Geysers Power Company
Calistoga Power Plant
10350 Socrates Mine Road
Middletown, CA 95461



STATE OF CALIFORNIA

Energy Resources
Conservation and Development Commission

| | |
|---|---|
| In the Matter of: | DOCKET NO. 1-81-AFC-1C |
| Application for Certification for the OXY Geothermal Plant No. 1 | GEYSERS POWER COMPANY'S PETITION AMENDMENT TO MODIFY BIOLOGICAL CERTIFICATION |

On February 1, 1982, the California Energy Commission (CEC) issued a License to Occidental Geothermal Inc. to construct and operate the OXY Geothermal Plant No. 1 Project. The plant began operation commercially on April 10, 1984.

Between 1982 and 1999, Occidental Geothermal underwent several name changes. In 1999, in accordance with Section 1569 (b) of Title 20 of the California Code of Regulations, Calpine Calistoga Holdings, LLC submitted a Petition to Transfer Ownership of the Calistoga Geothermal Power Plant from Calistoga Geothermal Partners, LP to Geysers Power Company, LLC both indirect wholly owned subsidiaries of Calpine Corporation. The Petition was granted. GPC currently identifies the power plant as the "Calistoga Power Plant" and it is referred in this Petition as the "Calistoga Power Plant".

In accordance with 20 CFR Section 1769, GPC is submitting a request to amend Biological Resources Condition of Certification 5-4 regarding the monitoring of boron drift effects on vegetation surrounding the Calistoga power plant. The following contains a description of the proposed modification including a discussion of the necessity of the change. The Petition demonstrates that the proposed modification does not undermine any assumption, rationale or finding in the final decision, will not result in significant impacts and will not affect the ability of the facility to comply with applicable laws, ordinances, regulations or standards (LORS).

Description of Proposed Modification

GPC is requesting approval from the CEC to modify Biological Resources Condition of Certification 5-4 which is associated with the required boron study for the Calistoga Geothermal Power Plant.

This amendment is being requested because twenty years of boron monitoring studies in the area of the Calistoga Power Plant indicate that there is not an impact on surrounding vegetation and further monitoring is not necessary.

The Final Decision stated that there was a possibility that vegetation injury will occur as a result of cooling tower drift; and that the effects of cooling tower drift on surrounding vegetation can be determined only through systematic monitoring.

GPC requests that Biological Resources Condition 5-4 be modified as follows:

> 5-4: Occidental shall monitor drift effects on the vegetation surrounding the power plant. Monitoring shall be conducted for one year prior to operation, annually for the first three years of operation, and then at five-year intervals or until it can be demonstrated that boron drift is not having a significant on the vegetation surrounding the power plant. ~~for the life of the power plant. Monitoring shall include large-scale (not smaller than 1:3000) false color infrared photographs (one stereo pair), taken in June, coupled with ground sampling at permanent study plots. Ground sampling will include examination by a qualified biologist for visible foliar injury and collection of foliar samples which will be analyzed for boron content at a qualified laboratory.~~
>
> Verification: Occidental shall submit annual reports to the CEC in those years in which the monitoring takes place. These reports shall include copies of all laboratory analyses, field survey work, and a stereo pair (full color copy) of aerial photographs of the leasehold.

**Necessity of Proposed Modification**

GPC is requesting approval of the modification so that the 5-year boron monitoring survey can be terminated.

## Effect of Decision's Findings, Assumptions and Rationale

The requirement for monitoring was initiated to assess the impacts of geothermal operations on local vegetation. A prime concern was the impact of boron on vegetation. A monitoring program which includes a 5-year-interval program of obtaining color infrared photographs of the Calistoga power plant site; and ground foliar sampling at the study plots for boron content was initiated.
Twenty years of monitoring for boron impacts on the Calistoga power plant indicate a decrease in the average boron concentration levels in leaves of surrounding plants. Additional monitoring and analysis is unlikely to add additional valuable information to studies of the impact of boron on vegetation.

## Analysis of Environmental Impacts

Mr. Douglas Nix of LandWatch, Incorporated has conducted the boron monitoring personally, for the Calistoga power plant since 1985. His last monitoring survey was in 2003. Mr. Nix of LandWatch recommends termination of boron monitoring in his 2003 report. He states that new information gathered over the past 20 years of monitoring, based on laboratory analysis of plant leaf tissues, onsite visual observations and through color infrared aerial imagery, indicates no significant impact of power plant drift on the surrounding vegetation. This information was not known during the certification proceedings as the monitoring had not been conducted.

See Attachment 1 for a copy of the report entitled "2003 Boron Drift Monitoring Survey for the Calpine Geothermal Power Plant".

## Compliance with LORS

The proposed changes to Biological Resources Condition of Certification 5-4 will not alter the assumptions or conclusions reached in the CEC's Final Decision. The third-party surveys have indicated no impact on the environment. Termination of the boron study will have no impact on the facility's ability to comply with applicable laws, ordinances, regulations and standards (LORS) as the facility is in compliance with all current LORS.

## Effect of Modification on Public and Surrounding Property Owners

The proposed changes to Biological Resources Condition of Certification 5-4 will have no impact on the environment, or to surrounding property owners or the public. The third-party surveys have indicated no impact on the environment so there is no need for continued monitoring or additional mitigation measures. There are no significant public health impacts from the proposed change.

A list of contiguous property owners is contained in Attachment 2. GPC is the current surface owner of the Calistoga power plant site. To the southwest of the property, the land is USA surface and minerals.

# ATTACHMENT 1

2003 Boron Drift Monitoring Survey for the Calpine Geothermal Power Plant

# LANDWATCH INCORPORATED

Environmental Monitoring & Management

# 2003 BORON DRIFT MONITORING SUMMARY FOR THE CALPINE GEOTHERMAL POWER PLANT #19

**PREPARED FOR:**

**CALPINE CORPORATION**
**10350 SOCRATES MINE ROAD**
**MIDDLETOWN, CA 95461**
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**PREPARED BY:**

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**NOVEMBER 17, 2003**


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# CALPINE CORPORATION
# BORON DRIFT MONITORING PROGRAM, 2003

## SUMMARY

Vegetation surrounding Calpine Corporation's Geothermal Power Plant (formerly Santa Fe Geothermal #1) was sampled from permanent transects that were established in September, 1985. These locations are field identified and the sampled woody plants are individually tagged for identical resampling in future years. Sampling the same plants is important due to the extreme variability in soil conditions within the The Geysers area. The 1983, 1984, 1985, 1986, 1992, and 1996 sample data show high variability in the concentrations of boron within the sampled plants. The 2003 sample results show similar variability, only with a decrease of 15.07 percent in th mean boron concentration. Outside (non-Calpine Corporation power plant) factors such as Calpine #3 Power Plant, well bore releases, orographic influences, and overall weather and wind patterns will influence these results.

No pattern of concentrations, like those noted by PG&E around its Units 5 & 6 (Malloch, et al., 1979), are discernable within this study.

## INTRODUCTION

### BACKGROUND

Condition 5-4 set forth by the California Energy Commission (CEC) requires a detailed monitoring program to assess the impacts of geothermal operations upon the local vegetation. Of prime concern are the impacts of boron on vegetation. Although boron is a necessary trace element, in high concentrations (>500 ppm) it can be deleterious or toxic to vegetation. This report summarizes the 2003 sampling program which compliments the already completed 1983, 1984, 1985, 1986, 1992, and 1996 work.

Boron is known to accumulate in the foliage of plants. Resulting accumulation may be either from root uptake, foliar deposition and subsequent absorption, or both. Species tolerance is highly variable and is influenced by drought tolerance and moisture levels within the surrounding soils.

### OBJECTIVES

The objectives of this investigation are to provide compliance documentation for the CEC and to assess the impact (if any) of Calpine Corporation's geothermal power plant operations upon the surrounding vegetation.

## METHODOLOGY

Field locations of transects were located in the same area (see Figure 1) as sampled for the 1983 through 1996 data collections. For consistency of data collection, and for inspection by Calpine Corporation personnel and CEC staff, transect ends were permanently marked and sampled vegetation were tagged with horticultural tags. Samples were collected from a total of 19 plant species which were labeled, bagged and submitted for laboratory analysis. Standard laboratory analysis using inductive coupled plasma (ICP) techniques (Method 6010) were used by MDS Harris Laboratories of Lincoln, Nebraska.

In addition to field sampling, false color infrared aerial photographs were taken on June 17, 2003. The photos were taken at a scale of 1" = 250' in stereo coverage. These photos were evaluated to identify any existing or developing problems that may not be visible from ground surveys.

## RESULTS

The laboratory analysis shows an overall decrease of 13.74 ppm in the average boron concentration compared to the 1996 results and a 32.15 ppm decrease compared to the 1985 results. A random scattering of foliar boron concentration is clearly evident in the data shown in Table 1. Table 2 compares the percent change between 1996 and 2003 boron concentration levels. The average boron concentration decreased 15.07 percent between 2003 and 1996 monitoring periods. Table 3 summarizes the visual assessment of leaf condition by species and transect. There was a .06 percent decrease in observed leaf damage between 1996 and 2003. As before, the majority of the damage was the result of insects and not boron damage. Table 4 provides an overall summary of the 2003 sampling results with high, low, and average values for boron concentration and leaf damage percentages. Table 5 summarizes the distance to cooling tower/boron concentration relationships. Transects 6 and 5 are the most distant from the cooling towers and had the highest average boron concentration. This is a complete reversal from the 1996 monitoring period when transects 2 and 3 (closest to the cooling towers) had the highest boron concentrations. No clear pattern between the distance to the cooling towers and the boron concentrations was observed. Review of the infrared aerial photographs did not reveal any problem areas.

## CONCLUSIONS

The 2003 data reconfirms the previous years data, namely that no distinct pattern is evident regarding boron concentration in the sampled vegetation. Localized impacts (i.e. venting, drilling, and well blow-out activities) may produce limited impacts. However, no trends in the laboratory analysis or the visual summary can be seen. Boron concentration values tend to increase and decrease by species and transect between monitoring periods. This variation may be influenced by the weather patterns between the monitoring periods. The end of California drought and the above normal to normal rainfall between the last monitoring periods may account for some of the overall decrease in boron concentrations through leaching of soluble boron in the soil.

## RECOMMENDATION

Tissue boron levels of the vegetation surrounding this geothermal power plant have been monitored for the past 20 years. During this time there has been no significant impact on the vegetation surrounding the power plant. This has been confirmed through laboratory analysis of the plant leaf tissues, onsite visual observations, and through infrared aerial imagery. Given the non-impacted of this power plant's steam emissions on the surrounding vegetation, it is the consultants recommendation that the boron monitoring of this site be concluded with this 2003 report.

**TABLE 1.**
**SUMMARY OF LEAF BORON CONCENTRATIONS**
**CALPINE GEOTHERMAL DRIFT MONITORING PROGRAM 2003**

| SPECIES | BORON CONCENTRATION (mg/kg or ppm) BY TRANSECT | | | | | | | | | | NO. OF OCCURRENCES | AVG. BORON CONCENTRATION BY SPECIES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| Adenostoma fasciculatum (chamise) | | | | 33 | | | 35 | | | | 2 | 34.00 |
| Arbutus menziesii (madrone) | | | | | | | | 34 | | | 1 | 34.00 |
| Arctostaphylos (manzanita) | 36 | 44 | 35 | 24 | 86 | 76 | 31 | 49 | | | 8 | 47.63 |
| Ceanothus cuneatus (buck bush) | | 56 | | | | | 38 | | | | 2 | 47.00 |
| Ceanothus integerrimus (deer bush) | | | | 50 | | | | | | | 1 | 50.00 |
| Ceanothus jepsonii (musk bush) | 27 | | | | 29 | | | | | | 2 | 28.00 |
| Cerocarpus betuloides (mountain mahogany) | | 73 | 46 | | | | 35 | | | | 3 | 51.33 |
| Pinus attenuata (knob cone pine) | 47 | | | | 27 | 41 | | 30 | | | 4 | 36.25 |
| Pinus sabiniana (digger pine) | 29 | | | | | | | | | | 1 | 29.00 |
| Polystichum munitum (sword fern) | | | | | | | | 30 | | | 1 | 30.00 |
| Pseudotsuga menziesii (Douglas fir) | 71 | | | 33 | | | | | | | 2 | 52.00 |
| Quercus chrysolepis (canyon live oak) | | 229 | 85 | 44 | | 152 | 43 | 47 | | | 6 | 100.00 |
| Quercus durata (leather oak) | 37 | | | | 45 | 85 | | | | | 3 | 55.67 |
| Quercus kelloggii (black oak) | | | | | | | | 55 | | | 1 | 55.00 |
| Quercus wislizenii (interior live oak) | | 74 | | 35 | | | 33 | | | | 3 | 47.33 |
| Rhamnus californica (coffeeberry) | 58 | | | | 43 | 118 | | | | | 3 | 73.00 |
| Trifolium hirtum (rose clover) | | | | | | | | | 27 | 78 | 2 | 52.50 |
| Umbellularia californica (bay) | | 83 | | | 254 | 161 | 34 | 54 | | | 5 | 117.20 |
| **NO. OF SPECIES PER TRANSECT** | **7** | **6** | **3** | **6** | **6** | **6** | **7** | **7** | **1** | **1** | **OVERALL AVG. BORON CONC. BY TRANSECT** | |
| **AVG. BORON CONC. BY TRANSECT** | **43.57** | **93.17** | **55.33** | **36.50** | **80.67** | **105.50** | **35.57** | **42.71** | **27.00** | **78.00** | | **59.80** |

**TABLE 2**
**COMPARISON OF PERCENT CHANGE IN BORON CONCENTRATION, 1996-2003**
**CALPINE GEOTHERMAL DRIFT MONITORING PROGRAM 2003**

| | PERCENT CHANGE IN BORON CONCENTRATION BETWEEN 1996 AND 2003 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPECIES | 1996 | 2003 | Tran. 1 | 1996 | 2003 | Tran. 2 | 1996 | 2003 | Tran 3. | 1996 | 2003 | Tran. 4 | 1996 | 2003 | Tran. 5 | 1996 | 2003 | Tran. 6 | 1996 | 2003 | Tran. 7 | 1996 | 2003 | Tran. 8 | 1996 | 2003 | Tran. 9 | 1996 | 2003 | Tran. 10 | NO. OF OCCURRENCES | % CHANGE IN AVG. BORON CONCENTRATION BY SPECIES |
| Arctostaphylos (manzanita) | 86 | 36.00 | -58.14% | 14.00 | 44.00 | 214.29% | 300.00 | 35.00 | -88.33% | 80.00 | 24.00 | -70.00% | 21.00 | 86.00 | 309.52% | 84.00 | 76.00 | -9.52% | 31.00 | 31.00 | 0.00% | 36.00 | 49.00 | 36.11% | | | | | | | 8.00 | -41.56% |
| Ceanothus jepsonii (musk bush) | 88 | 27.00 | -69.32% | | | | | | | | | | 38.00 | 29.00 | -23.68% | | | | | | | | | | | | | | | | 2.00 | -55.56% |
| Pseudotsuga menziesii (Douglas fir) | 77 | 71.00 | -7.79% | | | | | | | 30.00 | 33.00 | 10.00% | | | | | | | | | | | | | | | | | | | 2.00 | -2.80% |
| Pinus sabiniana (digger pine) | 65 | 29.00 | -55.38% | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1.00 | -10.77% |
| Pinus attenuata (knob cone pine) | 23 | 47.00 | 104.35% | | | | | | | | | | 86.00 | 27.00 | -68.60% | 78.00 | 41.00 | -47.44% | | | | 36.00 | 30.00 | -16.67% | | | | | | | 4.00 | -34.98% |
| Quercus durata (leather oak) | 83 | 37.00 | -55.42% | | | | | | | | | | 71.00 | 45.00 | -36.62% | 140.00 | 85.00 | -39.29% | | | | | | | | | | | | | 3.00 | -43.19% |
| Rhamnus californica (coffeeberry) | 24 | 58.00 | 141.67% | | | | | | | | | | 77.00 | 43.00 | -44.16% | 40.00 | 118.00 | 195.00% | | | | | | | | | | | | | 3.00 | 55.32% |
| Ceanothus cuneatus (buck bush) | | | | 75.00 | 56.00 | -25.33% | | | | | | | | | | | | | 48.00 | 38.00 | -20.83% | | | | | | | | | | 2.00 | -23.58% |
| Cercocarpus betuloides (mountain mahogany) | | | | 80.00 | 73.00 | -8.75% | 64.00 | 46.00 | -28.13% | | | | | | | | | | 26.00 | 35.00 | 34.62% | | | | | | | | | | 3.00 | -9.42% |
| Quercus chrysolepis (canyon live oak) | | | | 57.00 | 229.00 | 301.75% | 27.00 | 85.00 | 214.81% | 46.00 | 44.00 | -4.35% | | | | 140.00 | 152.00 | 8.57% | 58.00 | 43.00 | -25.86% | 52.00 | 47.00 | -9.62% | | | | | | | 6.00 | 31.58% |
| Quercus wislizenii (interior live oak) | | | | 300.00 | 74.00 | -75.33% | | | | 25.00 | 35.00 | 40.00% | | | | | | | 35.00 | 33.00 | -5.71% | | | | | | | | | | 3.00 | -60.56% |
| Adenostoma fasciculatum (chamise) | | | | | | | | | | 18.00 | 33.00 | 83.33% | | | | | | | 16.00 | 35.00 | 118.75% | | | | | | | | | | 2.00 | 100.00% |
| Umbellularia californica (bay) | | | | 540.00 | 83.00 | -84.63% | | | | | | | 87.00 | 254.00 | 191.95% | 120.00 | 161.00 | 34.17% | 30.00 | 34.00 | 13.33% | 39.00 | 54.00 | 38.46% | | | | | | | 5.00 | -28.19% |
| Ceanothus integerrimus (deer bush) | | | | | | | | | | 54.00 | 50.00 | -7.41% | | | | | | | | | | | | | | | | | | | 1.00 | -7.41% |
| Arbutus menziesii (madrone) | | | | | | | | | | | | | | | | | | | | | | 39.00 | 34.00 | -12.82% | | | | | | | 1.00 | -12.82% |
| Polystichum munitum (sword fern) | | | | | | | | | | | | | | | | | | | | | | 15.00 | 30.00 | 100.00% | | | | | | | 1.00 | 100.00% |
| Quercus kelloggii (black oak) | | | | | | | | | | | | | | | | | | | | | | 54.00 | 55.00 | 1.85% | | | | | | | 1.00 | 1.85% |
| Trifolium hirtum (rose clover) | | | | | | | | | | | | | | | | | | | | | | | | | 36.00 | 27.00 | -25.00% | 98.00 | 78.00 | -20.41% | 2.00 | -21.64% |
| **AVG. BORON CONCENTRATION BY TRANSECT** | **63.714** | **43.57** | | **177.67** | **93.17** | | **130.33** | **55.33** | | **42.17** | **36.50** | | **63.33** | **80.67** | | **100.33** | **105.50** | | **34.86** | **35.57** | | **38.71** | **42.71** | | **36.00** | **27.00** | | **98.00** | **78.00** | | **OVERALL AVG. % CHANGE IN BORON CONCENTRATION BY TRANSECT** | |
| **AVG. % CHANGE BY TRANSECT** | | | **-31.61%** | | | **-47.56%** | | | **-57.54%** | | | **-13.44%** | | | **27.37%** | | | **5.15%** | | | **2.05%** | | | **10.33%** | | | **-25.00%** | | | **-20.41%** | | **-15.07%** |

**TABLE 3.**
**SUMMARY OF VISUAL ASSESSMENT SURVEY FINDINGS**
**CALPINE GEOTHERMAL DRIFT MONITORING PROGRAM 2003**

| SPECIES | VISUAL ASSESSMENT OF LEAF CONDITION BY TRANSECT (% DAMAGE) | | | | | | | | | | NO. OF OCCURRENCES | DAMAGE BY SPECIES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| Arctostaphylos (manzanita) | 2 | 3.28 | 13.04 | 14.96 | 6.24 | 7.3 | 9.58 | 6.24 | | | 8 | 7.83 |
| Ceanothus jepsonii (musk bush) | 4.92 | | | | 1.38 | | | | | | 2 | 3.15 |
| Pseudotsuga menziesii (Douglas fir) | 1.84 | | | 3.66 | | | | | | | 2 | 2.75 |
| Pinus sabiniana (digger pine) | 8.2 | | | | | | | | | | 1 | 8.20 |
| Pinus attenuata (knob cone pine) | 20.34 | | | | 7.98 | 7.48 | | 6.12 | | | 4 | 10.48 |
| Quercus durata (leather oak) | 6.98 | | | | 4.38 | 2.64 | | | | | 3 | 4.67 |
| Rhamnus californica (coffeeberry) | 2.64 | | | | 3.02 | 4.84 | | | | | 3 | 3.50 |
| Ceanothus cuneatus (buck bush) | | 2.2 | | | | | 1.28 | | | | 2 | 1.74 |
| Cerocarpus betuloides (mountain mahogany) | | 5 | 8.26 | | | | 3.92 | | | | 3 | 5.73 |
| Quercus chrysolepis (canyon live oak) | | 8.52 | 2.4 | 4.96 | | 6.82 | 3.78 | 5.66 | | | 6 | 5.36 |
| Quercus wislizenii (interior live oak) | | 6.9 | | 0.72 | | | 2.1 | | | | 3 | 3.24 |
| Adenostoma fasciculaturm (chamise) | | | | 0 | | | 0 | | | | 2 | 0.00 |
| Umbellularia californica (bay) | | 10.28 | | | 3.2 | 3.96 | 2.6 | 3.34 | | | 5 | 4.68 |
| Ceanothus integerrimus (deer bush) | | | | 3.66 | | | | | | | 1 | 3.66 |
| Arbutus menziesii (madrone) | | | | | | | | 1.7 | | | 1 | 1.70 |
| Polystichum munitum (sword fern) | | | | | | | | 0.84 | | | 1 | 0.84 |
| Quercus kelloggii (black oak) | | | | | | | | 5.24 | | | 1 | 5.24 |
| Trifolium hirtum (rose clover) | | | | | | | | | 0 | 0 | 2 | 0.00 |
| **NO. OF SPECIES / TRANSECT** | **7** | **6** | **3** | **6** | **6** | **6** | **7** | **7** | **1** | **1** | **OVERALL % DAMAGE BY TRANSECT** | |
| **AVG. PERCENTAGE OF DAMAGE BY TRANSECT** | **6.70** | **6.03** | **7.90** | **4.66** | **4.37** | **5.51** | **3.32** | **4.16** | **0.00** | **0.00** | | **4.27** |

**TABLE 4.**
**VISUAL ANALYSIS AND BORON CONCENTRATIONS BY SPECIES**
**CALPINE GEOTHERMAL DRIFT MONITORING PROGRAM 2003**

| | BORON CONCENTRATION | | | VISUAL DAMAGE | | | |
|---|---|---|---|---|---|---|---|
| SPECIES | HIGH | LOW | AVG. | HIGH | LOW | AVG. | NUMBER OF OCCURENCES |
| Adenostoma fasciculatum (chamise) | 35 | 33 | 34 | 0 | 0 | 0 | 2 |
| Arbutus menziesii (madrone) | 34 | 34 | 34 | 1.7 | 1.7 | 1.7 | 1 |
| Arctostaphylos (manzanita) | 86 | 24 | 47.63 | 14.96 | 2 | 7.83 | 8 |
| Ceanothus cuneatus (buck bush) | 56 | 38 | 47 | 2.2 | 1.28 | 1.74 | 2 |
| Ceanothus integerrimus (deer bush) | 50 | 50 | 50 | 3.66 | 3.66 | 3.66 | 1 |
| Ceanothus jepsonii (musk bush) | 29 | 27 | 28 | 4.92 | 1.38 | 3.15 | 2 |
| Cerocarpus betuloides (mountain mahogany) | 73 | 35 | 51.33 | 8.26 | 3.92 | 5.73 | 3 |
| Pinus attenuata (knob cone pine) | 47 | 27 | 36.25 | 20.34 | 6.12 | 10.48 | 4 |
| Pinus sabiniana (digger pine) | 29 | 29 | 29 | 8.2 | 8.2 | 8.2 | 1 |
| Polystichum munitum (sword fern) | 30 | 30 | 30 | 0.84 | 0.84 | 0.84 | 1 |
| Pseudotsuga menziesii (Douglas fir) | 71 | 33 | 52 | 3.66 | 1.84 | 2.75 | 2 |
| Quercus chrysolepis (canyon live oak) | 229 | 43 | 100 | 8.52 | 2.4 | 5.36 | 6 |
| Quercus durata (leather oak) | 85 | 37 | 55.67 | 6.98 | 2.64 | 4.67 | 3 |
| Quercus kelloggii (black oak) | 55 | 55 | 55 | 5.24 | 5.24 | 5.24 | 1 |
| Quercus wislizenii (interior live oak) | 74 | 33 | 47.33 | 6.9 | 0.72 | 3.24 | 3 |
| Rhamnus californica (coffeeberry) | 118 | 43 | 73 | 4.84 | 2.64 | 3.5 | 3 |
| Trifolium hirtum (rose clover) | 78 | 27 | 52.5 | 0 | 0 | 0 | 2 |
| Umbellularia californica (bay) | 161 | 34 | 117.2 | 10.28 | 2.6 | 4.68 | 5 |
| **TOTAL NUMBER OF SAMPLES** | | | | | | | **50** |

**TABLE 5.**
**TISSUE BORON RANKING BY STATION, DISTANCE AND DIRECTION**
**CALPINE GEOTHERMAL DRIFT MONITORING PROGRAM 2003**

| CONC. BY TRANSECT | DIRECTION FROM COOLING TOWERS | | | |
|---|---|---|---|---|
| | NORTH | EAST | SOUTH | WEST |
| 6 | | 1450/105.5 | | |
| 2 | | 400/36.5 | | |
| 5 | | 1300/80.67 | | |
| 10 | 790/78 | | | |
| 3 | *330/55.33 | | | |
| 1 | | 990/43.57 | | |
| 8 | 650/42.71 | | | |
| 4 | | | | 710/36.5 |
| 7 | | | | 840/35.57 |
| 9 | | | | 470/27 |

* 330 feet from cooling towers/55.33 ppm average boron concentration for transect 3

# Appendix A
# Laboratory Analysis
# Data Sheets

MDS Harris

REPORT OF ANALYSIS

Sample Of: Plant

Submitted By:
Ralph Osterling Consulting
1650 Borel Place
San Mateo, CA 94402

Submitted For:
Calpine
Middleton, CA

| Date Received | Date Reported | Samples Will Be Stored Until | Laboratory No. |
|---|---|---|---|
| 22-Sep-03 | 23-Sep-03 | | 614294-614322 |

## REPORT OF ANALYTICAL RESULTS

| Client Sample Identification | Analysis | Result |
|---|---|---|
| T1-1 | Boron | 36 PPM |
| T1-2 | Boron | 27 PPM |
| T1-3 | Boron | 71 PPM |
| T1-4 | Boron | 29 PPM |
| T1-5 | Boron | 47 PPM |
| T1-6 | Boron | 37 PPM |
| T1-7 | Boron | 58 PPM |
| T2-1 | Boron | 44 PPM |
| T2-2 | Boron | 56 PPM |
| T2-3 | Boron | 73 PPM |
| T2-4 | Boron | 229 PPM |
| T2-5 | Boron | 74 PPM |
| T2-6 | Boron | 83 PPM |
| T3-1 | Boron | 35 PPM |
| T3-2 | Boron | 46 PPM |
| T3-3 | Boron | 85 PPM |
| T4-1 | Boron | 24 PPM |
| T4-2 | Boron | 33 PPM |
| T4-3 | Boron | 44 PPM |
| T4-4 | Boron | 35 PPM |
| T4-5 | Boron | 33 PPM |
| T4-6 | Boron | 50 PPM |
| T5-1 | Boron | 86 PPM |
| T5-2 | Boron | 29 PPM |
| T5-3 | Boron | 27 PPM |
| T5-4 | Boron | 45 PPM |
| T5-5 | Boron | 43 PPM |
| T5-6 | Boron | 254 PPM |

MDS Harris

REPORT OF ANALYSIS

| Sample Of | Plant |
|---|---|

| Submitted By | Submitted For |
|---|---|
| Ralph Osterling Consulting<br>1650 Borel Place<br><br>San Mateo, CA 94402 | Calpine<br><br>Middleton, CA |

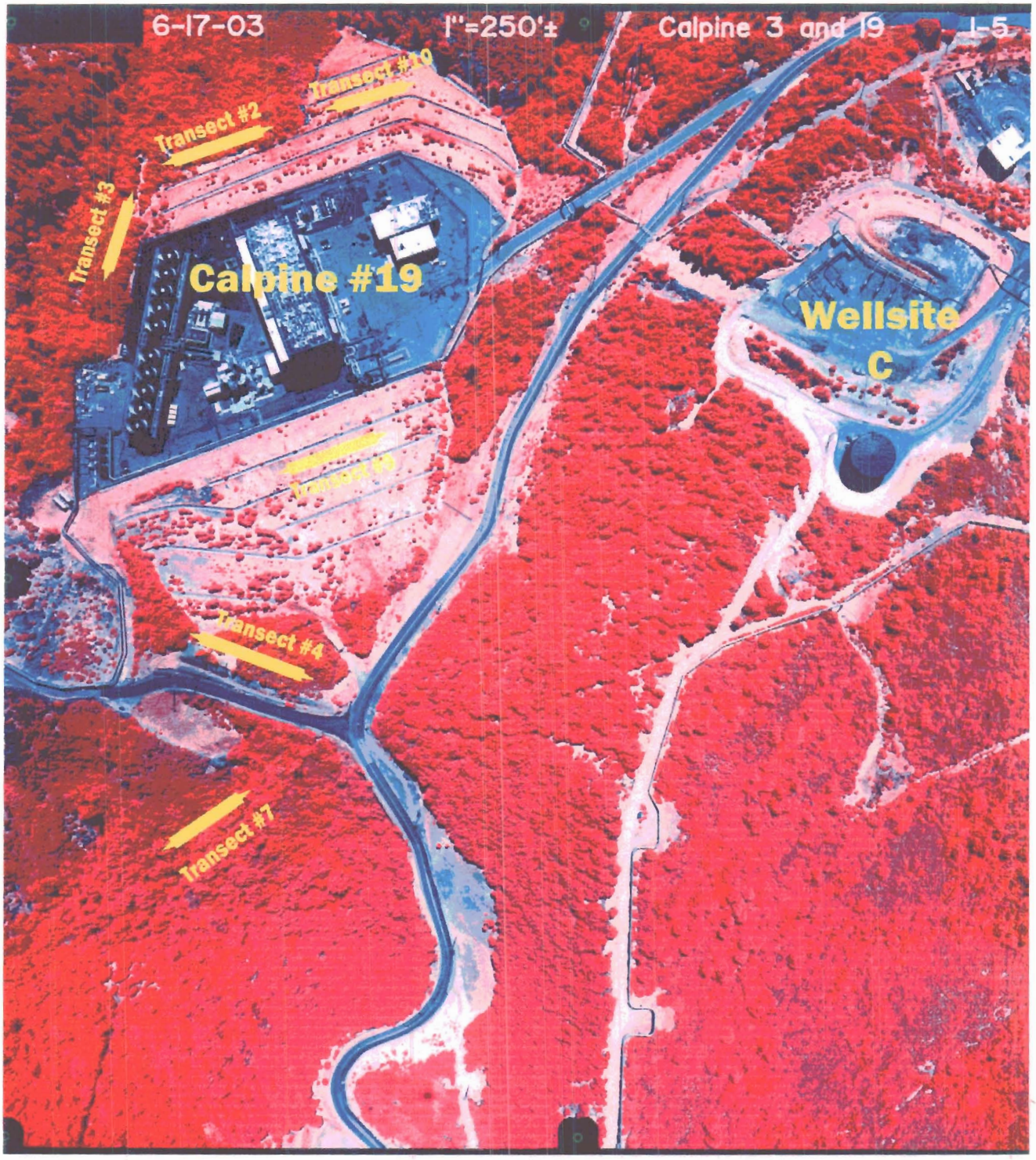
| Date Received | Date Reported | Samples Will Be Stored Until | Laboratory No. |
|---|---|---|---|
| 22-Sep-03 | 23-Sep-03 | | 614323-614349 |

**REPORT OF ANALYTICAL RESULTS**

| Client Sample Identification | Analysis | Result |
|---|---|---|
| T6-1 | Boron | 76 PPM |
| T6-2 | Boron | 41 PPM |
| T6-3 | Boron | 85 PPM |
| T6-4 | Boron | 118 PPM |
| T6-5 | Boron | 152 PPM |
| T6-6 | Boron | 161 PPM |
| T7-1 | Boron | 31 PPM |
| T7-2 | Boron | 38 PPM |
| T7-3 | Boron | 35 PPM |
| T7-4 | Boron | 43 PPM |
| T7-5 | Boron | 33 PPM |
| T7-6 | Boron | 35 PPM |
| T7-7 | Boron | 34 PPM |
| T8-1 | Boron | 49 PPM |
| T8-2 | Boron | 30 PPM |
| T8-3 | Boron | 47 PPM |
| T8-4 | Boron | 54 PPM |
| T8-5 | Boron | 34 PPM |
| T8-6 | Boron | 30 PPM |
| T8-7 | Boron | 55 PPM |
| T9-1 | Boron | 46 PPM |
| T9-3 | Boron | 60 PPM |
| T9-2 | Boron | 27 PPM |
| T10-1 | Boron | 58 PPM |
| T10-2 | Boron | 78 PPM |
| T10-3 | Boron | 45 PPM |

# Appendix B
# Color Infrared Aerial Photos
# and
# Transect Locations

# Calpine Geothermal Powerplant
# #19
# 2003 Boron Drift Monitoring Study
# Transect Locations

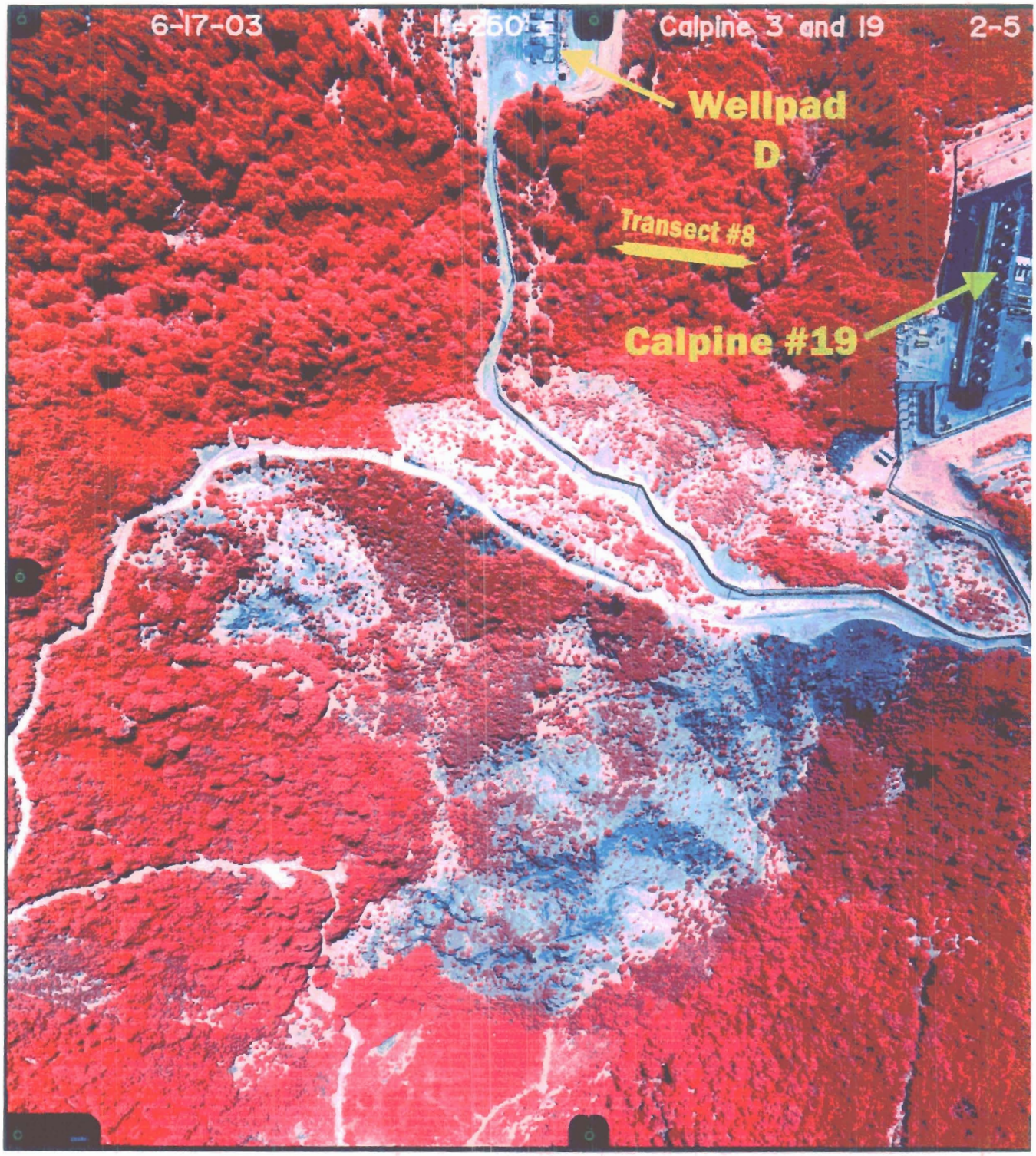



LandWatch, Incorporated

# Calpine Geothermal Powerplant #19
# 2003 Boron Drift Monitoring Study
# Transect Locations


LandWatch, Incorporated

# Calpine Geothermal Powerplant
# #19
# 2003 Boron Drift Monitoring Study
# Transect Locations



# ATTACHMENT 2

List of Property Owners

| | | |
|---|---|---|
| Ernest R. Angeli | 28905 River Road | Cloverdale, Ca 95425 |
| V.K. Leary | P.O. Box 811 | Cobb, Ca 95426 |