

**BUTT VALLEY RESERVOIR
and LAKE ALMANOR
SEISMIC REMEDIATION PROJECT**

**REVEGETATION/REFORESTATION PLAN
FINAL MONITORING REPORT**



December, 2000

Pacific Gas and Electric Company
Hydro Generation Department
San Francisco, California

INTRODUCTION

The following Revegetation/Reforestation Monitoring Report fulfills the requirement for the annual 2000 report and final report specified under Pacific Gas and Electric Company's Revegetation/Reforestation Plan approved by the Federal Energy Regulatory Commission (FERC) on May 5, 1997. This report is the third monitoring report for the project. A similar report was prepared and submitted to FERC in January 1999 and again in January 2000, covering revegetation/reforestation monitoring results for 1998 and 1999 respectively.

This revegetation/reforestation work was done as part of the Butt Valley and Lake Almanor Seismic Remediation Project. The project was undertaken to seismically strengthen Butt Valley and Canyon dams (Project Vicinity Map attached). Construction of the project, which was completed in 1997 required development of the Benner Creek Borrow Area, the East and West Laydown Areas, and the Skinner Flat Quarry. The Revegetation/Reforestation Plan addressed how these construction disturbed areas would be returned to natural condition to the extent possible. This final monitoring report documents implementation of the Revegetation/Reforestation Plan and results through 2000.

Included are Tables 1-5 which document Reforestation and Revegetation plant species and numbers installed by planting area. Herbaceous seed mixes are documented in Appendix A. Photo-documentation of each planting area is included in Appendix B. Also attached are Maps 1-4 which show the approximate planting areas.

PROJECT DESCRIPTION

The Revegetation/Reforestation Plan approved by FERC on May 5, 1997, identified two types of planting methods, revegetation and reforestation. The revegetation method involved field collection of shrub and tree seeds that were then to be nursery grown and planted as supercell liners or deepots. The revegetation plantings were to be protected with collars, wire screen, and weed control fabric. The Benner Creek Channel, Benner Borrow Area, and Skinner Flat were to receive revegetation plantings. The areas to be reforested were the East and West Laydown areas. Reforestation plantings were to consist of 1-year old nursery grown bareroot tree seedlings. The initial planting numbers cited in the plan were 5,550 trees and 7,150 shrubs using the revegetation method and 3,500 trees using the reforestation method for a total of 16,200 plants. No herbaceous seeding was proposed.

The plan as implemented in 1997 and 1998 included herbaceous seeding of all areas, an initial reforestation planting in all areas except the Benner Creek Channel, followed by a revegetation planting. In addition, an application of general fertilizer was applied to the Benner Creek Channel and Bank area, this was supplemental to the fertilizer applied with the revegetation plantings. These plan modifications were based on the recommendation of PG&E Company's revegetation consultants, and the Forest Service, responding to actual field conditions and a desire to enhance the success of the revegetation/reforestation work. At the completion of major planting work in 1998, a total of 19,143 trees and shrubs have been planted, either using the revegetation or reforestation method in addition to the herbaceous seeding.

Plan Implementation

The revegetation/reforestation work was implemented at four sites at Butt Valley Dam; at Benner Creek Channel Planting Area, Benner Borrow Planting Area, West Laydown Area, and East Laydown Area. The Lake Almanor (Canyon Dam) location includes the Skinner Flat Planting Area. The Benner Creek Channel Area was revegetated as a Montane Riparian Forest vegetation type, and all other planting areas were revegetated as Sierran Mixed Conifer Forest vegetation type (see Tables 1 - 5 for plant species breakdown).

Site Preparation

Major construction on the Seismic Remediation Project was completed in the Fall, 1997. As a result of project construction the Benner Borrow Area, the East and West Laydown Areas, and Skinner Flat Quarry areas were devoid of vegetation and highly disturbed due to earth-moving and grading operations. Immediately following completion of project construction in the Fall, 1997, these areas were re-graded for drainage and to provide a natural appearing topography. Topsoil stockpiled prior to construction was mixed with chipped wood mulch and spread throughout the planting areas. Large woody debris saved from removal of the timber from the sites was also placed in the planting areas. A new natural appearing channel was constructed for the relocated Benner Creek using a combination of rock rip-rap, and large woody debris. In addition, various bio-technical erosion control techniques were used in the Benner Creek Channel to minimize erosion prior to the establishment of plant material. A fertilizer/soil conditioner "Gro Power Plus", was mixed in with the topsoil at the Benner Creek Channel Planting Area and a majority of the Benner Borrow Planting Area. After site preparation work was completed, all planting areas were seeded with native herbaceous seed mixes (see Appendix A). Straw mulch was applied to the Benner Creek Channel Planting Area and on the steeper slopes of the Benner Borrow Planting Area.

Plant Materials

Reforestation plant material was *Pinus ponderosa* (Ponderosa Pine) seedlings, nursery grown from seed collected from the project area seed area. The revegetation plant material was from native seed and live cuttings collected in early 1997 in the project vicinity. The seeds and cuttings were taken to a nursery and the plants were grown in "supercell" liners and "tree bands". Tables 1 through 5 are a listing of plant species and numbers by planting area.

Planting

In April, 1998, *Pinus ponderosa* (Ponderosa Pine) reforestation plantings were installed in all areas except the Benner Creek Channel Planting Area. Bare-root seedlings were planted and a soil basin was placed around each plant location.

Following the reforestation plantings, in May through July 1998, the revegetation plantings were installed in all areas. Each plant location included a plant collar for root protection and to act as a water basin during hand irrigation with the exception of some *Salix spp.* (Willows) and *Juncus spp.* (Rushes), which were planted in areas that did not require irrigation. A slow release fertilizer was applied in the basin at all plant locations. Protective screens were applied to the shrub species favored by deer including, *Ceanothus cordulatus* (Mountain Whitethorn), *Ceanothus integerrimus* (Deerbrush), *Penstemon sp.* (Penstemon), *Physocarpus capiatius* (Nine Bark), *Sambucus mexicana* (Blue Elderberry), and *Sorbus californica* (Mountain Ash).

Plant Maintenance

Plant maintenance was performed during the Summer and Fall 1998, 1999 and again during the Summer and Fall 2000. The dates and maintenance tasks performed in 2000 are outlined below.

2000 Maintenance

5/15/00 - 5/17/00	Protective Screen Maintenance, Site Assessment, Selective Weeding
6/26/00 - 6/29/00	Plant Irrigation and Selective Weeding
7/17/00 - 7/20/00	Plant Irrigation and Selective Weeding
8/7/00 - 8/10/00	Plant Irrigation and Selective Weeding
9/5/00 - 9/8/00	Plant Irrigation and Selective Weeding
11/6/00 - 11/9/00	Final Debris Removal

During the maintenance visits the plants were watered and weeding and protective screen adjusted on an as-needed basis. All plants were given between one-half and one gallon of water each time they were irrigated. During the final maintenance visit, all protective hardware was removed from all sites and disposed of.

MONITORING

Prior to clearing, the Benner Creek Borrow Area, and the East and West Laydown Areas were forested with merchantable timber. Before removing the timber from these areas, PG&E Company was required to prepare and receive approval for a Timber Harvest Plan from the California Department of Forestry. The approved plan specified these areas were to be re-planted for timber production and meet established stocking requirements within three to five years following planting. If the stocking survey did not show the establishment of at least 300 trees per acres, the plan required PG&E Company to install supplemental plantings. Installation of the reforestation plantings followed the requirements of the plan. The stocking survey was completed during the Summer of 2000 and confirmed the Timber Harvest Plan stocking requirements had been met. As a result this report's establishment monitoring focuses on the revegetation plantings.

For 2000 plant monitoring fieldwork was performed on October 23 through October 26, 2000. For the revegetation plantings, a plant count was performed at each planting area. All live plants were counted and compared to the number of plants planted in each planting area to calculate survival percentages. A similar inventory was completed the previous year in November 1998 and again in October 1999. The results of these inventories, are included in Tables 1-5. Some supplemental plantings were installed in the Benner Creek Planting Area during Fall 1998. The supplemental planting numbers were included in the live plant count but were not added to the original planting numbers planted in each area.

All planting areas were photo-documented prior to woody plantings in Summer, 1997, Spring/Summer 1998, November 1998, September 1999, and October 2000. All photos are included in Appendix B for comparison.

Results

As of, November 2000, overall survival for the revegetation plantings at all areas was 61 percent compared to the 72 percent recorded in November 1998 and 63 percent recorded in November 1999. Plant summaries and overall survival for each planting area are shown in Tables 1 through 5. Surviving plants in general have put on growth since 1999 and display good vigor. Along Benner Creek, willows (*Salix spp.*) average two to three feet in height and are beginning to provide good cover. The rushes (*Juncus sp.*) planted along the creek are now well established. Naturally regenerating alders (*Alnus rhombifolia*) are becoming established along the creek as well. Other species performing well in the Benner Creek/Benner Borrow sites include California rose (*Rosa californica*), penstemon (*Penstemon sp.*), mountain whitethorn (*Ceanothus cordulatus*), deer brush (*Ceanothus integerrimus*), and ninebark (*Physocarpus capitus*). In the East Laydown, West Laydown and Skinner Flat planting areas, Ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*Pinus jeffreyii*), and sugar pine (*Pinus lambertiana*) were the better performers. Rubber rabbitbrush (*Chrysothamnus nauseosus*) is growing vigorously in the Skinner Flat site.

The herbaceous seeding component of the project has been successful in all of the sites, with the native grasses doing particularly well. Natural regeneration of manzanita (*Arctostaphylos sp.*), mountain whitethorn (*Ceanothus cordulatus*), and current (*Ribes sp.*) is relatively high in the Skinner Flat site. Germination of white sweet clover (*Melilotus alba*), a non-native weed that was reported as a problem in the West Laydown planting area in the 1999 monitoring report was relatively low in 2000.

Summary on Monitoring Results - 1998, 1999, and 2000

<u>Planting Area</u>	<u>Acres</u>	<u>% Survival 98</u>	<u>% Survival 99</u>	<u>% Survival 2000</u>
Benner Creek	1	82	74	71
Benner Borrow	5.4	66	53	52
West Laydown	4	48	36	68
East Laydown	4	59	55	34
Skinner Flat	9	77	70	54

TABLE 1: Benner Creek Channel Planting Area

Approximate Area Size: 1 Acre

No Reforestation Plantings

Revegetation Planting Installed 1998

<u>Botanical Name:</u>	<u>Common Name:</u>	<u>Number Planted:</u>
<i>Calocedrus decurrens</i>	Incense Cedar	25
<i>Ceanothus cordulatus</i>	Mountain Whitethorn	26
<i>Ceanothus integerrimus</i>	Deer Brush	66
<i>Cornus sericea</i>	American Dogwood	263
<i>Juncus spp.</i>	Rush	608
<i>Penstemon spp.</i>	Penstemon	70
<i>Physocarpus capiatatus</i>	Nine Bark	294
<i>Pinus ponderosa</i>	Ponderosa Pine	35
<i>Pseudotsuga menziesii</i>	Douglas-fir	65
<i>Rosa californica</i>	California Rose	253
<i>Salix spp.</i>	Willow	531
<i>Sambucus mexicana</i>	Blue Elderberry	137
<i>Sorbus californica</i>	Mountain Ash	24
Total Planted		2,397

As of November 2000

1,695 of the revegetation plants remain alive for a survival rate of 71 percent.

Supplemental Plants Planted (Fall 1998) - Benner Creek Channel Planting Area (not included above):

80 *Ceanothus cordulatus* (Mountain Whitethorn)

TABLE 2: Benner Borrow Planting Area

Approximate Area Size: 5.4 Acres

Reforestation Planting Installed 1998

<u>Botanical Name:</u>	<u>Common Name:</u>	<u>Number Planted</u>
<i>Pinus Ponderosa</i>	Ponderosa Pine	2,175

Revegetation Planting Installed 1998

<u>Botanical Name:</u>	<u>Common Name:</u>	<u>Number Planted</u>
<i>Abies concolor</i>	White Fir	102
<i>Abies magnifica</i>	Red Fir	108
<i>Calocedrus decurrens</i>	Incense Cedar	42
<i>Ceanothus cordulatus</i>	Mountain Whitethorn	30
<i>Ceanothus integerrimus</i>	Deer Brush	141
<i>Juncus spp.</i>	Rush	226
<i>Penstemon spp.</i>	Pine	168
<i>Pinus lambertiana</i>	Sugar Pine	42
<i>Pinus ponderosa</i>	Ponderosa Pine	40
<i>Pseudotsuga menziesii</i>	Douglas-fir	423
<i>Rosa californica</i>	California Rose	25
<i>Salix spp.</i>	Willow	67
<i>Sambucus mexicana</i>	Blue Elderberry	15
Total Planted		1,444

As of November 2000:

745 of the revegetation plants remain alive for a survival rate of 52 percent.

Supplemental Plants Planted (Fall 1998) - Benner Borrow Planting Area (not included above):

<i>Ceanothus cordulatus</i> (Mountain Whitethorn)	260
<i>Abies concolor</i> (White Fir)	4
<i>Pinus lambertiana</i> (Sugar Pine)	29
<i>Pinus ponderosa</i> (Ponderosa Pine)	54
<i>Pseudotsuga menziesii</i> (Douglas-fir)	15
Total Planted	362

TABLE 3: Skinner Flat Planting Area

Approximate Area Size: 9 Acres

Reforestation Planting Installed 1998

<u>Botanical Name:</u>	<u>Common Name:</u>	<u>Number Planted:</u>
<i>Pinus Ponderosa</i>	Ponderosa Pine	5,175

Note: An additional 550 *Pinus Ponderosa* were planted on the construction haul road from the quarry to Canyon Dam.

Revegetation Planting Installed 1998

<u>Botanical Name:</u>	<u>Common Name:</u>	<u>Number Planted:</u>
<i>Abies concolor</i>	White Fir	114
<i>Abies magnifica</i>	Red Fir	104
<i>Calocedrus decurrens</i>	Incense Cedar	10
<i>Chrysothamnus nauseosus</i>	Rubber Rabbitbrush	24
<i>Juncus spp.</i>	Rush	50
<i>Pinus jeffreyi</i>	Jeffrey Pine	331
<i>Pinus lambertiana</i>	Sugar Pine	190
<i>Pinus ponderosa</i>	Ponderosa Pine	204
<i>Pseudotsuga menziesii</i>	Douglas-fir	69
Total Planted		1,096

As of November 2000:

750 of the revegetation plants remain alive for a survival rate of 68 percent.

TABLE 4: West Laydown Area**Approximate Area Size: 4 Acres****Reforestation Planting Installed 1998**

<u>Botanical Name:</u>	<u>Common Name:</u>	<u>Number Planted:</u>
<i>Pinus Ponderosa</i>	Ponderosa Pine	1,740

Revegetation Planting Installed 1998

<u>Botanical Name:</u>	<u>Common Name:</u>	<u>Number Planted:</u>
<i>Abies concolor</i>	White Fir	76
<i>Abies magnifica</i>	Red Fir	48
<i>Calocedrus decurrens</i>	Incense Cedar	25
<i>Pinus jeffreyi</i>	Jeffrey Pine	103
<i>Pinus lambertiana</i>	Sugar Pine	40
<i>Pinus ponderosa</i>	Ponderosa Pine	80
<i>Pseudotsuga menziesii</i>	Douglas-fir	188
Total Planted		560

As of November 2000:

188 of the revegetation plants remain alive for a survival rate of 34 percent.

TABLE 5: East Laydown Area**Approximate Area Size: 4 Acre****Reforestation Planting Installed 1998**

<u>Botanical Name:</u>	<u>Common Name:</u>	<u>Number Planted:</u>
<i>Pinus Ponderosa</i>	Ponderosa Pine	2,860

Revegetation Planting Installed 1998

<u>Botanical Name:</u>	<u>Common Name:</u>	<u>Number Planted:</u>
<i>Abies concolor</i>	White Fir	111
<i>Abies magnifica</i>	Red Fir	72
<i>Calocedrus decurrens</i>	Incense Cedar	32
<i>Pinus jeffreyi</i>	Jeffrey Pine	132
<i>Pinus lambertiana</i>	Sugar Pine	49
<i>Pinus ponderosa</i>	Ponderosa Pine	102
<i>Pseudotsuga menziesii</i>	Douglas-fir	206
Total Planted		704

As of November 2000:

378 of the revegetation plants remain alive for a survival rate of 54 percent.

APPENDIX A

Herbaceous Seed Mixes Planted 1997

<u>Seed Mix #1 - Benner Channel Planting Area:</u>	<u>Pounds/acre:</u>
<i>Deschampsia elongata</i> (Plumas)	10.0
<i>Lotus purshianus</i> (Plumas)	5.0
<i>Vulpia microstachys</i> (Plumas)	5.0
<i>Hordeum brachyantherum</i> (El Dorado)	5.0
Total Pounds	25.0

<u>Seed Mix #2 - Benner Creek Planting Area:</u>	<u>Pounds/acre:</u>
<i>Lotus purshianus</i> (Plumas)	5.0
<i>Vulpia microstachys</i> (Plumas)	5.0
<i>Hordeum brachyantherum</i> (El Dorado)	5.0
<i>Festuca occidentalis</i> (Shasta Blue)	5.0
<i>Elymus glaucus</i> (Shasta Trinity)	5.0
Total Pounds	25.0

<u>Seed Mix #3 - East Laydown, West Laydown, Skinner Flat Planting Areas, and Benner Borrow Planting Areas:</u>	<u>Pounds/acre:</u>
<i>Hordeum brachyantherum</i> (El Dorado)	1.5
<i>Elymus glaucus</i> (Shasta Trinity)	11.0
<i>Bromus carinatus</i> (Mokelumne)	13.0
<i>Vulpia microstachys</i> (Plumas)	3.0
Total Pounds	28.5