitoring wells, several domestic water wells, natural springs and lakes within the Basin will also be monitored (Figure 1). After a baseline is established within the first three years the frequency of the monitoring program will be evaluated and adjusted as deemed appropriate. The surface springs, lakes and domestic wells that will be monitored were identified in USGS Open-File Report 95-750 and have been updated based on current availability and or existence in the fall of 2002 when some of the baseline sampling was done.

3.1 Hydrology Monitoring Wells

Prior to completion of construction, each project will complete shallow monitoring wells in each of the separate project areas. One of the shallow monitoring wells will be located in the power plant area which is the area with the greatest activity for handling geothermal fluids and other project related chemicals which could contaminate the groundwater. The shallow groundwater wells will be designed to monitor for possible shallow groundwater contamination in the project operations area. To achieve this goal the monitoring wells will be completed only into the upper part of the water table where the concentration of contaminants infiltrating with downward percolating groundwater would accumulate. The actual depths of each well will depend upon the site specific geology of each site and the number of water bearing formations encountered, if any,

during construction of the wells. The proposed locations of the shallow groundwater monitoring well for the Telephone Flat and Fourmile Hill Projects are shown on Figures 2 and 3, respectively.

The actual completion plan, perforation interval, and casing configuration of the shallow monitoring wells will be submitted to the BLM for approval and to the appropriate RWQCB office for review. Geological data from geotechnical bore holes drilled into the power plant area for purposes of defining the civil engineering criteria for the power plant facilities will be used to refine the casing configuration of the shallow monitoring well in the power plant area. Geological data from exploration wells will be used to refine the casing configuration for monitoring wells in the well field area.

Telephone Flat, which is located within the Medicine lake Basin, is in the Central Valley RWQCB district. At Telephone Flat it is proposed that three shallow wells be completed to at least 50 feet and no deeper than the equivalent of 50 feet deeper than the mean surface elevation of the surface of Medicine Lake which is believed to represent the regional water table in the Medicine Lake Basin (bottom elevation +/- 6620' average sea level). The Telephone Flat monitor wells will be spread through the development area on existing pads while the deep well will be centrally located on the power plant site. Well pad 87-13 was chosen for M-1 as it is the only existing well pad between the project and Paynes Springs. Well pad 31-17 was chosen for M-3 as it a proposed injection well location. Well pad 52-18, which will be constructed at the same time as the power plant location, is the location of M-2 so that it is near the power plant site. Fourmile Hill, which is outside the Medicine Lake Basin, is located in the North Coast RWQCB district. At Fourmile hill the depth to the water table ranges from about 600 to 800 feet and it is proposed that up to three shallow monitoring wells will be completed to penetrate approximately 30 feet below the water table. Each project will have one deep monitoring well which will have a casing configuration and perforation interval design that allows for sampling of the deeper water resources only.

The monitoring will include measurement of water levels in each of the monitoring wells and analysis of standard drinking water quality constituents and other constituents as specified by the RWQCB.

3.2 Meteorological Station and Snow Sample Baseline

A meteorological station in the Telephone Flat Project area at the US Forest Service gravel pit near well pad 87-13 collected two years of baseline data from November 20, 1993 to November 17, 1995. A meteorological station will be maintained during the development and operational phases of the project at a location approved the by the Siskiyou County Air Pollution Control District (SCAPCD) and will record precipitation, temperature, relative humidity, wind speed, wind direction, and net solar radiation. This information will be used to monitor climatic conditions that affect the hydrological water balance. A similar station ran in the Fourmile Hill Project area (at the 88-28 well site) from November 14, 1994 to November 17, 1995. A meteorological station will also be run for this project during its operational phase. Additionally, the lessee agreed to establish a meteorological and hydrogen sulfide monitoring station in the Forest Service Camp ground at Medicine Lake (it has been placed at the water tank above the campground), and the USFS will conduct periodic observations of the cooling tower

plume from Medicine Lake during the first year of Project operation. These observations will be anecdotal in nature and will not be statistically analyzed.

The California Water Resources Department also maintains a snow survey line in the Medicine Lake area at the west end of Medicine Lake and this data is made available on an annual basis. A snow core will be taken at each project location during development and prior to power plant operations to establish background levels of airborne contaminants in the annual snowpack. Snow core samples will be taken annually for the first three years of operations down wind (of the primary wind direction) of the cooling towers to monitor deposition rates of airborne contaminants (priority pollutant metals, particulates and pH). Snow cores were also taken by the USGS, 37 in April 1998 and 49 in April 1999 as part of their study of the geochemistry of the waters in northern California. The results are presented in the paper "The Geochemistry of Waters from Springs, Wells and Snowpack On and Adjacent to Medicine Lake Volcano, Northern California," Geothermal Resources Council Transactions, Volume 23, p. 319-326.

3.3 Geothermal Reservoir Monitoring

Pursuant to 43 CFR 3263.1., the Lessee will measure geothermal fluid production and injection in accordance with methods approved by the California State Office of the BLM. This information is proprietary and will be submitted monthly on a confidential basis to the BLM. In addition to production data, drilling and geologic records will be submitted. Well casing programs must be submitted to and approved by the BLM in order to assure safety and protect shallow water-bearing formations.

Certain chemistry and gas content analyses of the produced fluids and reservoir conditions are reported separately to the BLM and SCAPCD as part of on-going operations. These data are proprietary but the Lessee anticipates continuation of cooperation in providing access and data to the USGS for their regional hydrologic baseline data collection.

3.4 Hot Spot

The only known thermal surface feature in the Medicine Lake Highlands is the "Hot Spot." It occurs as two distinct gas vents on the northwest flank of Glass Mountain (T. 44 N., R. 4 E., Section 33ccd). The Lessee will record temperature and gas geochemistry at one of the vents. Observations will be made regarding the possible changes in the surrounding non-vegetated areas surrounding the Hot Spot. These data will be recorded semi-annually for the first three years of operations and annually thereafter, unless otherwise specified.

3.5 Lakes Within the Medicine Lake Basin

There are four lakes within the Medicine Lake Basin: Medicine, Little Medicine, Bullseye and Blanche (Figure 4). Medicine Lake is the largest, approximately 500 acres and 150 feet deep. Medicine Lake is the focus of this water quality monitoring program. Little Medicine, Blanche and Bullseye lakes are shallow and subject to significant natural

variations in temperature, elevation and possibly chemistry. It is proposed that "stage" measurements be taken only at Medicine Lake. However all the lakes will be monitored for chemistry. A staff gauge will be established at the public boat ramp on the east end of Medicine Lake and monitored twice annually. Water quality will be measured at Medicine, Little Medicine, Bullseye and Blanche lakes. The water quality of Medicine Lake will be sampled at its east end nearest the Telephone Flat project and at the west end nearest the Fourmile Hill Project. Water quality samples for these four lakes will be analyzed for nutrients, trace elements and major ion chemistry and ultra clean protocol sampling for Mercury twice annually for the first three years of Project development. A temperature profile of the sampling site will be taken to identify any stratification or thermalcline. The initial sampling will be timed to obtain samples during a stratified and unstratified condition. After three years of monitoring, the program will sample annually thereafter unless otherwise specified by the CVRWQCB, BLM or USFS.

Prior to power plant operations, baseline mud samples from the bottom of Medicine, Little Medicine, Bullseye, and Blanche lakes will be collected at designated monitoring sites. The mud samples will be split for chemical trace element and geological examination.

3.6 Springs In the Medicine Lake Area

Water chemistry and discharge rates from the selected springs will be monitored. In some instances the springs are on private land or must be accessed by private land. Thus, providing that the appropriate access is granted to the Lessee by the respective landowners, these springs will be sampled. The selected springs for groundwater monitoring are a subset of the springs identified by the USGS in 1992. These springs are shown in Figure 1 and are listed below:

- Payne Spring I — T 43N, R4E, Sec. 19bca
- Payne Spring II — T 43N, R4E, Sec. 19bdb
- Payne Spring III — T 43N, R4E, Sec 18cdcc
- South Schonchin Spring — T 43N, R4E, Sec. 03cdc (if this spring exists)
- Crystal Spring — T 43N, R4E, Sec. 15abd

During project operations, water chemistry samples and general discharge measurements on these springs will be made at least twice each year for the first three years of operations and annually thereafter, unless otherwise specified. Because Payne Springs is considered to be an outflow area of the Medicine Lake Basin shallow groundwater system, the following mitigation measure 4.3.1 will be followed from the Glass Mountain Geothermal Exploration Project (EA #CA027-EA95-06):

> *"In order to verify that no effects are occurring at Paynes Springs from implementation of wells at well pads 56-18 and 13-18, the lessee will collect water samples from the springs before drilling, during initial drilling, after drilling to 500 feet (the equivalent elevation to the springs), and after completion of these wells. If effects are identified after analysis of the samples, drilling at these wells will be halted until the hydrologic connection to the springs is better understood. BLM and USFS will compare the samples after they are analyzed."*

3.7 Shallow Wells In The Medicine Lake Basin

The following existing shallow groundwater wells will be monitored for water quality. In some instances the wells are on private land or must be accessed by private land. Thus, providing that the appropriate access is granted to the lessee by the respective landowners, these wells will be sampled. The selected groundwater wells for groundwater monitoring are a subset of the groundwater wells identified by the USGS in 1992. These groundwater wells are shown in Figure 1 and are listed below:

- Telephone Flat Supply Well — T 43N, R4E, Sec. 1dddd
- USFS Water Well — T 43N, R4E, Sec. 6ccbc
- USFS Campground Well — T 43N, R3E, Sec. 11dcd

These groundwater wells were identified by the USGS in 1992 as proposed sampling and monitoring locations for geothermal development in the Medicine Lake Basin. The USFS water well and the TF Supply water well are approximately 300 feet apart and produce from essentially the same groundwater zone. The monitoring program will monitor the consumption of water from the TF Supply well because this well will have the highest use.

The Telephone Flat Supply well and the USFS Campground wells have pumps and will be used to collect water quality samples. Water level will be measured twice each year for the first three years of the project to establish variations within the basin, and then once annually thereafter once a datum is established by the data. Groundwater temperature and specific conductance will be measured in the wells that are equipped with pumps when water levels are measured. Water samples will be collected for chemical analysis at the times the water levels are measured. Water level measurements will be taken during the early spring and late fall after prior to and after the heavy use period on the summer recreation season.

3.8 Sampling parameters at Monitoring Sites

The physical parameters and chemical constituents to be collected at monitoring sites were identified by the USGS in an appendix to Open File Report 95-750. The USGS recommended list of physical parameters and chemical constituents is enclosed in this monitoring plan as Appendix I. They have been added too as a result of input from the CVRWQCB including the update on ultraclean sampling protocol for mercury.

The analyses shall be made in accordance with the latest applicable EPA test methods or an alternate test procedure approved under the Code of Federal Regulations (40CFR 136) and be conducted by a laboratory certified by the CA State Department of Health Services. Some analysis that must be taken at the time of collection will be allowed by a Company representative or contractor with appropriate calibration and documentation.

Reporting

Monitoring well data will be reported quarterly by the beginning of the second month of the following quarter, to the BLM, USFS and RWQCB. Other raw data sets will not be included in the quarterly reports but will be available to responsible agencies upon request. A monitoring report will be prepared annually for the BLM, as well as the Central Valley and North Coast Regional Water Quality Control Boards. The annual report will summarize the results of the previous years', data collection and reporting. The report will be submitted in the first quarter of each year for the previous year's data collection. The report will be a public document.

In addition to the open file information provided in the annual Medicine Lake Basin Comprehensive Hydrology Monitoring Plan, both projects will be providing to the BLM the following proprietary reports:

- Well completion reports for each production and injection well
- Quarterly reports of production and injection rates
- Every two years the results of injection well casing mechanical integrity test

Each project is required under the Geothermal Resource Orders and RWQCB Waste Discharge Requirements to provide notice to the BLM and the RWQCB as soon as possible and to confirm in writing within two weeks after notification any of the following discharges:

- Discharge of drilling mud, additives, or geothermal fluids to surface drainage courses
- Discharge of noticeable petroleum products from storage tanks or the results of refueling operations or spills outside of containment basins
- Discharge of any toxic or hazardous materials outside of containment basins

The written information reporting discharges outside of approved containment areas shall include information explaining the reason for the discharge and shall indicate what steps were taken to correct the problem, and dates thereof, and what steps are being taken to prevent the problem from recurring.

The Lessee recognizes the importance the monitoring data and other proprietary geological data may have for the regional hydrological studies that are being conducted by the USGS. The Lessee proposes to continue cooperation with appropriate scientific agencies such as the USGS in the regional evaluation of the hydrology of the Medicine Lake Highlands. Copies of the annual report and raw data will be provided to the USGS under a separate Memorandum of Agreement between the Project Operators and the USGS. Based on a December 2005 conversation with USGS staff, this project, which was under the Volcano Hazards Program, has not been a priority in about 5 years and there is no new published information since the 1998 report.

Appendix 1

Physical Parameters and Chemical Constituents to be Collected at Monitoring Sites

A. Field parameters (measured with a multiparameter probe)
1) pH, alkalinity, temperature, specific conductance
2) Dissolved oxygen, when feasible (for instance, dissolved oxygen is not meaningful when samples are obtained from wells equipped with air-jet pumps)

B. Major chemistry (dissolved unless otherwise stated) and physical parameters (includes analytical methods)

1) Major ions:
Ca, ICP/MS
Mg, ICP/MS
Na, ICP/MS
K, ICP/MS
HCO_3, titration, 1 mg/L
Cl, ion chromatography, 1 mg/L
$S0_4$, ion chromatography, 1 mg/L
F, ion chromatography, 10 µg/L

2) Minor constituents:
SiO_2, colorimetry, molybate blue, 0.1 mg/L
Al, ICP/MS
Fe, ICP/MS
Mn, ICP/MS

3) Nutrients:
Total P colorimetry, 10 µg/L
Ortho P, colorimetry, 10 µg/L
$NO_2 + NO_3$, ion chromatography (EPA 300.0)
NH4, colorimetry, 0.01 mg/L

4) Dissolved Solids
Residue on evaporation, 1 mg/L

5) Turbidity:
nephelometry, 0.1 NTU

C. Trace elements (Total) ICP/MS unless specified otherwise:
a) As
b) Ag
c) B
d) Ba

e) Be
f) Cd
g) Total Cr
h) Cr VI ion chromatography EPA Method 218.6, if Total Cr is present
i) Cu
j) Hg, analysis by ultraclean protocol, CVAA-EPA Method 1631
k) Li
l) Mo
m) Ni
n) Pb
o) Sb
p) Se
q) Sr
r) Tl
s) Zn

D. Dissolved Gasses:
   a) CO_2, calibrated from alkalinity titration
   b) H_2S, calculated from total recoverable sulfide; total recoverable sulfide determined by iodometric titration with detection limit of 0.5 mg/L as S
   c) NH_3, calculated from ammonium ion concentration