CCPA No. 1

CENTRAL CALIFORNIA POWER AGENCY No. 1

DOCKET
84-AFC-2C (A1)
DATE AUG 0 7 1997
RECD. AUG 0 7 1997

August 7, 1997
ENV 97-067

By Hand Delivery

California Energy Commission
1516 9th Street
Sacramento, CA 95814

Attention: Docket Unit, MS-4

COLDWATER CREEK GEOTHERMAL POWER PLANT (AFC-84-2)
CONCEPTUAL SITE RESTORATION PLAN

With this letter, CCPA No. 1 is submitting its Conceptual Site Restoration Plan, which describes the specific measures CCPA No. 1 will take for stabilization and restoration of its power plant and associated steam field areas, in connection with closure of the project. The measures were described in more general terms in CCPA No. 1's Closure Plan and Project Description; the enclosed Plan adds revegetation and erosion control/stabilization details but is consistent with the Closure Plan and Project Description, a revised version of which was submitted to you on July 14, 1997. At the request of Robert Brand, we are delivering to you fifty (50) copies of the enclosed Plan.

In keeping with use permits issued for the development of the steam field, CCPA No. 1 is also submitting the enclosed Conceptual Site Restoration Plan to the Sonoma County Permit and Resource Management Department and the Lake County Planning Department with respect to the permitted steam field areas within each of the Counties. The representatives of each County receiving the Plan have confirmed to us their understanding that the Commission is performing environmental review of the entire project, and that the Commission is providing them the opportunity to comment on issues relating to environmental review of the greater project, while at the same time they retain any authority that specifically derives from the use permits and may discuss with CCPA No. 1 any requirements of their permits.

Please contact me or Stuart Husband if you have any questions or if you require further information. My telephone number is (707) 928-5208. Stuart Husband can be reached at (916) 732-6246. Thank you.

Very truly yours,

K. Byers.
by ANH

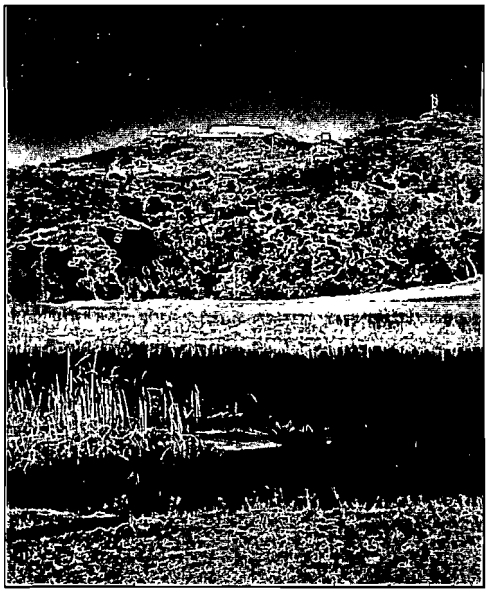
Ken Byers
Director

Enclosures

cc: Robert J. Brand, CEC Compliance Project Manager
Ronald F. Lipp, CCPA No. 1 General Counsel

CCPA No. 1 COLDWATER CREEK GEOTHERMAL PROJECT

Conceptual Restoration Plan



August 6, 1997

Prepared for:
Central California
Power Agency No. 1

ESA

CCPA No. 1 COLDWATER CREEK GEOTHERMAL PROJECT

Conceptual Restoration Plan Draft

August 6, 1997

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CCPA NO. 1 COLDWATER CREEK PROJECT
CONCEPTUAL RESTORATION PLAN

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CCPA NO. 1 COLDWATER CREEK PROJECT
CONCEPTUAL RESTORATION PLAN

I. INTRODUCTION

1. BACKGROUND

The Central California Power Agency No. 1 (CCPA No. 1) is a Joint Powers Agency that was formed for the purpose of constructing and operating a geothermal power plant in The Geysers-Calistoga Known Geothermal Resource Area (KGRA). CCPA No. 1 built and operated the Coldwater Creek Geothermal Power Plant (CCGPP). The well field, power plant and associated facilities are collectively termed the Coldwater Creek Geothermal Project (project).

The project is located in the northern portion of The Geysers-Calistoga KGRA in the Mayacamas Mountains, approximately 90 miles north of San Francisco. The commercially operating steam field is located within the Wildhorse Area 1 (A-1) and Area 2 (A-2), which encompass approximately 1,500 acres, most of which is in Sonoma County with small portions in Lake and Mendocino Counties. Steam field facilities are also located in Wildhorse Area 3, but these facilities were never developed and operated commercially. The power plant is on a knoll just west of the main ridge of the Mayacamas Mountains and is wholly in Sonoma County. Coldwater Creek Road, West Squaw Creek Road, and various roads within the steam field provide access to the project. Figure 1 (in envelope at the back of this report) shows the location of the project facilities.

Power plant construction began in 1985, and the power plant began commercial operation in May, 1988. CCPA No. 1 secured the steam production from the Wildhorse A-1 and A-2 steam field development areas, ultimately taking over ownership and operation of the steam field from its prior operators.

During its lifetime, the CCPA No. 1 project has experienced problems with steam field operations and project economics. The CCGPP was taken off line on May 30, 1996, for an extended maintenance and safety outage. The CCPA No. 1 Commission decided on June 26, 1996, to keep the power plant and steam field in long-term layup condition; pursue options for sale of the project and new markets for its output; and prepare and submit a Closure Plan for the

power plant for the California Energy Commission (CEC) review and approval, and pursue any other regulatory approvals required for project closure.

2. PROJECT FACILITIES ADDRESSED IN THIS PLAN

Table 1 presents a summary of the facilities, their location, relevant characteristics and proposed disposition as part of this restoration plan.

The Coldwater Creek Restoration Project involves the stabilization and restoration of the power plant site itself, adjacent vent station, 18 well pads, a spoils area, an existing permitted borrow area and one or two new borrow areas, a temporary equipment storage area ("the boneyard"), the storage yard, the field office and shop area, trails and support structures for the geothermal fluid gathering and reinjection system, six transmission line towers, and 15 microseismic stations. In general, and as part of the demolition phase, all equipment and buildings will be removed down to within one foot or less of the foundation, the pipelines and supports in the gathering and reinjection system will be removed at grade, and the transmission line towers will be removed at grade. Transmission line tower footings will be left in place, as will pipeline support footings, roads and the foundation for the power plant and for the cooling towers.

The Coldwater Creek Geothermal Project Closure Plan and Project Description (CCPA No. 1, 1997) describes in more detail the project facilities, their status while in long term layup condition, and other proposed actions as part of closure and demolition.

3. THE NEED FOR A CONCEPTUAL RESTORATION PLAN

CCPA No. 1 is assessing the issues associated with decommissioning the Coldwater Creek Geothermal Project. This restoration plan is intended to identify issues related to site restoration, including a review of requirements for revegetation and erosion control, any specific requirements for decommissioning in prior environmental documents, and geotechnical issues. This plan represents a conceptual plan that incorporates relevant known requirements, as well as considering geotechnical stability, erosional hazards, and revegetation practices that have been successful in The Geysers KGRA.

TABLE 1: ACREAGE, COUNTY, CURRENT CONDITION AND PROPOSED DISPOSITION OF FACILITIES IN THE COLDWATER CREEK GEOTHERMAL POWER PLANT PROJECT

Facility	Acreage/ Length	County	Current Condition	Proposed Disposition
Power plant	8.3 ac	Sonoma	Buildings, retaining walls and asphalt	Restore (see text)
Vent&mainline separator station	± 2 ac	Sonoma	Buildings, tanks, vessels and piping on unpaved site	Restore (see text)
Steam field shop	± 3 ac	Sonoma	Buildings and asphalt	Restore (see text)
Warehouse/storage yard	± 4 ac	Sonoma/ Mendocino	Buildings, asphalt and unpaved	Restore (see text)
Spoils area	± 2.5 ac	Sonoma	Unpaved	Restore (see text)
"Old boneyard"	± 2.5 ac	Sonoma	Unpaved	Restore (see text)
Gathering system pipelines	< 1 ac	Sonoma/Lake	Concrete footings, metal pipes and supports	Remove pipes and supports, leave footings in place
Gathering system trails	± 2.5 mi	Sonoma/Lake	Unpaved	Erosion control (see text)
Transmission line towers (6)	<1 ac	Sonoma	Concrete footings, metal towers	Remove towers, leave footings in place
Transmission line trails	< 1 mi	Sonoma	Unpaved	Erosion control (see text)
Well pad 1-3.4	1.9 ac	Sonoma	Unpaved; sump open	Restore (see text)
Well pad 1-4.4	2.1 ac	Sonoma	Unpaved; sump closed	Restore (see text)
Well pad 1-5.3	2.0 ac	Sonoma	Unpaved; sump closed	Restore (see text)
Well pad 1-5A.4	2.0 ac	Sonoma	Unpaved; sump closed	Restore (see text)
Well pad 1-6.4	2.4 ac	Sonoma	Unpaved; sump closed	Restore (see text)
Well pad 1-7.4	2.8 ac	Sonoma	Unpaved; sump closed	Restore (see text)
Well pad 1-9.4	2.4 ac	Sonoma/Lake	Unpaved; sump closed	Restore (see text)
Well pad 2-3.3	2.5 ac	Sonoma	Unpaved; sump open	Restore (see text)
Well pad 2-4.7	2.3 ac	Sonoma	Unpaved; sump closed	Restore (see text)
Well pad 2-5.7	1.9 ac	Sonoma	Unpaved; sump closed	Restore (see text)
Well pad 2-7C.2	2.3 ac	Sonoma	Unpaved; sump open	Restore (see text)
Well pad 2-8.2	1.4 ac	Sonoma	Unpaved; sump closed	Restore (see text)
Well pad 2-11.7	1.9 ac	Sonoma	Unpaved; sump open	Restore (see text)
Well pad 3-1.3	2.4 ac	Sonoma	Unpaved; sump open	Restore (see text)
Well pad 3-7A.2	1.7 ac	Sonoma	Unpaved; sump closed	Restore (see text)

TABLE 1: ACREAGE, COUNTY, CURRENT CONDITION AND PROPOSED DISPOSITION OF FACILITIES IN THE COLDWATER CREEK GEOTHERMAL POWER PLANT PROJECT (Continued)

Facility	Acreage/length	County	Current Condition	Proposed Disposition
Well pad 3-7B.2	2.7 ac	Sonoma	Unpaved; sump open	Restore (see text)
Well pad 3-8.3	2.0 ac	Sonoma	Unpaved; sump closed	Restore (see text)
Well pad Wildhorse 2	± 2 ac	Sonoma	Unpaved	Restore (see text)
Wildhorse 1 well site	<1 ac	Sonoma	Unpaved	Restore (see text)
Park and Ride lot	<2 ac	Lake	Paved	Leave in place
Microseismic stations (15)	<1 ac	Sonoma	Equipment, footings, unpaved	Remove equipment, leave footings in place
Existing borrow area	0.5 ac	Sonoma	Partly disturbed	Restore (see text)
Borrow Area A	1.8 ac	Lake, Sonoma	Naturally vegetated	Restore as needed (see text)
Borrow Area B	1.4 ac	Sonoma	Naturally vegetated	Restore as needed (see text)
Borrow Area C	0.9 ac	Sonoma	Partly disturbed	Restore as needed (see text)
Paved roads	± 12 mi	Sonoma/Lake Mendocino	Paved	Leave in place
Unpaved roads	± 8 mi	Sonoma/Lake/ Mendocino	Unpaved	Leave in place

4. RESTORATION TEAM QUALIFICATIONS

This plan was prepared by a design team (team) consisting of Environmental Science Associates (ESA) as the lead consultant, Golder Associates (Golder) for engineering issues and Circuit Rider Productions (CRP) for revegetation. ESA has been one of the leading firms involved in environmental studies in The Geysers since the mid-1970s and continuing to the present. ESA prepared the original environmental constraints studies and mapping of the Wildhorse Area 2 Geothermal Steam Field, which is the current subject of restoration planning. Through this experience, the company has become familiar with the resources and issues of the region. Golder has strong capabilities in earth stabilization, geotechnical and civil engineering design, seismic stability analysis, and erosion control, and vast experience in mining reclamation projects,

landfill development and closure, and site development planning. CRP has 21 years experience in The Geysers, including restoration planning and implementation during the operational period of the CCPA No.1 power plant and wellfield, and restoration responsibilities for the Geysers Effluent Pipeline Project, with over 40 miles of pipeline corridor requiring revegetation. Appendix A presents the qualifications of individual team members principally involved with preparing this plan.

5. PRINCIPLES, GOALS AND OBJECTIVES OF THIS PLAN

Revegetation/restoration goals attempt to address the broader needs of ecological function. Following Ewel (1987) these functions are *sustainability* (ability of the reconstructed community to perpetuate itself), *resilience* (the ability to recover following extreme perturbations), *productivity* (efficacy of resource use by the biotic community), *transformation of nutrients* (no net loss of microbial and chemical processes that cycle or concentrate nutrients and energy), and *support of food chains and biotic interactions* (maintaining animal ecosystems).

Closer to the ground, restoration objectives are determined by past and present site conditions, the intended subsequent management, and cost effectiveness. Site conditions in the project area are, for the most part, relatively harsh. Most of the areas used for the wellfield and power plant have been profoundly altered by grading, and in many cases are much compacted. Many of the level areas consist of exposed parent material, with little or no soil development. Moreover, the prevailing exposures in the project area are to the south and west, exacerbating the hot dry climate. Since the principal past uses of the project area were hunting and as watershed land, this plan assumes that restoration compatible with these uses is desirable.

This restoration plan consists of a review of existing written materials on the resources and regulatory environment surrounding the project, a field assessment of current site conditions (both geotechnical and biological), development of a set of prescriptions applicable to each facility site, and a description of monitoring requirements for evaluating the restoration effort once it is complete.

II. METHODOLOGY

1. REVIEW OF HISTORICAL SITE DESIGN, ENVIRONMENTAL AND CONSTRUCTION DOCUMENTATION

As an initial step in developing a restoration plan, ESA reviewed the California Energy Commission applications for the power plant project and related facilities (CCPA No. 1 1984, CEC 1985, CEC 1986, CEC no date), Sonoma County applications for the steam field development areas (ESA 1984, Ecoview 1984a), the Erosion Control Plan approved by the CEC (CCPA No. 1 1985a), the Biological Resources Mitigation and Monitoring Plan (MMRP; CCPA No. 1 1985b), the Closure Plan and Project Description (CCPA No. 1, 1997) as well as underlying technical reports on soils, geotechnical studies, and the biological resources present in the well field. These documents provided insight into past requirements for erosion control, revegetation, and monitoring.

In addition, the ESA team reviewed construction documentation maintained by CCPA No. 1, including designs and specifications for constructed facilities, as-built drawings, approved specifications, and minor grading permit applications. Follow-up reports, such as biological monitoring and revegetation assessments, were also reviewed.

2. CONCEPTUAL ENGINEERING ASSESSMENT

Team engineers prepared a description of the restoration grading and earth moving, drainage, erosion control features, and other site stabilization measures. The focus of the assessment was to determine long term stability of all restoration sites, including the retaining walls at the power plant site. The engineering assessment identified quantities of materials required for treatment of any restoration site to ensure stability, and identified regulatory requirements relative to slope and sump stability.

3. ESTIMATE OF BORROW NEEDS

The team engineers identified needs for fill and sub-soil materials as well as native topsoil to support revegetation efforts at the power plant site and elsewhere as needed. Taken into account in this process was a consideration of any environmentally constrained areas excluded from

consideration as a soil source, such as Caldwell Pines, or areas of known or potentially present sensitive plant and animal species. General sites were identified, as well as estimated areas of disturbance for soil borrow. The general equipment and manpower requirements to excavate and transport the soil borrow material to the restoration site were identified.

Specifically, the soil borrow investigation consisted of a review of available geologic maps of the area, review of infrared aerial photographs provided by CCPA No. 1 (approximate scale 1:6,000), and completion of a field reconnaissance to confirm the suitability, feasibility, and approximate volumes of potential sources. The field work was performed on May 8, 9, and 11, 1997. The full report on borrow material is included in this report as Appendix B.

4. BOTANICAL ASSESSMENT OF PROJECT AREA

During the site evaluation on May 8 and 9, 1997, shrub and tree densities in undisturbed sites were measured, and the condition of natural revegetation of woody species on cut and fill slopes assessed. This assisted the team in showing what plant densities are feasible under different conditions, as well as showing the species that grow best under low nutrient conditions. Species revegetating naturally on cut and fill slopes are the best candidates for the restoration program since they are most likely to thrive under restoration conditions.

In undisturbed sites, shrub densities were taken by randomly placing a 1 by 2 meter, rectangular three-sided plastic frame at ground level. The number of individuals of each shrub was recorded, by species.

At least ten plots were taken in mixed chaparral and chamise chaparral. Originally, tree density was to be measured using the point-centered quarter method, but trees in the oak savanna were too sparse and irregularly arranged for this method to work satisfactorily. As a result, trees were simply counted within areas delineated on aerial photographs, and the area encompassed was estimated, thus providing a measure of tree density.

The team also assessed natural regeneration of woody species on cut and fill slopes, partly to determine how rapidly revegetation has occurred, by what species, and what factors are associated with the best natural revegetation. Since woody plant density on cut and fill slopes tended to be sparse and irregularly arranged, the investigators counted and recorded the number of individuals of each species within bounded areas marked on the aerial photographs, usually

entire cut or fill slopes. The area of the bounded areas was later estimated from as-built maps supplied by CCPA No. 1.

As part of the site inventory, a sample tracking system was established that includes fields for existing information on the size and location of each facility, the exposure, slope, grading history, erosion control and revegetation history, status of revegetation, and stability of the site.

5. DEVELOPING SHORT-TERM EROSION CONTROL METHODS AND A LONG-TERM REVEGETATION AND EROSION CONTROL PROGRAM

The ESA team identified appropriate methods to control erosion on all disturbed sites including existing disturbed areas, areas to be scarified, soil borrow areas, soil stockpiles, vehicle track areas, and any other areas in which short term or long term disturbance may occur. Standard erosion control and revegetation methods used successfully in The Geysers' unique slope, soil cover, drainage, exposure, and geologic environment were drawn largely from the personal experience of the staff experts at CRP.

III. REVIEW OF THE REGULATORY ENVIRONMENT

In general, the permits issued by the counties and the CEC provided very little guidance with respect to closure of the project, and what guidance exists is divided up among many documents. Some of the Sonoma County use permits require submission of a site restoration plan to the Sonoma County Planning Department, although the nature of their review is not clearly indicated. As a result, CCPA No. 1 has determined that it will submit an overall site restoration plan to Sonoma County, and will provide the plan to CEC to assist CEC's environmental review of the project. Lake County use permits for the limited facilities developed in that county require approval of a site restoration plan. CCPA No. 1 will submit this site restoration plan also to Lake County, for reference to those provisions relevant to facilities constructed in Lake County. Mendocino County issued no use permits for the project.

At this time, it appears that the primary environmental permitting requirement governing site restoration involves the need to obtain grading permits from the appropriate county (most of the project lies in Sonoma County, but small areas of development extend into Lake and Mendocino counties). In Sonoma County, Ordinance #4467 calls for application for a grading permit when more than 50 cubic yards of material is moved. In addition, an NPDES permit may be required for stormwater discharges associated with construction and demolition activities.

CCPA No. 1 has entered into a Memorandum of Agreement with CEC and Sonoma County under which CEC is identified as the lead agency for the environmental review for the entire project in satisfaction of any requirements under CEQA.

IV. DESCRIPTION OF THE SITE

1. GENERAL DESCRIPTION OF THE POWER PLANT AND WELLFIELD

A. Location

The Coldwater Creek Geothermal Project is located primarily in the northeastern corner of Sonoma County, extending slightly into the western portion of Lake County and the southeastern portion of Mendocino County. It lies in the northwestern portion of the developed part of The Geysers-Calistoga Known Geothermal Resource Area (KGRA). The power plant draws geothermal fluid from two steam fields, Wildhorse A-1 and A-2 , which comprise 686 and 809 acres, respectively. These consist of portions of Sections 1 and 2, T11N R9W, MDB&M, and Sections 35 and 36, T12N R9W.

B. Topography, Soils and Hydrology

The area is hilly, with slopes of up to 70 percent not uncommon. Elevations range from approximately 1900 to 3000 feet above sea level. Soil types include the Maymen, Coshasset, Stonyford, Henneke, Kidd and Guenoc gravelly loams, Quenol gravelly silt loams, Laughlin, Boomer, and Los Gatos loams, the Yorkville/Laughlin complex and Rocklands (CCPA No. 1 1984). Underlying parent materials include volcanics, fine-textured marine sediments, intrusive igneous rocks, and a limited amount of metamorphics.

The project area is predominantly within the Squaw Creek drainage, a tributary of Big Sulphur Creek, which in turn is a tributary of the Russian River. Coldwater Creek is a small tributary of Squaw Creek, extending about one mile from its headwaters to its confluence with Squaw Creek. There are no significant groundwater resources in the vicinity of the power plant site or in the region (CEC 1984).

C. Vegetation

Vegetation on and in the project leasehold is a mosaic of grasslands, savannas, brushlands, woodlands and forests. Because the project area is situated on the north side of Squaw Creek, there is a preponderance of south- and west-facing slopes that support generally open vegetation types such as grasslands and savannas, and drought-adapted chaparral types. The vegetation

types within the leasehold are described in detail in the CCPA No. 1 Application for Certification (AFC) (1984). Briefly, the forest types (closed or nearly closed canopy dominated by trees) include ponderosa pine forest and mixed evergreen forest. Woodland types (open canopy dominated by trees) include: conifer-evergreen broadleaf types (such as knobcone pine/manzanita, foothill pine-oak); evergreen/broadleaf woodlands such as bay-oak-madrone; deciduous woodlands such as blue oak, Oregon oak, black oak and mixed oak woodlands. Savannas, very open tree-dominated types with an understory of forbs and grasses, are fairly common in the developed portion of the study area; they include mostly blue oaks, but foothill pine and Oregon oak may sometimes be present in savanna situations. Shrub-dominated communities include: chamise chaparral; chamise/mountain mahogany/ceanothus/manzanita; chamise/shrubby live oak/manzanita; shrubby live oak/silk tassel, manzanita; shrubby live oak/manzanita/ceanothus; and manzanita; brushlands dominated by shrubby oaks, ceanothus, mountain mahogany, manzanita and bay; seeps, springs, riparian, rock faces, ruderal (disturbed) areas, and non-native annual grassland.

D. Wildlife

The variety and mosaic patterns of the plant communities on the leasehold offer good wildlife habitat for this region. About 130 species of vertebrates are known or expected to occur on or in the vicinity of the project leasehold (CCPA No. 1, 1984). The power plant AFC and Wildhorse A-1 and A-2 leasehold EIRs describe wildlife resources for this area in more detail (ESA, 1984 and Ecoview 1984a). The principal game species in the project area are deer, California quail, and mourning dove.

E. Sensitive Biological Resources within the Project Area

Botanical resources. The only sensitive plant records reported from the project area have been of questionable identity or of very low priority. Ecoview (1984b) reported a possible *Ceanothus confusus* in Caldwell Pines, although BioSystems Analysis Inc. (1984) later concluded that it was instead a hybrid among several more widespread species of *Ceanothus* occurring there. BioSystems Analysis, Inc. (1984) found a population of the four-petaled pussy-paws (*Calyptridium quadripetalum*), a California Native Plant Society List 4 species, some distance from developed areas. It was concluded in the power plant AFC that no sensitive plant species would be impacted by that project.

Wildlife resources. The project area is known to support several "special-status" species, i.e., those with some degree of state or federal protection, or species whose populations are monitored by resource agencies due to concern over their decline. These include the ringtail, the golden eagle and peregrine falcon. Purple martin was observed to be nesting in a snag adjacent to the cut slope at Well pad 1-4.4 during our site assessment, and they have been reported nesting regularly in Caldwell Pines. A number of other special-status vertebrate species are reported as having suitable to marginal habitat in the project area: merlin, prairie falcon, Cooper's hawk, sharp-shinned hawk, mountain lion, long-eared owl, and yellow warbler (CCPA No. 1, 1984).

None of these species are permanent residents in areas to be disturbed by restoration activity and do not constitute a project constraint. Moreover, many of the sensitive and recreationally important species found in the project area benefit from a mix of habitats and a variety of age-class stands within habitat types. As such, the restoration of sites in the project area may represent a benefit to wildlife resources.

Sensitive natural communities. Areas of sensitive natural communities includes Caldwell Pines, an isolated, unlogged stand of ponderosa pines found along the ridgeline north of the power plant site, as well as seeps, springs and riparian woodland. The large wet meadow east of the field office and shops is an example of a spring and associated habitat that is of considerable wildlife value that should be protected.

These natural communities have been identified as significant and will be avoided during restoration activities. The restoration of the pipeline route through Caldwell Pines will cause no more surface disturbance than occurred during original construction of the pipeline. As a result, no additional effects to sensitive natural communities are expected as a result of restoration.

2. RESULTS OF SITE INVENTORY

A. Assessment of Geotechnical Stability of Well Pads

The ESA team's investigation included a site reconnaissance, a review of well pad as-built drawings, and a review of the following representative geotechnical reports:

- Cooper Engineers, Inc., "Report, Geotechnical Investigation, Proposed Geothermal Drill Pad 1-3.4 and Access Road, Wildhorse Lease Area, Sonoma County, California," dated July 19, 1985.
- Harding Lawson Associates, "Geotechnical Investigation, Wildhorse Drill Pads 3-7B.2, and 3-1.3 and Access Roads, The Geysers, Sonoma County, California," dated April 26, 1984.
- Cooper Engineers, Inc., "Report, Geotechnical Investigation, Proposed Geothermal Drill Pad 2-3.3 and Access Road, Wildhorse Lease Area, Sonoma County, California For GRI Operator Corporation," dated March 30, 1984.
- Cooper Engineers, Inc., "Report, Geotechnical Assessment, Proposed Geothermal Pad 2-11.7, Wildhorse Lease Area, Sonoma County, California, For GRI Operator Corporation," dated August 14, 1984.
- Donald Herzog & Associates, Inc., "Report, Geotechnical Investigation, Drill Pad 2-7C.2 and Access Road, The Geysers, Sonoma County, California," dated September 12, 1983.
- Field Engineering Associates, Inc., "Geotechnical Investigation, Well Pad 2-5.7, The Geysers, Sonoma County, California," dated May 21, 1985.

Based on this investigation, the ESA team concluded that the primary, long-term geotechnical stabilization of the well pads will predominantly consist of implementing standard erosion control measures during site restoration. Many of the sites exhibited shallow erosion gullies or appeared to be susceptible to erosion damage at the surface water discharge points near the edges of the well pads. Areas that are susceptible to erosion damage will be stabilized by placing rip-rap at the discharge locations and along the down-gradient ditches. In addition, existing metal culverts will be replaced with permanent surface water control ditches to minimize erosion damage following restoration (see Section V.3.A). A summary of these areas is presented in Table 2 (see also the letter reports prepared by Golder Associates, Appendix B).

The potential for deep-seated, slope failures (i.e., landslides), appears unlikely at the well pads based on the following information:

- CCPA No. 1 has indicated that a geotechnical study was completed for each well pad prior to construction. The geotechnical reports reviewed by the ESA team addressed the geological conditions and the stability of the sites prior to construction, and addressed construction procedures necessary to maintain stable slopes during the following construction. CCPA No. 1 has indicated that these recommendations were implemented in the design and construction of the well pads.
- Excluding the large erosion gully below Well pad 1-5A.4, no adverse conditions were observed by the ESA team that would be indicative of slope instability problems.

TABLE 2: SUMMARY OF WELL PAD OBSERVATIONS, COLDWATER CREEK RESTORATION PLAN

Drill Pad	Type of Existing Drainage	Sump Condition	Observations
1-3.4	CMP	Open	No well structure on site observed; no significant erosion problems observed.
1-4.4	CMP	Closed	No significant erosion problems observed.
1-5.3	None*	Closed	Minor erosion gully requiring repair. Surface water flow diverted beneath well pad via CMP.
1-5A.4	None*	Closed	Large erosion gully below well pad. Also minor erosion gully requiring repair.
1-6.4	CMP	Closed	No as-built provided; information from site visit. No significant erosion problems observed.
1-7.4	CMP	Closed	Drainage water diverted underground pad via CMP. Depression at sump observed.
1-9.4	CMP	Closed	No significant erosion problems observed.
2-3.3	CMP	Open	No significant erosion problems observed.
2-4.7	Rip-Rap*	Closed	Minor erosion gully requiring repair.
2-5.7	Rip-Rap	Closed	Depression at sump location observed.
2-7C.2	CMP	Open	No significant erosion problems observed.
2-8.2	CMP*	Closed	Minor erosion gully requiring repair.
2-11.7	None*	Open	Minor erosion gully requiring repair.
3-1.3	None*	Open	Minor erosion gully requiring repair.
3-7A.2	CMP	Closed	No significant erosion problems observed.
3-7B.2	CMP*	Open	Minor erosion gully requiring repair.
3-8.3	CMP	Closed	Depression at sump location observed.
Wildhorse 2	CMP	None	Several minor erosion gullies on the access trail to the well pad.

NOTES:

All sites to incorporate permanent erosion control measures such as gunite-lined drainage ditch.

* Areas where erosional gullies require repair prior to constructing permanent erosion/drainage controls.

In 1996, CCPA No. 1 implemented mitigation measures to address the large erosional gully below Well pad 1-5A-4. Localized grading above the gully will be completed during the restoration as part of the additional mitigation measures as discussed in Section V.3.8.

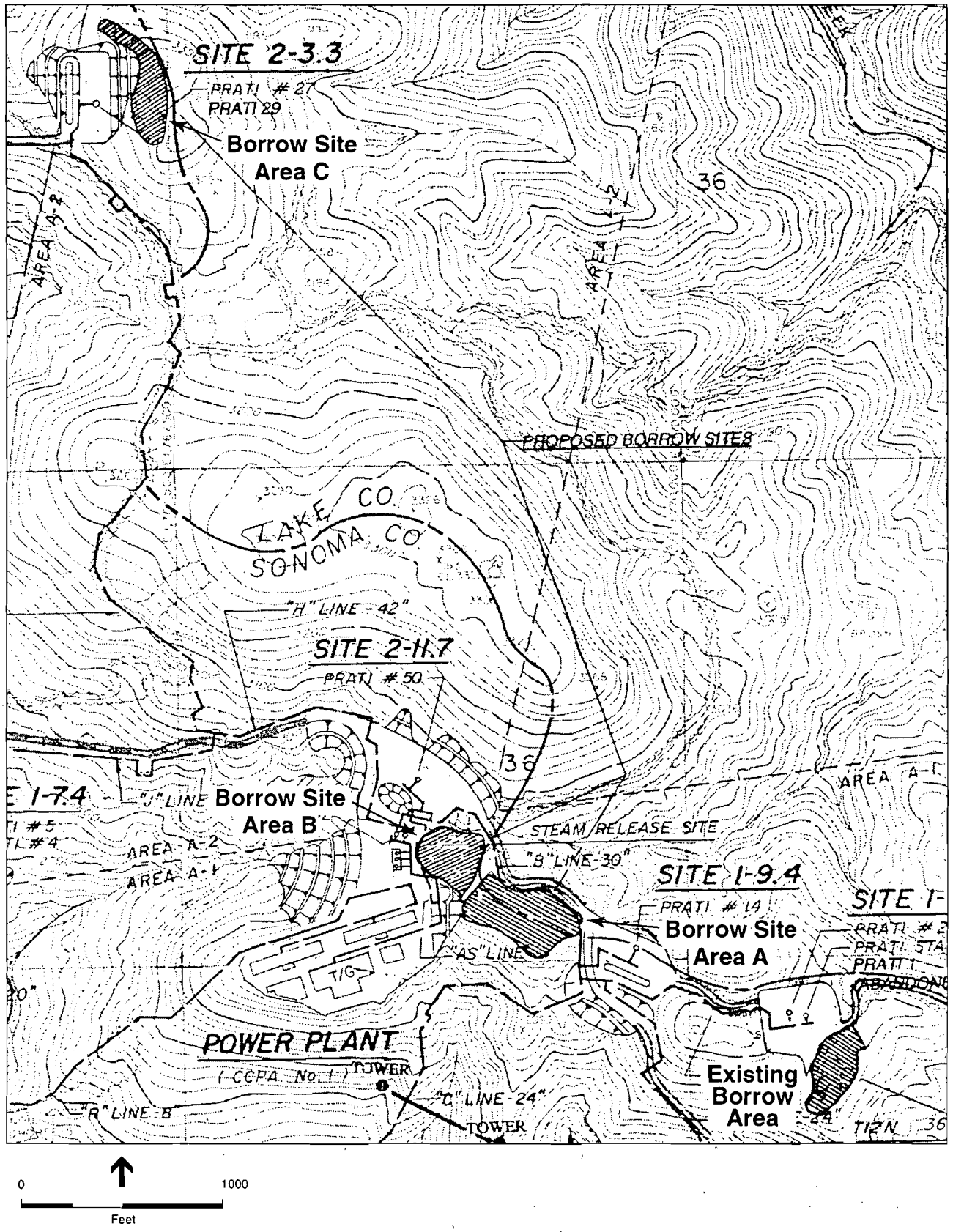
B. Identification of Potential Borrow Areas

The ESA team completed a soil borrow investigation to identify potential soil sources for the proposed site restoration. Areas that were excluded from consideration included the following:

- Environmentally sensitive areas such as "wet" meadows, the Caldwell Pines area, and areas with a large concentration of oaks;
- Area 4 due to its relative distance from the majority of the restoration work; and
- Areas with less than 5,000 cubic yard (cy) of soil borrow. The team assumed that it would be preferable to limit disturbances to a few, relatively large sources instead of numerous, smaller sources.

The borrow investigation identified five significantly different types of borrow materials, located in 13 different potential borrow areas (see Appendix B). In general, the value of borrow material for use in restoration is a function of the quantity of fine particles it contains. Clay particles, with their high surface area, provide nutrients and water-holding capability. To a lesser extent, sand also assists in holding water within the root zone, although it provides less nutrients. Borrow materials containing mostly gravel or rock provide the least favorable environment for restoration. Decomposed volcanic tuff near Well pad 2-3.3, which contains a high proportion of clay and other fines, was selected as the highest-quality borrow material, to be used in combination with metasediment, an intermediate quality borrow material available from the vicinity of the power plant site. Appendix B presents the full report on the identification of borrow materials for this project.

After reviewing the requirements for borrow material in the restoration approach selected by CCPA No. 1, two general areas were selected as being the most desirable in terms of proximity to the site where used, type of material, and sufficient quantity. Figure 2 shows the locations of the preferred borrow sites. Table 3 presents a summary of the borrow material type, source location, estimated volume and surface area of the two preferred borrow locations, as well as the attributes of the existing permitted borrow area located near Well pad 1-6.4. The preferred borrow areas are described in more detail in the paragraphs that follow.



SOURCE: Golder Associates

Coldwater Creek / 970204 ■

Figure 2

Borrow Material Locations

TABLE 3. BORROW MATERIAL VOLUME ESTIMATES

Borrow Material	Borrow Area Location	Estimated Available Volume* (cubic yards)	Estimated Borrow Needed (cubic yards)	Total Surface Area of Borrow Area (ac)	Estimated Surface Area to be Disturbed ** (ac)
Metasediment	Power Plant (Area A)	30,000-50,000	0	1.8 ac	0 ac
	Power Plant (Area B)	20,000-25,000	14,700	1.4 ac	0.8 ac
Tuff (Clay)	Site 2-3.3 (Area C)	25,000-30,000	4,100	0.9 ac	0.3 ac
Chert	Well pad 1-6.4	12,000	0	0.5 ac	0

NOTES:
* Available volume is considerably larger than quantity of borrow estimated to be used in restoration (see section V, Restoration Plan).
**Metasediment borrow likely to be taken from only one source so as to minimize surface disturbance.

Ridge Adjacent to the Power Plant Site. The power plant site lies west and southwest of a ridge and knob consisting of moderately to slightly weathered, medium strong to very strong, metasedimentary bedrock. The material within about 10 to 15 feet of the ground surface is generally moderately weathered. Area A straddles the Sonoma and Lake County line, while Area B lies entirely within Sonoma County. For Area A, assuming the upper 10 to 15 feet of the more weathered material is removed, approximately 30,000 to 50,000 cy of metasediment borrow material is available. If the borrow is limited to within Sonoma County (Area B), an estimated 20,000 to 25,000 cy of material is available.

Site 2-3.3 (Area C). This area, located in Sonoma County, consists of mostly fine grained tuff which has weathered to clay. An estimated 25,000 to 30,000 cy of clay borrow material is available.

C. Biological Site Inventory

Facilities site inventory. Appendix C presents the results of the site inventory, as well as a review of the as-built maps and a preliminary review of revegetation records. It represents a preliminary structure for a tracking system for ecological and engineering characteristics of the sites, as well as a means for following management actions initiated during the course of construction and restoration of the facilities. These data sheets, or some modification of them, may also be used as the basis for a tracking system for monitoring the success of revegetation efforts as part of the site restoration program

Inventory of natural revegetation on constructed slopes. Table 4 presents information on woody species regeneration at a number of cut and fill sites throughout the project area. As indicated in Appendix C, many slopes had no woody vegetation on cut and fill slopes. The areas sampled represent the areas with obvious woody growth.

Inventory of undisturbed vegetation. The inventory carried out in undisturbed vegetation helped to form the rationale for the revegetation prescriptions. In 12 plots taken in chamise chaparral, shrub density was slightly under 12,000 plants/acre; of these, 93 percent were chamise. In 8 plots taken in mixed chaparral, calculated shrub density was about 14,000 plants/acre. Although mixed chaparral includes a considerable variety of species, the predominant species in these plots (taken near Well pad 2-11.7) were chamise, shrubby live oak, poison-oak and mountain mahogany.

Tree counts were taken near well pads 2-7C.2 and 2-8.2, in open blue oak woodland. Densities were approximately 55 trees/acre, based on an estimate of acreage extent from the aerial photographs of the area. About 90 percent of the individuals were blue oak, with foothill pine (*Pinus sabiniana*) and valley oak (*Quercus lobata*) also present. The value would be much higher in a closed-canopy oak woodland or forest. The tree densities obtained in this survey were somewhat higher than that reported in environmental documentation for the Wildhorse A-2 EIR, where five, five and sixteen "old growth" oaks were reported on three proposed well pad sites (ESA 1984).

Several generalizations may be made about the results of this brief inventory. First, natural regeneration occurred best on north-facing (as opposed to south-facing) slopes, regardless of whether they were cut or fill. It was best on fine-textured soils: the fill slope at well pad 2-3.3,

TABLE 4: RESULTS OF WOODY SPECIES INVENTORY ON NATURALLY REVEGETATING SLOPES

	Location								Location					
	Pad 1-3.4 CUT	Pad 1-4.4 CUT	Pad 1-6.4 CUT	Pad 1-9.4 1:1 CUT	Pad 3-1.3 CUT	Pad 3-7B.2 CUT	Storage Yard CUT	Total, Cut	Pad 1-3.4 FILL	Pad 1-6.4 FILL	Pad 1-9.4 FILL	Pad 2-3.3 FILL	Pad 3-1.3 FILL	Total, Fill
ADJACENT VEGETATION	CHAP.	CHAP.	CHAP.	CHAP.	CHAP.	WDLD.	CHAP.		WDLD.	CHAP.	CHAP.	CHAP.	WDLD.	
EXPOSURE	ENE	S	S	E	S	SSW	W		S	S	N	NW	S	
WOODY SPECIES														
Adenostoma fasciculatum	8	41		1				50	18			3		21
Arctostaphylos glandulosa	23	2				49	11	85	1		7	92		100
Arctostaphylos canescens								0				30		30
Arctostaphylos manzanita		4						4				1		1
Arctostaphylos stanfordiana												4		
Baccharis pilularis	9							9	1					1
Ceanothus cuneatus		12					2	14	8	2	3	11	1	25
Ceanothus foliosus		1						1				10		10
Ceanothus integerrimus							6	6			2			2
Ceanothus thyrsiflorus								0				5		5
Cercocarpus betuloides		6	3				5	14		4	30			34
Eriodictyon californicum	88	18						106						0
Heteromeles arbutifolia	1							1						0
Lotus scoparius	41	18			96	1		156	2					2
Pickeringia montana							89	89				4		4
Pinus attenuata						1	1	2				3		3
Pinus ponderosa								0				5		5
Pinus sabiniana	1	1						2						0
Pseudotsuga menziesii												1		1
Quercus dumosa								0			2	1		3
Quercus wislizenii var. fr.	10							10			19	13		32
Rhus trilobata					12			12			26			26
Solanum sp.		2						2			1			1
Toxicodendron diversilobum							1	1	4					4
TOTAL INDIVIDUALS	181	105	3	1	108	51	115	564	34	6	90	183	1	314
AREA SAMPLED, AC	0.19	0.18	0.26	0.24	0.22	1.15	0.3	2.54	0.3	0.31	0.11	0.2	0.34	1.26
DENSITY (INDS/AC)	952	583	12	4	490	44	383	222	112	19	818	915	3	331

adjacent to the site identified as the highest-quality borrow area, had one of the highest shrub densities. Third, natural regeneration appeared best when a source of chaparral seed was available immediately uphill. By contrast, the cut and fill slopes surrounded by oak woodland had essentially no woody plant growth. Most surprising to the observers was the clear conclusion that the fill slopes had no more extensive woody regeneration than the cut slopes. This appears to be due to the fact that the cut slopes always are in closer proximity to seed sources, and because the hydroseeded annuals are less persistent, presenting the woody plants with an improved chance of establishment.

Species that occurred in many of the naturally revegetating areas were mountain mahogany, chamise, buckbrush, manzanita (*Arctostaphylos glandulosa* in particular), yerba santa (*Eriodictyon californicum*) and deerbrush (*Lotus scoparius*). Since these species are clearly able to pioneer in the austere conditions presented by cut and fill slopes in the project, these species form an excellent palette from which to choose revegetation materials.

In comparing the results of sampling in undisturbed chaparral with that of natural revegetation, the team found that the densities in the former, which measured in excess of 10,000 per acre, is too high to set as a revegetation goal over a reasonable period of time. These undisturbed stands have developed over decades, or perhaps centuries. Moreover, dense chaparral had far less deer use (as measured by pellet-plots) than revegetating stands. Instead, we recommend a revegetation goal of densities near 875 per acre. While seedling densities are likely to be higher, mortality among small young shrubs is high. Over a period of decades, the structure of the chaparral will continue to approach that of natural vegetation.

The success of natural revegetation--and the stability of established revegetation efforts elsewhere--argues against the need to regrade to natural topography, which would create new erosional risks, and would reset back to zero the revegetation clock. Instead, the stability of the vast majority of sites suggests that a more conservative approach is best. By keeping grading to a minimum, natural revegetation will continue on cut and fill slopes. Revegetation will be employed in unvegetated areas only, i.e., the well pads and graded portions of other facility sites which are unlikely to revegetate quickly because of their large size and degree of compaction.

V. THE RESTORATION PLAN

Table 5 summarizes the conceptual restoration plan. The sections that follow provide sufficient detail for evaluating the plan's adequacy and in developing costs for implementing the restoration program.

1. PLANNING CONCEPTS

A. Approach

The restoration plan is a final action driven primarily by regulatory compliance for the project. Beyond this, the restoration plan objectives are determined by the intended subsequent management, past uses and site conditions, and cost effectiveness. In the power plant and wellfield areas, soils have been profoundly altered by grading, and are in many cases little more than decomposed chert. Aspects in the project area are south and west--generally drier and less productive than north and east exposures. Taking this into account, and the fact that the area is expected to revert to its prior land use of watershed lands and private recreation, the primary objectives of the restoration program are considered to be:

- Minimize erosion;
- Minimize new surface disturbance;
- Enhance wildlife habitat value;
- Return naturally occurring plant materials to the sites; and
- Maintain visual quality.

Erosion control during the restoration operation will be updated, but consistent with techniques described in the CCGPP Erosion Control Plan (CCPA No. 1 1985b). Further erosion control measures at restoration sites include placing rip-rap at existing runoff discharge locations and along down-grade ditches and replacing metal culverts with surface water control ditches.

TABLE 5: SUMMARY OF CONCEPTUAL RESTORATION PLAN

Facility	Acreage/ length	Adjacent Vegetation	Engineering Treatment	Vegetation Prescription*
Power plant	8.3 ac	Chaparral	Construct surface water control ditches; apply 1 ft borrow over most paved /concrete areas; engineered fill in basins.	Direct seed herbaceous mix; allow natural revegetation of basins
Vent and mainline separator station	± 2 ac	Chaparral	Rip to relieve compaction	Direct seed with herbaceous mix
Steamfield shop	± 3 ac	Oak woodland, forest	Apply 1 ft borrow over perforated concrete/paved areas	Direct seed herbaceous mix
Warehouse/storage yard	± 4 ac	Chaparral	Apply 1 ft borrow over perforated paved/ concrete areas; in unpaved areas, rip to relieve compaction	Direct seed herbaceous mix in area with 1 ft borrow; elsewhere, allow natural revegetation
Spoils area	± 2.5 ac	Chaparral	None	None; allow natural revegetation
"Old boneyard"	± 2.5 ac	Chaparral	Erosion/drainage control required; rip	Direct seed shrubs
Gathering system pipelines	< 1 ac	Various	None	None; allow natural revegetation
Gathering system trails	± 2.5 mi	Various	Construct water bars as needed	Direct seed herbaceous mix
Transmission line towers (6)	< 1 ac	Various	None	None; allow natural revegetation
Transmission tower access trails	< 1 mi	Various	Erosion/drainage control required	Direct seed herbaceous mix
Well pad 1-3.4	1.9 ac	Chaparral, mixed evergreen forest	Erosion/drainage control required: rip	Direct seed shrubs
Well pad 1-4.4	2.1 ac	Chaparral	Erosion/drainage control required; rip	Direct seed shrubs
Well pad 1-5.3	2.0 ac	Oak woodland	Erosion/drainage control required; rip	Direct seed shrubs
Well pad 1-5A.4	2.0 ac	Chaparral	Minor regrading for drainage control Erosion/drainage control required; rip	Direct seed shrubs
Well pad 1-6.4	2.4 ac	Chaparral	Erosion/drainage control required; rip	Direct seed shrubs
Well pad 1-7.4	2.8 ac	Oak woodland	Erosion/drainage control required; rip	Direct seed shrubs
Well pad 1-9.4	2.4 ac	Chaparral	Erosion/drainage control required; rip	Direct seed shrubs
Well pad 2-3.3	2.5 ac	Chaparral	Erosion/drainage control required; rip	Direct seed shrubs
Well pad 2-4.7	2.3 ac	Oak woodland	Erosion/drainage control required; rip	Plant oaks

TABLE 5: SUMMARY OF CONCEPTUAL RESTORATION PLAN (Continued)

Facility	Acreage/ length	Adjacent Vegetation	Engineering Treatment	Vegetation Prescription
Well pad 2-5.7	1.9 ac	Oak woodland, forest	Erosion/drainage control required; rip	Plant oaks
Well pad 2-7C.2	2.3 ac	Chap./Oak woodland	Erosion/drainage control required; rip	Direct seed shrubs
Well pad 2-8.2	1.4 ac	Grass/Oak woodland	Erosion/drainage control required; rip	Direct seed shrubs
Well pad 2-11.7	1.9 ac	Chaparral	Erosion/drainage control required; rip	Direct seed shrubs
Well pad 3-1.3	2.4 ac	Oak woodland	Erosion/drainage control required; rip	Plant oaks
Well pad 3-7A.2	1.7 ac	Oak woodland	Erosion/drainage control required; rip	Plant oaks
Well pad 3-7B.2	2.7 ac	Oak woodland	Erosion/drainage control required; rip	Plant oaks
Well pad 3-8.3	2.0 ac	Oak woodland	Erosion/drainage control required; rip	Plant oaks
Wildhorse 1 well site	± 1 ac	Oak woodland	Erosion/drainage control required; rip	No treatment; leave in place
Well pad Wildhorse 2	± 2 ac	Oak woodland	Minor regrading for drainage control; erosion/drainage control required; rip	Direct seed herbaceous mix where regraded
Park and Ride lot	< 2 ac	Chaparral	None	Leave in place
Microseismic stations (15)	<1 ac	Various	None	Same as adjacent facilities
Borrow areas A and B	3.2**	Chaparral	None	Stockpile surface soil and respread
Borrow Area C	0.9**	Chaparral	None	Stockpile surface soil and respread
Permitted borrow area near Well Pad 1-6.4	0.5**	Chaparral	Minor regrading	Direct seed shrubs
Unpaved roads	± 8 mi	Various	None	No treatment; leave in place
Paved roads	± 12 mi	Various	None	No treatment; leave in place

* Direct seeding of shrubs is hand broadcasting followed by hand raking in; direct seeding of herbaceous mix may be either hand application or hydroseeding.
** Total acreage shown here, but only a portion is expected to be required for use as borrow area.

Finally, revegetation using both herbaceous and woody materials will reduce erosion while achieving other restoration objectives.

The project restoration plan prescribes site treatments which result in vegetation that occurs naturally within The Geysers area, although it may not have been present on the site when the wellfield was developed. Returning the area to exactly the same plant cover and topography could entail as much or more disruption than the original construction: a full soil profile restored to the power plant and office site might require removal of borrow material impacting two or more acres of currently undisturbed habitat, acres which would then have to be "restored" as a separate project. Also, in many cases the chaparral brushfields replaced by the power plant and well pads are less diverse and productive, and may provide poorer wildlife habitat, than what can result from a mix of vegetation types.

2. PRESCRIPTION FOR THE POWER PLANT SITE

The power plant site will have two different prescriptions for restoration, each of which will respond to a primary requirement: creating a stable cover for the power plant materials left in place, consistent with protecting the retaining wall structure.

A. Asphalt Areas and Concrete Pads

The entire power plant needs to be efficiently drained to maximize the longevity of the retaining wall by managing hydrostatic pressure. The existing power plant drainage system will be replaced with a new and more permanent system of drains and ditches. The objectives of the new drainage system are to minimize water infiltration behind the reatining wall and distribute site runoff in a manner that minimizes downstream impacts from high storm water flows. Conceptually, approximately one-half of the site runoff will be directed onto the existing engineered and revegetated fill slope north of the power plant; the rest of the site runoff will be directed into new ditches that drain to different locations. Theexisting fill slope drains into Coldwater Creek, which is a tributary to Squaw Creek.

The existing site drainage system that will be replaced consists of plant underdrains that flow into a concrete storm water collection sump. Currently, water in this storm water sump can be pumped to injection wells in the steam field. However, the storm water collection sump has an overflow level, which releases excess water onto the fill slope north of the power plant.

Manholes and drainage inlets to the existing plant underdrain system will be plugged so that, when restored, power plant site drainage will rely on the new system of drains and ditches.

The existing asphalt and surface concrete provide an impermeable layer to conduct water off the power plant site and will be left in place. Where these surfaces are over fill (an area of approximately one-half acre immediately behind the retaining walls), drainage is most important and there will be no soil cover provided in this area. The balance of the power plant site, approximately 6.8 acres (minus one acre for the cooling tower basins), will be covered with a relatively thin layer (one foot deep) of metasediment borrow material that will support a direct-seeded mixture of native and non-native, annual and perennial grass and forb (broadleaf) species. Growth of shrubs and trees might speed the deterioration of the asphalt; woody vegetation plant diversity will in any case be provided in the more moist and fertile soils in the basins. The amount of borrow material required to cover the described plant site area to a depth of about one foot would be approximately 11,000 cubic yards.

B. Basins

After the cooling tower basin wing-walls are removed, the remaining void will be partially filled and graded to allow the basin to accumulate precipitation and act as a man-made wetland. The basins will be filled primarily with engineered fill composed of fragmented concrete debris, in pieces no greater than two feet in diameter, potentially along with minor amounts of rock and asphaltic materials. The two-foot diameter stipulation allows for practicable demolition and transport while providing enough interstitial space for woody plant establishment. This debris would fill approximately 3,100 cy of a total 7,600 cy capacity in the cooling tower basins. In addition, the cooling tower basins would be capped with 2,600 cy of borrowed soil fill, half tuff and half metasediment. The basins would then be filled three-quarters full, and would be graded to create a smooth descent from the foundation top to the lowest central area, thereby providing an exit ramp for wildlife.

The cooling tower basins will form a plant substrate with an artificially perched water table. Higher seasonal soil moisture and greater rooting depth will allow herbaceous and woody species to invade the basin surfaces naturally; therefore, no revegetation materials are prescribed. It is assumed that water-dependent seeds will "pioneer" and establish themselves at the basin sites.

Water saturating the soil basin and reaching grade level will enter the power plant site drainage system and be directed off-site.

Smaller basins and sumps at the power plant site will be filled to capacity with approximately 1,400 cy of concrete debris.

C. Protection of the Retaining Wall

As an integral part of its restoration approach for the power plant site, CCPA No. 1 proposes to leave the power plant retaining wall and fill materials behind it in place, as it is anticipated that their removal is likely to induce greater potential environmental disruption than that which would result from long-term deterioration. Removal of the retaining wall and the fill material behind it would leave the slope considerably steeper than the angle of repose. Recontouring of the power plant site would entail a degree of soil compaction which, in itself, would reduce the level of success of revegetation efforts, and might also demand significant amounts of additional borrow material. Instead, the retaining walls are to be left in place for a more gradual, natural stabilization.

ESA team calculations indicate that under "dry" conditions, the retaining walls could be expected to function for approximately 80 years before corrosion of the metal reinforcement would be sufficient to result in failure of the wall. Under potential hydrostatic conditions, the longevity of the wall would be on the order of 50 years. The longevity of the wall is referenced to 1997 and accounts for the time since initial construction (a little more than 10 years), assuming that the corrosion test performed from one soil sample obtained on site is representative of the backfill materials.

The soil sample was determined to have a relatively low pH of approximately 4. However, other potential corrosion properties (resistivity, sulfates and chlorides content) were not indicative of highly corrosive soils. The metal reinforcement is assumed to be epoxy-coated in accordance with the project specifications. Dry conditions assume that a drainage system is incorporated as part of the cover in order to prevent water from infiltrating into the backfill. Hydrostatic conditions assume that the water levels behind the wall could reach a maximum of 25 percent of the wall height. Due to the presence of a toe drain located at the base of the fill/native bedrock contact, this is a reasonably conservative assumption. The presence of this existing toe drain, however, is not sufficient to prevent at least some hydrostatic pressures from developing behind

the wall. Longevity calculations take into account the potential occurrence of earthquakes following restoration. Corrosion rates and longevity are based on guidelines provided in Federal Highway Administration Publication FHWA-SA-96-072, dated October 1996.

It is difficult to predict the timing and nature of failure. However, because the retaining walls are a passive support system consisting of a large number of reinforcing elements that support relatively small loads, it is reasonable to assume that failure will be more gradual and involve localized areas as opposed to a sudden collapse of a large wall segment, especially if the soils are drier and the power plant pad is effectively drained. If hydrostatic pressures develop behind the wall, this will increase the likelihood that failure will be less gradual and involve a larger section of the wall. Hydrostatic pressures will stress the bottom reinforcing elements which could result in the failure of the entire height of a wall segment. Prescriptions for retaining walls areas therefore include a priority for protecting or enhancing drainage.

3. PRESCRIPTIONS FOR WELL PADS

The prescription for each well pad must consider the following attributes: well pad drainage, stability of the well pad as a whole, stability and maintenance of the sump, and appropriate revegetation method. The prescribed actions for each of these attributes is described below and is summarized in Table 5.

A. Well Pad Drainage

Existing drainage and erosion controls at the well pads generally consist of the use of corrugated metal piping (CMP), rip-rap lined ditches, and/or unlined drainage ditches. Most well pads use CMP as part of the drainage controls. Due to the limited life and relatively higher maintenance required for CMP, the drainage controls for the well pads will be replaced and/or modified to include more permanent and lower maintenance controls such as engineered drainage ditches. Generally, the engineered ditches will be sized to verify adequate capacity and include rip-rap and/or gunite lining for grades steeper than about 5 percent.

The engineer team observed minor erosional gullies along the edges of several well pads that will require repair prior to installation of the permanent drainage controls. These well pads are identified in Table 2. In addition, the Wildhorse 2 well pad was observed to contain several erosional gullies along the access trail to the well pad and a small, localized depresssion on the

well pad surface. These erosional gullies will be repaired to maintain accessibility to the well pad following restoration, and minor grading will be completed to promote positive drainage.

B. Well Pad Stability

The site review of well pad stability showed that only one well pad required special consideration. The existing erosion gully below Well pad 1-5A.4 is due to a debris landslide that occurred during the winter of 1995-1996. The existing erosional gully is located on a steep slope. It appears to be impractical to repair the gully to create a stable slope. However, a bench area remains above the gully that provides a small contributing area of runoff. To reduce the likelihood of future debris flows and erosional problems, minor regrading of the bench area would be performed to redirect all water to drainage areas on either side of the gully.

C. Sumps

Sumps constructed for the storage of drilling muds may be left in place where they have been cleaned of drilling muds and allowed to fill with water. Water, even ephemeral water, collected in these artificial pools has value for wildlife. Based on the team's observations of similar man-made wetlands in The Geysers, rapid, volunteer colonization of these areas is anticipated.

Filled sumps may not be differentiated from the rest of the pad areas, although the bentonite lining of the sumps will assist in moisture retention and may secure a higher survival of restored vegetation than other portions of the pad. The sump contents, if any, at Well pad 1-5A.4 will be removed if further gully development threatens the stability of the pad.

D. Vegetation Prescriptions

Vegetation restoration activities at the well pads are described in terms of restoration prescriptions expressed as seed mixes and rates, planting regimes for shrubs and trees, irrigation procedures, monitoring requirements and success criteria. Any prescription is driven by individual site attributes and limitations, but is ultimately derived from an ecologically defensible association of plant species and types, and may include simple "ripping" and natural regeneration, grass and forb seeding, and woody plant establishment. These prescriptions are described below.

Direct Seed Shrubs. This prescription is used where chaparral is an adjacent vegetation type. Chaparral thrives on rocky, exposed sites, and many species are well adapted to relatively harsh conditions. It is recommended for 11 of the 18 well pads.

The prescription is to rip the site to a depth of 6-12 inches to relieve compaction, followed by direct seeding of local chaparral species known to tolerate pioneering conditions. *Adenostoma fasciculatum, Lotus scoparius, Baccharis pilularis, Ceanothus cuneatus* and *C. integerrimus* and *Cercocarpus betuloides* and *Eriodictyon californicum* seeds will be included in the mix, if available, because of their demonstrated ability to thrive in conditions similar to the project area.

The seeds will be broadcast, then raked in. No seeding of annuals is done in connection with this treatment, since the annuals would compete with the woody species. No follow-up care is required.

Plant Oaks. For six of the 18 well pads, oak restoration is recommended as a compatible and visually pleasing approach. This prescription is the most intensive treatment, requiring considerable post-installation care, since young oaks are susceptible to root and crown browsing, competition from non-native annual plants, and drought.

The prescription is to rip the site to a depth of 6-12 inches to relieve compaction, then plant with 100 to 200 oak seedlings following a well-tested method (Bush and Thompson, 1990) including placement of oak seedlings from Super Cell leach tubes into a prepared hole, then installation of a Propex fabric mat on the ground to reduce competition from grasses and a protective screen to reduce herbivory. Seedlings will be irrigated only if drought conditions follow the plant installation. During "normal" rainfall years, liner and direct seeded oak plantings have been successful in The Geysers area without supplemental irrigation. The oaks will be maintained (weeded) for three years or until site access is limited by property reversion to the original owners. No other seeding of woody or herbaceous plants is proposed, since it would present competition with the oaks.

Leave in Place. This prescription is recommended for two areas, one well pad and one well site. The Wildhorse 1 well site is currently little more than an unpaved wide spot in the Coldwater Creek Road. The recommended action for this site is to leave it in place. The Wildhorse 2 well pad has a well-established cover of herbaceous vegetation. No revegetation is

planned here; however, if grading activities disturb the soil, direct seeding of an herbaceous mix will be used for erosion control.

4. ROADS AND PIPELINE ACCESS TRAILS

All of the paved access roads into the project area and gravelled access roads currently serving the well pads will be left in place. Bladed, ungravelled trails along pipeline routes will be closed, and erosion minimized by construction of waterbars where necessary. A mixture of grasses and annual forbs will be seeded on these areas to minimize erosion. Additional access trail restoration work at the Wildhorse 2 well pad is described in Section V.3.A.

5. OUTLYING BUILDINGS (FIELD OFFICE/SHOP COMPLEX AND WAREHOUSE/STORAGE YARD)

Since the field office/shop area is fully covered with asphalt (in the parking and access areas) or concrete (in the building areas), the recommended approach to restoration is to cover the site with borrow materials suitable for supporting herbaceous vegetation. The existing asphalt and surface concrete would be perforated to allow drainage and gradual decomposition in place. The entire site, approximately three acres, will be covered with one foot of combined tuff and metasedimentary borrow material that will support a direct-seeded mixture of native and non-native, annual and perennial grass and forb (broadleaf) species.

The warehouse/storage building has a concrete foundation and associated asphalt parking area which will be left in place and perforated to allow drainage. Like the paved areas of the field office/shop complex, the foundation of the warehouse/storage area will be covered with one foot of combined tuff and metasedimentary borrow material and direct-seeded with an herbaceous mix. The associated storage yard yard, which is not covered with asphalt, will be ripped to a depth of 6-12 inches to relieve compaction, and allowed to revegetate naturally. No subsequent care is prescribed.

The total amount of borrow material required for covering to one foot depth all paved or foundation areas in the field office/shop complex and warehouse/storage yard would be approximately 5200 cy.

6. ELECTRICAL DISTRIBUTION SYSTEMS

The 230 kV transmission system would be dismantled, the steel lattice towers removed down to the concrete footings. The footings would be left in place. Bladed access trails would have water bars constructed as necessary to reduce erosion. A mix of annual and perennial grasses and forbs would be broadcast on bladed areas as an erosion control measure. The 21 kV distribution system would be completely dismantled, with no further restoration planned except as necessary to restore vegetation after pole removal.

7. VENT AND MAINLINE SEPARATOR STATION

The vent/separator station adjacent to the power plant site differs from the power plant in that it is unsurfaced, and does not require protection of the retaining wall. After removal of the small building, tank, foundations and piping, the area will be ripped to a depth of 6-12 inches to relieve compaction, and seeded with an herbaceous mix.

8. BORROW AREAS

As currently envisioned in this plan, the borrow materials for the power plant and field office/shop complex would require only a portion of the borrow areas identified. An objective of CCPA No. 1's restoration approach is to minimize additional site disturbance from soil borrow. CCPA No. 1's soil borrow needs will disturb only a small portion of the sites identified in Table 3. Tuff (clay) borrow needs for both the power plant and steam field restoration are approximately 4,100 cy (affecting approximately 0.3 surface acres) from an available volume of 25,000 to 30,000 cy at Borrow Area C. Metasediment borrow needs for both power plant and steam field restoration are approximately 14,700 cy (affecting approximately 0.8 surface acres) from an available volume of 50,000 to 70,000 cy at Borrow Areas A and B.

It is anticipated that CCPA No. 1 will use only Borrow Area B as a source for metasediment borrow; this area is estimated to have sufficient available material for metasediment borrow needs. CCPA No. 1 has an existing permitted borrow site containing chert materials adjacent to Pad 1-6.4 Chert is not preferred material for revegetation purposes and, therefore, is not proposed for use in project restoration. However, CCPA No. 1 plans to maintain the materials in the existing borrow site as a reserve in case a use is identified for the closure project.

Some special restoration methods are recommended where disturbance is relatively short-term and topsoil and plant material can be stockpiled for respreading after the borrowing operation is complete. Soil and plant material from the uppermost 6 inches of the borrow areas to be used must be stockpiled separately while the borrow area is in use, preferably for as short a period as possible. The borrow area should have a final slope no steeper than 2:1. Upon completion of final grading, the stockpiled material will be spread over the borrow area. It will serve as a source of local seed and microorganisms. No further follow-up care is required.

The existing permitted borrow area will be graded as needed and direct-seeded with shrubs.

9. MISCELLANEOUS FACILITIES

As indicated in the section on well pads, some of the sumps constructed for the storage of drilling muds have subsequently been cleaned of mud and allowed to fill with water. These will be left in place if they are currently still open, providing habitat for wildlife. Rapid, volunteer colonization of these areas is anticipated, as is typical for such sites in The Geysers. If sumps are currently closed, they will be left in place consistent with the stability analysis described in Section IV.2.A above.

The 15 microseismic stations will have their equipment removed and supports removed at the top of the concrete footings. Where they are separate from well pads or other large facilities, these stations will be allowed to revegetate naturally; where they are a part of a well pad, their treatment will be the same as the well pad itself.

The spoils area was found to be geotechnically stable and was showing evidence of natural revegetation. No treatment is prescribed for this area.

The "boneyard" is a somewhat compacted area about the size of a well pad. The prescription for this site is to rip to a depth of 6-12 inches to relieve compaction, and direct seed with woody chaparral species, then rake in the seed. No further care is prescribed.

VI. MONITORING

1. EROSION CONTROL

Monitoring will consist of inspecting the engineered drainage structures annually for three years, preferably after the winter storms have ended. In the case where a heavy storm event occurs, the drainage/erosion structures should be monitored after this event. Monitoring should consist of examining the ditches for infilling from erosional deposits, breaks in the gunite-lined ditches, and erosion along the side, underneath, or at the outlet of the ditches.

2. SITE STABILITY

Stability of the site can be performed during the annual inspection of the erosion/drainage control structures. Monitoring will consist of visually inspecting the various facilities for slumping of the soil, debris flows, or instability associated with erosion from blocked drainage ditches. This monitoring will also take place for a three-year period following closure.

3. VEGETATION

A. Shrub Direct Seeding and Topsoil Spreading

Direct seeding of shrubs and topsoil spreading are expected to result in a sustainable shrub density of one shrub per 5 square meters, or about 825 plants/acre, for three years. Monitoring will consist of belt transects, quadrats, or other quantitative methods, repeated annual for three years. Reseeding will be carried out, following consultation with regulatory agencies, if shrub density remains below the target density despite normal weather conditions. If there is extended drought, CCPA No. 1 may instead request an extension of the time allowed to reach the target densities without reseeding.

B. Oak Planting

Success is defined as a 75 percent survival rate after three years. Monitoring will consist of annual counts of trees planted, repeated annually for three years. If survival rates fall below this measure, additional trees will be planted and maintained similarly to the original prescription.

C. Seed With Herbaceous Mix

Success for herbaceous seeding is a 75 percent plant cover, or 1,000 lbs dry residue per acre, sustained for three years. Monitoring will consist of step-point, pin-frame, clip plot, or other quantitative method, repeated annually for three years.

Since seeding with an herbaceous mix is used as erosion control, reseeding may be needed in the fall following evidence of site instability or erosion.

D. Leave in Place

Success criteria are limited to assuring that no adverse erosion is occurring. Annual monitoring will consist of a visual inspection to assure that the site is stable, repeated annually for three years.

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APPENDIX A. RESTORATION TEAM RESUMES

MARK F. WINSOR, Ph.D.

Managing Associate

Dr. Winsor has over 20 years' experience in environmental management and restoration planning. His responsibilities include direction of resource inventory and mapping, hydrological and water quality assessments, water resource and geological studies for planning, permitting, site sensitivity and constraints analyses, environmental impact assessments with a focus on hydrological and geologic issues, soils investigations and erosion/geomorphic investigations, hazard response planning, planning/policy assessments, and mitigation planning and monitoring. Typical work products include resource management plans, EIRs and EISs, reclamation/restoration plans, erosion control plans, draft permits, (e.g., NPDES), land development environmental feasibility analyses, policy assessments and site selection studies.

EDUCATION

Ph.D., Physical Geography/Geomorphology, University of Wisconsin
B.A., Geography, Arizona State University
Graduate studies at the University of Freiburg, Germany
Faculty, Department of Geography and Human Environmental Studies, San Francisco State University
Instructor, extension programs, University of California, Berkeley, and University of San Francisco

PROFESSIONAL EXPERIENCE

- Co-manager for the EIR on the *Penn Mine Site Long Term Solution Project* and Task Manager for Site Restoration Planning. The investigation involved identification of and environmental evaluation of alternatives to management of mine wastes that create acid mine drainage to the Mokelumne River from an abandoned copper and zinc mine. The EIR was produced on schedule by the East Bay Municipal Utility District and the Central Valley Regional Water Quality Control Board in compliance with a court agreement to stay litigation among the concerned parties for a year. Mr. Winsor led the investigations of alternative restoration concepts for the site in relation to varied environmental and economic objectives of the project. He directed vegetation and habitat restoration investigations and was principal investigator for the hydrological, geomorphic, soils, erosion control, sediment transport and visual components of site restoration planning for the project. He developed historical information about the pre-disturbance environment as a basis for defining feasible restoration objectives. The development of the restoration plan, as an adjunct to the acid mine wastes management plan developed by Golder Associates, was an important factor in resolution of the long term site solution.

- Project manager and hydrologic and erosion control studies for the 200MW *Balsam Meadow Hydroelectric Project*, Fresno County, CA, EIR prepared on a fast-track schedule for the California Public Utilities Commission on 120-foot high dam and other facilities. Studies included evaluation of disposal and long-term management of 565,000 yards of mined rock, including the innovative use in the innovative reconstruction of a degraded alpine meadow.

PROFESSIONAL EXPERIENCE (Continued)

- As part of a three-year program of comprehensive surface environmental studies review by the State of Nevada Nuclear Waste Project Office for the U.S. Department of Energy Yucca Mountain, Nevada, High Level Waste Repository Site Characterization Program, Mr. Winsor directed investigations of site restoration planning. The investigations included detailed field investigations and mapping of vegetation, wildlife habitat, threatened and endangered species, soils, geology, hydrology, geomorphology, meteorology and other environmental factors. He directed a comprehensive inventory and evaluation of land disturbance activities and types, evaluated the potential for impact to the environment and the potential for restoration in a report titled *Environmental Management Objectives, Impact Potential and Reclamation Planning for DOE Site Characterization at Yucca Mountain, Nevada.* In a subsequent study, Mr. Winsor prepared the *Plan for Establishing Re-creation Objectives for Disturbed Sites at Yucca Mountain, Nevada,* encompassing alternative restoration concepts for disturbances spread over an 80-square mile area.

- Project manager for site restoration planning program as part of the comprehensive program led by Mr. Winsor for selection, preparation of NEPA Environmental Assessments for environmental site characterization, Proponents Environmental Assessment (PEA), and oversight for the site characterization of for the California-Southwest Compact Low Level Radioactive Waste Disposal Facility Development Project. Contractor for US Ecology, the State's license designee and State of California. Site restoration planning involved detailed field studies of the biophysical environment, including studies of the endangered Desert Tortoise. Restoration plans related to ensuring short-term use of the site and long term habitat restoration of habitat of the tortoise were the focus of the plan at the Ward Valley site.

- Project manager for the *Piombo Pit Panhandle Reclamation Plan Supplemental EIR. The SEIR* is an investigation of groundwater flow and water quality impacts on the main wells supplying the Town of Windsor, potential hazards of pit capture and impacts on riparian vegetation from a controversial proposed aggregate mining operation by Kaiser Sand & Gravel Company on a stream terrace of the Russian River in Sonoma County; prepared for County of Sonoma.

- Project manager for the *EIR and Supplemental EIR on the Granite Construction Company Vernalis Project* in Stanislaus and San Joaquin counties, a proposed 310-acre aggregate mine and processing facility. As part of the investigations, Mr. Winsor led studies of reclamation of the site for compliance with the Surface Mining and Reclamation Act. Potential reclaimed use of the site for agriculture was the focus of the studies because of the presence of prime agricultural soils that would be removed by mining. Alternative reclaimed uses were identified and evaluated for their long-term feasibility.

- Principal technical investigator of soils, erosion and sedimentation, water quality and hydrology, and visual resources for the *Pine Creek Detention Basin EIR and Restoration Plan*, prepared for Contra Costa Flood and Water Conservation District. Project included a 48-acre storm water detention basin and channel modifications.

PROFESSIONAL EXPERIENCE (Continued)

- Principal investigator of geology, soils, seismic hazards, surface hydrology, groundwater and water quality impacts for the EIR on the proposed *Sycamore Ranch Quarry and Reclamation* in Ventura County. The proposed aggregate mining project was highly controversial with regard to earth and water resources issues because of its location on an active alluvial apron drained by two high gradient streams, the presence of nearby active earthquake faults and the use of groundwater in a major agricultural area. The EIR evaluated long-term reuse of the site following mining for citrus production.

- Project manager for the City of Lancaster *In-Lieu Fee Ordinance for Prime Desert Woodlands* and EIR; multi-tasked program of (1) vegetation mapping of stands of Joshua Tree and Juniper woodlands to select prime woodland preserves; (2) development of a model program for assessing fees on new development related to loss of graded prime desert woodlands; and (3) EIR on the long term impacts of the ordinance on new development in this rapidly developing high desert community in northern Los Angeles County, CA.

- Project manager for screening of alternatives and EIR for *Drainage Element of the Windsor Specific Plan*, prepared for the County of Sonoma; comprehensive environmental analysis of over 10 linear miles of floodways and adjoining flood hazard zones in an area undergoing transition from agricultural to urban uses. The study included identification of areas for preservation of habitat and establishment of restoration requirements for areas of potential channel and bank disturbance.

- Hydrologic, water quality and sediment management oversight for development of the Scottsdale Marsh Enhancement Project, a proposed multi-purpose plan for restoration of wildlife habitat combined with flood management and recreation objectives.

- Direction and oversight of watershed management plan for the 1,265-square mile Cosumnes River Basin in the central Sierra Nevada for the California Nature Conservancy. Work included development of a comprehensive resource inventory and strategy for management.

- Project manager for the *EIR on the Wildhorse Area 2 Geothermal Field Development Project*, prepared for the County of Sonoma; comprehensive environmental analysis of a geothermal energy development plan in The Geysers including access roads, well pads, steam collection lines, power transmission and other elements in the 809 acre leasehold; comprehensive impact assessment covering a wide range of issues.

- Project manager for the *Southeast Regional Wastewater Treatment Plant Facilities Improvement Project and Geysers Effluent Injection Program and Pipeline Project EIR/EIS* prepared for the Lake County Sanitation District, Bureau of Land Management and Department of Energy. Project involved impact assessments for over 36 miles of pipeline and 20 miles of distribution pipelines, detailed studies of energy development, and evaluation of controversial water contracting for out of basin water transfer from Clear Lake.

PROFESSIONAL EXPERIENCE (Continued)

- Project manager for the PRC 6423 (CA-953) *Cal-State Wells Geothermal Field Development Project Use Permit Application* in the Geysers, EA prepared for the California Division of Oil and Gas.

- Project manager for the *Glebe-State Exploratory Geothermal Project EIR* in the Geysers, prepared for Unocal.

- Directed *EIR/EA for the Mammoth Pacific II and III* geothermal development and power plant project at Casa Diablo for the Mono County Office of Energy Management, U.S. Bureau of Land Management and U.S. Forest Service.

- Directed *EA/EIR for PLES I* geothermal binary cycle power plant in Mono County, California, for the U.S. Bureau of Land Management and Great Basin Unified Air Pollution Control District.

- ESA project manager for the *Concept Bioreserve Plan for Elkhorn Slough*, preliminary concept development and implementation strategy prepared for the California Nature Conservancy.

- Project Director for the *Camp Roberts, California, National Guard Facility Environmental Management Analysis Program* (EMAP). Directed comprehensive mapping of land use, environmental and training activity use of the 44,000-acre Army National Guard base near Paso Robles, CA. EMAP program evaluation of environmental management plan compliance with all federal and state laws and regulations.

- Task leader for biophysical studies and principal investigator for geology, soils, hydrology and water quality for corridor selection studies in California and Nevada and the EIR/EIS for the *Trans-Sierra Intertie Project* (Sacramento Municipal Utilities District and Sierra Pacific Power Company).

- Principal investigator of hydrology, water quality, soils and erosion for the long-term closure plan for the Altamont Landfill in Alameda County. The Closure Plan of the 850-acre planned expansion area was developed and evaluated in the EIR prepared by ESA.

- Prepared environmental impact assessments for over 250 development projects throughout California with a focus on flood hazard, runoff impacts, erosion/sedimentation impacts, water quality, geology and seismic hazards.

PROFESSIONAL AFFILIATIONS

American Water Resources Association
Association of Environmental Professionals
Integrated Watershed Management Council
Soil and Water Conservation Society

THOMAS A. ROBERTS, M.S., C.W.B.

Senior Ecologist

Mr. Roberts is a Senior Wildlife Biologist and Land Management Ecologist with more than 19 years' experience. He served for ten years as a Biologist and Planner for the U.S. Forest Service, where he concentrated on riparian habitat restoration and endangered wildlife issues. This led to year at the Forest Service's Washington Office, where he was responsible for writing and editing USFS responses to appeals of National Forest Plans. After leaving the USFS, he worked as an independent consultant on a U.N. project studying arid rangelands in the Kingdom of Jordan. He returned to California in 1991 as a Senior Biologist and Project Manager for a Santa Cruz-based biological resources consulting company. There he specialized in biological data gathering and analysis for biological assessments and monitoring in major planning and construction efforts such as impoundments, energy development and linear facilities, projects spanning several years, vast areas and highly complex data sets. More recently, he has focused on Habitat Conservation Planning (especially involving vernal pools other aquatic systems). He is an accomplished writer and technical editor, with three novels, an essay collection and many scientific and non-technical reports and published articles.

EDUCATION AND PROFESSIONAL CREDENTIALS

B.A., 1969, Anthropology, Magna Cum Laude, Harvard University
M.S., 1977, Wildlife Biology, University of Massachusetts
1984, **Certified Wildlife Biologist** - The Wildlife Society
1995, Federal Fish and Wildlife Permit PRT-802103

PROFESSIONAL EXPERIENCE

Habitat Restoration and Monitoring; Sections 7 and 10 Endangered Species Consultation

- B&J Landfill, Vacaville. Conduct invertebrate surveys and monitoring of artificial and natural vernal pools, as part of CWA Section 404 permit provisions (ongoing).
- New Penn Mine Remediation - For Golder & Associates, wrote wildlife setting and impact sections for EIR on toxic clean-up of an abandoned copper mine along the Mokelumne River in Calaveras County (current).
- Arastradero Creek and Dam Rehabilitation (San Mateo County). Biotechnical advisor for stream stabilization project (current).
- Sunset Industrial Area - Placer County. Preparing conservation strategy for a 6,000 acre industrial park in Placer County, in conjunction with the Orchard Creek Vernal Pool Mitigation Bank. Developed vernal pool mitigation measures by creating and applying evaluation criteria to pools of different ecological value (1996).

PROFESSIONAL EXPERIENCE (Continued)

- Vernal Pool Assessment and Mitigation Study - Caltrans. Task Manager for vernal pool and valley elderberry longhorn beetle surveys in connection with a highway widening project. Helped develop "scoring" system for pools (1992).

- Wildlife monitoring at the San Leandro Marshlands Enhancement Project. Developed five-year shorebird, mammal and vegetation monitoring plan for restored marsh on S.F. Bay. Ongoing responibility for surveys and reports (ongoing).

- Palo Alto - Shorebreeze Project. Negotiated endangered species mitigation at a 60-unit housing project adjacent to Palo Alto Baylands. Species included salt marsh harvest mouse and California clapper rail. Ongoing discussions will result in a Section 7 consultation between USFWS and Army Corps of Egineers (current).

- San Mateo County, Colma Creek Flood Control Project. Prepared Habitat Conservation Plan amendments for Mission Blue and San Bruno Elfin butterfly impacts resulting from getechnical studies within the HCP area (current).

- Reliez Meadows (Contra Costa County). Designed mitigation wetlands and monitoring program in support of a 1601 Streambed Alteration Agreement (1995).

- Tulare County Multi-Species Habitat Conservation Plan - Project Manager for Tulare County's HCP. Full responsibility for negotiations, preserve design and conservation planning in a county-wide HCP (current).

- San Joaquin Multiple Species Habitat Conservation Plan - Biological Information Manager for comprehensive plan for up to 90 species of concern in San Joaquin County. Coordinated GIS and biological data and integrated information with preserve design and field surveys (1995).

Riparian and Riverine Systems

- Sycamore Ranch Project - Conducted field surveys and wrote impact and mitigation sections for EIR on aggregate mine operation in Ventura County. Analysis included dust, noise, water diversion, riparian impacts, road widening and traffic concerns, and an assessment of the practicability of site restoration (1995).

- American River Water Resources Investigations - U.S. Bureau of Reclamation and Montgomery Watson - Compiled and analyzed information on the effects of changed sedimentation and scouring rates downstream of several existing and proposed reservoirs on the following Rivers: American, Calaveras, Stanislaus, San Joaquin, Feather (1995).

PROFESSIONAL EXPERIENCE (Continued)

- Advisor on Wildlife Management Planning - American Falls Reservoir Management Plan (Snake River) Pocatello, Idaho - Bureau of Reclamation. Assessed the Snake River riparian zone and the Reservoir's unique sedimentation patterns for habitat mitigation and improvement for migratory birds and raptors (1991).

Endangered Species Survey and Monitoring (Current Permit [fairy shrimp] No. 802103)

- Modesto Amtrak Station - City of Modesto. Performed protocol-level surveys, and conducted agency negotiations, as required through Section 7, ESA (current).

- Permit (project-specific) for survey and relocation of desert tortoise, Mojave Pipeline Project (1991-1992); camera-station surveys for grizzly bear and gray wolf, Idhao Panhandle (1992); wintering habitat surveys for bald eagle (1993); breeding surveys for California spotted owl, least Bell's vireo and willow flycatcher (as USFS employee).

U.S. Forest Service Experience (employee and consultant)

- Consulting Wildlife Biologist - For the Medora Ranger District, Little Missouri National Grassland, Custer National Forest (North Dakota), reviewed the potential effects of. access roads and well sites. Wrote Biological Evaluation (BE) on the potential effects on federally protected and sensitive wildlife species (1994).

- Consulting Ecologist - U.S. Forest Service, Eldorado National Forest. Wrote environmental assessment and management plan for multiple-use of historic trail system and associated lands (1993). Project conducted as Task Manager for Region 5 On-Call Technical Services Contract (1991-1993).

- As a temporary employee at the USFS Washington Office, reviewed biodiversity and endangered species appeals of National Forest Management Plans and conducted a survey of information on the effects of aircraft overflights on wilderness wildlife (1990).

- Consulting Ecologist - for the Inyo National Forest, researched the ecological condition of, and developed a management program for, high elevation Sierra meadows (1985-1989).

PROFESSIONAL EXPERIENCE (Continued)

- Range and Wildlife Officer, Sierra National Forest (1985-1987). Conducted surveys of sensitive wildlife (including spotted owls and furbearers), prepared wildlife impact sections of timber sale EIRs and BAs and BEs for a variety of projects including hydroelectric development, prescribed fire and grazing allotments.

- Assistant Resource Officer, San Bernardino National Forest. Developed 10 year program to improve chaparral habitat through application of systematic prescribed fire; constructed small impoundments, rainwater catchments, and horizontal wells (1978-1985). Assisted in layout and administration of timber sales.

CEQA, Residential Development Projects

- EIR for General Plan Amendment for subdividsion on Woodlands Specific Area, San Luis Obispo County. Surveyed for plant and animal species of concern and developed specialized mitigations for overwintering monarch butterflies at Nipomo Mesa. The site, over 900 acres, had extensive cultural resources as well, which needed to be combined with natural resource considerations in mitigation design.

- Constraints Analysis on Bombay Property, Santa Cruz. Reviewed complex biological constraints on a 700 acre site, including sensitive invertebrates (Ohlone tiger beetle), nesting raptors and general biological diversity concerns.

- Supplemental EIR for Doublewood Golf Course, Fremont. Directed site surveys, wetland delineation, data analysis, and mitigation planning for 600-acre site in the City of Fremont. Concerns included mitigation for the California tiger salamander, discovered during site surveys.

- Livermore Area Projects. Rezoning and plan amendment biological constraints surveys were conducted and are in progress for several sites in North Livermore. Area has potential kit fox and vernal pool species.

- Prepared Constraints Analyses and CEQA documentation for expansion of East Bay Municipal Utilities District, South San Joaquin Irrigation District, and Dublin/San Ramon Services District water and wastewater treatment facilities, reservoirs, pipelines and flood control activities (current).

- Coastal Branch (Phase II) Aqueduct Project. For the Department of Water Resources, wrote the first draft of the project mitigation plan for a water pipeline corridor in central California. Plan involved close coordination with resource agencies and the application of raw field data to mitigation requirements.

PROFESSIONAL EXPERIENCE (Continued)

- Spread Coordinator - PGT-PG&E Natural Gas Pipeline-Oregon, Washington, and Idaho panhandle-Bechtel, Inc. Field director for preconstruction surveys and construction monitoring in a three-state region. Sixteen species of concern were located and mapped; provided estimates of extent of impact of construction operations (1992-1993).

Energy Generation and Transmission Projects: Data Gathering, Mitigation Monitoring and Environmental Analysis

- Project Manager - Sierra Pacific Power Transmission and Tuscarora Natural Gas Transmission Projects-Sierra Pacific Power Company. Projects involved several hundred miles of potential construction corridors for energy transmission, extensive surveys and data analysis. Several dozen potential species were surveyed and recorded using GPS technology and databases consistent with GIS mapping (1993-1994).

- Project Manager - Conducted surveys for Bonneville Power Administration along an 8-mile electrical transmission line in Modoc County, California. Prepared the Biological Evaluation to determine possible impacts to nesting greater sandhill cranes (1992).

- EIR/EIS Preparer - Southern California Edison. Assessed wildlife impacts, particularly waterfowl, bald eagle, and desert tortoise, for a proposed 33kV transmission line from the desert slopes to Big Bear Valley in the San Bernardino Mountains (1991-1992).

- Independent Consultant - Mojave Natural Gas Pipeline Project-Fluor-Daniel, Inc. Produced the environmental training videotape *Toe the Line* and other worker education videos (1991).

- EIR/EIS Preparer - Coso-Geothermal Project & Fallon Geothermal Field Project. The Coso Geothermal Field is an extensive energy development on the China Lake Naval Weapons Center. The Fallon project EIS had been challenged by project opponents as environmentally inadequate. Was brought in to revise draft EIS (1990).

PROFESSIONAL EXPERIENCE (Continued)

- Hydroelectric Impoundments - U.S. Forest Service, Sierra National Forest - had oversight responsibilities for mitigating riparian impacts of several planned and ongoing hydroelectric power generation and transmission projects. Utilities included PG&E (Helms Pump Storage), SCE (Balsam Meadow), Kings River Conservation District (Dinkey Creek Dam) and various proposed pump-storage facilities and run-of-the-river hyro facilities. Analysis involved impact assessment, Exhibit E review, and coordination with CDFG, FERC, USFWS, utilities and project proponents. (1985-1987).

Light Rail and Mitigation Planning Projects

- Los-Angeles to Bakersfield High-Speed Rail Corridor analysis. Reviewed project area and conducted complete constraints analysis for several alternative high-speed rail routes across the San Gabriel and Tehachapi Mountains. Work involved close consultation with state (CDFG) and federal agencies (USFWS, USFS) and organization of areal data into a format suitable for use with a linear facility.

Other Research and Management

- Integrated GPS technology into wildlife field inventory techniques (1993-1994).

- For Pacific Gas & Electric, established 2000 mil-acre plots along 34 transects at three different sites in and around proposed reservoir site in Modoc County, to determine deer use and migratory routes through the area (1991) .

- Researched the reproductive physiology of red-winged blackbirds for agricultural pest control (1975-1977).

SELECTED PUBLICATIONS

Technical Reports and Magazine Articles

"Measuring Ecological Change in a 'Restored' Tidal Marsh on San Francisco Bay: Avoiding The Wrong Yardstick" (in prep.)

"Distribution of nesting greater sandhill cranes in Modoc County" with R. Cull and A. Flannery **California Fish and Game 82 (3):137-140**

"Islands in the Rock: Horses, Mules, and Mountain Meadows," in **Wilderness Magazine** (in press).

SELECTED PUBLICATIONS (Continued)

1994 "Comparison of Wildlife Mitigation Strategies During Construction of an Interstate Natural Gas Pipeline" in **Transactions of the Western Section, The Wildlife Society**.

1991 "Death in the Gulf" **Buzzworm Magazine** (July).

1990 "A Well-Laid Plan for Squirrels and Men," **Outdoor California** (December).

1988 "Livestock Management and Productivity of Willow Flycatchers in the Central Sierra Nevada," with B.E. Valentine et al., **Transaction of the Western Section, The Wildlife Society**.

1985 "Mule Deer and Cattle Responses to a Prescribed Burn," with R.L. Tiller, **Wildlife Society Bulletin 13:248-252**.

1982 "Growth and Survival of Black Oak Seedlings," with C.A. Smith, **Tree Planter's Notes** 33(4).

Novels and Essay Collections:

1988, "Adventures in Conservation", **Stone Wall Press** Washington, D.C.;

1989, "Shy Moon", **Pineapple Press** Sarasota, FL.;

1989, "Beyond Saru", **Cliffhanger Press** Oakland, CA

BARBARA MALLOCH LEITNER

Plant Ecologist and Restoration Ecologist

Ms. Leitner, Plant Ecologist and Restoration Ecologist, has over 20 years' experience in the environmental field, most in the area of energy development. She has extensive experience in the identification of sensitive plant resources, vegetation habitat mapping, impact assessment, monitoring of project impacts on vegetation, vegetation management and restoration, Habitat Conservation Plans, and wildlife habitat studies. She has worked for over 13 years on projects in The Geysers, for 10 years in the Coso Known Geothermal Resource Area, and two years in the Glass Mountain KGRA.

EDUCATION

A.B., Botany, University of California, Berkeley
M.S., Ecology, University of California, Davis

PROFESSIONAL EXPERIENCE

Geothermal Project Permitting and Impact Assessment

- Prepared botanical resource inventories and impact assessments for 6 proposed units at The Geysers, 4 units at Coso (Inyo County, CA) and two units at Glass Mountain (Siskiyou County, CA) KGRAs, plus several additional wellfield, leasehold, and KGRA-wide surveys for botanical resources.

- Prepared assessments of operational impacts on vegetation for geothermal projects in The Geysers, Coso, and Medicine Lake KGRAs, as well as for two cogeneration power plant projects in California and Oregon. In addition, developed and implemented a vegetation monitoring program for four operating geothermal units at the Coso KGRA.

- Monitored rare plant populations in The Geysers for over 10 years.

- Served as co-investigator for ecological studies in connection with the Coso Grazing Exclosure, a mitigation program for the Mohave ground squirrel at the Coso KGRA.

Resource Management and Planning

- Prepared biological resource sections for Lake and Sonoma County geothermal resource elements, as well as participating in an overview of geothermal resource permitting for the U.S. Navy for the Coso KGRA.

- Developed and managed the biological monitoring program for The California Nature Conservancy preserves for five years.

- Participated in preparation of four Habitat Conservation Plans.

PROFESSIONAL EXPERIENCE (Continued)

Vegetation Management and Restoration

- Prepared five revegetation plans for: CalEnergy's Coso geothermal project; Owens Lake Soda Ash mining facility; the WyCal pipeline; the New Coalinga Airport; and a revegetation demonstration project for the U.S. Navy at China Lake.
- Developed guidelines for vegetation management for fire hazard reduction for the East Bay Hills following the 1991 fire.
- Managed The California Nature Conservancy's prescribed burning, livestock grazing and weed control programs for five years.

PROFESSIONAL AFFILIATIONS

Association of Environmental Professionals
California Botanical Society
California Native Plant Society
Society for Ecological Restoration, California Chapter
Society for Range Management

SELECTED PAPERS AND TECHNICAL REPORTS

Leitner, Philip, Barbara M. Leitner and John Harris. In prep. *Mohave ground squirrel studies for the Coso Grazing Exclosure Mitigation Program, 1995 and 1996 report*. Prepared for CalEnergy Co., Inc.

Leitner, Barbara M. In prep. *Preserve design for Tulare County Multi-Species Habitat Conservation Plan.* Prepared in collaboration with ESA Environmental Consulting and Toyon Environmental Consulting.

Leitner, Barbara M. 1997. *Monitoring report for 1996, operational effects on vegetation, California Energy Company's Coso geothermal project, Inyo County, CA.*

_____. 1995. *Revegetation plan, Owens Lake Soda Ash Company, Inyo County, California.* Prepared for MHA Environmental Consulting.

Leitner, Barbara Malloch and John Juette. 1994. *Habitat Management Plan, New Coalinga Airport.* Prepared for the City of Coalinga Planning Department, Coalinga, CA.

SELECTED PAPERS AND REPORTS (Continued)

_____ 1993. *Revegetation demonstration project at the U.S. Navy Naval Air Weapons Station, China Lake.* Prepared for MHA as Navy Delivery Order 19.

1993. *Assessment of impact assessment and mitigation measures, Coso Known Geothermal Resource Area, China Lake Naval Air Weapons Center.* Prepared for MHA Environmental Consulting, San Mateo, CA.

_____. 1991. *Little Geysers vegetation monitoring study.* Ninth year report covering 1990. Prepared for Unocal Corporation, Geothermal Division, Santa Rosa, CA.

_____. 1987. *Revegetation recommendations and plan for the China Lake Joint Venture Geothermal Development, Coso Known Geothermal Resource Area.* Prepared for McClenahan and Hopkins Associates, Kensington, CA. 21 pp.

_____ and Sally de Becker. 1987. *Monitoring The Geysers' panicum (Dichanthelium lanuginosum var. thermale) at the Little Geysers, Sonoma County, California.* Pp. 391-396 In: Elias, Thomas (ed.). *Conservation and management of rare and endangered plants.* California Native Plant Society, Sacramento, CA.

Leitner, Barbara and Philip Leitner. 1987. Biological resource portion of *The Sonoma County Geothermal Resource Element.* Prepared for Harding Lawson Associates, Novato, CA.

_____. 1988. Biological resource portion of the *Lake County Geothermal Resource and Transmission Line Element.* Prepared for Eliot Allen and Associates for Lake County.

Crane, N.L. and B.S. Malloch. 1985. *Survey of rare and endangered plant species of The Geysers-Calistoga Known Geothermal Resource Area. Pacific Gas and Electric Company Department of Engineering Research Report 411-78.257.* Pacific Gas and Electric Company, San Ramon, CA. 456 pp.

Malloch, B.S. 1979. "The effects of geothermal power plant operation on vegetation." Paper presented at the Edison Electric Institute Workshop on Biology, Portland, Oregon. September 18-20, 1979.

_____, M.K. Eaton, and N.L. Crane. 1979. *Assessment of vegetation stress and damage near The Geysers Power Plant Units. Pacific Gas and Electric Company Department of Engineering Research Report 411-79.194.* Pacific Gas and Electric Company, San Ramon, CA.

Meneghin, G.R., D.J. Hall, B.S. Malloch, and W.C. Chouteau. 1978. *The Geysers Unit 18 leasehold and site specific studies, terrestrial ecology.* Pacific Gas and Electric Company Department of Engineering Research Report 411-78.235. Pacific Gas and Electric Company, San Ramon, CA.

ROCKFORD J. (ROCKY) THOMPSON
Restoration Project Planner

PROFESSIONAL EXPERIENCE

Restoration Project Planner, Circuit Rider Productions, Windsor, California, 1990-Present: Oversees all restoration planning and consulting services at Circuit Rider Productions. Administration, contract management, and supervision of staff positions. Budget development for Environmental Group.

Vegetation Management Specialist, Circuit Rider Productions, Windsor, California, 1986-Present: Restoration project planning and management. Negotiations with regulatory agencies for project permits. Revegetation and erosion control plan design. Preparation of proposals and bids. Contract management.

Environmental Horticulturist, P.G.& E. Company, Civil Engineering Department, 1981-1986: Revegetation and Erosion Control planning preparation, project management and monitoring. Contract management. Landscape design and maintenance consultation. Revegetation research and publication preparation. Planning presentations to regulatory agencies.

Project Director, Circuit Rider Productions, 1980-1981: Founder and director of job training program in environmental restoration (Lake County TREE Project). Administration, supervised five staff positions, managed a native plant nursery.

Associate Biologist, P.G.& E., Department of Engineering Research, 1980: Rare plant field studies and vegetation mapping, environmental document preparation for power plant (geothermal and hydroelectric) siting, and EIR report preparation.

Botanical Consultant, Epsey, Huston & Associates. 1979-1980: Under contract with P.G.& E. to study the effects of Boron on vegetation. Development and implementation of sampling techniques and species selection of plants for study at The Geysers.

Instructor, Job Training Program, Circuit Rider Productions, 1979-1980: Timber Reforestation and Environmental Education (TREE Project). Duties included crew supervision and implementation of reforestation and revegetation projects.

Botanist, "Aggregate Resources Management Plan", Sonoma County Planning Department, 1979-1980: Assessment of the riparian habitat forest along the Russian River with emphasis upon the effects of gravel mining. Responsibilities included literature search, aerial photo interpretation, taxonomic identification (species list), classification and mapping of vegetation types, development of models of riparian communities for predicting future successional patterns and recommendations for future management

Botanical Consultant for "Cultural Resources Study - Warm Springs Ethnobotanical Project", 1978-1980: Collaborated with anthropologists under contract with U.S. Army Corps of Engineers to describe the extent of ethnobotanically significant plants within the Warm Springs Dams Project Area. Botanical inventories, detailed site mapping, design and implementation of transplant experiments and final report preparation.

Consultant: Field work including rare plant surveys, vegetation mapping, and botanical inventories.

- Geothermal leaseholds in Lake and Sonoma Counties
- California Native Plant Society; Rare Plant Inventory
- California Division of Forestry; Timber Harvest Plans
- California Department of Fish & Game; field work in several natural areas in Sonoma County
- Ethnobotanical field surveys of transmission line routes, north San Francisco bay counties

Supervisor, California Division of Forestry, 1978-1979: Responsible for eight-person conifer cone collection crew, site location, public relations, cone crop sampling and harvest throughout northern California.

Agricultural Aide, California Department of Food & Agriculture, Dutch Elm Disease Eradication Project, 1977-1978: Responsible for treatment of all diseased elms in Sonoma County. Extensive experience with use of pesticides, and spray equipment. Supervision and organization of treatment crews. Sampling of suspect diseased elms for lab analysis. Design and execution of experiments testing the effectiveness of various herbicides on sucker regrowth.

Researcher, 1976-1977: Co-author of research grant from the National Science Foundation to study the effect of emissions from geothermal energy production on lichens at The Geysers, California. Selection and hiring of three research assistants; literature search; field and lab work; budget management; computer data analysis; publication preparation. Presented findings of study at the 1976 Annual Meeting of Western Society of Naturalists.

COMMISSIONS AND BOARDS

City Planning Commissioner. Sebastopol, California (1991 - Present)
Chair, 1995-96

Trustee. Marin-Sonoma Vector Control District. (1995 - Present)

EDUCATION

B.A. Biology (with honors), Sonoma State University. January 1977. Emphasis in Botany, minor in Anthropology.

PUBLICATIONS

The Effects of Geothermal Emissions on the Distribution and Physiology of Lichens at The Geysers, CA. Senior Author (1977). Biology Department, Sonoma State University. National Science Foundation Grant. 53 pp.

Test Performance of Endangered Geyser's Panicum on Hydrothermally Altered Soils. Restoration and Management Notes. Vol 5, No. 2. 1987.

Deer Winter Range Restoration within 230 KV Transmission Line Right-of-Way in the Central Sierra Nevada Mountains of California. 1987. Fry, M. and Thompson, R. J. In Proceeding on 4th Symposium on Environmental Concerns in Right-of-Way Management. Purdue Univ. Press.

Acorn To Oak. 1989. Circuit Rider Productions. 36 pp.

Growing Natives: Planting Oaks. 1990 Fremontia 18 (3): 105 - 107.

TECHNICAL REPORTS & PLANNING DOCUMENTS

Ethnobotanical Resources of the Warm Springs Dam - Lake Sonoma Project Area. Sonoma County, California, (1979). Contributing author. U.S. Army Corps of Engineers, San Francisco District.

Aggregate Resources Management Plan. 1981. Contributing author. Sonoma County Planning Dept.

P.G.&E. Geysers Power Plants Vegetation Monitoring Study, Standard Operations Procedures Manual. 1980. Contributing author. Espey, Huston and Associates.

Santa Rosa Plains Endangered Plant Protection Program. 1988. Sonoma County Planning Dept. and Calif. Dept. of Fish and Game. 144 pp.

Kenneth G. Haskell, P.E.

Education B.Sc., Geological Engineering, Washington State University, 1985.
M.Sc., Geological Engineering, University of Idaho, 1987.

Affiliations Registered Professional Engineer, California, Washington.

Experience

Golder Associates, Associate Engineer, Oakland, California

Ken Haskell, P.E. has more than 12 years experience in landfill engineering design, construction and permitting. He has provided design and prepared detailed construction specifications for approximately 15 landfills, and is recognized by his clients for his ability to identify and secure regulatory approval for design alternatives that are technically effective and provide substantial cost savings over prescriptive regulatory designs. His value engineering approach to each project yields site-specific designs that maximize their return on investment, and meet demanding regulatory needs. Mr. Haskell was the Engineer of Record for an expansion design with a cumulative construction cost of more than $15 million for a 120-acre landfill site. Mr. Haskell's design team redesigned the facility and secured all necessary approvals after a previous contractor failed to gain permit approval by the Central Valley RWQCB. Mr. Haskell has provided engineering design for closure covers, liner systems expansions, leachate collection and removal systems, roads, fill plans, slope stability analyses, landfill gas collection systems and permitting for more than 15 solid waste facilities in California. He was the Design Engineer for a combined closure design for five landfills and 10 disposal units/trenches at Kettleman Class I Facility including regulatory approval for Innovative Engineered Alternatives. On this project, he developed innovative engineered alternatives that saved the client several million dollars. The alternatives were based on research on the effects of arid climates on clay covers, and included the removal of the clay layer from the cover system. He was also the Design Engineer for closure design of the LLNL Class I Pit 6 complex, which had significant seismic stability issues. The design obtained regulatory approval of innovative engineered alternatives. Mr. Haskell has also provided geotechnical investigations for numerous commercial developments that included the design of shallow and deep foundations and excavation support and design of mechanically stabilized earthwalls. He has extensive experience in landslide studies and slope stability evaluations, and has designed remedial measures for numerous slope failures. He has perpared reclamation plans for closure of facilities including quarries, mines and landfills. Mr. Haskell also designed a 35-foot deep groundwater interceptor trench as part of groundwater remediation program; prepared bid documents, design drawings and specifications for the groundwater interceptor trench and the relocation of groundwater treatment plant; screening excavated soils, soils aeration; design of a temporary retention pond for storing contaminated liquids.

Relevant Project Experience

Penn Mine Remediation, California

Environmental Impact Report (EIR), Feasibility Study and Conceptual design of Remedial Alternatives, Penn Mine, California

Design Engineer for the EIR identified and evaluated alternatives to provide for a long-term solution for water quality protection at the abandoned Penn Mine site in central California. The site is an abandoned copper mine in the foothills that contains mine wastes that have been responsible for Acid Rock Drainage (ARD), and metal contamination in the Mokelumne River and Camanche Reservoir for more than 140 years. As a result of several regulatory orders issued pursuant to the Clean Water Act (CWA), the East Bay Municipal Utility District and the Central Valley Regional Water Quality Control Board have committed to identify and evaluate alternatives for protecting water quality. Relevant regulatory requirements included the CWA, CERCLA, Chapters 7 and 15 of Title 23 of the California Code of Regulations (mine waste management, closure requirements for hazardous waste landfills). Dr. Dobson lead the identification and

evaluation of the measures to reduce or eliminate ARD generation through control of the waste materials (reducing the contact between water and waste), measures to contain ARD, and measures to treat ARD. The recommended Alternative includes construction of an onsite landfill and closure cover system to encapsulate the waste. In addition, alternatives include measures to divert and/or control surface and groundwater flow were assessed. All of the measures were evaluated for effectiveness (e.g., longevity of liner and cover systems), cost, constructability, operation and maintenance requirements, and regulatory compliance. The alternatives were evaluated and the environmental impacts associated with each assessed, in order to provide a basis for the selection of the long-term solution, which was developed through negotiations involving the parties. As project manager, he participated in meetings involving EBMUD, the RWQCB, the relevant regulatory agencies (EPA and the State Water Quality Control Board), and participants in the previous litigation. The negotiation process resulted in the selection of a preferred alternative which will be implemented over the next several years. The EIR was certified and a settlement agreement among the litigants was signed in February, 1997, ending over 10 years of litigation.

Leona Quarry Reclamation — Oakland, California

Project Manager for the preparation of a reclamation plan for the Leona Quarry. Project includes evaluating seismic hazards, static and seismic slope stability, design of rockfall mitigation hazards, and the preparation of surface water control and revegetation plans. A two-dimensional, finite element program (QUAD4M) was used to evaluate potential ground motions of the proposed final quarry slopes.

Project Manager, Landslide Remediation — Livermore, California

Project Manger for the investigation and design of remediation measures for several landslides at the Altamont Landfill in Livermore, California. Responsible for directing field investigation, interpretation of failure mechanisms, development of remediation alternatives with associated cost impacts, preparation of construction plans, and giving presentations to the regulators. Designated as the Engineer of Record for several construction projects at the site with a cumulative construction cost of more than $15 million.

Class I Hazardous Waste Pit 6 Landfill, Livermore, California

Lead Engineer for the final cover design of Lawrence Livermore's Pit 6 landfill. Design issues included cover design options, biotic layers, void spaces, stability and bridging capacity and seismic design. In order to cover the 2-1/2 acres of three trenches, six animal burial pits and low-level radioactive waste, Golder recommended a geogrid for stability against collapse or voids, geosynthetic clay liner, 60-mil HDPE geomembrane and 24-inches vegetative soil layer. The design which minimized the thickness of cover materials for geotechnical reasons is being constructed for a fraction of the cost of previous closures at the site, (saving millions of dollars), and meets all regulatory performance objectives for infilltration and flow.

Class I Hazardous Waste Kettleman Facility, Kettleman City, California

- **Cover Design for Landfill Closures** - Closure cover design for a combined cover systems to close four hazardous waste disposal areas ranging from 15 to 50 acres in size for RCRA Class I hazardous landfill. Developed engineered alternatives for cover design that reduced construction costs $3-5 million from previously approved prescriptive cover designs. Responsibilities included performing design calculations, and preparing construction drawings and specifications. Prepared a report recommending a design methodology for estimating settlements for landfills comprised primarily of liquid filled drums and for landfills comprised of compacted solid wastes.

- **Clay Liner/Cover Evaluation** - Responsible for clay liner and cover evaluation which included developing a field and laboratory testing program for a proposed clay source. Project objectives included evaluating permeability characteristics of the clay, developing placement and compaction recommendations, and investigation of desiccation mechanisms and the desiccation performance of various clay cover/liner systems. Responsible for the design and construction of a test pad to

address field permeability and desiccation of the clay. Instrumentation included two sealed, double-ring infiltrometers, and an array of thermistor probes and tensiometers to measure temperature and soil suction profiles with depth.

- **Construction Quality Assurance** - Field Engineer and QA Inspector for composite liner systems. The double composite liner was approved for RCRA and TSCA wastes. Placed primary, secondary and HDPE liner system with gravel drainage layers. Observed and mapped subgravel calculations, monitored clay placement and compaction.

- **Sludge Characterization** - Project Engineer responsible for performance of field experiment to characterize the strength of hazardous wastes insitu. Directed studies including drilling and sampling of wastes, and performance of shear strength tests using custom designed triaxal testing apparatus. Waste types included sludges, drums and other waste contamination.

Tri-Cities Landfill Class III Landfill, Fremont, California

Project Manager for feasibility study completed for the expansion of a Class III landfill over native Bay Mud. The project involved the evaluation of six development alternatives with respect cost, airspace, and technical issues such as stability, settlement and wetlands mitigation. The conceptual development was based on state and federal (Subtitle D) requirements for municipal waste landfills.

Groundwater Treatment Plant — San Francisco, California

Geotechnical engineering investigation and foundation recommendations for a proposed groundwater treatment plant.

Des Moines Watermain Failure — Des Moines, Washington

Completed a forensic investigation of the cause of watermain failure that resulted in a landslide. Provided expert witness testimony as part of an arbitration hearing.

Longacres Park Sewer — Renton, Washington

Geotechnical recommendations were provided for construction of a 9-ft diameter sewer in loose and compressible alluvial silts and clays of the Green River Valley.

Altamont Slope Remediation — Livermore, California

Project Manager for the investigation and design of slope remediation measures for several landslides that occurred within bedrock slopes comprised of claystone. The proposed remediation measures included a combination of constructing a slope buttress and flattening the slopes.

Ames Hilfiker Wall — Seattle, WA (1993)

Design Engineer for a 20-foot high Hilfiker retaining wall at the West Point Treatment Plant. The primary project concerns included long-term corrosion of the reinforcement and the suitability of on-site soils as backfill material.

Puget Sound Power and Light Company — Whatcom County, Washington

Project Manager for several power transmission line site investigations in Whatcom County. These projects involved characterization of the subsurface conditions and providing foundation recommendations for power poles in Bellingham and near the town of Ferndale. The investigations focused on the identification of locally occurring weak soils such as the Bellingham Drift Formation and evaluation of soil design parameters for PSP&L's computer program for analyzing lateral pile capacity.

Kenneth G. Haskell, P.E.

Westside Reservoir Slope Failure **Issaquah, Washington**
Project engineer for the remediation of a slope failure. The project involved the failure of a cut slope adjacent to a reservoir tank that services the City of Issaquah. Responsibilities included performing the field investigation (field mapping, installation of piezometers and monitoring slope inclinometers), performing slope stability analyses and evaluating alternative remedial designs, and providing field observation for the construction of a buttress wall and installation of horizontal drains.

Demolition Project **California**
Design Engineer for the demolition of a Port Manufacturing Facility in San Diego. Project includes the development of geotechnical recommendations for excavation/demolition of a basement and several deep pit structures located in loose, and/or saturation hydraulically placed sand.

Mine Remediation **California**
Design Engineer for the geotechnical evaluation of alternatives for remediating mine waste and acid mine discharge for the abandoned Penn Mine in Calaveras County. Engineering analyses included the slope stability of mine waste piles and conceptual design of surface water storage impoundments including the alternative of raising of Mine Run Dam.

Ostrom Road **Yuba County, California**
Geotechnical investigation for the rehabilitation of a failed, clay road subgrade along Ostrom Road. Recommendations were developed for stabilizing the subgrade with lime.

Leachate Evaporation Pond **Novato, California**
Project Manager for the design of a leachate evaporation pond founded on Bay mud. Geotechnical issues included settlement and foundation stability under static and dynamic conditions.

Waller Road Rehabilitation **Pierce County, Washington**
Design Engineer for the geotechnical investigation and development of recommendations for the rehabilitation of the road pavement along Waller Road in Pierce County, Washington.

Steilacoom Boulevard Project **Pierce County, Washington**
Geotechnical investigation and recommendations for the widening Steilacoom Boulevard which included a lateral expansion of an existing bridge.

Industrial Facility **Klamath Falls, Oregon**
Project Manager for the evaluation of potential geologic hazards for a proposed industrial facility in Klamath Falls, Oregon. The project included the review of historical seismicity and the estimation of design ground motions.

Turner Bridge Project **Grays Harbor County, Washington**
Design Engineer for the Turner Bridge Project, Grays Harbor County. Project consisted of a field investigation and developing geotechnical recommendations for a bridge alignment underlain by 40 to 50 feet of soft compressible organic silts and clays.

Maratta Creek Bridge **Cowlitz County, Washington**
Senior Engineer for the Maratta Creek Bridge Project, Mount St. Helens Memorial Highway, Cowlitz County. Project involved a forensic engineering analysis for WSDOT to determine the cause of excessive settlements that were observed at the abutments during construction.

Steilacoom Boulevard Project — **Pierce County, Washington**

Geotechnical investigation and recommendations for the widening Steilacoom Boulevard which included a lateral expansion of an existing bridge.

Kirby Canyon Geogrid Wall — **San Jose, California**

Design Engineer for a temporary, 50-foot high geogrid reinforced earthwall. During the construction of a 50-foot high toe berm with proposed 2H:1V side-slopes, it was discovered that the berm would be partially founded on refuse. Golder was contacted and asked to develop alternatives for steepening the outer slope so that the berm would be entirely founded on bedrock. Geogrid was used to reinforce and steepen the outer face to 1H:4V.

Sea-Tac Radar Tower — **Seattle, Washington**

Project Manager and design engineer for the foundation investigation for a proposed 90-foot high radar tower at the Sea-Tac International Airport. The radar tower is a settlement sensitive structure with maximum allowable differential settlements of 1/4-inch. The tower was founded on drilled piers embedded in glacial till.

Guy F. Atkinson Soil Nail Wall — **Renton, Washington**

Project Manager and design engineer for the design of a temporary soil nail shoring system for the SR-405 HOV lane improvements.

Technical Coatings Remediation Project — **Santa Clara, California**

Project Engineer for the design of a 35-foot deep groundwater extraction trench using slurry trench construction techniques. Project responsibilities included evaluation of construction alternatives, the design of a groundwater extraction trench and extraction piping system, developing a soils aeration plan for remediating soils contaminated with volatile organic compounds, preparation of engineering drawings and technical specifications, preparation of construction bid documents, project construction quality assurance, project health and safety, and coordinating construction and environmental permits with numerous state and local government agencies.

Sylvan Glen Development — **Tukwila, Washington**

Performed field investigation and developed geotechnical recommendations for the proposed development of an apartment complex.

Union Hill Road Realignment — **King County, Washington**

Project Engineer for the design of a permanent shoring system. The Union Hill Road project involves the widening and realignment of Union Hill Road located east of Redmond, Washington. Project responsibilities included providing geotechnical design recommendations for alternative retaining wall systems and the preparation of a preliminary design of a permanent soil nail wall.

Steele Street Alignment — **Pierce County, Washington**

Provided geotechnical engineering recommendations for the construction of a road embankment over peat soils.

Kenneth G. Haskell, P.E.

LANDFILL RELATED PROJECT EXPERIENCE

Class I Hazardous Waste Landfill **Livermore, California**
Lead Engineer for the final cover design of Lawrence Livermore's Pit 6 landfill. Design issues included cover design options, biotic layer, void spaces and seismic design. In order to cover the 2-1/2 acres of three trenches, six animal burial pits and low-level radioactive waste, Golder recommended a geogrid for stability against collapse or voids, geosynthetic clay liner, 60-mil HDPE geomembrane and 24-inches vegetative soil layer.

Hazardous Waste Landfill Closures **Kettleman City, California**
Design of cover systems to close four hazardous waste disposal areas ranging from 15 to 50 acres in size. Responsibilities included performing design calculations, and preparing construction drawings and specifications. Prepared a report recommending a design methodology for estimating settlements for landfills comprised primarily of liquid filled drums and for landfills comprised of compacted, solid wastes.

Clay Liner/Cover Evaluation
Hazardous Waste Landfill **Kettleman City, California**
Responsibilities included developing a field and laboratory testing program for a proposed clay source. Project objectives included evaluating permeability characteristics of the clay, developing placement and compaction recommendations, and investigation of desiccation mechanisms and the desiccation performance of various clay cover/liner systems. Responsible for the design and construction of a test pad to address field permeability and desiccation of the clay. Instrumentation included two sealed, double-ring infiltrometers, and an array of thermistor probes and tensiometers to measure temperature and soil suction profiles with depth.

Hazardous Waste Landfill **Kettleman City, California**
Field Engineer and QA inspector for composite liner systems at a large RCRA hazardous waste landfill at Kettleman City, California.

Hazardous Waste Facility **Arlington, Oregon**
Performed CQA inspection services for the closure of a five acre hazardous waste landfill cell. Responsible for the clay borrow source evaluation which included the installation and monitoring of two Sealed Double-Ring Infiltrometers.

Mixed Waste Disposal Facility **INEL, Idaho**
Completed a study to evaluate the performance of alternative cover systems for a low-level radioactive waste facility. Responsibilities included identifying alternative cover systems, and evaluating long-term performance with respect to infiltration, erosion, and settlement.

Project Manager, Landslide Remediation **California**
Project Manger for the investigation and design of remediation measures for several landslides at the Altamont Landfill in Livermore, California. Responsible for directing field investigation, interpretation of failure mechanisms, development of remediation alternatives with associated cost impacts, preparation of construction plans, and giving presentations to the regulators. Designated as the Engineer of Record for several construction projects at the site with a cumulative construction cost of more than $15 million.

Mine Remediation **California**
Design Engineer for the geotechnical evaluation of alternatives for remediating mine waste and acid mine discharge for the abandoned Penn Mine in Calaveras County. Engineering analyses included the slope stability of mine waste piles and conceptual design of surface water storage impoundments including the alternative of raising of Mine Run Dam.

Class III Closure/Post-Closure Maintenance Plans **Hollister, California**
Project Manager for the preparation of Closure/Post-Closure Maintenance Plans for San Benito County's John Smith Road landfill. The project include the design of a cover system, evaluation of slope stability, an assessment of seismic ground motions, and the preparation closure/closure plans in accordance with Title 14, California Code of Regulations.

Class II Landfill Expansion **Livermore, California**
Design engineer for the development of a 120 acre landfill that included both a vertical expansion over existing refuse and a lateral expansion over native ground. The project involved a comprehensive design effort that consisted of an evaluation of alternative base grades and cell geometries; a cost-benefit analysis of the various alternatives; and the design of the liner and leachate collection and removal systems, groundwater collection system, gas collection system, surface water control facilities, closure cover system, and construction sequencing. The project provided several technical challenges that included the design of a liner system over refuse, design of an underdrain system to control groundwater, and upgrading the site's surface water control facilities to accommodate a 1,000 year storm. The design required regulatory variances for a proposed engineered alternative to the State's groundwater separation requirement, and for an alternative liner system that utilized a geosynthetic clay liner in place of two feet of compacted clay.

Class II Landfill **Contra Costa County, California**
Design Engineer for a proposed large, regional municipal waste landfill facility. The project involved the preparation of conceptual site development drawings and the preparation of construction drawings and specifications for the initial 25-acre cell. Responsible for providing geotechnical recommendations for construction of the main access road, which included a 100-foot span bridge and required remediation of several landslides.

Landfill Closures **Presidio of San Francisco, California**
Project Manager for the investigation and closure design for two abandoned landfills. The closures are being implemented as part of a remediation and restoration program at Presidio military facility under the direction of the U.S. Army Corp of Engineers. Responsible for overall project management including scheduling, budget tracking, review of field data and closure cover design. Field investigation includes the use of geophysics (ground penetrating radar and electromagnetic surveys) to define the limits and depth of waste.

Class II Impoundment **Novato, California**
Project Manager for the design of a nine acre leachate storage and evaporation pond. The primary technical issues included foundation stability and settlement due to underlying Bay Mud soils.

Class III Landfill **Fremont, California**
Project Manager for feasibility study completed for the expansion of a Class III landfill over native Bay Mud. The project involved the evaluation of six development alternatives with respect cost, airspace, and technical issues such as stability, settlement and wetlands mitigation. The conceptual development was based on state and federal (Subtitle D) requirements for municipal waste landfills.

Class II Landfill **San Jose, California**
Performed borrow source investigations to identify cost-effective clay sources that could be used to construct low-permeability soil liners. Completed evaluations and assisted in identifying more than eight alternative clay sources. Provided design support for evaluating slope stability impacts of proposed design revisions to a Class II landfill cell. Also responsible for the design of a 50 foot-high, geogrid-reinforced toe berm that was constructed as part of the development of Class II Landfill.

Kenneth G. Haskell, P.E.

Municipal Waste Landfill — Arlington, Oregon

Resident Engineer for the construction of a 30-acre cell (Module 2) at the Columbia Ridge Landfill. Responsibilities included overall CQA management; coordinating construction activities between contractors; review of contractor invoices and quantities calculations; and management of on-site CQA staff. Responsibilities also included evaluation of borrow sources for use as a clay liner; the installation, monitoring, and evaluation of two sealed, double-ring infiltrometers; and completion of a trial field program using a BAT permeameter. Project Manager for the construction of the subsequent 32-acre cell (Module 3).

Municipal Waste Landfill — Arlington, Oregon

Project Manager for the evaluation of the on-site materials for use in constructing cover systems for two, small abandoned landfills owned by the County. The project involved laboratory testing and the preparation of placement and compaction recommendations for the soil cover.

Bow Lake Landfill — King County, Washington

Project Manager for an investigation that was completed to determine the limits of refuse for an abandoned landfill. The project primarily utilized non-intrusive investigation techniques such as aerial photograph interpretation and ground penetrating radar (GPR). A selected number of test pits were excavated to confirm the interpretations.

Class II Altamont Landfill Expansion, Livermore, California

Design Engineer for the development of a 120 acre landfill that included both a vertical expansion over existing refuse and a lateral expansion over native ground. The project involved a comprehensive design effort that consisted of an evaluation of alternative base grades and cell geometries; a cost-benefit analysis of the various alternatives; and the design of the liner and leachate collection and removal systems, groundwater collection system, gas collection system, surface water control facilities, closure cover system, and construction sequencing. The project provided several technical challenges that included the design of a liner system over refuse, design of an underdrain system to control groundwater, and upgrading the site's surface water control facilities to accommodate a 1,000 year storm. The design required regulatory variances for a proposed engineered alternative to the State's groundwater separation requirement, and for an alternative liner system that utilized a geosynthetic clay liner in place of two feet of compacted clay. Investigated and designed remediation measures for several landslides. Responsible for directing field investigation, interpretation of failure mechanisms, development of remediation alternatives with associated cost impacts, preparation of construction plans, and giving presentations to the regulators. Designated as the Engineer of Record for several construction projects at the site with a cumulative construction cost of more than $15 million.

Western Regional Landfill, Placer County, California

Technical Reviewer for CQA services for geosynthetics liner for 6 acres of the Western Regional Landfill in Placer County, California.

John Smith Road Class I and Class III Closure/Post-Closure Maintenance Plans, Hollister, California

Project Manager for the preparation of Closure/Post-Closure Maintenance Plans for San Benito County's John Smith Road landfill. The project include the design of a cover system, evaluation of slope stability, an assessment of seismic ground motions, and the preparation closure/closure plans in accordance with Title 14, California Code of Regulations.

Marsh Canyon Class II Landfill, Contra Costa County, California

Design Engineer for a proposed large, regional municipal waste landfill facility. The project involved the preparation of conceptual site development drawings and the preparation of construction drawings and specifications for the initial 25-acre cell. Responsible for providing geotechnical recommendations for construction of the main access road, which included a 100-foot span bridge and required remediation of several landslides.

Presidio Landfill Closures, Presidio of San Francisco, California

Project Manager for the investigation and closure design for two abandoned landfills. The closures are being implemented as part of a remediation and restoration program at Presidio military facility under the direction of the U.S. Army Corp of Engineers. Responsible for overall project management including scheduling, budget tracking, review of field data and closure cover design. Field investigation includes the use of geophysics (ground penetrating radar and electromagnetic surveys) to define the limits and depth of waste.

Redwood Class II Impoundment, Novato, California

Project Manager for the design of a nine acre leachate storage and evaporation pond. The primary technical issues included foundation stability and settlement due to underlying Bay Mud soils.

Geotechnical Investigation for Landfill Closure, Berkeley Landfill Berkeley, California

Performed geotechnical investigation to provide recommendations for landfill closure. Also provided field engineering services during earthwork construction for the City of Berkeley. Performed construction quality control during installation of gas recovery system within the landfill.

Landfill Foundation Investigation, Sejorong River Area, Sumbawa, Indonesia

Conducted a geotechnical field investigation to assess a proposed area in the Sejorong River Valley for a landfill. Investigation included exploratory borings, test pit excavations, sampling, and laboratory testing of soil samples for foundation design and landfill liner construction. Monitoring wells and piezometers were also constructed for long-term groundwater quality and levels.

Landslide Investigation Water Treatment Facility for Confidential Landfill Site California

Supervised and performed engineering design for the emergency response for remediation of a landslide for a critical water treatment facility at an existing landfill. Investigation phase included subsurface investigation, geotechnical laboratory testing, monitoring well and slope inclinometer installations. Design to stabilize the treatment plant included reinforced drilled piers with anchor bolts (tiebacks) drilled into underlying bedrock. To stabilize the parking area, soldier beam and tiebacks were designed. Supervised the field engineering during the construction of the various designed systems.

Landslide Investigation for Confidential Landfill, California

Performed emergency response for the remediation of a 450,000 cy landslide which failed into a waste containment cell. Investigation phase included field reconnaissance and mapping of the slide. During the emergency design, stability analyses were performed to assess existing conditions and remediation options.

Aggregate Source Investigation, Sejorong and Sekongkang River Systems Sumbawa, Indonesia

Performed geotechnical field investigation to assess quantity and quality of aggregate materials (sand, gravel, cobbles, and boulders) within the Sejorong and Sekongkang River Systems. Aggregate material was proposed for use in concrete production and riprap for the construction of roadways, mining and port facilities for the proposed Batu Hijau gold and copper mine.

Foundation Investigation, Benete Port Facility, Sumbawa, Indonesia

Conducted geotechnical field investigation for proposed port facility for the proposed Batu Hijau gold and copper mine. Field investigation consisted of borings using portable drill rigs and exploratory test pits using trackhoe excavator. Site located on liquefiable sand deposits, expansive clay, and hard volcanic bedrock.

Landslide Remediation for Ring Mountain Residential Developments, Tiburon, California

Provided geotechnical consultation for residential hillside developments for various private lot owners. Services include geotechnical investigation, foundation design, building plan review, and construction observation. Resident Feld Engineer during initial mass construction phase of hillside development, landslide repairs, and site grading.

Landslide Remediation/Repair, Petaluma, California

Provided field engineering services during landslide repair at Country Club Estates for Leonard Jay Enterprises.

Seismic Upgrading/Geotechnical Investigation, San Francisco, California

Conducted geotechnical investigation for seismic upgrade of a 2-story building at 520 Howard Street. Services included observation of test pit excavations and recommendation of allowable bearing capacity for upgraded building.

Geotechnical Investigation, San Francisco, California

Managed geotechnical investigation for a proposed DiSulveo sculpture near Embarcadero and Berry Street for SFRA. Recommendations included allowable bearing pressures.

Foundation Investigation, Point Reyes, California

Performed geotechnical investigation to provide recommendation for pile foundation at Drakes Beach Visitor Center addition for Point Reyes National Seashore Association.

Seepage Remediation, San Francisco, California

Provided construction on remediation of seepage problems associated with Fire Station No. 28 located in the North Beach area of San Francisco for the City of San Francisco.

Geotechnical Consultation for Deep Excavation, San Francisco, California

Provided geotechnical consultation during deep excavation by others adjacent to the San Francisco Newspaper's Army Street facility. Concern was potential building movement due to excavation activities and potential damage to printing presses with a low tolerance of settlement.

Ricardo L. Zepeda, Ph.D.

Golder Associates

Education Ph.D., University of California, Santa Barbara, Geological Sciences, 1993.
M.A., University of California, Santa Barbara, Geological Sciences, 1987.
B.S., University of California, Los Angeles, Earth and Space Sciences, 1980.

Affiliations Geological Society of America.
Association of Engineering Geologists.

Experience

Golder Associates, Oakland, California, Project Geologist

Responsible for geologic and hydrogeologic characterization and evaluation of geologic, seismotectonic, and volcanotectonic hazards associated with the siting and management of solid, hazardous, and nuclear waste facilities.

Relevant Project Experience

Kettleman Hills Facility, Kettleman City, California

Project Geologist for the seismotectonic evaluation of the Kettleman Hills Facility, Kettleman City, California. Work involved detailed geologic mapping of the Landfill B-18, Phase I and Phase II, subgrade in order to locate structural discontinuities, such as faults and joints.

Kirby Canyon Landfill, San Jose, California

Project Geologist for the seismotectonic evaluation of the Kirby Canyon Landfill, located in the southern San Jose, California. Work involved detailed geologic mapping of subgrade of Cell 2/5 in order to locate structural discontinuities, such as faults, shears, and joints. Data collection included detailed geologic mapping and fault trenching to be used in seismic design of the facility.

Lawrence Livermore National Laboratories, Pit 6 Landfill, Livermore, California

Project Geologist for the probabilistic seismic hazard assessment for the closure cover design for the Pit 6 Landfill at LLNL. Work included collection and review of data and evaluation of various earthquakes scenarios on a Holocene active fault mapped within 100 feet of the site.

Elk Hills Naval Petroleum Reserve Hazardous Waste Facility, Southern San Joaquin Valley, California

Project Geologist for auger soil sampling at the Elk Hills Naval Petroleum Reserve, southern San Joaquin Valley, California.

Altamont Landfill, California

Project Geologist for the geologic and hydrogeologic characterization at the Altamont Landfill. Work included detailed subgrade geologic mapping and bedrock landslide remedial investigations and evaluation as input for remedial design.

Palo Verde Nuclear Generating Station, Phoenix, Arizona

Project Geologist for the evaluation of the probabilistic seismic hazard to the Palo Verde Nuclear Generating Station. Work included identification and description of regional seismic sources within 300 km possibly capable of generating earthquakes greater than magnitude 5. Maximum magnitudes for seismic sources were developed along with activity rate, b-value, and estimates of probability of activity.

Idaho National Engineering Laboratory, Snake River Plain, Idaho
Project Geologist for the geologic and hydrogeologic characterization of the Idaho National Engineering Laboratory. Work involved the development of RCRA monitoring wells.

Proposed Marsh Canyon Landfill, Contra Costa County, California
Project Geologist for the seismotectonic evaluation of the proposed Marsh Canyon Landfill in Contra Costa County, California. Work included trenching of possible fault locations and the collection of soil geomorphic data used to determine relative ages of the unfaulted surface.

Proposed Sonoma County Landfill, Sonoma County, California
Project Geologist for the seismotectonic evaluation of a proposed landfill in Sonoma County, California. Work included detailed geologic mapping, test pitting, and installation of piezometers. Also reviewed detailed mapping of fault trenches and soil geomorphic analysis by another consultant.

University of California, Santa Barbara, San Joaquin Valley, California
Research Assistant for the evaluation of active tectonics, associated earthquake hazard, and soil chronology, Wheeler Ridge area, southern San Joaquin Valley, California. Work involved use of geophysical data, remote sensing analysis, radiometric dating techniques, soil description and classification, paleomagnetic analysis, and writing of U.S. Geological Survey end reports and semi-annual reports.

University of California, Santa Barbara, California
Geologist for the evaluation of active tectonics and associated earthquake hazard, Santa Barbara area, California. Work involved use of remote sensing, marine terrace analysis, tectonic geomorphology, and soil description and classification.

Simi Valley Landfill, Simi Valley, California
Project Geologist for the decommissioning of leachate monitoring wells and conducted detailed geologic mapping, and installed and sampled water monitoring wells at the Simi Valley Landfill, Simi Valley, California.

Municipal Waste Facility, San Leandro, California
Project Geologist for the hydrogeologic characterization and evaluation of a ruptured liner at a closed municipal waste facility. Work involved an extensive program of test pits.

Proposed Municipal Landfill Site, Albuquerque, New Mexico
Consulting Geologist for the seismotectonic evaluation of a proposed municipal waste facility, Albuquerque, New Mexico. Work involved detailed trench logging, soil geomorphic analysis, and collection of seismic refraction data.

U.S. Geological Survey. Menlo Park, California
Geologist responsible for field mapping following the 1980 Mammoth Lakes earthquakes, California; included evaluation of post-earthquake geodetic data from Mammoth Lakes, California. Analysis and reduction of seismic data from the 1979 Imperial Valley Earthquake, California. Geodetic monitoring of faults in the Imperial Valley, California.

Proposed Rockwell Urban Center, Manila, Philippines
Project Geologist for the paleoseismic investigation of a proposed urban center where a previously-mapped fault associated with a nearby active fault was projected into the site. Work included collection and review of data, geomorphic interpretation of stereoscopic aerial photographs, field geologic and aerial reconnaissance, and the examination of more than 310 m of exposure in 6 trenches across the projection of the splay.

Proposed Gold Mine, Northeast Washington
Project Geologist for the paleoseismic investigation of a proposed mine where a mapped fault projects through the proposed tailings disposal facility. Work included collection and review of data, geomorphic interpretation of stereoscopic aerial photographs, and field and aerial reconnaissance.

Proposed Gold Mine, Republic of Kyrgyzstan
Project Geologist for the field investigation of the seismotectonic hazard for a proposed open pit gold mine in the Republic of Kyrgyzstan (former Soviet Union). Work included aerial reconnaissance, detailed geologic and geomorphic mapping of five suspect lineaments, and EM-34 geophysical surveys.

Proposed Gold Mine, Magadan District, Far East Siberia
Project Geologist for the preliminary evaluation of the seismotectonic hazard of a proposed gold mine in Far East Siberia. The work included interviews of researchers working in the area, as well as the collection and evaluation of seismic hazard data, resulting in the development of a preliminary estimate of the peak acceleration possible at the site.

Proposed Gold-Copper Mine, Sumbawa Island, Indonesia
Project Geologist for the preliminary seismotectonic evaluation of a proposed mine on the island of Sumbawa, Indonesia. The work involved the collection and evaluation of seismicity and seismic hazard data in order to provide a preliminary estimate of the peak acceleration possible at the site.

Federally-Owned Uranium Millsite, Monticello, Utah
Project Geologist for the re-evaluation of a topographic lineament possibly representing a capable (active) fault and potential surface rupture hazard for a Federally-owned uranium millsite in Monticello, Utah. Work included review of geophysical investigation performed by others following the completion of the original 1992 investigation performed by Golder Associates.

500 Kv Addition, Mead Substation, Boulder City, Nevada
Project Geologist for the probabilistic seismotectonic hazards analysis for a proposed 500 Kv addition to the Mead Substation near Boulder City, Nevada. The investigation included the collection and review of available literature, data, and maps regarding the geology, structure, tectonics, and seismology of the region and the site vicinity.

Seismic Hazard/National Building Code, His Majesty's Government of Nepal
Project Geologist for the United Nations-funded evaluation of seismic hazard and risk assessment for the preparation and implementation of a national building code for His Majesty's Government of Nepal. Work included identification and characterization of potential earthquake sources within 150 km of the Nepal border, identification and characterization of potential secondary seismic hazards, and development of seismic hazard maps for Nepal.

Idaho National Engineering Laboratory, Snake River Plain, Idaho
Project Geologist for the evaluation of seismotectonic and volcanotectonic hazards of 3,200 km^2 area at Idaho National Engineering Laboratory (INEL), eastern Snake River Plain, Idaho, to satisfy requirements of Integrated Safety Analysis Report (ISAR). Study included an extensive literature review, interpretation of aerial photographs, and detailed geologic mapping.

Proposed Marsh Canyon Landfill, Eastern San Francisco Bay Area, California
Project Geologist for the seismotectonic evaluation of the proposed Marsh Canyon Landfill in the eastern San Francisco Bay Area, California. Work included fault trenching and the collection of soil geomorphic data used to determine relative ages of the unfaulted surface.

Ricardo L. Zepeda

Proposed Municipal Waste Facility, Albuquerque, New Mexico

Consulting Geologist for the seismotectonic evaluation of a proposed municipal waste facility, Albuquerque, New Mexico. Work involved detailed trench logging, soil geomorphic analysis, and collection of seismic refraction data.

University of California, Santa Barbara, San Joaquin Valley, California

Consulting Geologist for the evaluation of active tectonics and soil chronology of the southern San Joaquin Valley, California.

Los Alamos National Laboratory (LANL), Los Alamos, New Mexico

Project Geologist for the hydrogeologic characterization of Operable Unit 1144, Technical Area 49, at the Los Alamos National Laboratory, New Mexico. Work involved drilling and sampling of boreholes in an area where hydronuclear tests were performed during the mid-1960's; 80% of the LANL plutonium is located at this site.

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APPENDIX B. SOIL BORROW REPORT

Golder Associates Inc.

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Golder Associates

July 28, 1997

Ref: 973-7166

Environmental Science Associates
301 Brannan Street, Suite 200
San Francisco, California 94107

ATTENTION: Mr. Tom Roberts

RE: INTERIM STATUS REPORTSOIL BORROW AND GEOTECHNICAL EVALUATIONS COLDWATER CREEK RESTORATION PROJECT

Dear Mr. Roberts:

Golder Associates Inc. (Golder) is pleased to provide this interim status report on our soil borrow source investigation and geotechnical evaluations for the Coldwater Creek Project Restoration Plan. This status report summarizes our work to date and addresses the following issues:

- The location, approximate quantities and material composition of available on-site borrow sources;
- Geotechnical stability of well pad sites; and
- Estimated amount of the well pad surfaces that are comprised of fill soils and/or native materials.

These issues are discussed in detail below.

1. SOIL BORROW SOURCE INVESTIGATION

A soil borrow investigation was completed to identify potential soil sources for the proposed site restoration. In general, the soil borrow investigation consisted of a review of available geologic maps of the area, review of infrared aerial photographs provided by CCPA (approximately scale 1:6,000), and completion of a field reconnaissance to confirm the suitability, feasibility, and approximate volumes of potential sources. The reconnaissance was performed on May 8, 9, and 11, 1997

Based on discussions with CCPA and ESA personnel, areas that were excluded from consideration include the following:

- Obvious environmentally sensitive areas such as "wet" meadows, the Caldwell Pines area, and areas with a large concentration of oaks;

- Area 4 due to its relatively far distance from the majority of the restoration work; and

- Areas with less than 5,000 cubic yard (cy) of soil borrow. We have assumed that it would be preferable to limit disturbances to a few, relatively large sources instead of numerous, smaller sources.

The borrow investigation identified five significantly different types of borrow materials, which are summarized below.

- **Colluvium (Qls).** Colluvial deposits are associated with Quaternary landslides mapped in the area (Bedrossian, 1980). The colluvial soil generally consists of firm to stiff, brown, sand, silt, and clay with little to some gravel and cobble sized clasts. Occasional boulders may be present, although landslides with boulders exposed at the ground surface were generally avoided during the reconnaissance. Colluvial bedrock associated with the landslides is expected to consist of silt- and clay-rich metasediment that is moderately to highly weathered.

- **Tuff (Clay).** The tuff is exposed in a slope immediately east of Well Pad Site 2-3.3 The tuff is highly to completely weathered, massive to coarsely bedded, reddish brown to red, mostly clay with some medium sand, and very weak where exposed. Site personnel indicated that this material was used during construction for lining sump ponds.

- **Chert.** The chert bedrock is moderately to slightly weathered, strongly bedded, brown and green, very fine grained, and weak to very strong. The bedrock is strongly jointed and readily fractures with handling resulting in mostly gravel sized rock with 25 to 50 percent silty sand. Where exposed at the permitted borrow site (Figure 1; Site 1-6.4-(A)), the material near the surface is weak to medium strong, while the more deeply excavated material is very strong. Site personnel indicate that the borrow material has previously been excavated with no difficulty using a dozer.

- **Metasediment.** The metasediment bedrock is moderately to slightly weathered, massive to coarsely bedded, generally strongly jointed and relatively highly fractured, brown and olive brown, contains varying amounts of sand, silt, and clay, and is medium strong to very strong. Similar to the chert, the metasediment readily fractures with handling resulting in mostly gravel-sized rock with 25 to 50 percent silty sand. Due to the higher silt and clay content of the rock materials, the metasediment will break down to a soil material with time more readily than the chert. Metasediments are generally moderately weathered

within about 10 feet of the surface. However, weathering was observed to extend as deep as 20 feet in some locations.

- **Fill.** Fill material occurs at the "boneyard" and generally consists of loose to compact, brown, massive gravel with 25% to 50% fines. The majority of this fill appears to be derived from adjacent exposures of metasediment bedrock.

The location and estimated volumes of the borrow material are described below. These areas need further review by qualified team members to determine if they are located within areas that may be considered biologically or archaeologically environmentally sensitive. The borrow material locations are identified in Figure 1 and the volume estimates are indicated in Table 1. Soil quantities for each source should be considered approximate and were based on the aerial extent and depths that were estimated from available soil exposures.

Site 1-6.4. Site 1.6-4 consists primarily of the existing permitted borrow site. Additional borrow material was identified in the areas immediately adjacent to the existing borrow site. The existing borrow and adjacent sites are shown in Figure 1 and include the following materials and volumes:

- Area A consists of chert and is a permitted borrow area for the site. An estimated 10,000 to 15,000 cy of chert borrow material is available; and is generally consistent with CCPA's estimate.

- Area B consists of metasediment that appears to be moderately weathered to at least 10 to 15 feet in depth. The area contains about 2,500 cy of metasediment borrow material.

- Area C consists of metasediment that appears to be moderately weathered from 10 to 15 feet in depth. Area C contains about 3,000 cy of metasediment borrow material.

- Area D consists primarily of metasediment that appears to be moderately weathered from 10 to 15 feet in depth. Some bedrock is exposed along the ridge crest. An estimated 20,000 to 35,000 cy of metasediment borrow material is available.

Ridge Adjacent to the Power Plant Site. The Power Plant site lies west and southwest of a ridge and knob consisting of moderately to slightly weathered, medium strong to very strong, metasedimentary bedrock. The material within about 10 to 15 feet of the ground surface is generally moderately weathered. Area A straddles the Sonoma and Lake County line, while Area B lies entirely within Sonoma County. For Area A, assuming the upper 10 to 15 feet of the more weathered material is removed, approximately 30,000 to 50,000 cy of metasediment borrow material is available. If the borrow is limited to within Sonoma County (Area B), an estimated 20,000 to 25,000 cy of material is available.

Site 2-3.3 (Area A). This area consists of mostly fine grained tuff which has weathered to clay. An estimated 25,000 to 30,000 cy of clay borrow material is available.

Site 3-7B.2 (Area A). Borrow material at Site 3-7B.2-(A) consists of colluvial bedrock that is weak to very weak and highly weathered metasediment. An estimated 5,000 cy of colluvial borrow material is available. The material is actively failing onto the access road and the slope may require remediation (e.g., excavation to locally flatten the slope).

Site 3-7B.2-B (Area B). This area includes fine-grained colluvial soil associated with a Quaternary landslide. The ground surface is generally hummocky with no boulders exposed. An estimated 5,000 cy of material is available if the borrow is constrained to the open meadow, which is surrounded by oaks.

Site 3-7A.2 (Area A). This area consists of an apparent fine-grained colluvial soil associated with a Quaternary landslide; the ground surface is generally hummocky with no boulders exposed. An estimated 5,000 cy of material is available.

Site 3-8.3 Two landslides were identified southwest of Site 3-8.3 that may provide borrow materials. These areas include:

- Area A. This borrow area consists of a primarily fine-grained colluvial soil associated with a Quaternary landslide. The ground surface is generally hummocky with no boulders exposed. An erosional rill in the central part of the landslide has exposed mostly fine-grained soil to a depth of 8 to 10 feet. Assuming the material is about 10 to 15 feet thick, an estimated 20,000 to 25,000 cy of material is available from this landslide.

- Area B. This area consists of an apparent fine-grained colluvial soil associated with a Quaternary landslide. The ground surface is generally hummocky with no boulders exposed. Assuming the material is about 10 feet thick, an estimated 2,000 cy of material is available.

"Boneyard". The "boneyard" is composed primarily of fill derived from metasedmentary bedrock and native metasedimentary bedrock includes Area A and Area B on the north and south sides of the access road, respectively. In Area A, a small area approximately 30 feet by 30 feet of red clay imported from Site 2-3.3 was observed. An estimated 20,000 to 30,000 cy of borrow material is available at the "boneyard"

Table 1. Borrow Material Volume Estimates

Borrow Material	Borrow Area Location	Estimated Volume (cubic yards)	Estimated Area (Square feet)
Colluvium (Qls)	Site 3-7A.2-(Area A)	5,000	15,000
	Site 3-7B.2 (Area A)	5,000	15,000
	Site 3-7B.2 (Area B)	5,000	15,000
	Site 3-8.3 (Area A)	20,000-25,000	50,000
	Site 3-8.3 (Area B)	2,000	5,000
Chert	Site 1-6.4-(Area A)	10,000 - 15,000	8,000
Fill	"Boneyard" (Area A and Area B)	20,000-30,000	65,000
Metasediment	Site 1-6.4 (Area B)	2,500	7,500
	Site 1-6.4 (Area C)	3,000	10,000
	Site 1-6.4 (Area D)	20,000-35,000	65,000
	Power Plant (Area A)	30,000-50,000	80,000
	Power Plant (Area B)	20,000-25,000	60,000
Tuff (Clay)	Site 2-3.3 (Area)	25,000-30,000	40,000

2. GEOTECHNICAL STABILITY OF WELL PADS

The site's 16 well pads were investigated to determine if there were any major geotechnical stability issues that need to be addressed by the restoration plan. Our investigation included a review of available geotechnical reports for the well pad construction, well pad as-built drawings, and a site reconnaissance of each well pad site. The reconnaissance was performed on May 8, 1997. In general, our investigation indicates that the potential of deep-seated, slope failures is not likely at any of the well pad sites. However, many of these sites exhibit excessive erosion or the potential for excessive erosion. Therefore, long-term geotechnical stabilization measures will predominately consist of implementing standard erosion control measures during restoration. These erosion control measures are summarized below.

Erosion/Damage Control

Existing erosion control/drainage consist of either the use of corrugated metal piping (CMP), rip-rap, or drainage along native material (i.e. no engineered drainage control). Most well pads onsite utilize CMP as part of the drainage controls. Due to the limited life and ongoing maintenance issues related to CMP, the CMP erosion control/drainage system

should be replaced with a more permanent, low maintenance system consisting of elements such as a drainage ditch lined with gunite and/or riprap. Areas with existing rip-rap may need to be redesigned to adequately accommodate anticipated runoff. In addition, several of the well pads exhibited significant erosion that should be repaired during the restoration. A summary of the existing erosion/drainage controls and well pads with significant erosion requiring repair is presented in Table 2.

Debris Flow Adjacent to Pad 1-5A.4

We observed during our site visit that the gully continues to show an erosional scar. It appeared that the winter rains of 1997 saturated the area and continued to erode and expand the erosional gully. The exisiting erosional gully is located on a steep slope. It appears to be impractical to repair the gully to create a stable slope. However, there still is a small bench area above the gully that provides a small contributing area of runoff to the gully. To reduce the likelihood of future instability and erosional problems, it would be prudent to perform minor regrading of the bench area such that all water is directed to drainage areas on either side of the gully. Due to the potential for erosion gully to expand, it would be prudent to remove any remaining sump contents and transfer this material from well pad 1-5A.4 to another location onsite.

3. QUANTITY FILL AND NATIVE MATERIALS

Table 2 summarizes the relative proportion of each well pad surface that is comprised of native materials and fill soils. This estimate was based on our site reconnaissance and examination of as-built drawings. The site reconnaissance was performed on May 8, 1997.

We have enjoyed this opportunity to work with ESA and CCPA on this project. Please call if you have any questions or require additonal information.

Sincerely,

GOLDER ASSOCIATES INC.

FOR
Craig A. Hall, P.E.
Senior Engineer

Kenneth G. Haskell, P.E.
Associate

Attachments: Figure 1 - Borrow Material Locations
Table 2 - Summary of Drill Pads

Table 2.
Summary of Well Pads
Coldwater Creek Restoration Plan

Drill Pad	Visual Estimate		Plan Review Result			Existing Type of Culvert or Erosion Controls
	pproximat Cut (%)	Approximate Fill (%)	Approximate Cut (%)	Approximate Fill (%)	Approx Max. Fill Thickness (ft)	
1-5A.4	10	90	20	80	8	None*
1-6.4	80	20	80	20	-	CMP
1-3.4	10	90	100	0	0	CMP
1-4.4	20	80	40	60	16	CMP
1-5.3	90	10	0	100	5	None*
1-7.4	10	90	10	90	20	CMP
1-9.4	80	20	50	50	25	CMP
2-3.3	50	50	50	50	25	CMP
2-4.7	10	90	10	90	10	Rip-Rap*
2-5.7	50	50	50	50	10	Rip-Rap
2-7C.2	10	90	50	50	20	CMP
2-8.2	90	10	50	50	14	CMP*
2-11.7	40	60	60	40	20	None*
3-1.3	0	100	10	90	20	None*
3-7A.2	0	100	10	90	6	CMP
3-7B.2	0	100	50	50	15	CMP*
3-8.3	50	50	50	50	10	CMP
WH-2	90	10	-	-	-	CMP*

Note: * Denotes Well Pad Requiring Erosion Repairs

APPENDIX C. FACILITIES INVENTORY DATA SHEETS

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B. LEITNER

FACILITY: POWER PLANT
DATE CONSTRUCTED: 1985
SIZE OF LEVEL SURFACE: 8.3 AC
REFERENCE AIRPHOTO: 8-17-92 3-6

CONDITION OF SUMP (OPEN, CLOSED):NONE

CUT SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: ***
BENCHED? YES
HOW MANY BENCHES:2
REVEGETATION HISTORY:
MAY HAVE BEEN HYDROSEEDED

NOTES ON NATURAL REVEGETATION:
****

FILL SLOPE DATA:
APPROXIMATE SIZE: 2-3 AC
ASPECT: WEST
REVEGETATION HISTORY:
TREE AND SHRUB PLANTINGS INSTALLED SOON AFTER CONSTRUCTION AND MONITORED BY OSTERLING AND OTHERS.

NOTES ON NATURAL REVEGETATION:
***

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: MIXED CHAPARRAL

DEER PELLET GROUP COUNT (TAKEN ALONG LONG AXIS OF WELL PAD THROUGH CENTER): N/A

REMARKS:

USE OF SOIL CAP OVER MOST EXISTING ASPHALT AND CONCRETE SURFACES IS CURRENTLY UNDER CONSIDERATION. LARGE BASINS MAY BE PARTIALLY FILLED AND WETLAND VEGETATION ENCOURAGED. RETAINING WALL TO BE LEFT IN PLACE.

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B. LEITNER

FACILITY: VENT AND MAINLINE SEPARATOR STATION
DATE CONSTRUCTED: 1985
SIZE OF LEVEL SURFACE: ABOUT 2-3 AC
REFERENCE AIRPHOTO: 8-17-92 3-6

CONDITION OF SUMP (OPEN, CLOSED):NONE

CUT SLOPE DATA:
APPROXIMATE SIZE: NONE DISCUSSED HERE, BUT SEE DISCUSSION OF LOWER SLOPE OF WELL PAD 2-11.7
ASPECT: N/A
BENCHED? N/A
HOW MANY BENCHES:N/A
REVEGETATION HISTORY:
N/A
NOTES ON NATURAL REVEGETATION:
N/A

FILL SLOPE DATA:
APPROXIMATE SIZE: SEE DISCUSSION OF FILL SLOPE FOR POWER PLANT
ASPECT: N/A
REVEGETATION HISTORY:
N/A
NOTES ON NATURAL REVEGETATION:
N/A

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: CHAPARRAL TO S; DEVELOPMENT ON OTHER SIDES

DEER PELLET GROUP COUNT (TAKEN ALONG LONG AXIS OF WELL PAD THROUGH CENTER): 0

REMARKS:

SOIL IS HEAVILY COMPACTED HERE; IT PROBABLY SERVED AS A LAYDOWN AREA DURING POWER PLANT CONSTRUCTION. IT IS LARGELY UNPAVED. THERE ARE A COUPLE OF BUILDINGS AND TANKS WITH CONCRETE FOUNDATIONS; THESE FOUNDATIONS SHOULD BE REMOVED.

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B. LEITNER

FACILITY: STEAM FIELD SHOP AND FIELD OFFICE
DATE CONSTRUCTED: 1987-88
SIZE OF LEVEL SURFACE: ABOUT 3 AC
REFERENCE AIRPHOTO: 8-17-92 3-11

CONDITION OF SUMP (OPEN, CLOSED):NONE

CUT SLOPE DATA:
APPROXIMATE SIZE: NONE
ASPECT: N/A
BENCHED? N/A
HOW MANY BENCHES:N/A
REVEGETATION HISTORY:
N/A
NOTES ON NATURAL REVEGETATION:
N/A

FILL SLOPE DATA:
APPROXIMATE SIZE: VERY SMALL
ASPECT: MOSTLY E AND S
REVEGETATION HISTORY:
MAY HAVE BEEN HYDROSEEDED

NOTES ON NATURAL REVEGETATION:
GRASSY; NO WOODY VEGETATION NOTED

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: OAK FOREST TO W AND N; OAK WOODLAND TO E AND S.

DEER PELLET GROUP COUNT (TAKEN ALONG LONG AXIS OF WELL PAD THROUGH CENTER): 0

REMARKS:

SURFACE IS ENTIRELY PAVED, MOSTLY WITH ASPHALT. BUILDING FOUNDATION AND SOME ADDITIONAL AREAS ARE CONCRETE.

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B. LEITNER

FACILITY: STEAM FIELD WAREHOUSE AND STORAGE YARD
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: ABOUT 4 AC
REFERENCE AIRPHOTO: ***

CONDITION OF SUMP (OPEN, CLOSED):NONE

CUT SLOPE DATA:
APPROXIMATE SIZE: SMALL; ADJACENT TO COLDWATER CREEK ROAD
ASPECT: SW
BENCHED? NO
HOW MANY BENCHES:N/A
REVEGETATION HISTORY:
APPARENTLY NONE
NOTES ON NATURAL REVEGETATION:
APPARENTLY GOOD; DATA TAKEN ON THIS CUT SLOPE FROM GATE TO END OF CUT

ARCTOSTAPHYLOS GLANDULOSA-11
CEANOTHUS INTEGERRIMUS-6
PICKERINGIA MONTANA-89
TOXICODENDRON DIVERSILOBUM-1
CEANOTHUS CUNEATUS-2
CERCOCARPUS BETULOIDES-5
PINUS ATTENUATA-1
TOTAL--115 INDIVIDUALS

FILL SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: SW TO N, MOSTLY SW TO W
REVEGETATION HISTORY:
HYDROSEEDED AND PLANTED WITH WOODY VEGETATION, BOTH TREES AND SHRUBS
NOTES ON NATURAL REVEGETATION:
N/A; REVEGETATION EFFORTS APPEAR SUCCESSFUL

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: CHAPARRAL

DEER PELLET GROUP COUNT (TAKEN ALONG LONG AXIS OF WELL PAD THROUGH CENTER): 0

REMARKS:

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B. LEITNER

FACILITY: SPOILS AREA
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: ABOUT 2.5 AC TOTAL, INCLUDING SLOPED AREAS
REFERENCE AIRPHOTO: 8-17-92 2-2

CONDITION OF SUMP (OPEN, CLOSED):NONE

CUT SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: S
BENCHED? N/A
HOW MANY BENCHES:N/A
REVEGETATION HISTORY:
APPARENTLY NO REVEGETATION CARRIED OUT HERE.
NOTES ON NATURAL REVEGETATION:
CUT SLOPES HAVE MUCH NATURAL REVEGETATION: CEANOTHUS CUNEATUS, LOTUS SCOPARIUS, PINUS SABINIANA, ARCTOSTAPHYLOS, ADENOSTOMA FASCICULATUM

FILL SLOPE DATA:
APPROXIMATE SIZE: N/A
ASPECT: N/A
REVEGETATION HISTORY:
N/A
NOTES ON NATURAL REVEGETATION:
N/A

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: CHAPARRAL

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): NOT TAKEN

REMARKS:

THIS AREA APPEARS TO BE REVEGETATING NATURALLY. IT HAS GOOD SOURCE MATERIALS NEARBY, AND APPEARS STABLE.

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B. LEITNER

FACILITY: TRANSMISSION LINE TOWERS
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: <<0.1 AC
REFERENCE AIRPHOTO: 8-17-92 2-4 SHOWS #1 AND #2; 2-2 SHOWS #3 AND #4.

CONDITION OF SUMP (OPEN, CLOSED):N/A

TOWER LOCATION DATA:	#1	#2	#3	#4	#5	#6
APPROXIMATE SIZE:	***					
ASPECT:	S	S	S	S	LEVEL	LEVEL

REVEGETATION HISTORY:
NONE DONE
NOTES ON NATURAL REVEGETATION:
NONE

SOIL TYPE: ***

SOIL INSTABILITY NOTED? ***

SURROUNDING VEGETATION TYPES: ***

DEER PELLET GROUP COUNT: NONE TAKEN

REMARKS:

THESE AREAS OF DISTURBANCE ARE QUITE SMALL. THEY HAVE BEEN SUBJECT TO MINIMAL COMPACTION, AND THERE ARE GOOD PROPAGATION SOURCES NEARBY. RECOMMEND LEAVING ALONE WITH NO SPECIAL TREATMENT EXCEPT INSTALLING WATER BARS ALONG ACCESS ROADS AFTER THE SUPPORT SECTIONS HAVE BEEN REMOVED AND SEEDING WITH AN HERBACEOUS MIX FOR EROSION CONTROL.

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B. LEITNER

FACILITY: THE BONEYARD
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: ABOUT 2.5 AC
REFERENCE AIRPHOTO: 8-17-92 2-4

CONDITION OF SUMP (OPEN, CLOSED): NONE

CUT SLOPE DATA:
APPROXIMATE SIZE: <<1 AC
ASPECT: S
BENCHED? NO
HOW MANY BENCHES:N/A
REVEGETATION HISTORY:
****
NOTES ON NATURAL REVEGETATION:
****

FILL SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: S AND SE
REVEGETATION HISTORY:
SOME PINUS PLANTED ON FILL SLOPES.
NOTES ON NATURAL REVEGETATION:
MUCH BROMUS DIANDRUS IN THE FILL SLOPE.

SOIL TYPE: GRAVELLY
ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS.

SURROUNDING VEGETATION TYPES: TO N AND S IS CHAMISE CHAPARRAL WITH SCATTERED FOOTHILL PINE AND INTERIOR LIVE OAK. TO SE PAST WELL PAD 1-5A.4 IS MIXED EVERGREEN FOREST. DENSER FOOTHILL PINE AND LIVE OAK IN THE DRAW TO THE SW OF THE BONEYARD.

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): 0

REMARKS:

THIS AREA SEEMS LESS COMPACTED THAN WELL PADS, AND MORE FINES IN THE SURFACE. PLOTS TAKEN IN UNDISTURBED CHAMISE CHAPARRAL NEAR THE BONEYARD.

IN TEN 2 SQ METER PLOTS (1MX2M) TAKEN IN CHAMISE CHAPARRAL, MEAN DENSITIES (PER SQ M) WERE:

ADENOSTOMA FASCICULATUM-2.35
TOXICODENDRON DIVERSILOBUM-0.1

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B. LEITNER

FACILITY: WILDHORSE 1 WELL SITE
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: <1 AC
REFERENCE AIRPHOTO: ***

CONDITION OF SUMP (OPEN, CLOSED): NONE

CUT SLOPE DATA:
APPROXIMATE SIZE: NONE
ASPECT: N/A
BENCHED? N/A
HOW MANY BENCHES: N/A
REVEGETATION HISTORY:
****
NOTES ON NATURAL REVEGETATION:
****

FILL SLOPE DATA:
APPROXIMATE SIZE: <1 AC
ASPECT: S
REVEGETATION HISTORY:
***
NOTES ON NATURAL REVEGETATION:
***

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: SPARSE OAK WOODLAND

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): NOT TAKEN

REMARKS:

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD WILDHORSE 2
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: ABOUT 2 AC
REFERENCE AIRPHOTO: ***

CONDITION OF SUMP (OPEN, CLOSED):***

CUT SLOPE DATA:
- APPROXIMATE SIZE: ***
- ASPECT: ***
- BENCHED? ***
- HOW MANY BENCHES:***
- REVEGETATION HISTORY:
  - ****
- NOTES ON NATURAL REVEGETATION:
  - ****

FILL SLOPE DATA:
- APPROXIMATE SIZE: ***
- ASPECT: ***
- REVEGETATION HISTORY:
  - ***
- NOTES ON NATURAL REVEGETATION:
  - ***

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? ENGINEERS NOTED SOME EROSION ON ACCESS TRAIL

SURROUNDING VEGETATION TYPES: OAK WOODLAND

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): NOT TAKEN

REMARKS:

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 1-3.4
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 1.89 AC
REFERENCE AIRPHOTO: 8-17-92 1-1

CONDITION OF SUMP (OPEN, CLOSED):OPEN

CUT SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: W
BENCHED? NO
HOW MANY BENCHES:N/A
REVEGETATION HISTORY:
APPARENTLY HYDROSEEDED
NOTES ON NATURAL REVEGETATION:
SEE BELOW

FILL SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: ***
REVEGETATION HISTORY:
HYDROSEEDED BUT NO WOODY PLANTINGS
NOTES ON NATURAL REVEGETATION:
SEE BELOW

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS. SEEP IN SERPENTINIZED ROCK AT NE CORNER OF PAD; IT AND DRAINAGE APPEAR STABLE.

SURROUNDING VEGETATION TYPES: CANYON LIVE OAK FOREST TO S; CHAPARRAL TO N

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): 15

REMARKS:

COUNTS OF SHRUBS TAKEN ON CUT AND FILL SLOPES DATA SHEET #1

	FILL	CUT
ADENOSTOMA FASCICULATUM	18	8
ARCTOSTAPHYLOS GLANDULOSA	1	23
CEANOTHUS CUNEATUS		8
QUERCUS WISLIZENII VAR .F.	10	
TOXICODENDRON DIVERSILOBUM	4	
BACCHARIS PILULARIS	1	9
LOTUS SCOPARIUS	2	41
PINUS SABINIANA		1
HYPERICUM CONCINNUM		1
ERIODICTYON CALIFORNICUM		88
HETEROMELES ARBUTIFOLIA		1

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 1-4.4 PRATI STATE #24 AND 54
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 2.1 AC
REFERENCE AIRPHOTO: 8-17-92 2-2

CONDITION OF SUMP (OPEN, CLOSED):CLOSED

CUT SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: S
BENCHED? NO
HOW MANY BENCHES:N/A
REVEGETATION HISTORY:
****
NOTES ON NATURAL REVEGETATION:

ADENOSTOMA FASCICULATUM		41
ARCTOSTAPHYLOS GLANDULOSA	2	
ARCTOSTAPHYLOS MANZANITA		4
CEANOTHUS CUNEATUS		12
CERCOCARPUS BETULOIDES	6	
PINUS SABINIANA	1	
CEANOTHUS FOLIOSUS		1
ERIODICTYON CALIFORNICUM		18
SOLANUM SP.	2	
LOTUS SCOPARIUS	18	

FILL SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: ***
REVEGETATION HISTORY:
APPARENTLY HYDROSEEDED
NOTES ON NATURAL REVEGETATION:
FILL SLOPE VERY GRASSY. ONE FOOTHILL PINE ESTABLISHED

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? MINOR EROSIONAL AREA ABOVE CUT SLOPE

SURROUNDING VEGETATION TYPES: FOOTHILL PINE SAVANNA, OAK CHAPARRAL TO W

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): 15

REMARKS:

NOTE!
PURPLE MARTINS NESTING IN FOOTHILL PINE SNAG ADJACENT TO CUT SLOPE
SNAG ALSO APPEARS TO BE USED BY BATS AS A ROOST

EXTENSIVE GRADED AREA TO N; SEEDED WITH GRASSES; LITTLE OR NO WOODY VEGETATION.

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 1-5.3 WILDHORSE 5
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 2 AC
REFERENCE AIRPHOTO: 8-17-92 2-6

CONDITION OF SUMP (OPEN, CLOSED):CLOSED

CUT SLOPE DATA:
APPROXIMATE SIZE: SMALL
ASPECT: SW
BENCHED? NO
HOW MANY BENCHES:N/A
REVEGETATION HISTORY:
SEVERAL SPECIES OF PINES (KNOBCONE, GRAY) WERE PLANTED ON CUT SLOPE.
NOTES ON NATURAL REVEGETATION:
SPARSE ANNUALS

FILL SLOPE DATA:
APPROXIMATE SIZE: FAIRLY LARGE
ASPECT: S, W, AND NW
REVEGETATION HISTORY:
***
NOTES ON NATURAL REVEGETATION:
HERBACEOUS GROWTH IS DENSE

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? SMALL SLIP ON NW-FACING SLOPE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: BLUE OAK WOODLAND TO N AND S, MIXED OAK WOODLAND TO NW IN DRAW.

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): 5

REMARKS:

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 1-5A.4 PRATI STATE 10 AND 12
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 2.0 AC
REFERENCE AIRPHOTO: 8-17-92 2-4

CONDITION OF SUMP (OPEN, CLOSED):CLOSED, BUT THERE IS A SLIGHT DEPRESSION IN FILL

CUT SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: S-FACING
BENCHED? NO
HOW MANY BENCHES:N/A
REVEGETATION HISTORY:
****
NOTES ON NATURAL REVEGETATION:
****

FILL SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: ***
REVEGETATION HISTORY:
***
NOTES ON NATURAL REVEGETATION:
VERY GRASSY, BOTH AVENA AND DACTYLIS

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? YES; EROSIONAL GULLIES BELOW WELL PAD. SEE ENGINEERING SECTIONS OF RESTORATION PLAN

SURROUNDING VEGETATION TYPES: MIXED CHAPARRAL DOWNSLOPE TO S AND W; MIXED EVERGREEN FOREST TO N AND E.

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER):DOUBLE TRANSECT TAKEN; 7 PELLET GROUPS IN WET AREA, 3 OUTSIDE

REMARKS:

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 1-6.4 PRATI #2 AND PRATI STATE #1
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 2.4 AC
REFERENCE AIRPHOTO: 8-17-92 4-2

CONDITION OF SUMP (OPEN, CLOSED):CLOSED

CUT SLOPE DATA:
- APPROXIMATE SIZE: ***
- ASPECT: S
- BENCHED? NO
- HOW MANY BENCHES:N/A
- REVEGETATION HISTORY:
  - NO TREATMENT
- NOTES ON NATURAL REVEGETATION:
  - SEE DATA SHEET #6. 3 CERCOCARPUS BETULOIDES ON CUT SLOPE.

FILL SLOPE DATA:
- APPROXIMATE SIZE: ***
- ASPECT: ***
- REVEGETATION HISTORY:
  - PROBABLY HYDROSEEDED
- NOTES ON NATURAL REVEGETATION:
  - SEE DATA SHEET #6. ELYMUS GLAUCUS NOTED ON THIS SLOPE. ALSO, 2 CEANOTHUS CUNEATUS, 4 CERCOCARPUS BETULOIDES.

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS ON WELL PAD, BUT DRAINAGE ON BORROW AREA TO THE N APPEARS TO BE CUTTING AN EROSIONAL PATH.

SURROUNDING VEGETATION TYPES: MIXED CHAPARRAL

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): NOT TAKEN

REMARKS:

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 1-7.4 PRATI 8 AND 9
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 2.82 AC
REFERENCE AIRPHOTO: 8-17-92 2-6

CONDITION OF SUMP (OPEN, CLOSED): CLOSED

CUT SLOPE DATA:
APPROXIMATE SIZE: LARGE
ASPECT: SW
BENCHED? YES
HOW MANY BENCHES:4
REVEGETATION HISTORY:
****
NOTES ON NATURAL REVEGETATION:
VERY ROCKY, NO WOODY REVEG NOTED.

FILL SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: S
REVEGETATION HISTORY:
***
NOTES ON NATURAL REVEGETATION:
ARMORED WITH ROCK. SOME TREES GROWING IN ROCK, THEY SEEM TOO LARGE TO HAVE GROWN SINCE PAD WAS CONSTRUCTED.

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? THIS PAD APPEARS TO BE ON A SLOPE WITH SOME NATURAL INSTABILITY. THE LANDFORMS HAD THE APPEARANCE OF HISTORIC LANDSLIDES, AND THERE WAS A SEEP AND AN EPHEMERAL DRAINAGE ON THE UPHILL SIDE OF THE PAD.

SURROUNDING VEGETATION TYPES: OAK-FOOTHILL PINE SAVANNA TO N AND W AND OAK WOODLAND TO S AND E.

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): NOT TAKEN

REMARKS:

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 1-9.4 PRATI #14
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 2.44 AC
REFERENCE AIRPHOTO: 8-17-92 3-5

CONDITION OF SUMP (OPEN, CLOSED):CLOSED; SOIL IS MOUNDED OVER THE SUMP

CUT SLOPE DATA:
APPROXIMATE SIZE: SMALL
ASPECT: E AND N
BENCHED? NO
HOW MANY BENCHES:N/A
REVEGETATION HISTORY:
HYDROSEEDED
NOTES ON NATURAL REVEGETATION:
SCANTY REVEGETATION ON E-FACING SLOPE, MOST APPARENTLY FROM ROOT SPROUTS.

FILL SLOPE DATA:
APPROXIMATE SIZE: SEVERAL SLOPES
ASPECT: N AND S
REVEGETATION HISTORY:
***
NOTES ON NATURAL REVEGETATION:

DATA TAKEN ON N-FACING SLOPE: ARCTOSTAPHYLOS GLANDULOSA-7
CEANOTHUS CUNEATUS-3
CEANOTHUS INTEGERRIMUS-2
CERCOCARPUS BETULOIDES-30
QUERCUS WISLIZENII VR F.-21
RHUS TRILOBATA-26
SOLANUM SP.-1
QUERCUS DUMOSA-2

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS.

SURROUNDING VEGETATION TYPES: CHAPARRAL

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): NOT TAKEN.

REMARKS:

A NUMBER OF DEER NOTED ON PAD DURING FIELD OBSERVATIONS. THIS SITE HAS MUCH ROSE CLOVER GROWING ON THE PAD.

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 2-3.3
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 2.5 AC
REFERENCE AIRPHOTO: ***

CONDITION OF SUMP (OPEN, CLOSED): OPEN, BUT NO EMERGENT VEGETATION

CUT SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: W
BENCHED? YES
HOW MANY BENCHES:2
REVEGETATION HISTORY:
****
NOTES ON NATURAL REVEGETATION:
NOT SAMPLED, BUT REVEGETATION SPREADING FROM THE TOP OF THE CUT SLOPE DOWN TOWARDS THE WELL PAD.

FILL SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: W
REVEGETATION HISTORY:
***
NOTES ON NATURAL REVEGETATION:
EXTENSIVE NATURAL REVEGETATION. TOP SLOPE (ABOVE TOP BENCH)
WOODY VEGETATION COUNTED:

ADENOSTOMA FASCICULATUM	3	PINUS ATTENUATA	3
ARCTOSTAPHYLOS GLANDULOSA	92	QUERCUS DURATA	1
CEANOTHUS CUNEATUS	11	PICKERINGIA MONTANA	4
ARCTOSTAPHYLOS CANESCENS	30	PSEUDOTSUGA MENZIESII	1
CEANOTHUS THYRSIFLORUS	5	QUERCUS WISLIZENII	13
CERCOCARPUS BETULOIDES	1	PINUS PONDEROSA	5
ARCTOSTAPHYLOS STANFORD.	4	ARCTOSTAPHYLOS MANZANITA	2

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? NONE NOTED

SURROUNDING VEGETATION TYPES: CHAPARRAL

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): NONE TAKEN

REMARKS:

AREA HAS COMBINATION OF FINE-TEXTURED FILL, W-FACING EXPOSURE, DIVERSE LOCAL SEED SOURCES, AND HIGH ELEVATION (HIGHER PRECIP). REVEGETATION IS APPARENTLY ALL NATURAL.

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 2-4.7
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 2.3 AC
REFERENCE AIRPHOTO: ***

CONDITION OF SUMP (OPEN, CLOSED):CLOSED

CUT SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: ***
BENCHED? ***
HOW MANY BENCHES:***
REVEGETATION HISTORY:
****
NOTES ON NATURAL REVEGETATION:
****

FILL SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: S
REVEGETATION HISTORY:
***
NOTES ON NATURAL REVEGETATION:
NO WOODY VEGETATION NOTED. GRASS GROWTH IS DENSE.

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? ***

SURROUNDING VEGETATION TYPES: OAK WOODLAND

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): ***

REMARKS:

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 2-5.7
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 1.9 AC
REFERENCE AIRPHOTO: 3-11

CONDITION OF SUMP (OPEN, CLOSED):CLOSED

CUT SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: W
BENCHED? YES
IF YES, HOW MANY BENCHES: 3
REVEGETATION HISTORY: ****
NOTES ON NATURAL REVEGETATION:

****

FILL SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: S, W, AND N
REVEGETATION HISTORY:***
NOTES ON NATURAL REVEGETATION:

***

SOIL TYPE: ***

ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: MIXED EVERGREEN FOREST TO NORTH; OAK SAVANNA TO S.

DEER PELLET GROUP COUNT (TAKEN ALONG LONG AXIS OF WELL PAD THROUGH CENTER): ***

REMARKS:

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97

FACILITY: WELL PAD 2-7C.2
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 2.3 AC
REFERENCE AIRPHOTO: ***

CONDITION OF SUMP (OPEN, CLOSED):OPEN

CUT SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: S
BENCHED? YES
IF YES, HOW MANY BENCHES: 1
REVEGETATION HISTORY: ****
NOTES ON NATURAL REVEGETATION:

****

FILL SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: S
REVEGETATION HISTORY:***
NOTES ON NATURAL REVEGETATION:

***

SOIL TYPE: ***

ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: CHAMISE CHAPARRAL UPSLOPE, BUT MOSTLY OAK SAVANNA

DEER PELLET GROUP COUNT (TAKEN ALONG LONG AXIS OF WELL PAD THROUGH CENTER): ***

REMARKS:

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 2-8.2 PRATI 8 AND 9
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 1.41 AC
REFERENCE AIRPHOTO: 8-17-92 2-6

CONDITION OF SUMP (OPEN, CLOSED):CLOSED

CUT SLOPE DATA:
APPROXIMATE SIZE: VERY MINIMAL
ASPECT: S?
BENCHED? NO
HOW MANY BENCHES:N/A
REVEGETATION HISTORY:
****
NOTES ON NATURAL REVEGETATION:
SPARSE HERBACEOUS.

FILL SLOPE DATA:
APPROXIMATE SIZE: VERY SMALL
ASPECT: S TO SE
REVEGETATION HISTORY:
***
NOTES ON NATURAL REVEGETATION:
ANNUAL HERBACEOUS VEGETATION ON FILL SLOPES. NO WOODY PLANTS.

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? SOME EROSION ON N SIDE; RUNOFF FROM WELL PAD IS CAUSING DOWNCUTTING

SURROUNDING VEGETATION TYPES: MIXED OAK WOODLAND ON N SIDE ALONG STREAM. BLUE OAK WOODLAND ON OTHER SIDES.

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): 0

REMARKS:

WE TRIED TO DO POINT-CENTERED QUARTER TREE TRANSECTS IN THIS AREA, BUT THE AREAS OF OAK WOODLAND WERE TOO SMALL. INSTEAD WE MAPPED AND COUNTED TREES FOR DENSITY.

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 2-11.7 PRATI #50
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 1.9 AC
REFERENCE AIRPHOTO: 8-17-92 3-6

CONDITION OF SUMP (OPEN, CLOSED):OPEN

CUT SLOPE DATA:
APPROXIMATE SIZE: LARGE
ASPECT: S-SW
BENCHED? YES?
IF YES, HOW MANY BENCHES:1?
REVEGETATION HISTORY:
****
NOTES ON NATURAL REVEGETATION:
NON-NATIVE GRASSES GROWING HERE.

FILL SLOPE DATA:
APPROXIMATE SIZE: LARGE
ASPECT: ONE AREA--S; ONE AREA--SW
REVEGETATION HISTORY:
***
NOTES ON NATURAL REVEGETATION:
ALL HERBACEOUS GROWTH ON F-FACING SLOPE ABOVE ROCK MUFFLER. A DENSE CHAMISE PATCH SUGGESTS THAT IT WAS LEFT INTACT DURING GRADING. S-SW-FACING SLOPE W OF MAIN ACCESS TO POWER PLANT IS PRIMARILY ANNUALS BUT WAS NOT SURVEYED IN DETAIL. IT APPARENTLY IS BENCHED.

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS.

SURROUNDING VEGETATION TYPES: MIXED CHAPARRAL TO N AND E; MOSTLY DISTURBED TO S. ??? TO WEST.

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): 0

REMARKS:

WE TOOK SOME SHRUB DENSITY PLOTS TO THE NORTH OF THIS WELL PAD.

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B. LEITNER

FACILITY: WELL PAD 3-1.3
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 2.4 AC
REFERENCE AIRPHOTO: ***

CONDITION OF SUMP (OPEN, CLOSED):OPEN

CUT SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: ***
BENCHED? NO
IF YES, HOW MANY BENCHES: N/A
REVEGETATION HISTORY: ****
NOTES ON NATURAL REVEGETATION:

****

FILL SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: WSW
REVEGETATION HISTORY:***
NOTES ON NATURAL REVEGETATION:

***

SOIL TYPE: ***

ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: OAK WODLAND/SAVANNA

DEER PELLET GROUP COUNT (TAKEN ALONG LONG AXIS OF WELL PAD THROUGH CENTER): ***

REMARKS:

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B. LEITNER

FACILITY: WELL PAD 3-7A.2
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 1.7 AC
REFERENCE AIRPHOTO: ***

CONDITION OF SUMP (OPEN, CLOSED):CLOSED

CUT SLOPE DATA:
APPROXIMATE SIZE: N/A
ASPECT: N/A
BENCHED? N/A
IF YES, HOW MANY BENCHES: N/A
REVEGETATION HISTORY: N/A
NOTES ON NATURAL REVEGETATION:

****

FILL SLOPE DATA:
APPROXIMATE SIZE: SMALL
ASPECT: S
REVEGETATION HISTORY: APPARENTLY HYDDROSEEDED
NOTES ON NATURAL REVEGETATION:

VERY GRASSY

SOIL TYPE: ***

ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: OAK SAVANNA

DEER PELLET GROUP COUNT (TAKEN ALONG LONG AXIS OF WELL PAD THROUGH CENTER): ***

REMARKS:

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B. LEITNER

FACILITY: WELL PAD 3-7B.2
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 2.7 AC
REFERENCE AIRPHOTO: ***

CONDITION OF SUMP (OPEN, CLOSED):CLOSED

CUT SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: S
BENCHED? YES
IF YES, HOW MANY BENCHES: 1
REVEGETATION HISTORY: MAY HAVE BEEN HYDROSEEDED
NOTES ON NATURAL REVEGETATION:

FILL SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: SW
REVEGETATION HISTORY: MAY HAVE BEEN HYDROSEEDED
NOTES ON NATURAL REVEGETATION:

VERY GRASSY

SOIL TYPE: ***

ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: OAK SAVANNA

DEER PELLET GROUP COUNT (TAKEN ALONG LONG AXIS OF WELL PAD THROUGH CENTER): ***

REMARKS:

RECOMMEND OAK PLANTING AS BEING COMPATIBLE WITH ADJACENT VEGETATION. LITTLE NATURAL REGROWTH OF WOODY VEGETATION DUE TO LACK OF SEED SOURCE.

CCPA FACILITIES INVENTORY LAST UPDATED: 7/30/97 B.LEITNER

FACILITY: WELL PAD 3-8.3 PRATI STATE 31 AND (?) 37
DATE CONSTRUCTED: ***
SIZE OF LEVEL SURFACE: 2.0 AC
REFERENCE AIRPHOTO: N/A

CONDITION OF SUMP (OPEN, CLOSED):CLOSED

CUT SLOPE DATA:
APPROXIMATE SIZE: ***
ASPECT: SW
BENCHED? NO
HOW MANY BENCHES:N/A
REVEGETATION HISTORY:
****
NOTES ON NATURAL REVEGETATION:
SPARSE HERBACEOUS; NO WOODY PLANTS

FILL SLOPE DATA:
APPROXIMATE SIZE: <0.5 AC
ASPECT: LONGEST SIDE IS SW; MINOR FILL AREAS FACING NW AND SE.
REVEGETATION HISTORY:
***
NOTES ON NATURAL REVEGETATION:
GOOD GROWTH OF NON-NATIVE GRASSES AND VETCHES. NO WOODY PLANTS.

SOIL TYPE: ***
ANY SOIL INSTABILITY NOTED? NONE NOTED BY BIOLOGISTS

SURROUNDING VEGETATION TYPES: BLUE OAK WOODLAND

DEER PELLET GROUP COUNT (ALONG LONG AXIS OF WELL PAD THROUGH CENTER): 3

REMARKS:

WELL PAD SURFACE IS RATHER GRASSY, SUGGESTING GREATER THAN USUAL PROPORTION OF FINE PARTICLES.