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Final Environmental Impact Statement

AD-A207 707

Ox Mountain Sanitary Landfill Apanolio Canyon Expansion Site

San Mateo County, California

Volume II - Appendix

US Army Corps of Engineers
San Francisco District

April 1989

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Harding Lawson Associates
Engineers and Geoscientists

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Federal environmental impact document concerning a regulatory permit application by Browning-Ferris Industries of California under Section 404 of the Clean Water Act. The proposed project consists of the development of a Sanitary landfill in Apanolio Creek, San Mateo County, California

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Public Notice and Response Letters

Public Notice

US Army Corps
of Engineers
San Francisco District
211 Main Street
San Francisco, CA 94105

PUBLIC NOTICE NO. 16611S91 DATE: 8 June 1987

REPLY TO: REGULATORY BRANCH

RESPONSE REQUIRED BY: 8 July 1987

1. Browning - Ferris Industries (BFI), San Mateo County District, P.O. Box 1068, San Carlos, California 94070, has applied to the Department of the Army for authorization to place fill in association with various structures, e.g., roadways, sedimentation basins, dams, for the development of a sanitary landfill in Apanolio Creek, located approximately three miles northeast of Half Moon Bay, San Mateo County, California. This application is being processed pursuant to the provisions of Section 404 of the Clean Water Act (33 U. S. C. 1344).

2. PURPOSE: BFI currently operates a landfill site at Ox Mountain Ranch, located three miles from Half Moon Bay. The Ox Mountain Ranch consists of two principal canyons, the Corinda Los Trancos Canyon and Apanolio Canyon. The Corinda Los Trancos Landfill has been used as a solid waste disposal site since 1976, and will reach design capacity within two years. BFI proposes to expand the existing operation westward into the neighboring Apanolio Canyon. The applicant states that other landfills in San Mateo County are reaching capacity and have limited or no expansion potential, and that Ox Mountain is designated as the county wide disposal facility after 1990.

PROJECT DESCRIPTION: The expansion site is 285 acres in the upper portion of Apanolio Canyon, a steep, narrow canyon watershed on the coastside of San Mateo County (Pilarcitos Creek Watershed). The proposed project would fill the canyon from a 500 foot elevation to a 1200 foot elevation, with an average depth of 185 feet. Access to the proposed landfill will be from Highway 92 through the present Corinda Los Trancos gate. The existing haul road will be extended over the ridge to the working portion of the landfill. Refuse will be dumped at the working face and compacted by heavy equipment. The working face will be covered daily to prevent nuisance or public health problems. Cover material is to be excavated from canyon walls. Filling will begin in the lowest part of the canyon. Each 25-foot lift will be filled in from the bank of the canyon to the ultimate leading edge of the landfill. As work begins on each lift, a 25-foot band of vegetation along the adjacent canyon walls will be removed. Based on today's technology, the applicant estimates that this site has the capacity to serve as a solid waste disposal facility for the county of San Mateo until the year 2084.

WORK REQUIRING CORPS AUTHORIZATION: In order for Apanolio Canyon to become operational as a landfill, it is necessary to do extensive site preparation. A Corps of Engineers permit is required under Section 404 of the Clean Water Act for some of the preparation activities which involve placement of fill materials. These activities include access road construction, installation of a sedimentation basin, gabion dam and spillway, retention dam, and storm drain trench. Approximately 3.43 arces of wetlands regulated by the Corps of Engineers would be impacted by these preparation activities. The applicant proposes to mitigate for the lost wetland habitat with a series of off-site and on-site mitigation projects. A discussion of the proposed mitigation activities is contained in the Environmental Assessment portion of this public notice

3. The applicant states that he has notified the Regional Water Quality Board, San Francisco Bay Region, to determine the need for State water quality certification. If the State Water Resources Control Board determines that this project is consistent with the California Water Quality Control Plan Requirements adopted by the Regional Board and Sections 301, 302, 303, 306 and 307 of the Clean Waster Act, the State will issue a Certificate of Conformance with Water Quality Standards to the project proponent. Those parties concerned with any water quality problems that may be associated with this project should write to the Executive Officer, California Regional Water Quality Control Board, San Francisco Bay Region, 1111 Jackson Street, Oakland, California 94607, by the close of the comment period of this public notice.

4. In accordance with the requirements of the National Environmental Policy Act of 1969 (Public Law 91-190), and pursuant to Council on Environmental Quality's Regulations 40 CFR 1500-1508 and Engineer Regulation 200-2-2, Appendix B, Corps of Engineers has assessed the environmental impacts of the activity proposed in subject application. The resulting Preliminary Environmental Assessment is presented in the sections that follow. Worksheets and other supporting data used in the preparation of this Environmental Assessment are on file in Impact Analysis Section, Regulatory Branch, San Francisco District. The Preliminary Environmental Assessment resulted in the following findings:

a. IMPACTS ON THE AQUATIC ECOSYSTEM

(1) <u>Physical/Chemical Characteristics and Anticipated Changes</u>

Substrate - Long-term major impacts would occur due to converting the existing sand, rubble and bedrock substrates in the aquatic ecosystem to layered refuse and upland soil. The existing steep stream gradients would be transformed to a compacted, nearly level finished grade upon project completion. Final depths of fill would be up to 700 feet with the entire site accepting approximately 21,000,000 cubic yards of grading material and 124,800,000 cubic yards of solid waste.

Currents/Circulation - Long-term impacts would result from the culverting of Apanolio Creek below the fill. Retention basins would slow, if not completely stop, currents in the lower reaches of the project area. These impacts are considered moderate.

Drainage Patterns - Major impacts would occur due to the rerouting of natural runoff and stream flows in the upper portions of the watershed around the landfill, converting Apanolio Creek to a subterranean drainage culvert and impounding other runoff with retention ponds.

Streamflow - Major impacts would occur primarily due to eliminating the natural flows of Apanolio Creek and impounding and eliminating some of the natural flows in the lower reaches of the project area.

Water Supply (Natural) - Moderate adverse impacts would occur due to eliminating 5,600 feet of Apanolio Creek as a viable stream. Moderate adverse impacts to water depths would occur at the lower reaches of the project area by converting a shallow free-flowing stream to deeper non-flowing retention basins. Adverse impacts on water availability would particularly effect downstream interests that use the water for domestic and irrigation purposes.

Aquifer Recharge - The upper portions of Apanolio Canyon has been described as a prime recharge area and a fairly large water reservoir is present in the very fractured and sheered material and stream bottom sands throughout the site. Modifications to the aquatic ecosystem described under "Drainage Patterns" would have moderate adverse impacts due to diverting and/or eliminating much of the water in Apanolio Creek for aquifer recharge. Major adverse impacts would occur if a systems failure resulted in breeching the isolation barriers between ground water and the land fill thereby contaminating subsurface waters.

Erosion/Sedimentation - Clearing vegetation and other construction-associated activities would result in moderate adverse impacts due to increased erosion of steep hillsides and sedimentation into downstream waters. Construction work previously done has had a noticable increase of siltation in Apanolio Creek. However, a large portion of Apanolio Creek is proposed to be eliminated and siltation basins are proposed to reduce down-current silts.

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Water Quality - Adverse impacts are, and would continue to occur due to increased levels of suspended particulates entering the water from eroding denuded areas. Sedimentation basins are expected to moderate these impacts downstream of the project area. Potentially major adverse impacts would occur if project features designed to isolate leachates or underground pipes should fail. The landfill site is not to receive hazardous wastes, but would accept dewatered sludge and, possibly, bagged asbestos. An impermeable clay liner under the landfill, a leachate collection system and water quality monitoring are proposed to avoid such occurances, however, the RWQCB has indicated that the currently proposed ground water monitoring program is not acceptable and the wells are of poor design. In addition, the project design is similar to that existing at the neightboring Los Corinda Trancos landfill. The EIR for the Apanolio Creek landfill indicates that after 12 years of monitoring at the Corinda Los Trancos site (in operation since 1976), there is a slight rising trend in the concentration of total dissolved solids and salinity. The Apanolio Canyon site is expected to be in operation until 2084 according to the permit application and the existing landowner would be responsible for correcting any water quality problems.

(2) <u>Biological Characteristics and Anticipated Changes</u>

Wetlands - The Corps of Engineers preliminarily indicated that approximately 11 acres of wetlands and stream bottom would be impacted by the landfill. However, a lack of conclusive hydrology information in much of the projected area resulted in this figure being revised to 3.43 acres. The riparian wetlands on-site are dominated by mature red alders. Considering the historical loss of riparian ecosystems in California and the regional scarcity of perennial water, these adverse impacts are considered moderate to major in scope. Due to the non-water-dependent nature of a the landfill and its potential adverse impacts to the aquatic ecosystem, these impacts are also considered cumulative and controversial.

Riffle and Pool Areas - Also in Corps jurisdiction is the riffle/pool complex of Apanolio Creek. This habitat-type is considered a special aquatic site. The project would eliminate 5,600 linear feet of Apanolio Creek.

Endangered Species - Although appropriate habitat doesn't seem to exist on-site for the Federally listed endangered San Francisco garter snake, there is a high likelihood that the snake exists in Apanolio Creek downstream from the project area. Maintaining high water quality would be most important for the survival of that expected snake population. In addition, considering the local distribution of the of the snake, Apanolio Canyon may be an important migratory pathway.

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Several invertebrate species now under consideration for Federal listing may occur in the project area. These include the San Francisco forked-Tail Damselfly, Leech's Skyline Diving Beetle, Rickseeker's Water Scavenger Beetle, Myrtle's Silverspot Butterfly and the San Francisco Tree-lupine Moth. Initial contact with the U.S. Fish and Wildlife Service's Endangered Species Office indicates that the Service believes past surveys to be inadequate and would recommend trapping studies for the mentioned species.

Habitat for Fish - Despite existing small dams on Apanolio Creek, shocking studies conducted by the California Department of Fish and Game in 1986 resulted in steelhead trout population estimates of 1,502 per mile and 892 per mile in the lower and upper portions of Apanolio Creek, respectively. Steelhead consisted of young-of-the-year (0+) and juvenile (1+) individuals. Other fish species that may occur in Apanolio Creek include sculpin, three-spined stickleback and silver salmon. Apanolio Creek has been described as providing excellent steelhead habitat due to its perennial nature (27 per cent of the perennial stream lengths in the Pilarcitos watershed), excellent water quality, undercut banks, dense riparian vegetation and well developed riffle/pool complex. However, reduction in habitat quality has been observed recently due to local agricultural activity and on-site disturbance (i.e., road construction, stream crossing and bulldozing of riparian vegetation).

The project would eliminate about 5,600 feet of stream habitat. The applicant proposes to mitigate this loss by modifying low-flow barriers on Pilarcitos Creek at Highway 92 and San Pdero Creek in Pacifica that impede fish pasage. The magnitude of these impediments is unknown, however, CDFG has already provided partial restoration to the barrier on Pilarcitos Creek with funds available for such restoration purposes. The proposed work may increase fish accessibility to 18,800 linear feet of potential stream habitat.

In addition, BFI proposes to enhance the estuary/marsh habitat at the mouth of Pilarcitos Creek by planting riparian cover and creating a deeper permanent holding marsh. This is expected to provide better cover for juvenile steelhead. However, considering the shifting, droughty nature of the sand substrate and the influence of brackish water characteristic of estuaries, the feasibility of this proposal is difficult to assess.

BFI also proposes to provide streambank stabilization and pool development below the project area on Apanolio Creek, create pool habitats with weirs and plant riparian vegetation in the upper reaches of Los Trancos Creek, remove log and stump barriers in Los Trancos Creek, plant unvegetated streambanks in Los Trancos Creek and place boulders, rocks, gravel and anchored logs in Los Trancos Creek. Evaluation of these latter mitigation measures indicates that streambank stabilization and pool development in Apanolio Creek and planting unvegetated streambanks in Corinda Los Trancos Creek should provide needed benefits to steelhead trout provided high water quality can be maintained over the life of the project. The value of habitat enhancements proposed for Corinda Los Trancos Creek are unknown since no fish were found in this stream during shocking studies. This was attributed to excessive silts and sands in the stream bottom and, possible pollutants emanating from the landfill. Initial studies on transplanting trout into Corinda Los Trancos Creek indicated low survival of fish after few days. Other specifics needed to be evaluated include the need to remove naturally occurring logs and stumps, to place boulders, rocks and anchored logs into the stream and the impediments of weirs on upstream pool developments. Monitoring of mitigation impacts is proposed for only five years.

Habitat for Other Aquatic Organisms - Elimination of about 5,600 linear feet of stream/wetland complex would have long-term adverse impacts to aquatic-dependent invertebrates important to food chain production and amphibians such as the red-legged frog, a preferred prey species of the San Francisco garter snake.

Wildlife Habitat - The U.S. Fish and Wildlife Service estimates that 98 per cent of California's riparian habitats have been lost. At least eight acres of riparian woodland would be eliminated by the project. The mature alder forest on the project area can be expected to be important habitat to, particularly, resident and migratory birds. In addition, important furbearers and game mammals such as bobcat, fox, rabbit, squirrel and mule deer are expected to use the riparian areas for foraging and travel corridors. There also have been reports of mountain lions in Apanolio Canyon.

Biological Availability - Whereas landfill designs attempt to minimize contamination hazards, design failures or natural events such as earthquakes over the life span of the project may result in the escape of contaminants that could enter biological food chains.

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b. IMPACTS ON ENVIRONMENT OUTSIDE THE AQUATIC ECOSYSTEM

(1) Physical Characteristics and Anticipated Changes

Air Quality - Adverse impacts to local air quality would result from exhaust fumes emitted from transfer trucks and heavy equipment used in landfill preparation. These impacts are considered relatively minor due to the temporary nature of much of the pollutants and the remoteness of the site. Additional adverse impacts to air quality would occur due to airborne dust resulting from land preparation and continuous landfill operations. BFI proposes to mitigate some of these adverse impacts by watering down dirt roads and asphalting or gravelling regularly used roads.

Noise Conditions - Minor adverse increases in noise levels over the life of the project Since the landfill site is remote, these impacts are considered minor. However, impacts along Highway 92 would be considered somewhat more important due to the proximity of businesses and residences.

Geologic Hazards - Known active faults in the vicinity of the proposed site include the San Andreas Fault (2.5 miles to the east) and the Seal Cove Fault (4.5 miles to the west). The potentially active Pilarcitos Fault is located 1.3 miles east of the site. An April 22, 1987 "Notice of Tentative Updated Waste Discharge Requirements for BFI" issued by the California Regional Water Quality Control Board indicated that BFI had not conducted an adequate stability analysis demonstrating landfill statibility during a maximum probable earthquake. If an adequate analysis is not conducted and the landfill separates from the bedrock, important adverse impacts to primarily, water quality would occur.

(2) Biological Characteristics and Anticipated Changes

Terrestrial Habitat - Approximately 282 acres of coastal strand, coastal scrub mixed evergreen forest, chapparral, grassland, and non-wetland riparian habitats would be eliminated by the landfill. This is considered a long-term major adverse impact due to the remoteness and steep terrain, this area appears not to have been completely logged or burned for at least 50 years. Proposed mitigation includes controlled burns on a 10 to 15 year cycle to enhance remaining habitat above the 1200-foot contour, revegetating the Corinda Los Trancos landfill upon closure (estimated date is 1988), and revegetating the Apanolio Canyon landfill upon closure (estimated date is 2084). The controlled burns would maintain early successional characteristics of those areas above the 1200-foot contour, however, the mitigation plan concludes that fire control would be very difficult due to terrain, fuel loading and very limited access. Revegetation of the Corinda Los Trancos landfill would provide about 100 acres of grassland habitat. The success of this would depend on the ability of plants to grow on the compacted impermeable cap required upon closure and other effects of the landfill (e.g, methane gas escape). Revegetation efforts at the Apanolio Canyon landfill would be concurrent with the fill operation. Therefore, due to noise and human activity, the expected benefits would be limited until final landfill closure. Final land-use determination (e.g., recreational development) also would affect habitat quality.

Terrestrial Wildlife - Long-term adverse impacts to terrestrial wildlife species would occur due to the loss of about 232 acres of habitat. Most species affected would include those listed under "wetlands" and "Endangered Species", however, other typically upland species such as California quail, various reptiles and other mammals also would be adversely impacted. Indirect impacts to secretive animals such as the mountain lion would occur in surrounding habitat due to disturbance from landfill operation. Mitigation measures are described under "Terrestrial Habitat". In addition, the applicant proposes to develop ridgetop watering ponds since water in the upper reaches of the canyon is considered a limiting resource. However, considering the availability of springs, seeps, the perennial flow through the lower three-fifths of Apanolio Creek, and the presence of a fog-drip forest on the ridgetop that produces extensive pools of water, it appears that water would not be limiting and the value of these ponds is questionable.

(3) Socioeconomic Characteristics and Anticipated Changes

Aesthetic Quality - The proposed project would have long-term adverse impacts on local aesthetics due to accumulation of litter along the roadsides during truck transport and converting 235 acres of pristene undisturbed scrub/forest to landfill. Since the area is not readily visible to local people, these impacts are considered moderate.

Agricultural Activity - Long-term minor adverse impacts to agricultural activity would occur due to modifications to the flows of Apanolio Creek which is used by down-stream horticulturalists.

Business and Industry Activity - The project would have moderate beneficial impacts to local businesses and industry by providing a long-term disposal site for generated refuse. The project would also provide the applicant with long-term benefits in the form of maintaining their current business status in San Mateo County.

Commercial Fishing - Long-term adverse impacts to commercial steelhead fishing would occur due to the loss of a viable producing stream. Mitigation described under "Habitat for Fish" may provide some enhancement to the fishery to help offset this loss.

Economics - The project would provide major long-tem benefits to the applicant due to its ability to continue waste disposal operation near its present Corinda Los Trancos site, thereby precluding the need to consider, evaluate, and possibly purchase an alternative site. Adverse impacts would result from the capital outlay necessary to construct the elaborate infrastructure necessary to develope the site and provide for water quality. If contamination of surface or ground water occurs, additional expenditures would occur in an attempt to correct problems. Long-terms benefits to San Mateo County would occur due to providing a waste disposal site that is somewhat cheaper than longer hauling to an alternative site. In addition, disposal within the County would result in keeping finacial resources within the County and providing an important tax source.

Energy - Long-term beneficial impacts would occur due to shorter haul lengths if the landfill was sited in San Mateo as opposed to a site outside the county. However, considerable energy resources would still be used in transporting and disposing of the refuse.

Methane gas recovery has been addressed and should become a viable option in about two years. This would provide minor long-term benefits if implemented, however, no specific plans for such recovery are known.

Additional energy resources could be conserved by recycling recoverable materials. Estimates indicate that 25 to 30 per cent of refuse could conceivably be recovered, however, to be cost effective, recycling effects probably need to be tied to a refuse-to-engry facility. The EIR for this project indicates that a refuse-to-energy facility could be feasible by 1990, however, this would have have to be confirmed through a more detailed feasibility study.

Public Facilities and Services - Long-term solutions for refuse disposal has been discussed in San Mateo County since the initial use permit for Corinda Los Trancos (1965). The County directed the operator at that time to apply for a separate use permit for the Apanolio Canyon Site. The project would provide long-term major benefits to the public by providing waste disposal site for San Mateo County for nearly a century. Apanolio Canyon is expected to be the County-wide landfill in about 1990.

Public Health and Safety - Long-term moderate benefits would occur due to the ability to provide a single waste disposal facility for San Mateo County for nearly a century, thereby precluding potential haphazard disposal or accumulations in residential areas that would foster vermin production. Proliferation of nuisance species at the landfill be controlled by daily covering of refuse. If a system failure should occur, long-term major adverse impacts would occur due to contamination of the waters of Apanolio Creek, Pilarcitos Creek, and possibly even Half Moon Bay.

Recreational Fishing - Impacts would be similar to those described under "Commercial Fishing".

Traffic Conditions - Two-lane Highway 92 is the sole transportation route to the landfill site and is an important east-west connection across the Coast Range. The steep grade, narrowness and curvature of the road contribute to a relatively high rate of accidents. The project would result in an increase in collection and transfer trucks. According to the EIR, 15 transfer trucks per day use the Corinda Los Trancos site. This is projected to increase to 95 transfer trucks per day in 2000. Other adverse impacts to transportation would result if any available route should become inaccessible (e.g., the Devil's Slide area on Highway 1). The adverse impacts expected on Highway 92 should be reduced by improvement, proposed by the California Department of Transportation. Other mitigating options include expanding the number of signs and warning devices and restricting landfill operating hours.

(4) Historic Cultural Characteristics and Anticipated Changes

The Corps of Engineers has checked published and unpublished state and federal inventories that list documented significant prehistoric and historic cultural resources. There are no such resources situated within or adjacent to the proposed project area.

An archaeological investigation of the proposed project area has been conducted by a private consultant. The primary and secondary terraces of Apanolio Creek as well as the stream bottom within the project area were the only areas examined during the field phase of the study. Because the Apanolio Creek canyon is "deeply dissected" and marked by "steep-sided" terrain, and more preferable locations are found nearby, the study report indicated that evidence of significant prehistoric and historic resources would be expected on at these relatively flat areas.

No significant cultural resources were located in the areas examined. Although a 1915 USGS map indicated that two structures existed within the project area prior to this date, no structural remnants were observed. Remains of iron pipe were noted in the areas examined. These materials possibly represent water conduit remnants.

The proposed undertaking, as described in the current permit application, should therefore not impact documented significant cultural resources, including sites eligible for the National Register of Historic Places. It is unknown at this time whether the Native American community has concerns regarding the proposal.

c. SUMMARY OF INDIRECT IMPACTS

No important indirect impacts have been identified.

d. SUMMARY OF CUMULATIVE IMPACTS

Important cumulative impacts include the increased loss of perennial streams in the Bay Area, impacts to the local aquifer, degradation of water quality, loss of special aquatic sites (wetlands and riffle/pool complexes), possible effects on endangered species, loss of steelhead trout habitat, loss of terrestrial habitat and associated wildlife and traffic conditions.

e. Conclusions and Recommendations:

Based on an analysis of the above identified impacts, a determination has been made that the proposed action may have a significant impact on the human environment. An Environmental Impact Statement will, therefore, be prepared to evaluate the environmental consequences of the proposed action.

5. Evaluation of this activity's impacts includes application of the guidelines promulgated by the Administrator of the Environmental Protection Agency under Section 404(b) of the Clean Water Act (33 U.S.C. 1344(b)). An evaluation was made by this office under the 404(b)(1) Guidelines and it was determined that the proposed project is not water dependent. The applicant has not submitted an Analysis of Alternatives and has been informed that such an Analysis is required and will reviewed for compliance with the Guidelines.

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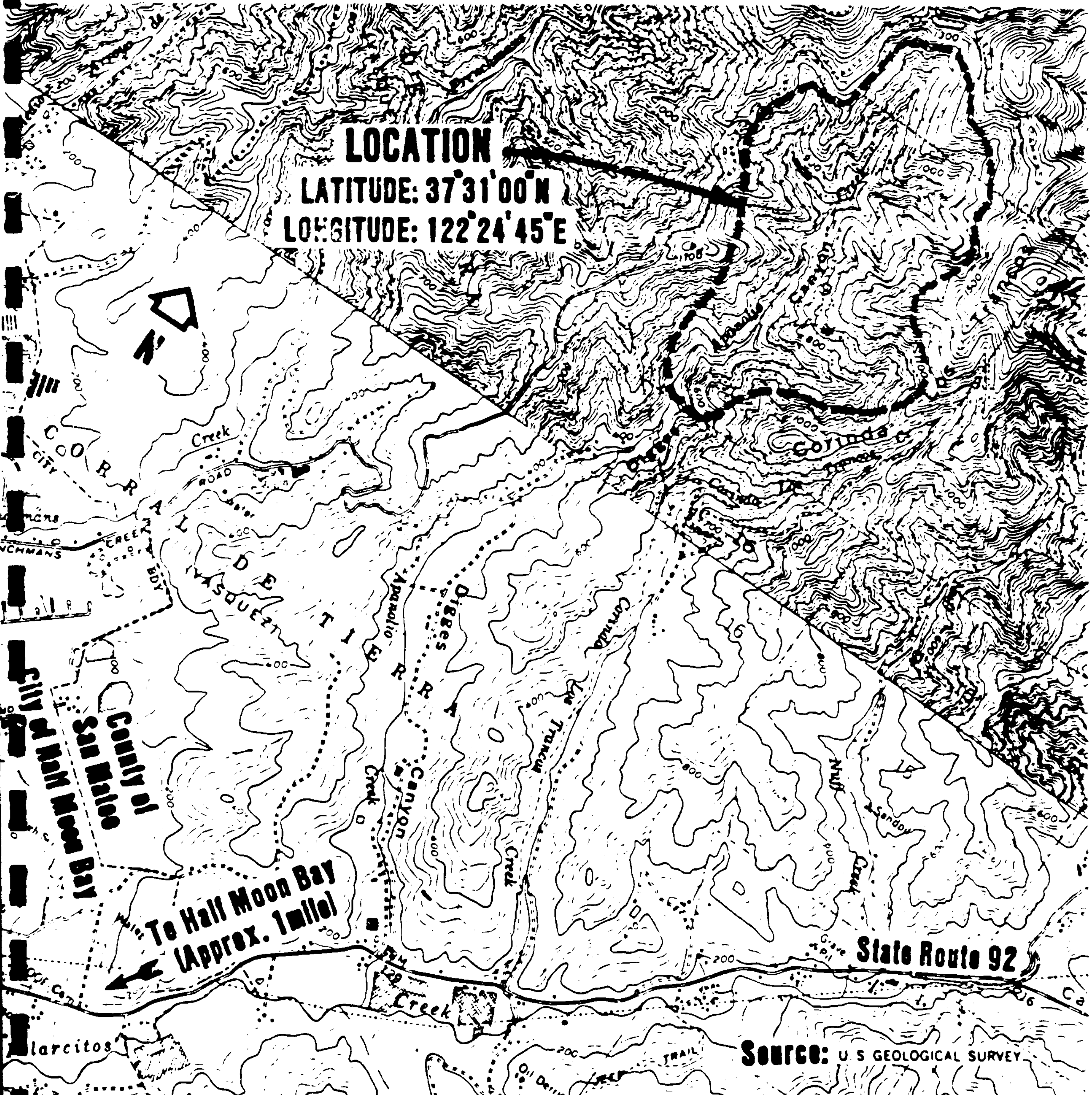
6. The decision whether to issue a permit will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest. Evaluation of the probable impacts which the proposed activity may have on the public interest requires a careful weighing of all those factors which become relevant in each particular case. The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. The decision whether to authorize a proposal, and if so the conditions under which it will be allowed to occur, are therefore determined by the outcome of the general balancing process. That decision will reflect the national concern for both protection and utilization of important resources. All factors which may be relevant to the proposal must be considered including the cumulative effects thereof. Among those are conservation, economics, aesthetics, general environmental concerns, wetlands, cultrural values, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, consideration of property ownership, and, in general, the needs and welfare of the people.

7. Interested parties may submit in writing any comments concerning this activity. Comments should include the applicant's name, the number, and the date of this notice and should be forwarded so as to reach this office within the comment period specified on page one of this notice. Comments should be sent to: Lieutenant Colonel Andrew M. Perkins, Jr., District Engineer, Attention: Regulatory Branch. It is Corps policy to forward any such comments which include objections to the applicant for resolution or rebuttal. Any person may request, in writing, within the comment period of this notice that a public hearing be held to consider this application. Requests for public hearings shall state, with particularity, the reasons for holding a public hearing. Additional details may be obtained by contacting the applicant whose address is indicated in first paragraph of this notice, or by contacting Dave Hodges of our office (telephone (415) 974-0426). Details on any changes of a minor nature which are made in the final permit action will be provided on request.



PURPOSE: FACILITIES REQUIRED TO DEVELOP A SANITARY LANDFILL

DATUM: MLLW

ADJACENT PROPERTY OWNERS: SEE ENG FORM 4345

VICINITY MAP

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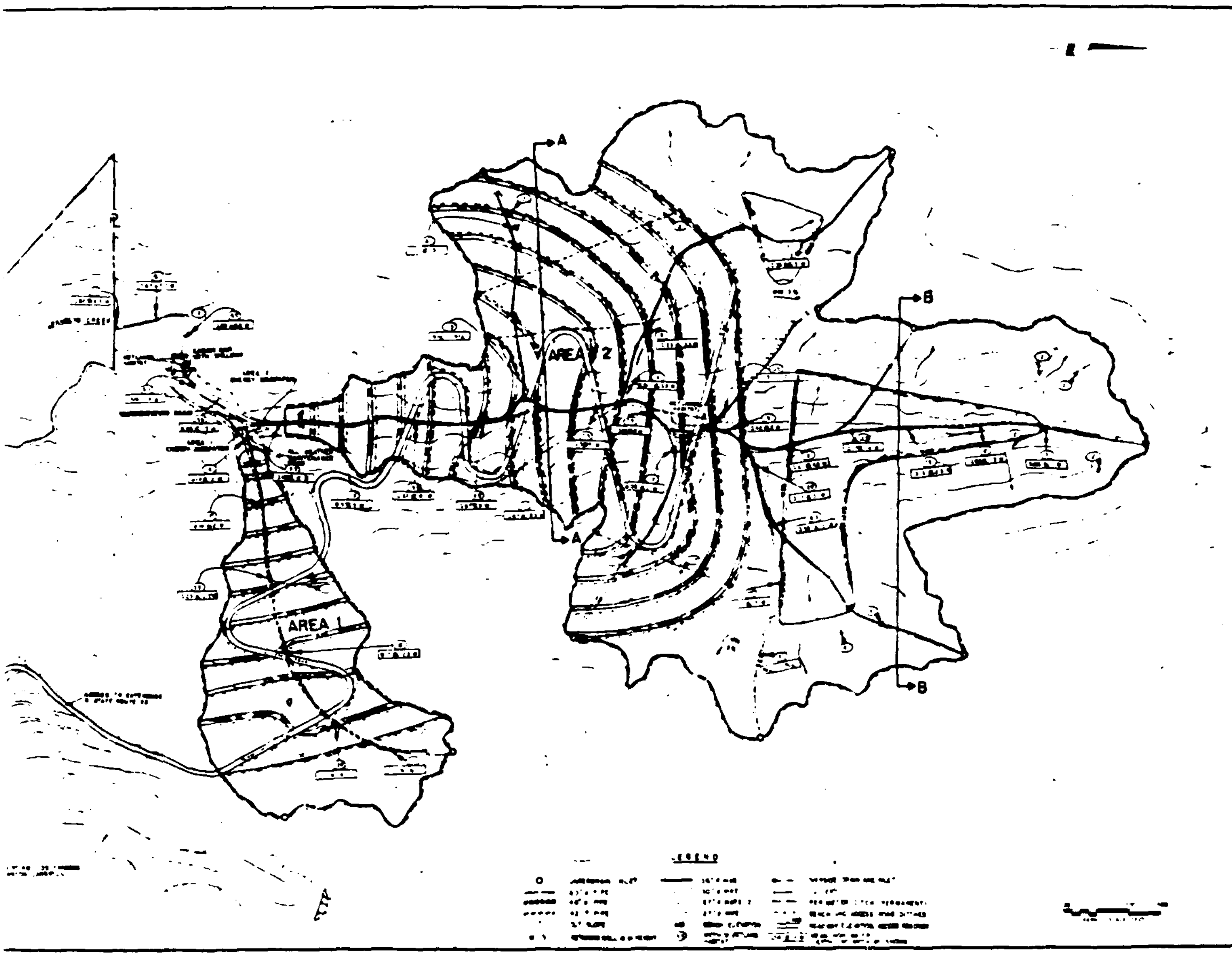
FEET

BFI OF CALIFORNIA, INC.
225 SHOREWAY ROAD
SAN CARLOS, CA 94070

No. 16611S91
PROPOSED SEDIMENTATION BASIN AND DAM, RETENTION DAM, UNDERDRAIN, ENERGY DISSIPATOR AND ROADWAYS
IN: APANOLIO CREEK
AT: DIGGES CANYON
COUNTY OF: SAN MATEO STATE: CA
APPLICATION BY: BFI OF CALIF.,INC.
SHEET 1 OF 4 DATE: 4-13-87



NO. 16611S91

PURPOSE: FACILITIES REQUIRED TO DEVELOP A SANITARY LANDFILL

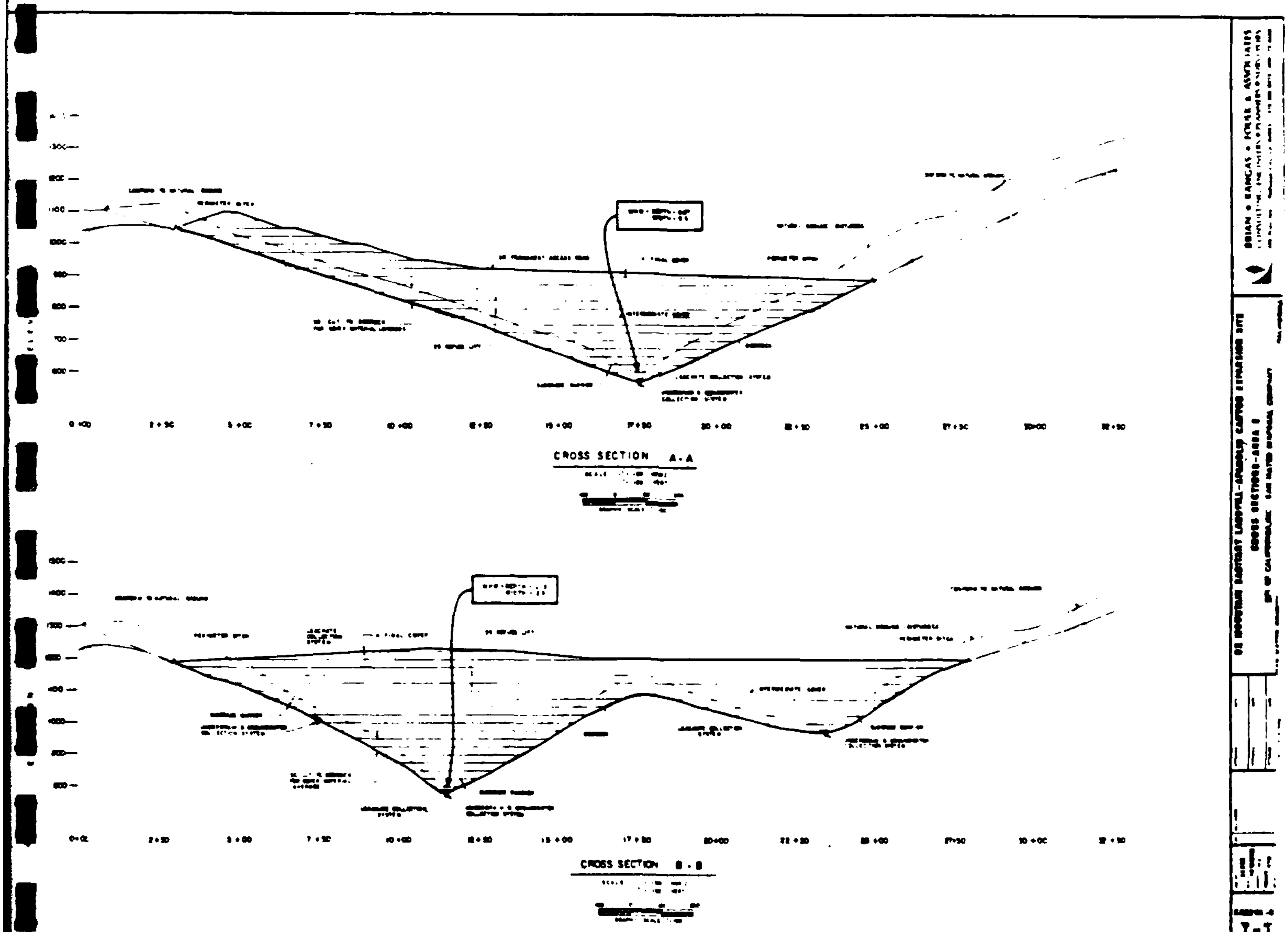
PLAN VIEW

PROPOSED SEDIMENTATION BASIN AND DAM, RETENTION DAM, UNDERDRAIN, ENERGY DISSIPATOR AND ROADWAYS
IN: APANOLIO CREEK
AT: DIGGES CANYON
COUNTY OF: SAN MATEO STATE: CA
APPLICATION BY: BFI OF CALIF.,INC.
SHEET 2 OF 4 DATE: 4-13-87

DATUM: MLLW

ADJACENT PROPERTY OWNERS:
SEE ENG FORM 4345

BFI OF CALIFORNIA, INC.
225 SHOREWAY ROAD
SAN CARLOS, CA 94070



No. 16611S91

PURPOSE: FACILITIES REQUIRED
TO DEVELOP A SANITARY LANDFILL

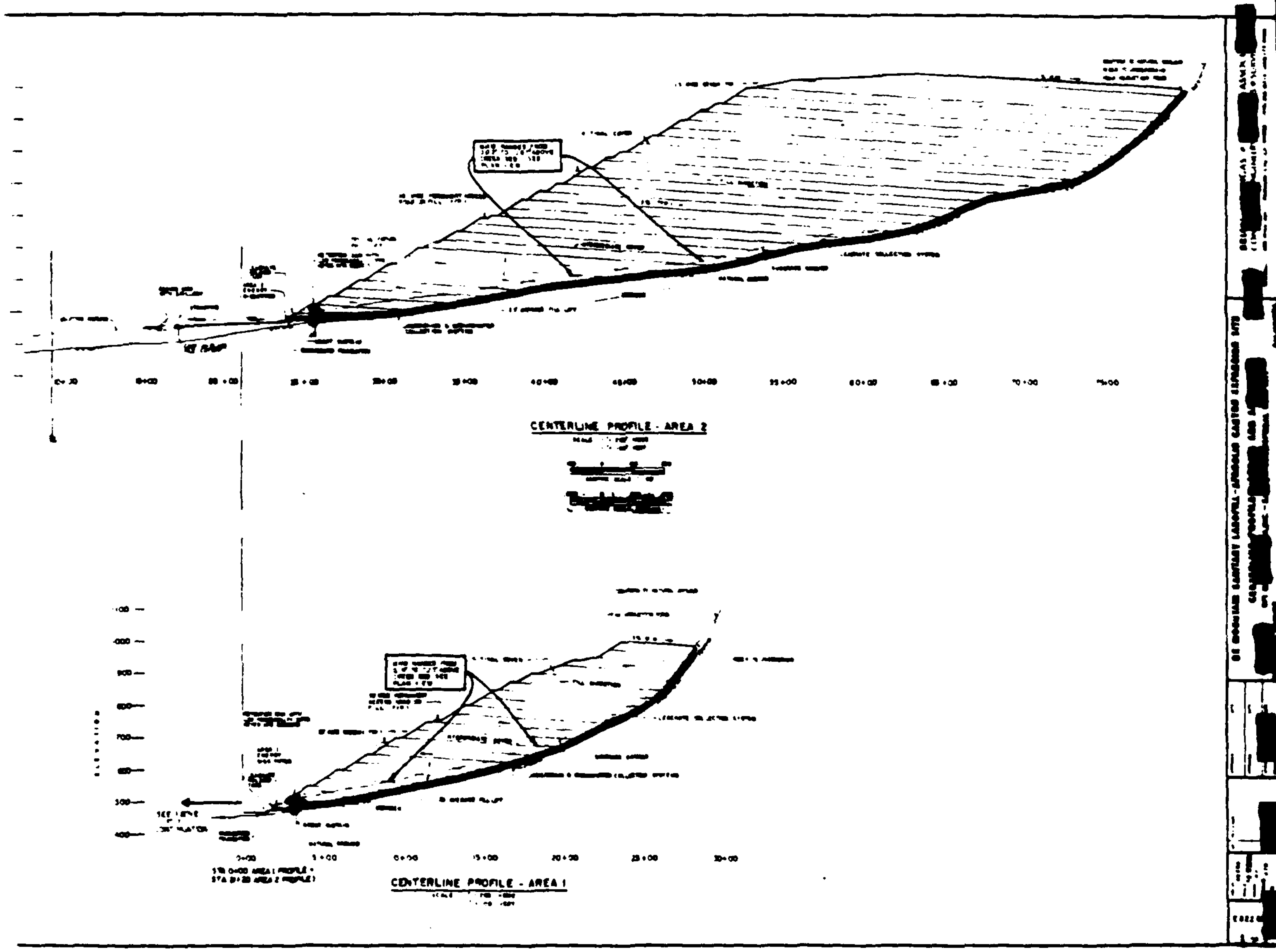
DATUM: MLLW

ADJACENT PROPERTY OWNERS:
SEE ENG FORM 4345

SECTION VIEWS

BFI OF CALIFORNIA, INC.
225 SHOREWAY ROAD
SAN CARLOS, CA 94070

PROPOSED SEDIMENTATION BASIN AND
DAM, RETENTION DAM, UNDERDRAIN,
ENERGY DISSIPATOR AND ROADWAYS
IN: APANOLIO CREEK
AT: DIGGES CANYON
COUNTY OF: SAN MATEO STATE: CA
APPLICATION BY: BFI OF CALIF., INC.
SHEET 3 OF 4 DATE: 4-13-87



No. 16611S91

PURPOSE: FACILITIES REQUIRED TO DEVELOP A SANITARY LANDFILL

DATUM: MLLW

ADJACENT PROPERTY OWNERS: SEE ENG FORM 4345

SECTION VIEWS

BFI OF CALIFORNIA, INC.
225 SHOREWAY ROAD
SAN CARLOS, CA 94070

PROPOSED SEDIMENTATION BASIN AND DAM, RETENTION DAM, UNDERDRAIN, ENERGY DISSIPATOR AND ROADWAYS
IN: APANOLIO CREEK
AT: DIGGES CANYON
COUNTY OF: SAN MATEO STATE: CA
APPLICATION BY: BFI OF CALIF., INC.
SHEET 4 OF 4 DATE: 4-13-87

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

06 ... 1987

Colonel Galen H. Yanagihara
District Engineer
U.S. Army Corps of Engineers
San Francisco District
ATTN: Regulatory Functions Branch
211 Main Street
San Francisco, California

Subject: Public Notice No. 16611S91, June 8, 1987
Browning-Ferris Industries, Apanolio Canyon Creek,
San Mateo County, CA

Dear Colonel Yanagihara:

The Environmental Protection Agency (EPA) has reviewed the subject public notice regarding a proposal to discharge fill material into Apanolio Canyon Creek under Section 404 of the Clean Water Act. We believe that significant aquatic resources exist within the project area and that the proposed project will result in adverse impacts to waters of the United States, including special aquatic sites, as defined under EPA's 404(b)(1) Guidelines. EPA believes that the project, as proposed, fails to comply with these Guidelines (40 CFR 230.10) and recommends that no permit be issued.

Specifically, the project will result in the loss of between 3.43 and 10.8 acres of wetlands and pool/riffle habitat. Apanolio Creek, in the project area, supports regionally-significant populations of steelhead trout (*Salmo gairdnerii gairdnerii*). EPA believes that project-related impacts to this habitat will cause or contribute to significant degradation of the aquatic ecosystem.

The 404(b)(1) Guidelines presume that there is a less environmentally-damaging practicable alternative to a discharge of fill into special aquatic sites when the project purpose is not water dependent. A permit cannot be granted unless the applicant clearly demonstrates that there are no less-damaging alternatives available. In considering alternatives, the applicant should consider other sites, including those not already owned by the applicant and including sites that may be outside of San Mateo County, if their use as landfills is practicable. The applicant has not clearly demonstrated that there are no less-damaging alternatives available.

If the applicant can clearly demonstrate that the proposed project is the least-damaging practicable alternative, the project still would not be permittable if it causes or contributes to significant degradation of waters of the United States. EPA will further evaluate the project impacts and proposed mitigation measures if the analysis of alternatives demonstrates that the project purpose can only be served by filling Apanolio Creek Canyon.

We agree with the Corps' determination that an Environmental Impact Statement must be prepared for this project. We will submit detailed scoping comments to assist in the Corps' preparation of that document. These comments will include recommendations regarding additional information necessary to determine compliance with EPA's 404(b)(1) Guidelines, as well as recommendations regarding water quality and seismic safety issues.

Should you have questions regarding 404(b)(1) compliance please direct them to Thomas G. Yocom of my staff at 974-8175. Questions regarding EPA's EIS scoping comments should be directed to Rick Hoffmann at 974-8191.

Sincerely,

Charles W. Murray, Jr.

Charles W. Murray, Jr.
Assistant Regional Administrator
for Policy and Management

cc: USFWS, McKevitt, Sacto
NMFS, Bybee, Santa Rosa
CDFG, Lollock, Sacramento

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 South Ferry Street
Terminal Island, California 90731

July 8, 1987 F/SWR33:TDW

Colonel Galen H. Yanagihara
District Engineer
San Francisco District
Corps of Engineers
211 Main Street
San Francisco, California 94105

Dear Colonel Yanagihara:

This letter is in response to Public Notice (PN) Number 16611S91, Browning-Ferris Industries (BFI), proposing to place fill in association with the development of a sanitary landfill in Apanolio Creek, near Half Moon Bay, San Mateo County, California. We recommend against issuance of a permit for this project.

The National Marine Fisheries Service (NMFS) is responsible for preserving and restoring anadromous fish resources, particularly steelhead trout. The proposed project could increase the cumulative loss of steelhead resources in California. In addition, proposed mitigative efforts adjacent to the project site may not benefit the resources impacted. We encouraged the preparation of an Environmental Impact Statement (EIS) in our letter of May 4, 1987 (enclosed), to examine alternatives identifying fishery resource impacts and evaluate mitigative options. The Environmental Assessment in the PN indicates that an EIS will be prepared.

Therefore, since all information needed to fully evaluate this project is not available, we recommend against permit issuance. My staff is available to assist in reviewing information regarding fishery resources prepared for the EIS.

If you have questions regarding these comments, please contact Diane Windham of my staff, at the National Marine Fisheries Service, 777 Sonoma Avenue, Room 325, Santa Rosa, California 95404; telephone (707) 525-4275.

Sincerely,

E.C. Fullerton
Regional Director

Enclosure

cc: CDFG
FWS
EPA
RWQCB
Applicant

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 South Ferry Street
Terminal Island, California 90731

May 4, 1987 F/SWR33:JRB

Lt Colonel Andrew M. Perkins, Jr.
District Engineer
San Francisco District
Corps of Engineers
211 Main Street
San Francisco, California 94105

Dear Colonel Perkins:

We appreciated the opportunity to attend a discussion meeting April 27, 1987 involving Santa Clara County's proposal to expand its refuse landfill operation at the Apanolio Creek site. At that meeting we only briefly outlined our concerns for fish resources and you requested an early detailed scoping of our concerns, thus the intent of this letter.

The National Marine Fisheries Service is responsible for preserving and restoring anadromous fish resources. Of particular concern is steelhead trout, an anadromous fish of considerable recreational importance. Historically, coastal streams similar to Apanolio Creek supported steelhead runs all along the coast as far south as San Diego County. Because of human disturbances, most coastal streams south of San Francisco no longer provide suitable habitat for steelhead. Only remnant runs remain in a few select streams where several active enhancement projects struggle to preserve these fish.

We are aware that an Environmental Impact Report was prepared in compliance with the California Environmental Quality Act. We understand that a thorough assessment of fish (steelhead) resources was not included in that report. At the meeting on April 27, we concluded after the California Department of Fish and Game's presentation, that sufficient information currently is not available to assess the impact of the landfill project on steelhead trout.

Data were presented suggesting that the creek supports 1,500 to 2,000 steelhead yearlings per mile of creek, in those stretches where fish passage is not significantly hampered. In fact, photographs shown at the meeting suggest excellent potential for a fishery restoration program, especially for improving fish passage by removing or modifying obvious barriers. This potential would be lost forever if the proposed landfill operation were approved.

Eliminating a viable steelhead stream to accommodate a landfill operation would establish an unacceptable precedent. This action would encourage other landfill proposals with similar or perhaps greater potential impacts to fisheries. A thorough examination of alternatives must be required. We recognize that disposal of refuse is a paramount problem in the San Francisco Bay area. This only exemplifies the unusual precedent that would be set by approving this project.

We encourage you to require the preparation of a Federal Environmental Impact Statement (EIS). Anything less would not appear to be consistent with provisions of the National Environmental Policy Act.

If it is determined that an EIS will be required, we will provide you detailed comments identifying information that will be required to assist us in reviewing fishery impacts and identifying suitable, compensating options. Until then, we must discourage this project on the basis of unknown impacts to steelhead trout and the precedent for similar related projects.

Sincerely,

E.C. Fullerton
Regional Director

CONFIRMATION OF COMPUSERVE SENT 7/7/87

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Division of Ecological Services
2800 Cottage Way, Room E-1803
Sacramento, California 95825

July 7, 1987

District Engineer
Corps of Engineers, San Francisco District
Regulatory Functions Branch Attn: Dave Hodges
211 Main Street
San Francisco, California 94105

Subject: Public Notice No. 16611S91, Browning-Ferris Industries, San Carlos, California; Ox Mountain; Apanolio Creek, San Mateo County, California

Dear Sir:

We have reviewed the public notice dated June 8, 1987 regarding a proposal for a landfill expansion into the headwaters of Apanolio Creek and its adjoining riparian wetlands.

These comments have been prepared under the authority, and in accordance with the provisions, of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The applicant proposes to expand an existing landfill by disposing of refuse from San Mateo County in 285 acres of Apanolio Canyon, part of the Pilarcitos Creek watershed. The proposed project would fill the canyon from its current 500-foot elevation to 1200-foot, with an average depth of 185 feet. The Service responded to a pre-discharge notification on the proposed project in a letter dated February 26, 1987.

Apanolio Creek's pool and riffle reaches within the proposed landfill site support and are spawning habitat for a salmonid population. According to a recent study conducted by the California Department of Fish and Game (CDFG), a total population estimate of 1,502 steelhead per mile of stream was calculated for the lower section of Apanolio Creek within the project site. As stated in our response on the pre-discharge notification (enclosure), a diverse and mature stand of riparian wetland borders the creek. The riparian wetland within the proposed area is extremely important habitat for a variety of small mammals, amphibians, and migratory birds. Besides their value as wildlife habitat, riparian areas are also an integral part of the aquatic ecosystem. The vegetation within this zone provides shade, helping to regulate the stream's temperature. Insect drop from this vegetation contributes to the food supply for the stream's fish population. Both riffle/pool complexes and riparian wetlands are considered special aquatic habitats. According to the Final Environmental

Impact Report (EIR) prepared by San Mateo County on the proposed project, the upper canyon supports bobcat, deer, coyote, and mountain lion.

Old growth Douglas fir stands, such as those found in the proposed project area, are particularly important to the marbled murrelet, a pelagic seabird listed as a species of special concern by the State of California. According to the California Department of Fish and Game, the small population size of this murrelet renders it vulnerable to extirpation should a threat materialize. This bird is an old growth dependent species that throughout most of its range nests only in old growth stands of Douglas fir and coast redwood. In the early 1970's the discovery of the first nest ever recorded for this species in North America on a moss-covered limb of Douglas fir in Big Basin Redwoods State Park (northern Santa Cruz County, about 20 miles south of the proposed project area) ended one of the great mysteries of North American ornithology in the 20th century. According to Sowls et al. (1980) coastal waters and associated nesting habitats in mature stands of coniferous trees from Santa Cruz to Half Moon Bay support the second largest concentration of marbled murrelets in the state. Logging of old growth forests as well as the gill and trammel net fishery and offshore oil spills cumulatively pose significant threats to the future of this species. Accordingly, surveys should be conducted to determine if this species uses the proposed project site.

As discussed in the public notice, the federally-listed endangered San Francisco garter snake is expected to occur downstream from the project area. Maintenance of adequate stream flows as well as high water quality is imperative for the survival of the snake. The public notice also notes several candidate invertebrates that should be considered since the proposed project would have long term implications. Because the project is a major construction activity and an Environmental Impact Statement is required, preparation of a biological assessment will be necessary pursuant to 50 CFR 402.12. Formal consultation pursuant to Section 7 of the Endangered Species Act should be initiated subsequent to completion of the biological assessment.

In our response to the pre-discharge notification, we placed the riparian wetlands and the stream in Resource Category 2 because of the scarcity of riparian habitat and its importance to migratory birds and fishery resources of Apanolio Creek. However, after additional consideration we have placed the stream ecosystem/riparian canyon complex within Apanolio Creek in Resource Category 1 because stream habitat found in the proposed project area is valuable, scarce in this ecoregion and, for all practical purposes, irreplaceable. The mitigation goal for this Resource Category is no loss of existing habitat value. Because the old growth Douglas fir stands within the canyon contribute to the wildlife value of the riparian wetlands, support intrinsically high wildlife values, stabilize and contribute to the watershed, and buffer the stream, we have placed it in Resource Category 2. The mitigation goal is no net loss of in-kind habitat value. If it is determined that these stands are nesting areas for the marbled murrelets, the Service will reconsider the Resource Category designation for this habitat.

Construction and operation of the proposed landfill would result in the loss of over one mile of valuable stream habitat used by steelhead trout. It would also destroy over 285 acres of Apanolio Canyon, including the riparian zone bordering Apanolio Creek and old growth Douglas fir. The wildlife resources these areas support would be lost. The landfill may adversely impact the endangered San Francisco garter snake within the proposed project site. If leachate from the landfill seeps into the water table or the downstream reach of Apanolio Creek, stream habitat in the entire lower Pilarcitos watershed, would be degraded. This would result in a significant adverse impact to steelhead trout, and potentially endangered San Francisco garter snake habitat. Alteration of the flow regime in Apanolio Creek could further degrade aquatic habitat.

It is Service policy to recommend against the authorization of proposals which would result in the destruction of valuable wetland habitat for non-water dependent purposes. It is also our policy to recommend that adverse biological impacts to all habitats be minimized to the greatest extent possible. Unavoidable impacts to fish and wildlife habitats must be compensated for in accordance with the mitigation goals set forth in the Service's Mitigation Policy. The proposed landfill is not a water dependent project.

We disagree with the Corps of Engineers jurisdictional determination, adopted from studies contracted by the applicant. It appears that the Corps took jurisdiction only over the immediate streambed but did not take jurisdiction over the adjoining riparian wetlands, vegetated with predominantly hydrophytic plants. We believe there are hydrologic indicators outside the stream bed to provide the required hydrology parameter. To accurately determine the hydrology parameter for the Corps' jurisdictional determination would require hydrologic modeling of water surface profiles. We are unaware that this has been done and recommend the Corps with the Environmental Protection Agency reevaluate the jurisdictional determination.

We agree with the Corps of Engineers determination that the adverse impacts of the proposed project necessitates the preparation of an Environmental Impact Statement. We believe that Apanolio Canyon is unsuitable as a land fill site because of the adverse biological impacts that would occur both within the project site and downstream if leachate seeps into the stream or water table. We also believe there are practicable upland alternatives which should be pursued. It would be a bad precedent to approve a landfill which causes the permanent loss of a perennial stream/riparian habitat/canyon ecosystem. Because the proposed project would eliminate a perennial stream/riparian habitat/canyon ecosystem which is scarce and of high value to fish and wildlife resources, and because it is not water dependent, the Service recommends against authorization of the proposed landfill. We also recommend the following information/study results be included in the Environmental Impact Statement if this project is pursued:

1. Hydrologic monitoring of baseline conditions of Apanolio Creek which would include gauging and precipitation stations;

2. Independent hydrological determinations of water surface profiles at different flows including the 2.2 year event to ascertain a final jurisdictional determination;

3. Determinations of post-project stream flow within Apanolio and Pilarcitos Creeks;
4. Surface water monitoring stations downstream of the existing land fill as well as analysis of the water quality leachate wells required by the San Francisco Regional Quality Control Board;

5. An adequate discussion of the anticipated direct and indirect impacts on the endangered San Francisco garter snake both within and downstream of the proposed project site. This discussion should include an assessment of potential habitat loss caused by the fill and any loss or degradation of habitat resulting from leachate contamination. A two year field survey for the endangered San Francisco garter snake on the project site and in areas downstream should be conducted if the applicant disputes the presumption that the snake is present and could be affected;

6. Field surveys for the candidate species mentioned in the public notice;

7. Field studies to determine if marbled murrelets nest in the proposed project area;

8. Analysis of proposed project impacts resulting from changes in water quality and streamflow (i.e. changes in biotic community with presence of leachate, reduction of riparian stream corridor from diminished stream flow, increased erosion and turbidity);

9. Cumulative assessment of remaining riparian wetlands and old growth Douglas fir stands within the Coastal San Francisco Bay area;

10. An adequate discussion of practicable alternatives such as (a) use of existing landfills at Kirby Canyon, Altamont and Newby Island; (b) less environmentally damaging sites for a new landfill (e.g. coastal plain terraces in the region); and (c) alternative technologies, such as curb-side recycling and waste energy recovery.

The above views and recommendations constitute the report of the Department of the Interior on this public notice.

If you have any questions about these comments, please contact Cay C. Goude at (916) 978-4613. If you have any questions regarding endangered or candidate species, please contact Peter Sorensen at (916) 978-4866.

Sincerely yours,

James J. McKevitt
Field Supervisor
U.S. Department of the
Interior Coordinator

Enclosure

cc: Reg. Dir., (AHR), FWS, Portland, OR
Dir., CDFG, Sacramento, CA
Reg. Mgr., CDFG, Reg. III, Yountville
Regional Water Quality Control Board, Oakland
SESO, Sacramento
EPA, San Francisco
NMFS, Santa Rosa
Save San Francisco Bay, Berkeley
California Waterfowl Association, Concord
Urban Creeks Council, Berkeley
Cal-Trout, San Francisco
Applicant

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Division of Ecological Services
2800 Cottage Way, Room E-1803
Sacramento, California 95825

February 26, 1987

District Engineer
Corps of Engineers, San Francisco District
211 Main Street
San Francisco, California 94105

Subject: Pre-Discharge Notification 16611S91, disposal of refuse from San Francisco at Ox Mountain: Apanolia Creek, San Mateo County, California

Dear Sir:

We have reviewed the pre-discharge notification dated February 10, 1987, regarding a proposal to dispose of refuse in a riparian wetland and special aquatic area along Apanolia Creek.

These comments have been prepared under the authority, and in accordance with the provisions, of the Fish and Wildlife Coordination Act (48 Stat 401, as amended; 16 U.S.C. 661 et seq.).

The proposed expansion site consists of 285 acres of the Apanolia Canyon which is part of the Pilarcitos Creek watershed. The proposed project would fill the canyon from the 500 foot elevation to the 1200-foot level, with an average depth of 185 feet.

A diverse and mature stand of riparian wetland borders Apanolia Creek. The riparian wetland within the proposed area is extremely important as habitat for a variety of small mammals, amphibians, and migratory birds. According to the Final Environmental Impact Report (EIR) prepared by San Mateo County on the proposed project, the upper canyon supports bobcat, deer, coyote, and mountain lion. Besides their value as wildlife habitat, riparian areas are also an integral part of the aquatic ecosystem. According to a recent study conducted by the California Department of Fish and Game (CDFG), a total population estimate of 1,502 steelhead per mile of stream was calculated for the lower section of Apanolia Creek within the project site (approximately 200 yards downstream from the first proposed dam site). The CDFG study states that Apanolia Creek provides quality steelhead spawning and nursery habitat due to its steep gradient and perennial flow through most of its length, even during years of low precipitation.

According to the Final EIR on this project, Dr. Ted Papenfuss, hired as a consultant to the County, did a reconnaissance survey for the Federally listed endangered San Francisco garter snake from Highway 92 up to the intersection of Apanolia Creek with its first major tributary. He did not observe any San Francisco garter snakes, but EIR states "...since otherwise good habitat was available, their presence in lower Apanolia Canyon could not be ruled out on the basis of his survey." We therefore strongly recommend that a more intensive survey for this species be conducted to provide adequate assurance that the project will not adversely affect this listed species. We recommend a live trapping effort, using drift traps and drift fences be conducted in the areas identified by Dr. Pappenfuss as potentially suitable habitat for this snake. Without such trapping, the Service believes the proposed project could affect the San Francisco garter snake; this will require consultation pursuant to the Endangered Species Act.

The U.S. Fish and Wildlife Service Mitigation Policy (Federal Register 46 (15): 7644 - 7663, January 23, 1981) provides internal guidance for establishing appropriate compensation goals for proposed projects impacting waters of the United States. Under the Mitigation Policy, resources are divided into four categories to assure that recommended compensation is consistent with the fish and wildlife values involved. These Resource Categories cover a range of habitat values from those considered to be unique and irreplaceable to those believed to be of low value to fish and wildlife resources. The Mitigation Policy does not apply to threatened or endangered species.

California has lost an estimated 98 per cent of its riparian habitat because of past urban development, agricultural conversion, and various flood control activities. Steelhead trout populations have seriously declined in coastal streams due to channelization projects, passage problems, and a decline in water quality associated with other developments. Because the riparian woodland provides habitat for steelhead trout and migratory birds, and is scarce, we placed the riparian wetland and stream in Resource Category 2. The mitigation goal is no net loss of in kind habitat value. The canyon slope, which supports a mature Douglas fir stand, would be placed in Resource Category 3 because of its relative abundance. The mitigation goal for this Resource Category is no net loss of habitat values while minimizing loss of in-kind habitat value.

According to the pre-discharge notice, the area of impact would be between [illegible].3 acres and 10.8 acres. On September 23, 1986, we participated in the jurisdictional determination with the Corps of Engineers, Environmental Protection Agency, Department of Fish and Game, and the applicant's representative. We observed that Corps staff was very conservative in their delineation of wetlands. We believe that there may be even more than 10 acres of wetlands within the Corps' jurisdiction and therefore recommend that the Environmental Protection Agency participate in the final jurisdictional determination.

According to the Corps' regulations, we believe it is inappropriate for the Corps to even consider this as a possible Nationwide permit for the following reasons:

1. The Corps of Engineers own preliminary wetland determination indicates that there are at least 10.8 acres of wetland/streambed habitat within their jurisdiction; we believe this figure may be conservative. Nationwide permits cannot be issued for fill of wetlands 10 acres or more in size.

2. The activity would significantly disrupt the movement of those aquatic species indigenous to the waterbody (steelhead trout); and

3. The site appears to support habitat for the endangered San Francisco garter snake; a small population may exist there. Our Sacramento Endangered Species Office considers the past surveys to be inadequate and recommends that a more comprehensive trapping survey be done.

The Service strongly recommends that an individual permit be required for the proposed project because of the value the riparian wetlandhas to species of special concern to the Service, the overall scarcity of the resource on a regional basis, and the project's potential impact to endangered species.

The above views and recommendations constitute the report of the Department of the Interior on this pre-discharge notice.

If you have any questions about these comments, please contact Cay C. Goude at (916) 978-4613.

Sincerely yours,

Fred T. Nakaji

Fred T. Nakaji
Acting Field Supervisor
U.S. Department of the
Interior Coordinator

cc: Reg. Dir., (FWE), FWS, Portland, OR
Dir., CDFG, Sacramento, CA
Reg. Mgr., CDFG, Reg. III, Yountville
CDFG, Linda Ulmer
SESO, Sacramento
EPA, San Francisco
NMFS, Santa Rosa
Save San Francisco Bay, Berkeley
Urban Creeks Council, Berkeley
Cal Trout, Sacramento
Applicant

Resources Building
1416 Ninth Street
95814
(916) 445-5656
TDD (916) 324-0804

California Conservation Corps
Department of Boating and Waterways
Department of Conservation
Department of Fish and Game
Department of Forestry
Department of Parks and Recreation
Department of Water Resources

GEORGE DEUKMEJIAN
GOVERNOR OF
CALIFORNIA

THE RESOURCES AGENCY OF CALIFORNIA
SACRAMENTO, CALIFORNIA

Air Resources Board
California Coastal Co
California Tahoe Con
California Waste Man
Board
Colorado River Board
Energy Resources Co
and Development C
San Francisco Bay Cons
and Development Com
State Coastal Conser
State Lands Division
State Reclamation Board
State Water Resources C
Board
Regional Water Qualit
Control Boards

Colonel Andrew Perkins
Corps of Engineers
ATTN: Regulatory Branch
211 Main Street
San Francisco, CA 94105

July 9, 1987

Public Notice 16611-S91 (Browning-Ferris Industries)
Place fill, Apanolio Creek, San Mateo County.

Dear Colonel Perkins:

The State has reviewed the subject public notice, coordinating review with the agencies listed below.

Attached for your consideration are comments received from the Departments of Fish and Game and Parks and Recreation.

Thank you for providing an opportunity to review this project.

Sincerely,

Gordon F. Snow

Gordon F. Snow, Ph.D
Assistant Secretary for Resources

Attachments (2)

cc: Department of Boating and Waterways
Department of Parks and Recreation
Department of Fish and Game
Department of Health Services
Department of Transportation
Coastal Commission
State Lands Commission
San Francisco Bay Regional Water Quality Control Board

Memorandum

To : Honorable Gordon K. Van Vleck
Secretary for Resources

Attn: Gordon F. Snow
Projects Coordinator

Date : July 7, 1987

From : Department of Fish and Game

Subject : U. S. Army Corps of Engineers, Public Notice 16611S91, Browning-Ferris Industries (BFI) Landfill Near Half Moon Bay, San Mateo County

The Department of Fish and Game (Department) has reviewed the Public Notice for a sanitary landfill to be located in the headwaters of Apanolio Creek near Half Moon Bay, San Mateo County. Department personnel have been involved in extensive field review of this project proposal and other landfill proposals in the six Bay Area counties for several years.

Every large landfill we have reviewed in recent years has been of a highly controversial nature involving important wildlife and/or fish resources and their habitats. Unfortunately, this project is no exception. The proposal would inundate or otherwise make inaccessible to potentially migratory fish 3,100 feet (0.54 mile) of Apanolio Creek and its attendant wetland vegetation consisting predominantly of mature red alders. Presently a fifty-year old diversion structure downstream of the project creates a barrier to upstream migration by steelhead except "possibly under an extreme flood event when a cascade of water four to five feet deep might allow fish to move along the side of the creek banks." (Ted VandeSande, Department Hydraulic Engineer, Oral Communication, April 22, 1987). The obstruction consists of a combined total drop of eight feet and a twenty-five foot concrete apron below two barriers. Fish found above the dam in the project site are essentially residualized steelhead and rainbow trout. Below this dam, the fish are sea-run steelhead. If fish passage was provided at this point, it would provide steelhead access to an additional 8,700 feet (1.6 miles) of stream of which 3,100 feet (0.54 miles) would be eventually eliminated by the project.

In our February 4, 1987 correspondence to BFI's consultant Ralph Osterling on this project, we stated "assuming the water dependence and/or alternative analysis requirements of the Corps are met, we will continue to work with BFI to resolve any fish and wildife resource problems that are involved." At the April 27, 1987 meeting convened by the Corps on this project, we were provided with an April 24, 1987 habitat mitigation plan prepared by the applicant's consultant (copy attached). Most of the proposed measures would resolve long-standing problems for the steelhead fishery within Pilarcitos Creek and adjacent drainages.

If all the measures can be implemented in a timely manner, we believe the steelhead trout resource of the Pilarcitos Creek drainage and the San Pedro Creek drainage can be markedly improved. This in turn would compensate for the projected loss of residualized steelhead trout and rainbow trout and their habitat.

One issue that was not addressed in the Public Notice that should be addressed in the EIS is how water temperatures will be kept at preproject levels. We suggest all low flows be piped around the proposed debris dam to maintain these temperatures. This would also facilitate removing silt from the debris dam when it becomes necessary.

We are aware that a study is underway to trap in the project area for the State- and Federal-listed endangered San Francisco garter snake. We look forward to the completion of this study and recommend the Corps include the study results in the draft EIS.

We will forward our formal comments on this project after we have reviewed the draft EIS. Theodore Wooster, Environmental Services Supervisor, telephone (707) 944-2011; and Linda Ulmer, Fishery Biologist, telephone (408) 336-3359 are available to assist the Corps during the prepration of the EIS.

Pete Bontadelli

Pete Bontadelli
Acting Director

Attachment

RALPH OSTERLIN
CONSULTANTS I

RALPH OSTERLING CONSULTANTS INC.
HABITAT MITIGATION PLAN
SAN MATEO COUNTY - BFI
OX MOUNTAIN REGIONAL LANDFILL

A)Apanolio Creek (1989-90)

1)Replant bare and unstable riparian areas along the lower creek.
- a)Owner approval
- b)Species composition:
  - 1)Willows
  - 2)Alders
  - 3)Herbaceous
  - 4)Vines and shrubs
  - 5)Fish and Game coordination.

2)Rebuild outlet on Bongards Dam.S
- a)Owner approval
- b)Fish and Game coordination.
- c)BFI implementation

3)Create more habitat pools in the creek.
- a)Owner approval.
- b)Fish and Game coordination.
- c)BFI implementation.
- d)Boulder/rubble placement.
- e)Pool creation structures.

4)Remove debris that hinder or prevent fish passage.
- a)Owner approval
- b)Fish and Game coordination.
- c)BFI implementation

5)Create additional instream fish and benthic cover.
- a)Boulder/rubble placement.
  - 1)Boulders and rubble for cover.
  - 2)Gravel placement for spawning habitat.
- b)Instream structures.
- c)Owner approval
- d)Fish and Game coordination.
- e)BFI implementation

6)Stream bank stabilization
- a)Create channel improvements
- b)Mid-stream direction deflectors.
- c)Rip-rap installation
- d)Place gravels in the creek bed.
- e)1/4 to 3/4 inch river run gravel.
- f)Fish and Game coordination.
- e)Owner approvals.

7) Investigate the possibility of stocking the creek with fish from Silver King Hatchery.
    a) Steelhead and silver salmon
    b) Use a mix of age classes.
        1) Yearlings for increasing the population in the creek.
        2) Older fish to promote a faster return time.
    c) Wait until after all instream work is completed.
    d) Fish and Game coordination.

8) Wildlife control burning.
    a) Create upland habitat
    b) CDF coordination.
    c) 20 acre patches.
        1) Maximum edge areas
        2) Helitorch burning
    d) 150 acres a year.
        1) Reburn every 10 years
        2) Monitor growth and utilization.

9) Develop springs around the upper drainage.
    a) Upland game species identification.
    b) Develop game cover.
    c) Perennial water supply.

10) Revegetate the new landfill as it is created.
    a) Annual grasses and forbs.
        1) Wildlife forage.
        2) Fast establishment
    b) Silt management.

11) Surface roads to reduce sedimentation.
    a) Sedimentation structures on roads.

12) Redo Gossett Dam and Lower Dam for fish passage.
    a) Open during winter.
    b) Sediment cleanout.
    c) Owner approval.
    d) BFI implementation.
    e) Fish and Game coordination.

B) Los Trancos Creek
    1) Same as Apanolio Creek (1,3,4,5,6,7,8,9)

    2) Los Trancos landfill final revegetation. (1989-91)
        a) Annual grasses and herbaceous plants for wildlife species.
        b) Roadside fencing to prevent unauthorized access.
        c) Brush piles for game cover.
            1) Quail and small game.
            2) CDF&G direction.
        d) Herbicide rooting barrier in clay cap.

3)Watering pond at head of canyon. (1989-91)
   a)Revegetate with riparian cover species.
   b)Cleanout silt and debris.
   c)Provide shade for water temperature modification.

4)Reroute the creek through the lower road sediment pond. (1989-91)
   a)Annual cleanout or more as required of Los Trancos ponds.
   b)Below waste management activities.
   c)During high flows.

5)Investigate establishing an aquatic community in Los Trancos Creek. (1989)

C)Pilarcitos Creek (1987-88
   1)Build marsh habitat at mouth area
      a)Owner approval.
      b)BFI implementation.
      c)Fish and Game and State Park coordination.

D)San Pedro Creek Pacifica (1987)
   1)Remove fish barriers
      a)Owner approval
      b)Fish and Game design and coordination.
      c)BFI implementation

E)Monitoring (1987-92)
   1)Annual monitoring program for steelhead populations to confirm success of programs.
      a)Use of electro fishing techniques.
         1)Apanolio Creek
         2)Los Trancos Creek
         3)San Pedro Creek

   2)Monitor stream sediment loads annually.
      a)100 foot stream transects evaluated.
         1)Apanolio Creek
         2)Los Trancos Creek
      b)Evaluate sediment pond cleanout operations.
         a)Apanolio Creek
         b)Los Trancos Creek

      c)Photo points.

   3)Set up track-traps and other wildlife monitoring stations. (1988)

   4)Set up baseline data. (1987)

F)Quality Assurance

1)Based on monitoring studies, subject to all approved permits, implement recommendations for improving the mitgation program.

2)Corrections shall be made in a timely fashion.

3)Bonding of $250,000

G)Project summary

This mitigation plan shall be implemented for the n Apanolio Landfill. The goal is to at least create a replaceme of habitat lost due to landfill construction. Programs including landfill planting revegetation and habitat for upland gam Sediment control, fisheries enhancement and maintenance wi replace and enhance the resource value.

Landowner and governmental agency cooperation is imperative fo the successful implementation of this plan. Projects removed from the BFI ownership can only be accomplished with full cooperatio of all involved.

Monitoring programs shall be implemented to document the present habitat and continued to assess the success of the plan. The long term programs will be modified to improve the enhancement of the watershed as indicated by the results of the monitoring program.

H)Approvals

The above work will begin after all required permits have been received.

The Resources Agency of Calif

Memorandum

Date : July 2, 1987

To : Gordon F. Snow, Ph.D.
Assistant Secretary for Resources

From : Department of Parks and Recreation

Subject: USCE Public Notice 16611 S91

Mitigation for the proposed project includes the creation of an estuary within Half Moon Bay State Beach. The Department of Parks and Recreation has objections to this proposal.

1. The Department objects to the concept of off-site mitigation particularly when it requires the commitment of public lands.
2. A popular trail would be displaced for the creation of the estuary.
3. The creation of an estuary is an unproven or undemonstrated possibility.
4. There are physical limitation or constraints to the success of the proposal including: lack of adequate inflow to sustain an estuary, and an exposed, shallow and warm stream above the proposed estuary which would act as a thermal barrier to most downstream fish.
5. The estuary would be shallow, and therefore prone to siltation, and exposed. The resultant warm waters would limit the estuary function as a rearing area for salmonids.

The Department is also concerned about the reduction of water quality downstream from the landfill. The Public Notice states that the creek below the Corinda Los Trancos Landfill is showing an increase in total disolved solids and salinity. The project design is similar to that existing at the neighboring Corinda Los Trancos site, and suggests that similar and cumulative impacts to water quality may occur.

This project is a substantial and long-term commitment of a portion of the watershed with potential for significant adverse impacts on and off-site. The Department recommends that the permit be held in abeyance until the completion of the Environmental Impact Statement.

Richard G. Rayburn, Chief
Resource Protection Division

cc: Central Coast Region
San Mateo Coast District
Natural Heritage Section

CALIFORNIA—THE RESOURCES AGENCY GEORGE DEUKMEJIAN, Govern

CALIFORNIA COASTAL COMMISSION
,1 HOWARD STREET, 4TH FLOOR
SAN FRANCISCO, CA 94105
(415) 543-8555

June 22, 1987

Lt. Colonel Andrew M. Perkins, Jr., District Engineer
U.S. Army Corps of Engineers
San Francisco District
211 Main Street
San Francisco, CA 94105

RE: Public Notice 16611S91--Browning Ferris Industries (BFI)

Dear Lt. Colonel Perkins:

This letter will serve as notice of the Commission's intent to review the above referenced project under the provisions of the Coastal Zone Management Act, Section 930.50 et seq., Consistency for Activities Requiring a Federal License or Permit. We have come to this conclusion because of a recent letter from the U.S. Fish and Wildlife Service containing new information about impacts of the project on the endangered San Francisco garter snake (Thamnophis sirtalis tetrataenia).

It is our understanding that the Corps has determined that it will be necessary to prepare an Environmental Impact Statement (EIS) in order to evaluate the environmental consequences of the proposed action. Presumably, this EIS will address the issue identified by the USFWS. Therefore, we encourage the Corps to not issue the required permit until such time as the EIS is reviewed and finalized.

Thank you for your cooperation in this matter. If you have any questions, please contact Mr. Michael Buck of my staff.

Sincerely,

James W Burns

JAMES W. BURNS
Chief Deputy Director

cc: Central Coast District Office
BFI
USFWS
RWQCB, San Francisco Bay Region

STATE OF CALIFORNIA—THE RESOURCES AGENCY
GEORGE DEUKMEJIAN, Governor
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION
1111 JACKSON STREET, ROOM 6040
OAKLAND 94607
Phone: Area Code 415
464-1255

July 20, 1987
File No. 2178.03(MFC)
2179.7117(KJT)

Lt. Colonel Andrew M. Perkins, Jr.
U.S. Army Corp of Engineers
211 Main Street
San Francisco, CA 94101

ATTN: Regulatory Functions Branch

SUBJECT: Browning-Ferris Industries Application for the Development of a Sanitary Landfill in Appanolio Creek, near Half Moon Bay, San Mateo County (U.S. Army Corp of Engineers Public Notice: 16611S91)

Dear Lt. Colonel Perkins, Jr.:

We have reviewed Public Notice 16611S91 regarding Browning-Ferris Industries (BFI) application for a Department of the Army permit to develop a sanitary landfill in Appanolio Canyon, located approximately three miles northeast of Half Moon Bay in San Mateo County. The following potential impacts have been identified with the proposed activity: loss of perennial streams, degradation of water quality, and loss of beneficial uses of the area (i.e. wildlife and aquatic species habitat).

This letter serves as notification within the 60 day review period, as required by 33 CFR 325.2(b)(ii), that the Regional Board does not waive water quality certification for this project at this time. The applicant will be informed that a complete application package must be submitted to the Regional Board for a water quality certification determination. According to Section 401(a)(1) of the Clean Water Act, the State must act on the request for certification within a reasonable period of time (which shall not exceed one year from the submittal of a complete application package to the Regional Board). Water quality certification for this project cannot be determined until such time that a complete application package has been received by the Regional Board. We, therefore, specifically request that the District Engineer determine that a longer period of time is necessary and reasonable for the State to act.

If you have any further questions please contact Ken Theisen at 464-1308.

Sincerely,

Roger B. James
Executive Officer

ABAG
ASSOCIATION OF BAY AREA GOVERNMENTS
Mailing Address: ■ P.O. Box 2050 ■ Oakland, CA 94604-2050

July 7, 1987

Lieutenant Colonel Andrew M. Perkins, Jr.
District Engineer
U. S. Army Corps of Engineers
San Francisco District
211 Main Street
San Francisco, CA 94105

Attention: Regulatory Branch

RE: Public Notice No. 16611S91; 8 June 1987

Dear Lieutenant Colonel Perkins:

The Notice states that Browning Ferris Industries has applied for a permit to place fill, in association with various structures, for development of a sanitary landfill in Apanolio Canyon in San Mateo County. The Notice concludes that an Environmental Impact Statement will be prepared and we understand from the San Mateo County Public Works Department that an Analysis of Alternative sites is under way. ABAG will wish to comment more fully on those documents when they are available.

The following staff comments suggest some regional issues not considered in the Preliminary Environmental Assessment that should be discussed fully in the DEIS. There are also some statements and conclusions--primarily in the section on Socioeconomic Characteristics and Anticipated Changes--that we feel are inaccurate, incomplete or inappropriate. The comments reflect concerns of Bay Area local elected officials that have been embodied in ABAG's Regional Plan for the San Francisco Bay Area. ABAG's Executive Board has not taken a position on this project.

1. Local and regional waste management and disposal capacity needs.

State law makes each county and its cities responsible for the safe and environmentally sound management and disposal of all wastes generated within and disposed of within that county. Increasingly strict environmental controls over the location and operation of sanitary landfills, and intense opposition to any landfill that is perceived to be near enough to threaten property values, have led all Bay Area counties--and their franchised operators--to look to remote canyons to meet their mandated responsibilities. Browning Ferris Industries, in cooperation with San Mateo County, purchased land comprising Corindo Los Trancos and Apanolio Canyons with the expectation that environmental impacts could and would be mitigated, and that the people of San Mateo County would have refuse disposal capacity well into the next century. It was even conceived that the City and County of San Francisco, which has no space for landfills and has had to export its garbage for decades, might send its refuse to the Ox Mountain landfill.

We agree that San Mateo County and BFI should investigate other possible sites in the County--and they are doing so--but we also expect that any other possibly suitable site will have potential adverse environmental consequences requiring expensive mitigation.

We also agree with the need for a countywide, vigorous, comprehensive (residential, commercial/industrial) recycling and composting effort to reduce the need for landfill capacity. The County Board of Supervisors has formed a committee that is moving fast to get such a program established. There is also the potential for a waste-to-energy facility in Redwood City that would further divert wastes from landfilling.

There are many economic issues involved--the cost to the applicant to provide the air and water quality protections required by state and federal law and to mitigate impacts on fish, wildlife and vegetative resources; the cost to San Mateo County and all its residents and businesses if garbage has to be trucked to a landfill in another county--as much as 80 miles away. The DEIS should describe these costs that include gasoline and truck mainenance costs, payments to the receiving county for road maintenance and landfill closure, and compensation for reducing the long-term availability of the landfill to that county's residents.

However, environmental issues are equally important. Proper disposal of wastes is a regional environmental quality and health issue as much as is protection of natural resources. The DEIS should weigh public health and safety benefits provided by proper waste disposal against unavoidable impacts on biological resources in San Mateo County.

An equally important regional environmental necessity is adequate land disposal capacity for wastes that must be landfilled. With many of the region's existing landfills closing and the increasing difficulty in finding new sites meeting environmental criteria and public acceptance, the region's long-term disposal capacity is shrinking. Ultimately the entire region will depend on large landfills in only three or four counties. In order to make this capacity last as long as possible, ABAG's policies support maximum reduction of wastes going to landfills through comprehensive recycling and resource recovery efforts. But landfills will still be necessary.

Each county's first priority, under State law, is to provide for its own wastes for at least 20 years into the future. Whenever a county, as is the case with San Francisco, must take its wastes to another county, it not only reduces that county's ability to accommodate its own population's needs but diminishes the capability of the region as a whole.

The best interests of the 9-county Bay region would be served by a set of requirements and conditions--attached to permit and project approval--to:

a) protect water quality;

b) mitigate impacts on biological resources to the extent feasible; and

c) dramatically reduce wastes requiring landfilling through recycling and composting;

that would permit San Mateo County to establish long-term disposal capacity.

2. <u>Other comments on the Preliminary Environmental Assessment</u>.

We do not have staff to review the sections on impacts on water supply and quality and on biological resources. Many of the impacts discussed appear to be serious. We are troubled, however, that the findings in the section on socioeconomic characteristics and anticipated changes either do not include all the necessary considerations or that some of the conclusions appear to lack objectivity.

o Economics - There is long-term benefit to residents and businesses from a landfill within the county, in terms of not having to bear the costs of exportation. These costs are considerable--for road maintenance and improvements, for landfill closure and loss of capacity of the receiving county, as well as added gasoline and truck maintenance costs of the long haul. These should be fully discussed in the DEIS.

  The statement that the project would provide the applicant with long-term benefits in the form of maintaining their current business status in San Mateo County is not appropriate to an objective analysis.

o Residents and businesses also receive long term public health benefits from having proper waste disposal capacity.

o Long-term adverse impacts to commercial steelhead fishing are cited. The extent of commercial fishing in this area should be described.

o Energy resources are already being used in transporting and disposing of refuse at Ox Mountain (Corinda Los Trancos Canyon); no significant change would be involved with any other site in San Mateo County. Significant additional consumption of energy would occur, however, if wastes had to be hauled to a site in another county--anywhere from 40 to 80 miles away.

- o Methane recovery systems are required by air quality regulations and must be built into any new, large, landfill.

- o The County is taking steps to establish extensive recycling activity. Such programs are cost-effective in several Bay Area communities (San Jose, Palo Alto, Sunnyvale, El Cerrito) without being tied to a refuse-to energy facility. On the other hand, the waste-to-energy plan being considered for Redwood City is designed to complement a comprehensive recycling effort in the County.

- o System failure is cited many times as a possible cause of major adverse impacts on water quality or the environment, whether from design flaws or natural events such as earthquakes. Landfill operators must adhere to strict requirements for studies and to standards for for design and operation expressly to minimize such possibilities, in regulations monitored and enforced by the California Waste Management Board, the Department of Health Services, the Regional Water Quality Control Board and the Bay Area Air Quality Management District.

- o Traffic conditions - There must be an error in the statement that the number of transfer trucks would increase from the current 15 per day to 95 by the year 2000. Nor do we think that the Ox Mountain site, reached via Rte. 92, should be held accountable for increased traffic problems that might result from Rte. 1 becoming inaccessible in the Devil's Slide area.

In summary, we recommend that:

1. Proper waste management and adequate land disposal capacity are regional issues that must be taken into account in the DEIS;

2. The region as a whole will receive long-term benefits if San Mateo County is able to manage its own wastes internally; and

3. A more thorough and even-handed analysis of economic impacts and benefits is necessary.

Thank you for the opportunity to review this document. Please call me at 464-7953 if you have any questions about these comments. We look forward to receiving the DEIS.

Sincerely,

Yvonne San Jule

Yvonne San Jule
Planning Director

6014 COLLEGE AVENUE / OAKLAND, CALIFORNIA 94618 / (415) 658 7470

August 25, 1986

Lt. Colonel Andrew M. Perkins
District Engineer
U. S. Army Corps of Engineers
211 Main Street
San Francisco, CA 94105

Dear Colonel Perkins:

The San Francisco Bay Chapter of the Sierra Club urges the Army Corps to deny the permit to expand the Ox Mountain Landfill in Apanolio Canyon near Half Moon Bay in San Mateo County, California, under Section 404 of the Clean Water Act.

We are deeply disturbed by the loss of prime habitat for fish and birds and other riparian species, both animal and plant, that the extension of this landfill would represent in one of California's few remaining coastal riparian canyons and trout-spawning sites. Full exploration of possible sites for such a landfill (including sites outside outside of the ownership of the project sponsor, Browning Ferris) was not done as part of the Environmental Impact Report process, nor has any mitigation for the destruction of this extremely valuable and now-scarce habitat-type been proposed.

We believe that degradation of the environment such as will occur if this project is carried out is exactly what the Clean Water Act's provisions were meant to protect against. We hope the Army Corps will act to protect this rare riparian resource.

Sincerely,

Judith Goldsmith

Judith Goldsmith, for the Sierra Club Urban Creeks Task Force

July 2, 1987

Lt. Col. Andrew M. Perkins, Jr., District Engineer
U.S. Army Engineer District, San Francisco
211 Main Street
San Francisco, Ca. 94105-1905

Attn: Regulatory Branch

Subject: Comments regarding Public Notice No. 16611S91
Applicant: Browning-Ferris Industries
San Mateo County District
P.O. Box 1068
San Carlos, Ca. 94070

Deart Lt. Col. Perkins:

We own approximately 75 acres of prime agricultural land in Apanolio Canyon down stream of the proposed Browning-Ferris Industries' landfill expansion. As a down stream user of water on Apanolio Creek, I am very much concerned about the possible degradation of our water quality along with a possible reduction in our supply. Apanolio Creek has been our water source for both domestic and agricultural use for many years and continues to be so to the present day. From about 1880 to 1950, Apanolio Creek supplied Half Moon Bay with water. By 1950, it became inadequate to supply the demand and the reservoir and pipping system became part of our property. We have enjoyed a quality supply of water for many years. This is our only source of water; we do not have a municipal supply.

Apanolio Creek, from my years of first-hand observation is dependent on springs and rainfall. In addition, drippy, wet fog in the dry summer months is especially beneficial to supporting Apanolio Creek. If one mile of Apanolio Creek is to be enclosed in culvert, precipitation and springs will not be allowed to feed the creek. In my estimation, such a move will have an adverse impact on the water flow and significantly curtail our supply.

Concerning water quality, over the last four years I have noticed increasing levels of turbidity. In addition, more silting of the creek bed is taking place. I attribute this to preliminary grading taking place by Browning-Ferris Industries. Silting of the creek bed will cause washouts of the stream banks for those of us downstream, ultimately erroding large pieces of prime agricultural land.

We operate a nursery. As you know, nurseries require a good water supply. We have made our living here at this location for many years. Much time and money has been invested to make this a productive enterprise. Now I feel our livelihood is in jeopardy due to the uncertainty of the future of our water supply. I would like to have a legal guarantee assuring me that I will continue to receive water in quality and quantity equal to what we have been receiving over the last forty years.

According to the Local Coastal Plan promulgated by the County of San Mateo, agriculture is to prevail. Recently, I received notice from the State Water Resources Board in Sacramento that Browning-Ferris Industries made application to appropriate water from Apanolio Creek for industrial purposes. They applied for approximately 70 gallons per minute twelve months of the year. To my knowledge the appropriation of water from Apanolio Creek was never addressed in the Environmental Impact Report. Should this appropriation ever be granted, it would completely destroy our water supply and agriculture would suffer. This is in direct opposition to the provisions of the Local Coastal Plan.

It is my understanding that this landfill is supposed to be of a non-hazardous nature, yet in your public notice you mention bagged asbestos. From all I have read, asbestos has proved to be a hazardous material. I find it hard to accept that anyone would want to chance contaminating a virgin wilderness such as Apanolio Canyon with a landfill operation accepting materials such as asbestos.

I question the merits of an impermeable clay liner under the landfill acting as a safeguard. From my research I have discovered sooner or later it will deteriorate and ultimately fail.

If my information is correct, there was never any time devoted to searching out possible alternative sights for this landfill operation. To the south of Half Moon Bay, there are several dry, non-productive canyons that would be suitable for such an operation, where the adverse impact on Fish & Wildlife and the human environment would be minimized much more than in Apanolio Canyon.

Yours truly,

Ronald D. Bongard

Ronald D. Bongard

cc: Ms. Joanne Cox, Water Quality Control Board

G. Berta Vegetable Growers
Route 1, Box 2-CB
Half Moon Bay, CA 94019
and
Raymond Chiesa
400 Miramontes Avenue
Half Moon Bay, CA 94019
June 26,1987

Executive Officer
California Regional Water Quality Control Board
San Francisco Bay Region
Oakland, CA 94607

Dear Executive Officer:

Re: Public Notice No. 16611S91

As farmers, utilizing water from Apanolio Creek, we find the lack of concern for farming in this report a major ommission. The San Mateo County Local Coastal Plan and the California Coastal Act are both written to control our options on our property. They state that agriculture must be "enhanced and preserved." The act not only "preserves" but "forces" a farmer to stay in the business of farming. How can you farm without water?

The report, page three, Water Supply (Natural) expresses "moderate adverse impacts." How can eliminating the natural flow be a moderate impact on downstream agriculture? Especially when "Aquifer Recharge" and contamination is a possibility. What effect will there be, due to lack of aquifer recharge, on wells? Should we expect salt water intrusion?

What constitutes the responsibility of the existing landowner to correct water quality problems? What if the problem effects our operations? What value will be placed on unusable agricultural land, is there any? A "slight using trend" at Corino Los Trancos site showed in 11 years, who will enforce the correction responsibility in 87 years? Are our children and grandchildren expected to bare the consequences of improper dumping? We have discovered the danger of abestos, who knows what information will be known in the next century? What will be the effect if a contaminent is discovered under Proposition 65? Who is responsible?

This request will impact our operation. This request appears to be contrary to the State Coastal Act. Before any further action we suggest a complete environmental report be prepared, concentrating on agriculture. This report should also contain information as to the options available to downstream water users and the ramifications of the Coastal Act and Local Coastal Program on property values and conversions.

Sincerely,

Iolanda Berta

Raymond Chiesa

Iolanda Berta, Owner
G. Berta Vegetable Growers

Raymond Chiesa, Farmer
G. Berta Vegetable Growers

cc: Lieutenant Colonel Andrew M. Perkins, Jr.

enc: San Mateo County General Plan Policy 9.4
San Mateo County Local Coastal Plan Policies 5.22 and 5.23

9.4 Land Use Objectives for the Rural Lands

Protect and enhance the resources of the Rural Lands in order to: (1) protect and conserve vegetation, water, fish and wildlife resources, productive soil resources for agriculture and forestry, and other resources vital to the sustenance of the local economy; (2) carefully manage and enhance the use, production, conservation or extraction of soils, timber, minerals and other natural resources; (3) protect and enhance the unique scenic quality and pastoral character of the rural lands; (4) provide a diversity of outdoor recreational opportunities for existing and future County residents; (5) protect the public health and safety by minimizing the location of new development in potentially hazardous areas and directing infrastructure improvements to areas that will benefit the greatest number of rural residents and visitors; (6) minimize the amount of environmental damage caused by construction of major and minor roads or other infrastructure improvements; and (7) promote local employment opportunities and enhance creative enterprise by encouraging visitor-serving facilities, ancillary and accessory uses vital to resource production operations, and adaptive reuse of existing nonresidential structures consistent with protection of surrounding resources.

DEFINITIONS

9.5 Rural Service Centers

Define Rural Service Centers as small rural communities having a combination of land uses which provide services to surrounding rural areas.

9.6 Rural Subdivisions

Define Rural Subdivisions as clusters of residential development subdivided into parcels that are generally less than or slightly larger than five acres. Rural Subdivisions can include vacant parcels or neighborhood commercial uses, but are predominately developed with single family homes.

5.20 Agricultural Management Practices

a. Encourage proper soil conservation techniques and proper grazing methods.

b. Encourage the development of conservation plans on a watershed by watershed basis with the Soil Conservation Service.

c. Require that compost, processing waste water, and other by products of agricultural activities be properly disposed of on land or through suitable sewage disposal systems, if available. Prohibit disposal in perennial or intermittent streams or sensitive habitats.

AGRICULTURAL WATER SUPPLIES

5.21 Water Supply

Establish strategies for increasing agricultural water supplies without endangering sensitive habitats.

5.22 Protection of Agricultural Water Supplies

Before approving any division or conversion of prime agricultural land or other land suitable for agriculture, require that:

a. All non-agricultural uses permitted on a parcel demonstrate the existing availability of a potable and adequate on-site well water source.

b. Adequate and sufficient water supplies needed for agricultural production and sensitive habitat protection in the watershed are not diminished.

c. All new non-agricultural parcels are severed from land bordering a stream and their deeds prohibit the transfer of riparian rights.

5.23 Priorities for Use of Agricultural Water Supplies

Recommend to the California State Water Resources Control Board that when issuing permits for appropriative water rights they establish the following priorities:

(1) the protection of minimum stream flows as determined by the State Department of Fish and Game,

(2) new and existing agricultural operations,

(3) new and existing farm family and farm labor housing,

(4) coastal dependent uses,

(5) public recreation and visitor serving facilities,

331 Kelly Avenue
Half Moon Bay, CA 94019

July 3, 1987

Col. Andrew M. Perkins, Jr.,
District Engineer
US Army Corps of Engineers
Sn Francisco District
211 Main Street
San Francisco, CA 94105

Attention: Regulatory Branch

Re: Browning-Ferris Industries (BFI)
Public Notice No. 16611891
June 8, 1987

Dear Sir:

We wish to protest the application for landfill of Apanolio Canyon Creek by the above-named applicant, because it would decrease the flow of water in Pilarcitos Creek from which we have obtained the water (since 1937) for farming purposes, and we are dependent on this water for our crops.

We are also concerned (according to your report), that if there was a system failure, "long-term major adverse impacts would occur due to contamination of the waters of Apanolio Creek, Pilarcitos Creek, and possibly even Half Moon Bay."

Please, we urge you to give this your serious consideration and reject this application for landfill of Apanolio Creek.

Yours very truly,

Dino Andreotti, Sr.
Dino Andreotti, Sr.

Dino E. Andreotti, Jr.
Dino E. Andreotti, Jr.

From: Gilbert B. and Ferne E. Gossett
G Bar G Ranch
Rt.1 Box 30A
Half Moon Bay, CA 94019

To: Lt. Col. Andrew M. Perkins, Jr., District Engineer
U. S. Army Engineer District, San Francisco
211 Main Street
San Francisco, CA 94105-1905

Attn: Regulatory Branch

Subject: Comments regarding Public Notice No. 16611S91
Dated: 8 June 1987
Applicant: Browning-Ferris Industries
San Mateo County District
P.O. Box 1068
San Carlos, CA 94070

As the adjacent downstream property owners of the proposed landfill project, we are very concerned about the potential impacts on our water supplies, both surface and subsurface.

QUALITY- We have personally used the water of Apanolio Creek and water from both of our wells for household use (including drinking water), livestock and irrigation for the past thirteen years. Former owners had done so dating back prior to 1900. At the time that BFI applied to the County Planning Commission for a permit to expand their operation into Digges Canyon (Also called Apanolio Canyon), we had Sequoia Labs test our well water to establish a bench mark for contaminants which they, and the State, consider hazardous and which might come as a result of the refuse disposal operation. None were found ([illegible] report attached).

Although this proposed fill is supposed to be of a non-hazardous material, tons of partially used and empty household chemical containers, industrial chemical refuse, garden spray containers and plant trimmings which contain chemical spray residue will be included. Most household and garden chemical containers instruct the user to dispose of the residue and/or empty container by placing it in a plastic bag and then in their garbage. Many of these chemicals are more concentrated than those allowed to be used within the agricultural industry. The experience throughout the Nation has been that linings used to contain leachate within the fill site do eventually fail.

QUANTITY- To the best of our knowledge, with the exception of the drought year of 1978, Apanolio Creek has been a year-round free flowing stream which has provided water to ourselves, downstream neighbors and, at one time to a portion of the Half Moon Bay residents. This supply has been minimal as is borne out by trial actions in the San Mateo Superior Court, starting in 1913 and returning to the Court as late as 1917. (Case No.4456)

In the years that we have owned this property, we have used our irrigation well regularly, pumping at 90 GPM, and have never experienced a run dry. This well was cleaned and redeveloped this year and was test pumped at 125 GPM, maintaining a 65 ft. pumping level.

The house well was also redeveloped last year due to a casing failure. It test pumps at 2.5 GPM, but is of a much higher quality. As with the irrigation well, we have never experienced a run dry.

All three of our water sources are dependent on rainfall and the water collected from summer fog by the trees and other vegetation. Since waters falling on the fill site will not be allowed to flow into the stream or to percolate into the aquifer, it appears to us that both our surface . and underground water supplies will be significantly diminished if the landfill project is allowed.

SILTING- In the past several years we have experienced major problems as the result of silting. When the stream bed has been raised by heavy silting (as much as 6 ft. in Jan 1982), the waters reach soils which are very light, sandy and easily eroded. The resulting wash causes trees to fall and greatly increased bank erosion. We have lost more than three tillable acres to the creek in the past ten years.

GENERAL CONCERNS- Although BFI works daily covering refuse in their current operation, a large part of the garbage remains exposed. This provides a feeding ground for raccoons, rodents and other varmints whose populations have now increased to the point where we have had to abandon the growing of pumpkins as a field crop. We are presently working to enclose areas with electric fences since these animals also destroy fruit, corn, squash and other garden crops - often heavily damaging the trees as well. Air inflated plastic bags are often carried from the present site - landing in the trees and brush in Digges Canyon. These problems will only increase if operations are extended into Digges Canyon.

We are attaching a copy of commentary provided for the San Mateo County Planning Division by Gilbert B. Gossett in October 1983. Many of the questions and comments still prevail. We would like to call particular attention to a couple of points.

1. On pages S-7 and S-8 of the Draft Environmental Impact Report prepared for the County of San Mateo points out that other sites outside Ox Mountain Ranch properties were not considered.

We are told that there is a large canyon East of Corinda Los Trancos Canyon, to the North of the Piombo Quarry. We understand that this canyon is not used, is more barren and isolated than Digges Canyon, and that it has very little surface water except in the rainy season.

Many very large, essentially dry and barren, canyons lie to the South of Half Moon Bay. Underground water supplies are also very poor in these areas.

2. On page S-7, it is stated that a "forefill" in Corinda Los Trancos Canyon would provide for the County's needs until about 2008. It has also been established that presently there are no fish in the Corinda Los Trancos Creek. For whatever reason this is true, continued fill in that same canyon should have little additional adverse effect. The lifetime of the "forefill" can be extended through increased recycling efforts. During this time, a complete resource recovery / incineration system could be developed which could handle both garbage and sewage treatment plant sludge (which is also an increasing problem).

Gilbert B. Gossett

Gilbert B. Gossett

Ferne E. Gossett

Ferne E. Gossett

Owners: G Bar G Ranch
Rt. 1 Box 30A
Half Moon Bay, CA 94019

Signed: 18 June 1987

Copies to: Mr. Lino Valbusa, Browning-Ferris Industries
Ms. Joanne Cox, Water Quality Control Board
Ms. Sandra Anfang, Half Moon Bay Library

SEQUOIA Analytical Laboratory
2549 Middlefield Road
Redwood City, CA 94063 • (415) 364-9222

Gilbert Gossett
Route 1, Box 30A
Half Moon Bay, CA 94019

Date Sampled: 11/09/83
Date Received: 11/09/83
Date Reported: 11/29/83

Sample Number	Sample Description
3110135	Digges Canyon Well

ANALYSIS

Cyanide, mg/L	< 0.02
DBCP, ppb	< 1
GC Solvent Scan, ppb	
TCE	< 1
Total Organic Carbon, mg/L	2.9
Total Coliform Bacteria, Col/100 mL	< 1

SEQUOIA ANALYTICAL LABORATORY

Arthur G. Burton
Laboratory Director

smr

COMMENTARY FOR: Bill Rozar,
Planner of Project #83042607
San Mateo County Planning Division

FROM: Gilbert B. Gossett
Resident of Digges/Apanolio Canyon

SUBJECT: Draft EIR for the Ox Mountain Sanitary
Landfill/Apanolio Canyon Expansion

The following comments and questions dealing with the "Environmental Impact Report for the Apanolio Canyon Expansion of the Ox Mountain Landfill" are sequenced to follow the topics as addressed in the report.

Page S-3. The water runoff is estimated at about 150 cubic feet per second. In a recent discussion which I had with the engineers at the Soil Conservation District Office, located on Main Street, Half Moon Bay, I was told that 2% of the years we should expect slightly more than 1,000 cubic feet per second at the point where the road crosses the Apanolio Creek, about 200 feet downstream from our Southern property line. I would estimate that the runoff from the slopes East and West of our property would account for less than 1/2 of this, so there appears to be a large disparity in these numbers.

Pages S-3, S-10, S-11, III-3, III-6 (#7), III-7, III-39. Throughout the report, in aforementioned pages, the issue of protection of the water quality is raised. Unless a system is provided which will, in fact, protect the surface and subsequently the ground water under the most severe storm conditions, water pollution will occur.

According to documents which were given to us at the time that we purchased our property in Digges Canyon, a water company known as Apanolio Water Company did exist and obtained its water from the Apanolio Creek. They apparently supplied water to the local area at one time. The Coastside Water District is, according to reports, near capacity. Apanolio Creek, as it now exists, has the greatest potential to supply addtional water. As a waste disposal, the site has a potential of a few years. As a water source, the potential is virtually forever.

Pages S-7, S-8. On these pages the report points out that other sites outside of the Ox Mountain Ranch properties were not considered. Such a short-sighted approach is hardly justifiable. A larger, more barren and isolated canyon exists just East of the present Los Trancos fill site. That canyon has already been essentially destroyed by the Pilarcitos Quarry operation and work by operations of the previous quarry owners.

In addition, numerous dry canyons many times the size of the proposed site exist South of Half Moon Bay. A number of these would be accessible from both Highway 35 and Highway 1, reducing the traffic flow and hazards on at least the Western slopes of Highway 92.

Page S-7. Another question which I must raise is that of the "forefill" in Los Trancos Creek which would provide the County's needs until about 2008. During the intervening years, a resource recovery/incinerator system could be developed which would eliminate the need for landfill in any location. Even the ash residue can be recycled into fertilizer. This type of operation has proven to be cost-effective in the Eastern portion of the United States. Power generated in the process is used to operate the plant including the air scrubbers. No air pollutants result from these operations. Such an installation would be entirely in agreement with AB524, AB3302 and AB3433.

Some of these operations are reported to make a profit through recycling and power generation over and above the collection fees paid by their customers.

Pages S-10 and S-11. These pages address the question of erosion. Due to the length of the stream diversion system, I question the practicality of a pipe large enough to accomodate the 100-year flood flow as related by the Soil Conservation engineers. An additional problem which is not addressed is the potential of massive slides resulting from increased concentrations of water run-off from the haul road. One such slide resulted from the old fire road on the East rim of the canyon in the January 1982 storm. This slide deposited close to one foot of sand on our Northeast meadow. A second (larger) slide was caused by the run-off from the paved road on the West rim of the canyon, moving thousands of yards of decomposed granite which buried our garden area, camper and small out buildings in from one to four feet of sand. During all of this, the creek bed was raised by over six feet, as still evidenced by sand deposits. The bed has now dropped to a level below what it has been in the nine years that we have owned this property.

Page I-15. The issue of water quality after closure of the landfill operation is lightly touched upon. Phrases such as "probably require groundwater and surface water monitoring" and "If water quality deteriorates" hardly reassures those of us who, or whose heirs, will be affected. Even in the earlier 1900s, gold mine operations were required to post substantial bonds to guarantee restoration of lands and protection of water quality in and about their operations. What kind of bond or security would the County of San Mateo or the State of California require in order to protect those of us who depend upon the ground and creek waters for domestic, livestock and irrigation purposes?

Page II-4. A statement is made on page II-4 that a sufficient amount of water is to pass by the land fill so that fish life down stream will be maintained. This does not address the question of the water rights of the property owners located down stream. These rights were established on August 3, 1912 and supported by Superior Court for San Mateo County in action No. 4456 on September 4, 1913. They specifically speak to the right to take water for domestic use, irrigation and farming.

Again on page II-4, a statement is made regarding permits and hazardous wastes. Although Los Trancos fill is not established as such, nor is the Apanolio Canyon project projected as such, there is no monitoring process set up to determine what is trucked into the landfill in closed transfer trucks, packer trucks or private vehicles.

Page II-12. On this page it is pointed out that the Local Coastal Program requires that creation of dust, erosion and odor not extend beyond the landfill itself. With the frequent winds which blow down the canyon in the early morning and the volume of water which flows in winter months, I question that this can be done.

In paragraph IV of "Alternatives to the proposed action", no consideration is given to the possibility of incineration or compaction or grinding of refuse for disposal off the Continental Shelf. The waste being considered would be as safe for sea life as it is for life on land.

Pages III 65-69. Since a noise level acceptability has been established, how do Browning-Ferris Industries, operators of the landfill project, propose to keep the refuse trucks from using "Jake-type" brakes (Compression braking) which certainly will exceed the "accepted level". In addition, will they be able to control the noise levels of private vehicles which may have faulty mufflers or other noise creating conditions.

Page IV-13. Again, on this page the issue of water quality is brought up. It is pointed out that levels of some pollutants (TDS) measured in the ground water monitoring well below the landfill have continued to rise since the operation was started. The water of Los Trancos Creek has already been degraded. We and other residents of Digges Canyon drink the water of Apanolio Creek and have done so for years. Our greatest concern is for the future protection of this water source.

Pollution of the creek would also affect the native Rainbow Trout which inhabit the Apanolio Creek.

A copy of a complete water analysis of our well, located approximately 15 feet from the creek, is attached hereto. This report shows that this water meets the standards set by the California Health and Safety Code and the California Administrative Code (Title 22) for water suppliers. The well was tested in lieu of the creek water upon the advice of the Analytical Laboratory. We have been assured that base line tests of the creek water will be required prior to the beginning of any work should the project be approved.

In summary, we feel that many questions and potential problems need further examination and research prior to approval being granted for this project, the implementation of which could result in irreparable damage to the Half Moon Bay area.

Gilbert B. Gossett

Gilbert B. Gossett

A-2

Notice of Intent (NOI) and Response Letters

Also during these consultations, under the terms of the Bilateral Cotton, Wool and Man-Made Fiber Textile Agreements of August 19, 1983, as amended, the two governments further agreed to increase the 1987 level for Category 335, for special carryforward of 75,000 dozen, to 405,474 dozen.

To the extent used, carryforward will be deducted from the level established for the 1988 agreement year.

In reviewing the import charges, the U.S. Customs Service determined that 7,969 dozen were incorrectly charged to the 1986 limit for Category 335 and has reduced the charges accordingly. As a result, overshipment charges of 7,969 dozen are being deducted from the 1987 limit and charged back to the 1986 limit.

A description of the textile categories in terms of T.S.U.S.A. numbers was published in the Federal Register on December 13, 1982 (47 FR 55709), as amended on April 7, 1983 (48 FR 15175), May 3, 1983 (48 FR 19924), December 14, 1983, (48 FR 55607), December 30, 1983 (48 FR 57584), April 4, 1984 (49 FR 13397), June 28, 1984 (49 FR 26622), July 16, 1984 (49 FR 28754), November 9, 1984 (49 FR 44782), July 14, 1986 (51 FR 25386) and in Statistical Headnote 5, Schedule 3 of the TARIFF SCHEDULES OF THE UNITED STATES ANNOTATED (1987).

Adoption by the United States of the Harmonized Commodity Code (HCC) may result in some changes in the categorization of textile products covered by this notice. Notice of any necessary adjustments to the limits affected by adoption of the HCC will be published in the Federal Register.

This letter and the actions taken pursuant to it are not designed to implement all of the provisions of the bilateral agreement, but are designed to assist only in the implementation of certain of its provisions.

Ronald I. Levin,

Acting Chairman, Committee for the Implementation of Textile Agreements.

August 13, 1987

Committee for the Implementation of Textile Agreements

Commissioner of Customs,

Department of the Treasury, Washington, DC 20229

Dear Mr. Commissioner: This directive amends, but does not cancel, the directive of December 23, 1986, concerning imports into the United States of certain cotton, wool and man-made fiber textile products, produced or manufactured in the People's Republic of China and exported during the twelve-month period which began on January 1, 1987 and extends through December 31, 1987.

Effective on August 19, 1987, the directive of December 23, 1986 is further amended to include an adjusted limit of 405,474 dozen [1] to the previously established restraint limit for cotton textile products in Category 335, as provided under the terms of the bilateral agreement of August 19, 1983, as amended.[2]

Also effective on August 19, 1987, you are directed to deduct 1986 overshipment charges, amounting to 7,969 dozen, from the charges made to the import restraint limit established in the directive of December 23, 1986 for Category 335 for the twelve-month period which began on January 1, 1987 and extends through December 31, 1987. This same amount is to be charged to the 1986 limit.

The Committee for the Implementation of Textile Agreements has determined that these actions fall within the foreign affairs exception to the rulemaking provisions of 5 U.S.C. 553(a)(1).

Sincerely,

Ronald I. Levin,

Acting Chairman, Committee for the Implementation of Textile Agreements.

[FR Doc. 87-18869 Filed 8-17-87; 8:45 am]

BILLING CODE 3510-DR-M

[1] The limit has not been adjusted to account for any imports exported after December 31, 1986.

[2] The agreement provides, in part, that (1) with the exception of Category 315, any specific limit may be exceeded by not more than 5 percent of its square yard equivalent total, provided that the amount of the increase is compensated by an equivalent square decrease in one or more other specific limits in that agreement year; (2) the specific limits for categories may be increased for carryover or carryforward; (3) administrative arrangements or adjustments may be made to resolve minor problems arising in the implementation of the agreement.

DEPARTMENT OF DEFENSE

Office of the Secretary

Defense Science Board Task Force on Armor Anti-Armor Competition; Cancellation

ACTION: Cancellation of Meeting.

SUMMARY: The meeting notice for the Defense Science Board Task Force on Armor Anti-Armor Competition for August 12 and 17, 1987 as published in the Federal Register (Vol. 52, No. 133, Page 26171, Monday, July 13, 1987, FR Doc 87-15844.) has been cancelled. In all other respects the original notice remains unchanged.

Linda Lawson,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

August 12, 1987.

[FR Doc. 87-18819 Filed 8-17-87; 8:45 am]

BILLING CODE 3810-01-M

Engineers Corps, Department of the Army

[Regulatory Permit Application No. 16611S91]

Intent To Prepare a Draft Environmental Impact Statement (DEIS); Proposed Expansion of Ox Mountain Sanitary Landfill Into Apanolio Canyon; San Mateo County, CA

AGENCY: San Francisco District, U.S. Army Corps of Engineers, Department of Defense.

ACTION: Notice of Intent to Prepare a DEIS.

SUMMARY:

1. Proposed Action

Browning-Ferris Industries (BFI), San Carlos, California, has applied for a Department of the Army permit under section 404 of the Clean Water Act (33 U.S.C. 1344) to expand the existing Ox Mountain Ranch solid waste disposal site into the adjacent Apanolio Canyon. The site is along Apanolio Creek, approximately three miles northeast of Half Moon Bay, San Mateo County, California. The expansion site is 285 acres in the upper portion of Apanolio Canyon. The Canyon would be filled from a 500-foot elevation to a 1200-foot elevation, with an average depth of 185 feet. Refuse would be dumped at the working face and compacted by heavy equipment. The San Francisco District, Corps of Engineers, will prepare an environmental impact statement (EIS) for the proposed project pursuant to the National Environmental Policy Act.

2. Alternatives

The EIS will address all the practicable alternatives that will go before the ultimate decision maker for the permit application. The EIS will consider those reasonable alternatives which are both practical and within the capability of the applicant and within the jurisdiction of the Corps; those alternatives which are within the capability of the applicant but outside the jurisdiction of the Corps; those which are reasonably foreseeable, beyond the capability of the applicant but within the jurisdiction of the Corps; and those reasonably foreseeable, although beyond both the capability of the applicant and outside jurisdiction of the Corps. Based on the above, the alternatives being considered by the Corps of Engineers at this time are:

a. *Proposed project:* The 285 acre expansion into Apanolio Canyon

b. *Reduced project at proposed location:* Filling of less acreage
c. *No action:* Permit denial, no expansion into Apanolio Canyon
(1) Offsite landfill disposal alternatives—new and existing landfill sites.
(2) Alternative technologies including waste recycling and refuse to energy.

Additional alternatives identified during the scoping process will also be considered in the EIS.

3. Scoping Process

a. A scoping meeting will be held on Thursday, September 3, 1987, at the offices of the San Francisco District, Corps of Engineers, 211 Main Street, San Francisco, California, Room 917A, from 9 AM to 11 AM. Government agencies, public and private interest groups, and the public are invited to participate in the scoping process by attending the meeting. The purpose of the scoping meeting is to identify significant issues and alternatives to be considered in depth in the EIS.

b. Any person may also participate in the scoping process by submitting written comments to the Corps of Engineers. Comments should be addressed to Colonel Galen H. Yanagihara, District Engineer, San Francisco District, Corps of Engineers, 211 Main Street, San Francisco, California, 94105 and received within 21 calendar days of the date of this notice.

c. The issues which have been identified to date and which will be analyzed in the EIS include impacts on:

(1) Aquatic ecosystem
(2) Wetlands
(3) Hydrology and water quality
(4) Riffle and pool areas/fish habitat
(5) Terrestrial ecosystem
(6) Endangered species
(7) Cultural resources
(8) Business and industrial activity
(9) Economics
(10) Public facilities and services
(11) Public health and safety

Additional significant issues identified during the scoping process will also be analyzed in the EIS.

D. Environmental review and consultation as required by sections 401 and 404 of the Clean Water Act, as amended (33 U.S.C. 1341 and 1344); section 307 of the Coastal Zone Management Act of 1972, as amended (16 U.S.C.1456(c)); the Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq.*); the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*); Executive Order 11990, "Protection of Wetlands", 24 May 1977; and other applicable statutes or regulations will be conducted concurrently with the EIS process.

It is estimated that the draft EIS will be made available to the public on or about 20 November 1987.

5. Questions regarding the scoping process or preparation of the EIS may be directed to Barney Opton, Environmental Branch, San Francisco District, Corps of Engineers (Telephone No.: (415) 974-0441. General questions concerning the processing of the permit application may be directed to Dave Hodges, Regulatory Branch (Telephone: (415) 974-0426).

Dated: August 11, 1987.

Galen H. Yanagihara,

Colonel, Corps of Engineers, District Engineer.

[FR Doc. 87-18778 Filed 8-17-87; 8:45 am]

BILLING CODE 3710-FB-M

Defense Communications Agency

Membership of the Defense Communications Agency SES Performance Review Board

AGENCY: Defense Communications Agency, DOD.

ACTION: Notice of membership of the Defense Communications Agency SES Performance Review Board.

SUMMARY: This notice announces the appointment of the members of the SES Performance Review Board (PRB) of the Defense Communications Agency. The publication of PRB membership is required by 5 U.S.C. 4314(c)(4).

The Performance Review Board provides fair and impartial review of Senior Executive Service performance appraisals and makes recommendations regarding performance and performance awards to the Director, Defense Communications Agency.

EFFECTIVE DATE: August 1, 1987.

FOR FURTHER INFORMATION CONTACT: Ms. Mary Painter, Personnel Management Services Branch, Civilian Personnel Division, Personnel and Administration Directorate, Defense Communications Agency (202) 692-2794.

SUPPLEMENTARY INFORMATION: In accordance with 5 U.S.C. 4314(c)(4), the following are names and titles of the executives who have been appointed to serve as members of the SES Performance Review Board. They will serve a one-year renewable term, effective August 1, 1987.

Cordon K. Soper, Associate Director for Engineering and Technology (Code H110)
John W. Beach, Deputy Director, Resource Management (Code H600)
Benham E. Morriss, Deputy Manager, National Communications System (Code Q100)
E. William Harding, Acting Director, Defense Communications System Organization (Code B100)
David T. Signori, Jr., Director, Center for Command and Control, and Communications Systems (Code A100)
Glenwood M. Stevener, Director, Joint Data Systems Support Center (Code C100)
George A. Bombel, Brigadier General, USA Director, Joint Tactical Command, Control and Communications Agency (Code JTC$_3$A)

T. R. M. Emery

Rear Admiral, USN, Vice Director.

[FR Doc. 87-18791 Filed 8-17-87; 8:45 am]

BILLING CODE 3610-05-M

DEPARTMENT OF EDUCATION

Compromise Claim; Deganawidah-Quetzalcoatl University

AGENCY: Office of Postsecondary Education, ED.

ACTION: Notice of intent of compromise claim.

SUMMARY: Notice is given that the Department intends to compromise a claim of $33,820.05 against Deganawidah-Quetzalcoatl University (D-Q University) pursuant to 20 U.S.C. 1234a(f). That claim is the subject of an appeal now pending before the United States Court of Appeals for the Ninth Circuit, *D-Q University v. Bennett*, CA No. 86-7097.

DATE: Interested persons may comment on the proposed action by submitting written data, views, or arguments on or before October 2, 1987.

ADDRESSES: Comments should be addressed to Richard A. Hastings, Director, Debt Collection and Management Assistance Service, U.S. Department of Education, Room 5102, R.O.B. 3, 7th and D Streets SW., Washington, DC 20202.

SUPPLEMENTARY INFORMATION: The claim in question was based on a March 8, 1978 Final Letter of Determination (FLD) which was issued by the Department of Health, Education and Welfare (DHEW), Office of Education. The audit report which supported the FLD was issued on November 14, 1975 by an independent certified public accounting firm. The audit covered the University's general funds and certain grants it administered for the one-year periods ending June 30, 1974, August 31, 1974, and June 30, 1975. The grant programs involved included, among

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

Colonel Galen H. Yanagihara
District Engineer
Attn: SPNPE-R
Corps of Engineers, S.F. District
211 Main Street
San Francisco, CA 94105

13 OCT 1987

Dear Colonel Yanagihara:

The Environmental Protection Agency (EPA) has reviewed the Notice of Intent (NOI) for the project titled Proposed Expansion of Ox Mountain Sanitary Landfill Into Apanolio Canyon; San Mateo County, California. Our detailed comments are enclosed.

Our review is based on the Council on Environmental Quality (CEQ) Regulations (40 CFR Parts 1500-1508).

We appreciate the opportunity to comment on the proposed project. Please send three copies of the Draft Environmental Impact Statement to this office at the same time it is officially filed with our Washington, D.C. office. We also request notification of any public hearings or workshops to be held on this project. If you have any questions, please contact David Powers, Office of External Affairs at (415) 974-8187 or FTS 454-8187.

Sincerely yours,

for Rick Hoffmann
Environmental Review Coordinator

Enclosure (3 pages)

cc: Ken Theisen, RWQCB
Linda Ulmer, CDFG
Cay Goude, USFWS

Section 404 Permit Comments

As stated in our February 25, 1987 response to Predischarge Notification PDN-16611S91, the Environmental Protection Agency (EPA) believes that significant aquatic resources exist within the project area and that the proposed project will result in adverse impacts to waters of the United States, including special aquatic sites, as defined under the Clean Water Act, Section 404(b)(1) Guidelines.

Specifically, the project will result in the loss of between 3.3 and 10.8 acres of wetlands and pool/riffle habitat. Information provided to EPA by the California Department of Fish and Game (CDFG) indicates that Apanolio Creek supports regionally significant populations of steelhead trout (*Salmo gairdnerii gairdnerii*). EPA believes that the proposed project will cause or contribute to significant degradation of the wetlands and pool/riffle habitat.

EPA will review the project for compliance with *Federal Guidelines for Specification of Disposal Sites for Dredged or Fill Material* (40 CFR 230), promulgated pursuant to Section 404(b)(1) of the Clean Water Act.

a. EPA's evaluation will focus on the maintenance of water quality, the protection of fisheries and wildlife resources, threatened or endangered species, and special aquatic sites, including wetlands.

b. These regulations require that no discharge shall be permitted which will result in unacceptable adverse impacts on the aquatic ecosystem.

c. If applicable, the results of further studies should indicate the amount of dredging required, potential disposal sites, types of fill material to be utilized, quantities to be discharged into waters, and special aquatic sites that fall under Section 404 jurisdiction.

d. Under the Section 404(b)(1) guidelines, wetlands and pool/riffle complexes are considered "special aquatic sites" (40 CFR 230.3 [q-1], 230.41 and 230.45). The regulations require that, when a project associated with the discharge is not water dependent, the discharge of dredged or fill material into the special aquatic site shall not be permitted unless the applicant can demonstrate that there are no practicable alternatives to the proposed discharge. The term "water dependent" applies to a project that requires access, proximity to, or siting within the special aquatic site in order to fulfill its basic purpose. The purpose of the proposed project must be defined objectively in detail. Examination of practicable alternatives should include but not be limited to consideration of the following points:

1) Sites other than the proposed project site (we strongly recommend consideration of other sanitary landfills both in San Mateo County and in other nearby counties),

2) Rearrangement of the project within the proposed site,

3) Downscaling of the project to avoid or minimize impacts to special aquatic sites.

Water Quality Comments

For each alternative, the DEIS should:

1. Fully discuss the project's compliance with State and local water quality management plans and State-adopted, EPA-approved water quality standards.

   a. The DEIS should focus on maintaining and protecting the beneficial uses of Apanolio and Pilarcitos Creeks.

   b. These existing and potential beneficial uses include:

      1) Cold Fresh Water Habitat
      2) Warm Fresh Water Habitat
      3) Wildlife Habitat
      4) Fish Migration
      5) Fish Spawning
      6) Water Contact Recreation
      7) Non-Contact Water Recreation
      8) Municipal and Domestic Supply
      9) Agricultural Supply
      10) Preservation of Rare and Endangered Species

   c. EPA recommends that project planning be fully coordinated with the San Francisco Bay Region Water Quality Control Board (RWQCB) to ensure protection of water quality and maintenance of beneficial uses.

2. This project has the potential to result in a lowering of water quality. Therefore, an antidegradation analysis should be prepared. Specific guidance on how to prepare an antidegradation analysis for this project may be obtained by contacting the RWQCB at (415) 464-1255.

3. Sanitary landfill activities are proposed at the project site. Given the use of Pilarcitos Creek as a domestic water supply, the potential for degradation of water quality in Apanolio and Pilarcitos Creeks should be discussed in detail. Both potential impacts from leachate and polluted discharge should be assessed.

4. Cold fresh water habitat, fish migration/spawning, and preservation of rare and endangered species are among the most sensitive beneficial uses. The potential for the project to increase toxicity, sedimentation, and temperature and to decrease dissolved oxygen in Apanolio and Pilarcitos Creeks should be discussed along with the consequent impacts to fishery and wildlife-related beneficial uses.

5. Apanolio Creek provides 18% of the annual discharge in the Pilarcitos Creek watershed (FEIR, 1984). The proposed project has the potential to alter Apanolio Creek's flow regimes and volumes. Given the fisheries-associated beneficial uses of Pilarcitos and Apanolio Creeks, discuss the impacts of changes in flow regimes/volumes on the species composition and biomass production of stream benthos as it relates to fish production and recruitment. The importance of Apanolio Creek in supporting Pilarcitos Creek's fisheries should also be addressed (e.g., spawning areas, food production, gravel recruitment, temperature regulation).

6. Discuss current drainage patterns in the project locale and include hydrologic maps of the area. The discussion should assess how altering drainage patterns and characteristics will affect drainage hydrology, surface runoff, erosion potential, soils, vegetation, and, therefore, water quality and beneficial uses.

7. Identify appropriate mitigation and contingency measures to protect water quality during both fill site preparation and operation. This should include both an in-depth description of proposed containment features and contingency measures which would be implemented if containment features are not effective in protecting water quality. The monitoring which will ensure the adequacy of the containment features should also be discussed.

Ground Water Comments

For each alternative, the DEIS should:

1. Discuss current ground water conditions in the project locale and assess all likely changes in ground water resulting from this project, including alterations of the water table depth and chemical composition changes. The discussion should also identify the relationship between surface water flows and ground water flows.

2. Identify the monitoring and mitigation which will be implemented to detect and minimize adverse impacts to ground water quality.

B-1

Plants Observed in Apanolio Canyon
(Table B-1)

Table B-1
Plants Observed in Apanolio Canyon
(Source: Thomas Reid Associates, 1984)

Latin Name	Common Name	Location	Abund.	Commun.
Achillea millefolium	Yarrow	Canyon Rim	*	CT
Achillea millefolium var. californica	Common Yarrow	Borrow Hill	r	CT
		Finger Canyon	c	
		Rim Road	c	
		Proposed Pond	c	
Adiantum pedatum var. aleuticum	Five-Fingered Fern	Apanolio Creek	r	RF
Aesculus californica	California Buckeye	Finger Canyon	r	ME
Alchemilla occidentalis	Dew Cup	Rim Road	r	G
Alnus oregana	Red Alder	Apanolio Creek	a	ME,R
		Proposed Pond	c*	
Amsinckia intermedia	Common Fiddleneck	Digges Canyon	c	D
Anagallis arvensis	Scarlet Pimpernel	Borrow Hill	a	D
		Rim Road	a	
		Proposed Pond	a	
		Apanolio Creek	r	
Aquilegia formosa var. truncata	Columbine	Apanolio Creek	r	ME
Arbutus menziesii	Madrone	Canyon Rim	*	FW
		Rim Road	r	
Artemesia californica	California Sage	Finger Canyon	r	CS
		Rim Road	a	
		Canyon Rim	*	
		Canyon Rim	*	D,R
Baccharis pilularis var. consanguinea	Coyote Brush	Borrow Hill	a	C
		Finger Canyon	a	
		Rim Road	a	
		Proposed Pond	c	
		Canyon Rim	*	
Brassica sp.	Mustard	Apanolio Creek	r	D
Brassica campestris	Common Mustard	Borrow Hill	c	D
		Rim Road	r	
		Proposed Pond	a	
Brodiaea pulchella	Common Brodiaea	Rim Road	r	G
Bromus spp.	Brome or Chess	Borrow Hill	a	G
Bromus carinatus	California Brome	Finger Canyon	a	G
Bromus mollis	Soft Chess	Finger Canyon	a	G
Calochortus sp.	Mariposa Lily	Rim Road	r	G,ME
Carex spp.	Sedge	Canyon Rim	*	FM,G
		Apanolio Creek	c	FM
Castilleja sp.	Paint Brush	Rim Road	r	C,CS,
Ceanothus sorediatus	Jimbush	Borrow Hill	a	ME,C
		Finger Canyon	a	
		Rim Road	a	
Ceanothus thyrsiflorus	Blue Brush	Borrow Hill	a	ME
		Finger Canyon	a	
		Rim Road	a	
		Proposed Pond	c	
		Digges Canyon	a	
		Canyon Rim	*	
Cercocarpus betuloides	California Mountain Mahogany	Canyon Rim	*	C
Chlorogalum pomeridianum	Soap Plant	Borrow Hill	r	C
Cicuta douglasii	Water Hemlock	Apanolio Creek	r	FM,R
Cirsium sp.	Thistles	Canyon Rim	*	D
Cirsium vulgare	Common Thistle	Borrow Hill	c	D
		Finger Canyon	a	
		Apanolio Creek	r	
Conium maculatum	Poison Hemlock	Borrow Hill	a	D,R
		Apanolio Creek	c	
		Canyon Rim	*	
		Rim Road	c	
Cornus californica	Creek or Westen Dogwood	Finger Canyon	r	R
Cortaderia selloana	Pampas Grass	Canyon Rim	*	D
Cotoneaster sp.	Cotoneaster	Canyon Rim	*	D
Cryptantha sp.	White Forget-me-not	Finger Canyon	r	C
Cyperus eragrostis	Tall Cyperus	Finger Canyon	r	R

Latin Name	Common Name	Location	Abund.	Commun.
Cytisus scoparius	Scotch Broom	Canyon Rim	*	D
Delphinium californicum	Coast Larkspur	Borrow Hill	r	C
Dentaria californica	Milkmaids	Apanolio Creek	r	RF
Diplacus aurantiacus	Sticky Monkeyflower	Borrow Hill	r	C,CS
		Finger Canyon	c	
		Rim Road	c	
		Digges Canyon	a	
		Canyon Rim	*	
Disporum smithii	Fairy Bells	Finger Canyon	r	RF
		Apanolio Creek	r	
Dryopteris arguta	Coastal Wood Fern	Borrow Hill	c	ME
		Apanolio Creek	a	
Equisetum spp.	Horsetail	Apanolio Creek	c	RF
Equisetum telmateia var. braunii	Giant Horsetail	Finger Canyon	c	R
Eriodictyon californicum	Yerba Santa	Canyon Rim	*	C
Eriogonum latifolium	Buckwheat	Finger Canyon	r	CS,CT
		Rim Road	c	
Eriophyllum staechadifolium	Lizard Tail	Borrow Hill	c	CS,CT
		Finger Canyon	c	
		Rim Road	r	
		Proposed Pond	c	
		Digges Canyon	c	
		Canyon Rim	*	
Eriophyllum confertiflorum	Yellow Yarrow	Rim Road	c	C
Erodium cicutarium	Red-stemmed Filaree	Finger Canyon	a	G
Eschscholzia californica	California Poppy	Borrow Hill	c	G,D,CT
		Rim Road	r	
		Canyon Rim	*	
Foeniculum vulgare	Sweet Fennel	Canyon Rim	*	D
Fragaria californica	Calif Strawberry	Borrow Hill	r	CS,CT
		Rim Road	c	
		Canyon Rim	*	
Galium spp.	Bedstraw	Borrow Hill	r	ME
		Finger Canyon	r	
		Apanolio Creek	r	
Gnaphalium sp.	Everlasting	Rim Road	c	C
		Proposed Pond	r	
		Canyon Rim	*	C,D
Gnaphalium californicum	Everlasting	Finger Canyon	c	C
Grossularia sp.	Gooseberry	Apanolio Creek	c	R
Helenium puberulum	Rosilla	Rim Road	r	FM
Heracleum maximum	Cow Parsnip	Borrow Hill	c	CS
		Finger Canyon	a	
		Rim Road	c	
		Apanolio Creek	c	
		Canyon Rim	*	
Heuchera micrantha	Alum Root	Finger Canyon	c	RF
Holodiscus discolor	Cream Bush	Finger Canyon	r	C
Iris douglasiana	Douglas' Iris	Borrow Hill	r	G
		Finger Canyon	r	
Juncus sp.	Rush	Apanolio Creek	c	FM,G
Layia gaillardioides	Woodland Layia	Finger Canyon	r	CS,G
Lithophragma affinis	Woodland Star	Finger Canyon	r	ME
Lonicera sp.	Honeysuckle	Canyon Rim	*	C,ME,R
Lotus humistratus	Short-podded Trefoil	Rim Road	a	C
Lotus scoparius	Deerweed	Rim Road	c	C
Lupinus affinis	Lupine	Finger Canyon	r	G
Lupinus arboreus	Tree Lupine	Borrow Hill	c	CS,CT
		Finger Canyon	r	
		Proposed Pond	c	
		Canyon Rim	*	
Lupinus bicolor	Lindley's Annual Lupine	Finger Canyon	r	CS,G,ME
		Rim Road	r	
Lupinus nanus	Sky Lupine	Rim Road	r	G
Madia sp.	Tarweed	Finger Canyon	r	RF
Marah fabaceus	Valley Manroot	Borrow Hill	c	CS,CT
		Finger Canyon	c	

Table B-1 (Continued)
Plants Observed in Apanolio Canyon

Latin Name	Common Name	Location	Abund.	Commun.
		Rim Road	c	
		Apanolio Creek	r	
		Canyon Rim	*	
Mimulus guttatus	Common Large Monkey Flower	Finger Canyon	r	R
		Apanolio Creek	a	
Montia perfoliata	Miner's Lettuce	Finger Canyon	c	FW
		Canyon Rim	*	
Myosotis latifolia	Wood Forget-me-not	Finger Canyon	c	RF
		Rim Road	c	
		Apanolio Creek	a	
		Canyon Rim	*	
Nasturtium officinale	Water Cress	Apanolio Creek	r	R
		Finger Canyon	r	
Oxalis oregana	Redwood Sorrel	Apanolio Creek	a	RF
Phacelia californica	California Phacelia	Borrow Hill	r	CS
		Finger Canyon	c	
		Rim Road	c	
		Proposed Pond	a	
Phacelia malvaefolia	Stinging Phacelia	Digges Canyon	c	CS
		Rim Road	r	
Pinus radiata	Monterey Pine	Finger Canyon	r	ME
Plantago lanceolata	Ribwort	Borrow Hill	a	D
		Rim Road	a	
		Proposed Pond	a	
		Canyon Rim	*	
Polypodium sp.	Polypody	Canyon Rim	*	ME
Polypodium californicum	California Polypody	Apanolio Creek	r	ME
Polystichum munitum	Western Sword Fern	Apanolio Creek	c	RF
		Finger Canyon	c	
		Canyon Rim	*	
Potentilla glandulosa	Sticky Cinquefoil	Rim Road	r	CS
Pseudotsuga menziesii	Douglas Fir	Borrow Hill	r	RF
		Rim Road	c	
		Proposed Pond	r	
		Apanolio Creek	r	
		Canyon Rim	*	
Pteridium aquilinum var. pubescens	Bracken Fern	Canyon Rim	*	G
Quercus agrifolia	Live Oak	Digges Canyon	r	ME
		Canyon Rim	*	
Rhamnus californica	Coffeeberry	Finger Canyon	c	C
		Rim Road	c	
		Proposed Pond	r	
		Canyon Rim	*	
Rhus diversiloba	Poison Oak	Borrow Hill	c	C,CS,FW,ME
		Finger Canyon	c	
		Digges Canyon	c	
		Canyon Rim	*	
Ribes sp.	Currant	Canyon Rim	*	C
		Apanolio Creek	c	
		Canyon Rim	*	
Ribes malvaceum	California Black Currant	Finger Canyon	c	C
Rubus sp.	Wild Raspberry	Canyon Rim	*	R,RF
Rubus leucodermis	Wild Raspberry	Canyon Rim	*	R,RF
Rubus parviflorus var. velutinus	Thimbleberry	Canyon Rim	*	R
		Apanolio Creek	a	R
		Canyon Rim	*	
Rubus spectabilis var. franciscanus	Salmonberry	Rim Road	c	ME
Rubus ursinus	Pacific Blackberry	Borrow Hill	a	CS
		Finger Canyon	a	
		Rim Road	a	
		Proposed Pond	c	
		Apanolio Creek	c	
Rumex acetosella	Sheep Sorrel	Borrow Hill	c	D
		Proposed Pond	a	

Latin Name	Common Name	Location	Abund.	Commun.
		Canyon Rim	*	
Salix spp.	Willow	Finger Canyon	r	R
		Apanolio Creek	r*	
		Proposed Pond	c*	
Sambucus sp.	Elderberry	Finger Canyon	r	ME
Sambucus callicarpa	Red Elderberry	Apanolio Creek	a	CS
Satureja douglasii	Yerba Buena	Borrow Hill	r	C
		Finger Canyon	r	
		Canyon Rim	*	
Scrophularia californica	Coast Figwort	Apanolio Creek	a	C,CS
		Canyon Rim	*	C,CS
		Rim Road	c	C,CS
		Proposed Pond	c	
Senecio vulgaris	Common Groundsel	Apanolio Creek	r	D,G
Silene gallica	Common Catchfly	Rim Road	r	D,G
		Proposed Pond	c	
Sisyrinchium bellum	California Blue-Eyed Grass	Rim Road	r	G
		Borrow Hill	r	
Smilacina stellata var. sessilifolia	Slim Solomon	Finger Canyon	r	FW
		Rim Road	r	
		Apanolio Creek	r	
		Digges Canyon	r	
Solanum sp.	Nightshade	Apanolio Creek	r	C,CS
Solanum nigra	Nightshade	Canyon Rim	*	C,CS
Solanum umbelliferum	Nightshade	Borrow Hill	c	C,CS
		Finger Canyon	c	
		Rim Road	c	
		Apanolio Creek	c	
		Digges Canyon	r	
Stachys bullata	Hedge Nettle	Borrow Hill	a	ME,R
		Finger Canyon	a	
		Rim Road	c	
		Apanolio Creek	c	
Stipa sp.	Stipa grass	Rim Road	c	FW,G
Symphoricarpos albus	Common Snowberry	Apanolio Creek	r	ME
Taraxacum sp.	Dandelion	Proposed Pond	c	D
Tellima grandiflora	Fringe Cups	Finger Canyon	r	ME,CS
		Apanolio Creek	c	
Thalictrum polycarpum	Meadow Rue	Apanolio Creek	r	C,CS
		Finger Canyon	c	
Thelypodium sp.	California Mustard	Canyon Rim	*	CS
Trifolium sp.	Clover	Finger Canyon	r	G
Urtica sp.	Nettle	Finger Canyon	c	CS
		Apanolio Creek	a	
		Canyon Rim	*	
Vaccinium sp.	Huckleberry	Canyon Rim	*	C,RF
Vaccinium ovatum	California Huckleberry	Rim Road	r	C,RF
Vicia sp.	Vetch	Apanolio Creek	c	D,G
Vicia americana	American Vetch	Borrow Hill	c	D
		Finger Canyon	c	
Zauschneria californica	California Fuschia	Rim Road	r	C,FW

ABUND:
- r - rare (seen in one or two places)
- c - common (seen in several places along trail)
- a - abundant (seen consistently everywhere along trail - dominant)
- * Abundance measurements were not made during this reconnaissance.

COMMUN:
- C - Chapparal
- CS - Coastal Scrub
- CT - Coastal Strand
- D - Disturbed
- FM - Freshwater Marsh
- FW - Foothill Woodland
- G - Grassland
- ME - Mixed Evergreen Forest
- RF - Redwood Forest
- R - Riparian
- SW - Saltwater Marsh

Latin and Common names Thomas, Flora of the Santa Cruz Mountains of California

B-2

Animals Expected or Observed in Apanolio Canyon
(Table B-2)

Table 3-2
Animals Expected or Observed in Apanolio Canyon
(Source: Thomas Reid Associates, 1984)

Latin Name	Common Name	Habitat	Observation Status
Fishes			
Salmo gairdnerii	Steelhead	A	CDFG (Pilarcitos Ck.)
Cottus sp.	sculpin	FW	CDFG (Pilarcitos Ck.)
Gasterosteus aculeatus	three-spine stickleback	A	CDFG (Pilarcitos Ck.)
Oncorhynchus kisutch	silver salmon	A	CDFG (Pilarcitos Ck.)
Amphibians			
Hyla regilla	Pacific treefrog	R	T. Papenfuss
Rana aurora	red-legged frog	R	CDFG**
Reptiles			
Thamnophis elegans	Western terrestrial garter snake	R, B, W, G	T. Papenfuss
Pituophis melanoleucus	gopher snake	B, W, G	G. Gossett
Coluber constrictor	racer	R, G	G. Gossett
Masticophis lateralis	striped racer	B, R, W	E
Birds			
Buteo jamaicensis	red-tailed hawk	W, G	G. Gossett, R. Langston, B. Rozar
Lophortyx californicus	California quail	B, G	G. Gossett
Zenaidura macroura	mourning dove	W, G, B	G. Gossett
Selasphorus sasin	Allen's hummingbird	B, W	R. Langston, CDFG**
Pipilo fuscus	Calif. brown towhee	B, R	R. Langston
Melanerpes formicivorus	acorn woodpecker	W	CDFG**
Bubo virginianus	great horned owl	B, G, R, W	CDFG**
Spinus tristis	American goldfinch	W, B	T. Peterson, CDFG**
Zonotrichia leucophrys	white-crowned sparrow	B	CDFG**
Parus rufescens	chestnut-backed chickadee	W	T. Peterson, CDFG**
Columba fasciata	band-tailed pigeon	W	CDFG**
Pheucticus melanocephalus	black-headed grosbeak	R, W	CDFG**
Junco oreganus	Oregon junco	W	CDFG**
Thryomanes bewickii	Bewick's wren	B, W	T. Peterson
Hirundo rustica	barn swallow		T. Peterson, CDFG**
Empidonax difficilis	western flycatcher	W	CDFG**
Aphelocoma coerulescens	scrub jay	W, B, R	CDFG**
Cyanocitta stelleri	Steller's jay	R, W	CDFG**
Turdus migratorius	robin	G, W	CDFG**
Corvus brachyrhynchos	common crow	G, W	T. Peterson

Table B-2 (Continued)
Animals Expected or Observed in Apanolio Canyon

Latin Name	Common Name	Habitat	Observation Status
Mammals			
Mephitis mephitis	skunk	B, W	G. Gossett
Procyon lotor	raccoon	R, W	G. Gossett
Odocoileus hemionus columbianus	mule deer	B, G, W	G. Gossett
Thomomys bottae	botta pocket gopher	G	G. Gossett, T. Peterson
Neotoma fuscipes	dusky-footed woodrat	B, R, W	G. Gossett, T. Peterson
Mustela frenata	weasel	B, G, R, W	G. Gossett
Sylvilagus bachmani	brush rabbit	B	G. Gossett
Urocyon cinereoargenteus	gray fox	B, W	G. Gossett
Lynx rufus	bobcat	B	G. Gossett
Felis concolor	mountain lion	W	G. Gossett

** CDFG stream survey of Pilarcitos Creek from the mouth to Stone Dam.

Habitats: R = riparian; B = brush (scrub, chaparral); W = woodland; G = grassland; FW = freshwater; A = anadromous

Butterfly Species Noted in Apanolio Canyon*
May 20, 1983 Field Reconnaissance

LATIN NAME	COMMON NAME
Paratrytone melane	Umber Skipper
Papilio eurymedon	Pale Swallowtail
Pieris rapae	Cabbage White
Pieris napi venosa	Veined White
Anthocharis sara reakirtii	Reakirt's Orange-Tip
Euphydryas chalcedona	Chalcedon Checker-Spot
Phyciodes campestris	Field Crescent
Vanessa cardui	Painted Lady
Coenonympha californica	California Ringlet
Danaus plexippus	Monarch

*Northeast of Gossett property and lower sections of the present Ox Mountain Landfill

B-3

Marbled Murrelet Survey
(Point Reyes Bird Observatory)

Marbled Murrelet survey at Apanolio Canyon, San Mateo County

Marbled Murrelets (*Brachyramphus marmoratus*) nest in old-growth coniferous trees in California, particularly Douglas Fir (*Pseudotsuga menziesii*) and Coast Redwood (*Sequoia sempervirens*) within 75 km of the ocean. The U. S. Fish and Wildlife Service has estimated that 2000 birds comprise the total state population which occur in two disjunct populations: 1) a small area of old-growth forest located between Big Basin Redwoods State Park (northern Santa Cruz County) and at least as far north as Sam McDonald Park (near La Honda, southern San Mateo County); and 2) several large patches of old-growth forest located between Sonoma County and the Oregon border. The exact northern limit of the small southern population is not known, although murrelets have been observed at sea in some numbers as far north as Half Moon Bay during the breeding season (April-September). Since the proposed site for landfill expansion in Apanolio Canyon, San Mateo County, is located from 1-2 km inland from Half Moon Bay and contains old-growth Douglas Fir, we surveyed the site to determine if Marbled Murrelets were using Apanolio Canyon as a nesting area. In addition, we examined the habitat of the Canyon with respect to the known characteristics of a Marbled Murrelet nest discovered in Big Basin Redwoods State Park and forest habitat where murrelets from the southern population occur, to further assess the potential of the Canyon as a nesting area.

Marbled Murrelet nests are very difficult to find because they are located high on the branches of old-growth trees and murrelets visit them at night. Thus, specialized techniques are required to determine if they are nesting in a specific location. Through on-going research by the Point Reyes Bird Observatory, we have found that Marbled Murrelets can be detected by hearing their loud vocalizations and observing birds as they fly above and within the canopy of old-growth forests during a one-to-three hour period around dawn. During the breeding season, this behavior occurs every morning, regardless of weather conditions, although the length of time will vary. Thus, it is sufficient to survey a specific area only once to determine the presence or absence of relatively large numbers of Marbled Murrelets, if such a survey is conducted during the main part of the breeding season (May-July).

On 30 July 1987 between 0500-0630 hours(PDT), we conducted a survey for Marbled Murrelets at two accessible locations in the Apanolio Canyon proposed landfill site (see Figure 1). Observation Post #1 was located at the end of a dirt road at the southern end of the site. This post occurred at the base or junction of two major drainages - one continued north into the proposed site and the other continued to the northeast towards the present landfill site (in the next adjacent canyon). This post was surrounded by coastal scrub on the side of a hill above riparian habitat associated with Apanolio Creek and offered an excellent view of several scattered stands of Douglas Fir. Observation Post #2 was located closer to the center of the site, near the largest stands of Douglas Fir within the site and near the junction of several smaller side drainages. From these observation posts, we were confident that we would detect Marbled Murrelets either in transit to nest sites or near nest sites, if they were present. Although the survey date was near the end of the main breeding season, Marbled Murrelets had been detected in large numbers during the week previous at several localities to the south. No Marbled Murrelets were detected during this survey. But we cannot rule out the possibility that a few birds may nest in the Canyon and may have completed nesting by the date of this survey. In our opinion, large numbers of Marbled Murrelets do not nest in Apanolio Canyon.

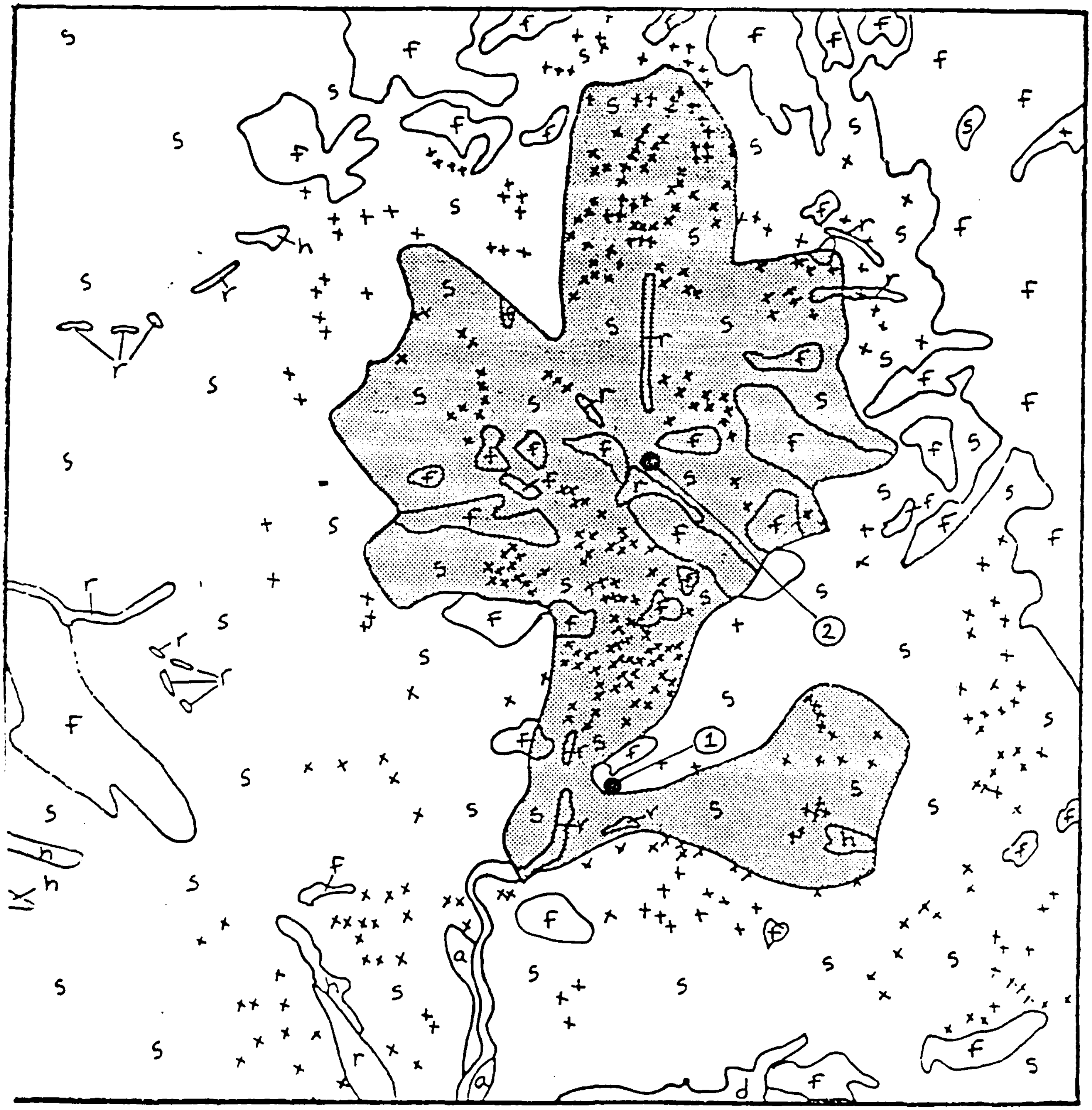
Between 0630-0800 hours, we walked through the area between the two observation posts, viewed most of the Douglas Fir stands in the site and then drove along the dirt road along the ridge to the north of the site to view the site from above. It was evident that Apanolio Canyon contained transitional habitat between coastal scrub and grasslands to the west and forested areas over the ridge to the east (see Figure 1). In the Canyon, Douglas Fir trees were generally shorter, with smaller diameters, and had smaller diameter branches than Douglas Firs located in known Marbled Murrelet nesting areas in Big Basin Redwoods State Park and other nearby areas. The Douglas Fir in which the Marbled Murrelet nest was found in Big Basin Redwoods State Park was 61-m high and 167 cm in diameter. The nest was located on a 45-m high branch that was 41 cm in diameter at the base, 15-m long, and the basal half of the limb was covered with bright green moss (Isothecium cristatum). None of the Douglas Fir in the Canyon approached these tree and limb dimensions although the largest branches of some trees may have been physically large enough for a murrelet nest (approximately 10 x 7 cm) and most branches had luxuriant coverings of lichen and bright green moss (Isothecuim stoloniserum; voucher specimen in the California Academy of Sciences). However, several other factors likely cause murrelets to nest only in larger old-growth trees, especially the need for: 1) large, flat branches (because murrelets do not build a nest and lay the egg directly on the branch); 2) branches located high in the canopy within an open crown structure (for access by adult murrelets visiting the nest and for chicks fledging from the nest); and 3) branches which offer protection for the nest from predators and weather. Douglas Fir in the Canyon often had sloping branches, large branches were often close to the ground, and (since trees were grouped in small isolated stands [see Figure 1]) tree branches were almost completely unprotected from predators and sun, wind, and fog. But since the nest-site requirements of Marbled Murrelets are not well known, we cannot rule out the possibility that murrelets could use such habitat. In our opinion, Apalonio Canyon does not contain suitable nesting habitat for Marbled Murrelets.

Harry R. Carter
Staff Biologist

Thomas G. Sander
Field Biologist

Figure 1. Vegetation map of the Apanolio Canyon proposed landfill site. The large dots indicate observation post locations used to survey for Marbled Murrelets on 30 July 1978.

FIGURE III - 4
SITE VEGETATION



0 1000 2000
0 200 400 600
NORTH

LEGEND:

- s Coastal Scrub
- f Woodland
- r Riparian
- h Herbland
- a Agricultural
- d Disturbed Open
- x Tree
- Project Site

SOURCE: Thomas Reid Associates From San Mateo County Normal Color Aerial Photo, March 1983. March 1981.

B-4

Review of Available Scientific Information on Six Candidate Insects
(Entomological Consulting Services)

Update on Status of Candidate Insects
(Entomological Consulting Services)

REVIEW OF AVAILABLE SCIENTIFIC INFORMATION

ON SIX CANDIDATE INSECTS

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16 October 1987

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INTRODUCTION

This report has been prepared at the request of Mr. Ralph Osterling to assist is preparation of an EIS for the Ox Mountain Sanitary Landfill, Apanolio Canyon Expansion, located near Half Moon Bay in San Mateo County, California. It reviews the available scientific information on six insects which the U.S. Fish & Wildlife Service regards as potential candidates (U.S. Fish & Wildlife Service, 1984) for eventual listing as endangered or threatened species. In particular, it summarizes the known geographic range of each insect, plus identifies habitat and ecological requirements for each taxon, if such information is available.

In preparing this report the following activities were undertaken: 1) a site visit to the Pilarcitos Quarry, Ox Mountain Landfill, and Apanolio Canyon to determine vegetation and habitat types present in each area; 2) review of the final EIR document and available aerial photography; 3) located and reviewed the available entomological literature for each insect; 4) contacted the U.S. Fish & Wildlife Service to determine if it had on file any additional unpublished information about each insect; and 5) contacted several entomologists who either had expertise with the various insect species of concern or were knowledgeable about related insect species.

During my site visit on 22 September 1987, I observed the following habitats and vegetation types at the three parcels: 1) dense coastal sage scrub vegetation; 2) douglas fir forest; 3) riparian with 100% vegetative cover of trees and shrubs; 4) rock outcrops; 5) small, manmade areas of grassland; 6) manmade retention, sedimentation, and aeration ponds; and 7) some weedy ruderal vegetation in disturbed areas. My observations were corroborated by the information in the final EIR (San Mateo County, 1984).

SPECIES ACCOUNTS

San Francisco Forked-Tail Damselfly

Insect Order: Odonata (Dragonflies and Damselflies)
Family: Coenagrionidae (Narrow-winged Damselflies)
Scientific Name: Ischnura gemina (Kennedy, 1917),
Common Name: San Francisco Forked-Tail Damselfly
Federal Classification: Category 1 Candidate
State of California Classification: Not Listed

Distribution and Habitat Requirements

This damselfly, whose scientific name is Ischnura gemina (Kennedy), is endemic to the greater San Francisco-San Jose Bay area. It was described as a new species in 1917 (Kennedy, 1917) based on four specimens collected at Coyote Creek and Sharon Pond in Santa Clara County. Until recently it was known only from about 50 specimens collected at about a dozen localities between Pt. Reyes (Marin County) and the Salinas River (Monterey County). Beginning in the late 1970's, Garrison and Hafernik (1981) conducted a search in portions of Marin, San Francisco, San Mateo counties and discovered the damselfly at seven localities. All but one of the newly discovered sites were found in highly disturbed, urbanized areas. Hafernik and his graduate students at San Francisco State University have continued to monitor the damselfly and study its population biology at sites in San Francisco and Burlingame.

Evaluation of the Project Site

I spoke with Dr. John Hafernik by telephone to learn more about the damselfly's habitat requirements and known geographic range in an effort to better evaluate the project site conditions as possible habitat for the damselfly. He indicated that known localities in San Mateo County which support the damselfly lie east of the Coast Range. He described the damselfly's preferred habitat as creeks, seepages, or flood-control drainages with calm pools or ponds. The vegetation associated with these waterways usually consists of scattered clumps of cat-tails (Typha), sedges (Juncus), willows (Salix), duckweed (Lemna), waterfern (Azolla), and watercress (Nasturtium). When I described the drainages that occur on the project site and their 100% closed canopy of trees and shrubs, Dr. Hafernik said that this would not be typical habitat for the damselfly, as it prefers the more open situations as described above. For these reasons, the damselfly would probably not be expected to occur at the project site.

San Francisco Tree Lupine Moth

Insect Order: Lepidoptera (Butterflies and Moths)
Family: Tortricidae (Tortricid moths)
Scientific Name: Grapholita edwardsiana (Kft., 1907)
Common Name: San Francisco Tree Lupine Moth
Federal Classification: Category 2 Candidate (soon to be downgraded to Category 3C)
State of California Classification: Not Listed

Distribution and Habitat Requirements

The San Francisco Tree Lupine moth was described by Kearfoot in 1907 based on a series of four specimens collected during the 1880's with the only collection label data as "San Francisco, Cal." The moth was believed to be an endemic of the San Francisco sand dunes, which were largely destroyed due to expanding urbanization. Thus the species remained unknown until 1961, when, Dr. Jerry A. Powell of the University of California, Berkeley, rediscovered a population along Lobos Creek in association with Tree Lupine, Lupinus arboreus, near Baker Beach in San Francisco. In 1977, Powell located three more moth populations at Baker Beach and Lake Merced in San Francisco, and San Bruno Mountain in northern San Mateo County (Powell, 1979). During 1979, Powell and I located the moth at 13 sand dune remnants along the western coastline of the San Francisco Peninsula (Arnold, 1981).

On the basis of its rediscovery, our belief that this moth had a very limited geographic range, and numerous threats to many of its remaining habitat sites, Dr. Powell and I petitioned the U.S. Fish & Wildlife Service in 1982 to recognize the moth as a threatened species. During the review process, the Service contracted with David L. Wagner, then a graduate student of Dr. Powell's, to conduct a more extensive survey for the moth. Based on Wagner's survey, the moth's range is now known to be much greater, ranging from as far north as Bolinas Lagoon (Marin County), to Salmon Creek (Monterey County), and inland as far east as the Berkeley Hills. Wagner (1984a) suggests that the moth may eventually be found over an even wider geographic range as additional surveys of northern and southern coastal areas are undertaken. Furthermore, Wagner (1984b) has determined that G. edwardsiana is probably conspecific with another species G. lana, which is known from Washington, Oregon, and California. Based on the results of these studies, the U.S. Fish & Wildlife Service plans to reclassify G. edwardsiana from a Category 2 to a Category 3C (species determined to be more widespread since their original publication) in a forthcoming Notice of Review (J. Singleton, U.S. Fish & Wildlife Service, personal communication 6 Oct. 1987).

Evaluation of the Project Site

During my one-day site visit, stems of *Lupinus arboreus* were collected at the Pilarcitos Quarry property. Larvae of *G. edwardsiana* were found feeding internally in some of the stems. Although the moth was found here, it is now known to occur throughout a much greater geographic range than we originally believed. For this reason, the U.S. Fish & Wildlife Service is now in the process of downgrading its candidate status. Thus the moth's presence at the project site should not be a concern.

Myrtle's Silverspot Butterfly

Insect Order: Lepidoptera (Butterflies and Moths)
Family: Nymphalidae (Brush-Footed Butterflies)
Scientific Name: Speyeria zerene myrtleae dos Passos and Grey, 1945
Common Name: Myrtle's Silverspot or Fritillary
Federal Classification: Category 2 Candidate
State of California Classification: Not Listed

Distribution and Habitat Requirements

Myrtle's Silverspot butterfly was described in 1945 by dos Passos and Grey as an inhabitant of the coastal grassland vegetation type found in association with sand dunes, especially rear dunes, and sandy areas west of the coast range in San Mateo County. Subsequent surveys have found the butterfly occurring in similar meadow habitat on the inland side of sand dunes at Pt. Reyes (Marin County) and Bodega Bay (Sonoma County). Historically, the silverspot also probably occurred in the dunes that formerly existed at the western end of San Francisco. At present, the silverspot is believed to be extinct south of Marin County (Tilden, 1965). The last known specimen collected in San Mateo County was at Pescadero on 12 July 1950.

All silverspots feed as larvae on violets (Viola). Although the exact violet species used by Myrtle's Silverspot in San Mateo County is not known, it is presumed to have been Viola adunca, since this violet grows in similar habitats in other coastal areas.

Evaluation of the Project Site

Most of the acreage at the project site consists of dense coastal sage scrub, Douglas fir forest, or riparian vegetation. No natural grassland, as required by Myrtle's Silverspot, was observed during my survey of the project site. Although a few, small, man-made pockets of grassland have been created, their total area, a few hundred square feet, is inadequate to support this butterfly. Also, no violets were noted at the project site during a botanical survey conducted for the final EIR (San Mateo County, 1984). As the appropriate habitat and larval foodplant for Myrtle's Silverspot are lacking, I would not expect to find this butterfly at the project site.

Leech's Skyline Diving Beetle

Insect Order: Coleoptera (Beetles)
Family: Dytiscidae (Predaceous Diving Beetles)
Scientific Name: Hydroporus leechi R.Gordon, 1981
Common Name: Leech's Skyline Diving Beetle
Federal Classification: Category 2 Candidate
State of California Classification: Not Listed

Distribution and Habitat Requirements

Leech's Skyline Diving Beetle was described by Gordon in 1981 based on four male specimens collected from a pond off Skyline Blvd. in Pacifica (San Mateo County). The precise location is in the Edgemar District of Pacifica, 4.6 miles south of the San Francisco line on the east side of Skyline Blvd. The female of this species is unknown. One specimen was collected on 16 March 1951, while a series of three males was collected on 9 Oct. 1967. The beetle is named after Hugh B. Leech, a coleopterist who worked for many years at the California Academy of Sciences, and specialized on several aquatic groups of beetles.

Apparently the beetle is known only from the type series of four male specimens. There is no information about its ecological or habitat requirements in the published entomological literature.

The genus Hydroporous in North American contains more than 100 named species. Most of the published papers on the genus deal with descriptions of new species. Gordon (1981) described the H. niger-H. tenebrosus species complex, to which H. leechi belongs, as the "most taxonomically difficult group among all North American Dytiscidae". General information of habitat and ecological requirements for any Hydroporous species is sparse. I could locate only a couple of papers that even mentioned the specific environment in which distantly related species of Hydroporous were found. One species was found in lotic depositional areas while the other was in lentic areas associated with vascular hydrophytes. I even examined the literature for European species and could not find any useful information on the habitat and ecological requirements of these beetles.

Evaluation of the Project Site

Without more specific information on the habitat and ecological requirements of a close relative of H. leechi, it is difficult to infer exactly what these requirements may be for H. leechi. I assume that since it was collected from a permanent pond off Skyline Drive in Pacifica, a pond or perhaps a pool in a stream would be likely places to look for the beetle at the project site. Based on my brief survey of the project site, the only ponds noted were sediment or aeration ponds, in which substrata, vegetation, and potential prey species would probably differ from those in a more natural pond environment. A couple of very small pools were observed in the creeks at the project site. I also checked with J. Singleton, entomologist for the U.S. Fish & Wildlife Service (personal communication, 6 October 1987), to find out if the Service was aware of any unpublished information that would assist us in determining this beetle's habitat and ecological requirements. She was not aware of any new information. Thus based on the currently available information for this insect I cannot be certain whether or not it is likely to occur at the project site. A field survey may be necessary to determine its status there.

Leech's Chaetarthria Water Scavenger Beetle

Insect Order: Coleoptera (Beetles)
Family: Hydrophilidae (Water Scavenger Beetles)
Scientific Name: Chaetarthria leechi D.C. Miller, 1974
Common Name: Leech's Chaetarthria Water Scavenger Beetle
Federal Classification: Category 2 Candidate
State of California Classification: Not Listed

Distribution and Habitat Requirements

Miller (1974) described C. leechi as a new species in his revision of the new world Chaetarthria. Like the previously mentioned dytiscid beetle, it is named after Hugh B. Leech. The only known specimens at the time of revision were collected along Hayfork Creek in Trinity County, California on three dates in July and August of 1971 and 1972 by Leech. The locality is at 2700 feet elevation. A search of the annual index of Zoological Record for the period 1974-1986, did not yield any additional published information about this species.

A few of the other 15 species of Chaetarthria usually burrow in sand at the margins of streams and river. Beyond this, Miller (1974) notes that for the genus "nothing is known of their biology". Leech communicated to Miller that the specimens he collected from Hayfork Creek were found in sand with little silt in localities where the water was quiet. Also, Leech (1948) reported that adults other species of Chaetarthria are nocturnal. Other genera of the family Hydrophilidae favor quiet waters with abundant vegetation. Adults feed chiefly on vegetation or are omnivorous. Larvae are generally predaceous.

Perkins (1976) studied five species of Chaetarthria along the sandy shoreline of the San Gabriel River in Southern California. He found that the five species each occupied a distinct zone of preference along the stream bank, ranging from 5 inches from the waterline and extending to as much as 36 inches up the bank. However, exact microhabitats of the separate species were not determined. C. leechi was not one of the species studied.

Evaluation of the Project Site

As the only known collection locality is quite distant and at least 2,000 feet higher than the project site, I would be surprised to find this species at the project site. J. Singleton of the U.S. Fish & Wildlife Service (personal communication, 6 Oct. 1987) indicated that since C. leechi was known only from Trinity County, it should not be a concern for the project site.

Ricksecker's Water Scavenger Beetle

Insect Order: Coleoptera (Beetles)
Family: Hydrophilidae (Water Scavenger Beetles)
Scientific Name: Hydrochara rickseckeri Horn, 1895
Common Name: Ricksecker's Water Scavenger Beetle
Federal Classification: Category 2 Candidate
State of California Classification: Not Listed

Distribution and Habitat Requirements

Horn (1895) described this aquatic species based on the collection of one male specimen in 1893 from Harris' Pond, California. This specimen, the holotype, is in the Horn Collection at the Museum of Comparative Zoology (Harvard University). Even though this species was described over 90 years ago, it is still known from only a few specimens, all which have been collected in the San Francisco Bay area. In preparing his revision of 21 Holarctic species in the genus Hydrochara, Smetana (1980) was only able to locate and examine a total of 14 adult specimens of H. rickseckeri from major entomological collections in North America. These specimens were collected at the following localities: Alameda County (Oakland and Boy Scout of America Camp, Oakland); Marin County (Bolinas); San Mateo County (Woodside Pulgas Temple); and Sonoma County (6.5 mi. northeast of Penngrove). Collection dates ranged from 27 January to 30 July.

Most of the species of Hydrochara are similar in appearance and frequently difficult to identify. They range in size from about 10 to 20 mm. H. rickseckeri is the smallest member of the genus, and this feature plus its coloration, punctation, and genital morphology are the primary characteristics for differentiating it from other members of the genus Hydrochara. Smetana (1980) divided the genus into several species groups. H. rickseckeri is one of only two species in the similis group. H. similis occurs in India (Oriental Region).

Unfortunately, there is very little biological information available for species of the aquatic genus Hydrochara and none specific to H. rickseckeri. In general, members of the family Hydrophilidae favor quiet waters with abundant vegetation. Adults feed primarily on vegetation or are omnivorous, hence the common name of scavenger beetles. Larvae are generally believed to be predaceous.

Biological information for other species in the genus Hydrochara can be summarized as follows.

1) Smetana (1980) noted that H. caraboides, a Holarctic species, occurs in standing water always with plentiful vegetation, but especially favored shallow water of small ponds, swamps, and along the edges of lakes. Adults are attracted to light and are active from early spring until fall.

2) Matta (1974) and Wooldrige (1967) reporting on H. obtusata, a common species throughout eastern North America, Canada, and the Pacific Northwest, observed it in a wide variety

of aquatic habitats, but that shallow water with rich vegetation was favored. Other habitat associations included: sphagnum ponds in Wisconsin; farm ponds and similar lentic habitats in Massachusetts; and occasionally under stones and pieces of wood in very wet habitats along the edges of water. Adults regularly come to light.

3) Smetana (1980) noted that H. flavipes, a Mediterranean species, is found in standing water, with adults being attracted to lights during the period February through November.

4) Leech (1948) observed that H. lineata, endemic to desert regions of the Southwestern U.S. and Mexico, was associated with mineralized water and hot springs.

Evaluation of the Project Site

Without knowing more about the specific conditions of the aquatic habitats in which specimens of H. rickseckeri has been collected, it is difficult to definitively evaluate its possible occurence at the project site. Based on the limited biological information for related species, I doubt that H. rickseckeri would be found in streams at the project site as the water move rather swiftly and there are few pools. However, as related species have been found associated with standing water, including farm ponds, the sediment or aeration ponds at the project site might be able to support this beetle. Smetana (1980) and others report that standing water with rich vegetation seem to be particularly favored by Hydrochara, however there is no mention whether the vegetation is submerged or emergent. During my brief visit to the project site, I did not notice lush emergent vegetation growing in association with the sediment and aeration ponds. For this reason and the proximity of a historical collection site, a survey to determine this beetle's status at the project site may be necessary.

OTHER INSECTS OF CONCERN

In addition to the six candidates that I was asked to review, I also was on the lookout for habitat for two other federally-listed endangered insects and a seventh potential candidate. The endangered San Bruno Elfin butterfly (Callophrys mossii bayensis) occurs at several sites in the Coast Range in San Mateo County in association with north-facing rock outcrops where its larval foodplant, Sedum spathulifolium grows. Similarly, the endangered Mission Blue butterfly (Icaricia icarioides missionensis) is found in coastal grasslands of San Mateo County where its larval foodplants (Lupinus variicolor, L. albifrons, or L. formosus) grow. The candidate Callippe Silverspot (Speyeria callippe callippe) is also found in grassland areas of San Mateo County, in association with its larval foodplant, Viola pedunculata.

Although a few rock outcrops were observed during my site visit, none were north-facing in their orientation. Also, the botanical survey for the final EIR did not find any Sedum spathulifolium present. Thus the endangered San Bruno Elfin butterfly would not be expected to occur at the project site.

All grassland at the project site consists of very small, manmade pockets amongst dense coastal sage scrub, which, according to the EIR, lack the requisite foodplants for the Mission Blue and Callippe Silverspot. Thus both of these butterflies would not be expected to occur at the project site.

SUMMARY

This report summarizes available scientific information on six insects considered candidates for possible recognition as endangered or threatened species by the U.S. Fish & Wildlife Service. In particular, this report discusses the known geographic range, habitat requirements, and likelihood of occurrence in the vicinity of the Ox Mountain Sanitary Landfill, near Half Moon Bay, California.

1) The San Francisco Tree Lupine moth was found at the project site, but the U.S. Fish & Wildlife Service is in the process of downgrading its status to a non-candidate classification.

2/3) Requisite habitat conditions for Myrtle's Silverspot and the San Francisco Fork-Tailed damselfly at the project site are lacking, thus these insects would not be expected to be found there.

4) The only known collection site of Leech's <u>Chaetarthria</u> Water Scavenger beetle is along a sandy creek in Trinity County at 2700 feet elevation. Due to the geographic distance and elevational differences, it does not seem likely that this species would occur at the project site.

5) Leech's Skyline Diving beetle is known only from a natural pond in Pacifica (northern San Mateo County). All ponds at the project site are man-made for retention, sedimentation, and aeration uses. Due to the paucity of information about this beetle's ecological requirements and the proximity of a historical collection locality to the project site, a field survey may be necessary to determine its status at the project site.

6) Similarly, Ricksecker's Water Scavenger beetle is known from only a few sites in the greater San Francisco Bay area. Although this beetle's specific habitat requirements are unknown, information from related species suggests that the standing water in the sediment and aeration ponds at the project site might possibly be habitat. A field survey may be necessary to determine its status at the project site.

Two other federally-listed endangered butterflies, the San Bruno Elfin and Mission Blue, plus a seventh candidate, the Callippe Silverspot, would not be expected to occur at the project site as their habitats (north-facing rocky outcrops or grassland) and obligate larval foodplants are lacking.

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ENTOMOLOGICAL CONSULTING SERVICES

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25 October 1988

Mr. Ralph Osterling
Ralph Osterling Consultants, Inc.
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RE: Ox Mountain Sanitary Landfill, Apanolio Canyon Expansion EIS - update on status of candidate insects

Dear Ralph:

As you recently requested, I have contacted various specialists and museums to update the status of six insects that are candidates for listing as endangered or threatened species. These insects have been identified by state and federal resource agencies as potentially inhabiting the Ox Mountain project site. The common and scientific names of these insects are as follows:

a) San Francisco Forked-Tail Damselfly (Ishnura gemina);
b) San Francisco Tree Lupine Moth (Grapholita edwardsiana);
c) Myrtle's Silverspot Butterfly (Speyeria zerene myrtleae);
d) Leech's Skyline Diving Beetle (Hydroporus leechi);
e) Leech's Chaetarthria Water Scavenger Beetle (Chaetarthria leechi); and
f) Ricksecker's Water Scavenger Beetle (Hydrochara rickseckeri).

In October 1987, I prepared a report for you, titled "REVIEW OF AVAILABLE SCIENTIFIC INFORMATION ON SIX CANDIDATE INSECTS", which summarized the known geographic distribution and habitat requirements of each insect, plus evaluated the likelihood of each insect occuring at the proposed project site. In the interim, new surveys and other studies have been conducted for a few of these candidate insects. The purpose of this letter is to summarize the findings of studies undertaken since the completion of my earlier report and with the new information, re-evaluate the potential for each insect to occur at the project site.

San Francisco Forked-Tail Damselfly.

At the time of my 1987 report, the damselfly was known from seven localities in Marin, San Francisco, San Mateo and Santa Clara counties. In November 1987, Dr. John Hafernik and his students at San Francisco State University conducted a survey of 14 sites in Alameda, San Francisco, San Mateo, and Santa Clara counties to update the damselfy's status at known localities and attempt to discover new localities. The damselfly was found in natural, but often polluted creeks and marshes, plus man-made drainage channels supporting emergent vegetation such as Typha, Scirpus, Salicornia and Cotula. Adult damselflies were observed near Burlingame, Belmont, and San Bruno in San Mateo County, East Palo Alto in Santa Clara County, and Glen Park in San Francisco. Based on this new survey and his earlier studies, Dr. Hafernik still believes that the damselfly prefers creeks, seepages, or flood-control drainages with open, calm pools or ponds. Thus habitat conditions at Apanolio Canyon, where the drainages are characterized by rapid waterflow with little pooling and have closed canopies of trees and shrubs, suggest that the damselfly would not be expected to occur there. Furthermore, all localities in San Mateo County now known to support the damselfly, lie east of the Coast Range.

San Francisco Tree Lupine Moth.

No additional studies have been completed since my 1987 report. However, as I noted in that report, this moth has been found to occur throughout a much greater geographic range than it was earlier believed to be limited to. For this reason, the U.S. Fish & Wildlife Service eventually intends to downgrade its candidate status.

Myrtle's Silverspot Butterfly.

No new studies have been undertaken on this butterfly, whose populations south of Marin County are believed to be extinct due to loss of its sand dune habitat. However, since no sand dune habitat occurs at the proposed project site and the butterfly's larval foodplant, Viòla adunca, was not discovered during botanical surveys for the EIR, the silverspot would not be expected to occur at this site.

Leech's Skyline Diving Beetle.

At the time of my 1987 report, this beetle was known only from a pond off Skyline Boulevard in Pacifica. However, Dr. R.D. Gordon, who described this species in 1981, recently returned several loaned specimens to the California Academy of Sciences which he has identified as this species. Based on these new identifications, the geographic range of the beetle has been greatly expanded. These specimens are from several California counties, including Mariposa, Madera, Mono, Plumas, Shasta, Siskiyou, Sonoma, Tehama, plus Colorado, Oregon, and Washington. Thus this beetle's geographic range is considerably greater than was earlier believed. Although the U.S. Fish & Wildlife Service has not made any official decision at this time, it is likely that the candidate status of this beetle will eventually be downgraded due to this new information.

Leech's Chaetarthria Water Scavenger Beetle.

No new information has become available about this species. I even spoke with Dr. D.C. Miller, the coleopterist who described this species in 1974. As I noted in my earlier report, this species is known only from a few specimens collected from Hayfork Creek in Trinity County at an elevation of about 2,700 feet. Although the exact microhabitat of this species is not known, Dr. Miller doubted that it would be found in or near the proposed project site.

Ricksecker's Water Scavenger Beetle.

In November and December 1987, Dr. Hafernik and his students attempted to locate the type locality for this beetle, Harris Pond in Sonoma County, in an effort to learn more about its biology and habitat requirements. Documents from the "Historical Atlas of Sonoma County" indicate that Jacob Harris owned a ranch in 1893 located just north of the city of Santa Rosa and along the present-day Calistoga Road. However, the documents did not identify the precise location of the ranch or pond where the beetle was first collected in 1893. Thus, Hafernik and his students conducted a survey of the area north of Santa Rosa along Calistoga Road. Although several ranches still remain in that area, no ponds were observed. They did stop and collect at Mark West Creek, located along Calistoga Road about five miles north of Highway 12, but did not find the beetle. They also visited a historical collection site located about 6.5 miles north of Penngrove on Lichau Road, where the beetle was found in a vernal pool in June 1969. No vernal pools or depressions where pools might form were observed. Like the previously mentioned locality, no specimens of this beetle were found.

As several of the historical collection records of this beetle suggest that it is associated with ponds or vernal pools, it seems unlikely that it would occur in the swift streams located at the proposed project site. Potentially the beetle might occur in association with the man-made sediment and aeration ponds at the project site. However, a field survey would be necessary to determine its status in these ponds.

That summarizes the new information on these candidate insects. If you have any questions, just give me a call.

Sincerely,

Richard A. Arnold

Richard A. Arnold, Ph.D.

B-5

Apanolio Canyon Sensitive Plant Investigation
(Charles A. Patterson)

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September 27, 1988
OST388

Mr. Ralph Osterling
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Re: Apanolio Canyon sensitive plant investigation.

Dear Mr. Osterling:

At your request, I have conducted a survey of the proposed Apanolio Canyon landfill site with the purpose of looking for any sensitive plant species and/or suitable habitat for same which might occur in this area. I made a visit to the site on September 19, during which I observed the canyon in general as well as examining the various habitats present. I was able to look at approximately 90 percent of the site, some of which was from a distance, but which was still observable as to the vegetation cover, species composition, and specific habitat conditions. Although this was not the most opportune time period for identifying some sensitive plant species, it was adequate to assess the suitability of the local habitats for such species. Further, some of the regional sensitive plants such as Montara Mountain manzanita would, in fact, be identifiable at this time based on non-flowering morphology. The following sections summarize my findings and conclusions:

General Vegetation

Most of the canyon study area is covered by a relatively dense and uniform stand of chaparral dominated by blue-blossom ceanothus (Ceanothus thyrsiflorus) and coyote bush (Baccharis pilularis ssp. consanguinea), plus generally lesser amounts of California sagebrush (Artemisia californica), poison oak (Toxicodendron diversilobum), bush monkeyflower (Diplacus aurantiacus), and coffeeberry (Rhamnus californicus). There are also scattered individuals of yerba santa (Eriodictyon californicum), gooseberry (Ribes sp.), yellow bush lupine (Lupinus arboreus), and elderberry (Sambucus sp.).

The slopes of the canyon are relatively steep and the dense shrubby vegetation is a typical and common cover for this type of terrain and habitat. There is essentially no good rock habitat in the area, although there are a few very small erosion scarps and nearly bare outcrops near the bottom of the main canyon. Mo of the canyon's slopes are exposed to the west or south (some to the southea and there is very little variation in cover extent, shrub density, and spec composition. The very bottom of the main canyon contains some ripari woodland and thicket vegetation, and the highest slopes (generally above proposed landfill extent) support a broken forest of Douglas-fir (Pseudotsug menziesii), coast live oak (Quercus agrifolia), and occasional tanbark o (Lithocarpus densiflorus) and madrone (Arbutus menziesii). The extreme head the canyon (on the ridge and in the fog-drift zone) also includes abundant coast forest understory species such as sword fern (Polystichum munitum huckleberry (Vaccineum sp.), and California polypody fern (Polypodium californicum). The lower slopes in the canyon contain scattered small stands Douglas-fir set within the overall expanse of chaparral.

The more disturbed parts of the study area (e.g., along roads) support a typi assortment of non-native herbs and shrubs, including broom, pampas grass brome grasses, thistles, poison hemlock, wild oats, and others. Pockets herbaceous vegetation are scarce in the study area because of the genera dense and extensive brush, and what there is present in the way of low herb cover is almost exclusively disturbed weedy vegetation. There is no signific native grassland or associated natural meadow or herb communities. Non-native annual grassland occurs only sporadically, generally as weedy strips vegetation along trails and roads.

Habitats

The study area can be characterized as a steep coastal canyon dominated chaparral, plus zonal communities of forest and riparian woodland at the high and lowest elevations respectively. The slopes are relatively uniform in slope and general aspects, and they contain virtually no exposed rocks. The slop support nearly complete coverage by just a few shrub species, and there is very little variation in the terrain, topographical gradients, or substrate condition None of the habitats are particularly unusual or noteworthy, all being common the immediate vicinity as well as the region. There are no unusual rock types (such as serpentine or exposed sandstone), and the hydrologic features a limited to the simple ravine-bottoms and the main riparian corridor toward the bottom of the study area.

Sensitive Plant Species

No rare, endangered, or otherwise sensitive plant species were encountered during the field survey, nor were any habitats seen which were especially suit for such species. While there are several sensitive plants known to occur in t general region (the closest being Scarper Peak where Montara Mountain manzanita is reported), none are reported as occurring within the study area. Table 1 summarizes the known sensitive plants of the general region. Based on the predominant local habitats (steep uniform hillsides, Douglas-fir groves, and riparian ravines), the sensitive plant most likely to occur in the study area is Montara Mountain manzanita. However, the dense chaparral present in the study area is composed almost exclusively of coyote bush, ceanothus, coastal sagebrush, and poison oak. No manzanita plants of any species were found in the study area.

There is very little, if any, suitable habitat for the more herbaceous sensitive plants of the region (Pentachaeta, Silene, Hesperolinon, Orthocarpus, etc.). Also, many of the known sensitive species are restricted to somewhat special substrates such as serpentine and/or other exposed rocks (Erysimum, Hesperolinon) or other uncommon habitat conditions (e. g., coastal bluffs, dunes, vernal pools, etc.). These restricted types of habitats are not present in the study area. Also, any species typically associated with the wetter Douglas-fir communities, such as are found at the head of Apanolio Canyon, will not be affected by the proposed landfill since the limits of filling are generally well below the most extensive and well developed conifer forest.

Conclusions

There appears to be little probability that any sensitive plant species occur within the actual landfill site. There is no obvious suitable habitat present, and no individuals or significant populations were seen. Based on the abundance of common, uniform chaparral on the canyon's walls and the apparent lack of any unusual habitat conditions, it is likely that no sensitive plant populations are present, and the impacts to any sensitive plant species should be insignificant

I hope this letter helps clarify the situation in the Apanolio Canyon study area and gives you the information you need. Please feel free to call if you have any questions.

Sincerely, Charles Patterson

Charles A. Patterson

Table 1. Summary of target sensitive plant species of west-central San Mateo Co.

PLANT TAXON	COM. NAME	LIST	R-E-D	FWS	CDFG	ELEVATION	HABITAT	FLOWER PERIOD
Acanthomintha obovata ssp. duttonii	San Mateo thorn-mint	1b	3-3-3	C1	E	500 - 2000' ?	serpentine, mixed ever-green forest	May
Arctostaphylos montaraensis	Montara Mountain manzanita	1b	2-2-3	C2	-	500 -1500'	granitic sand and sandstone	January to March ?
Campanula californica	swamp harebell	1b	2-2-3	C2	-	low elevations	freshwater swamp, marshes	June to September
Cirsium fontinale var. fontinale	fountain thistle	1b	3-3-3	C2	E	500 - 2000' ?	wet spots on serpentine clay	June to October
Eriophyllum latilobum	San Mateo woolly sunflower	1b	3-2-3	C1	-	below 500'	grassy and rocky sparsely	May to June
Erysimum franciscanum var. crassifolium	thick-leaved wallflower	1b	2-2-3	-	-	low elevations near coast	coastal bluffs, sand hills	March to April
Helianthella castanea	Diablo helianthella	1b	2-2-3	C2	-	500 - 4000'	grassy hillsides, oak woodland	April to May
Hesperolinon congestum	Marin dwarf flax	1b	3-2-3	C1	-	below 2000' ?	dry slopes; serpentine; coastal	May to June
Holocarpha macradenia	Santa Cruz tarweed	1b	3-3-3	C1	E	low elevations	heavy soils, coastal grassland	June to October

Table 1. Summary of target sensitive plant species of west-central San Mateo Co.

PLANT TAXON	COM. NAME	LIST	R-E-D	FWS	CDFG	ELEVATION	HABITAT	FLOWER PERIOD
Limnanthes douglasii var. sulphurea	Pt. Reyes meadowfoam	1b	3-2-3	C2	E	500 - 2000' ?	moist places in coastal scrub	March to May
Microseris decipiens	Santa Cruz microseris	1b	2-2-3	C2	-	low elevations	coastal prairie, grassland	April to May
Orthocarpus floribundus	San Francisco owl's clover	1b	2-2-3	C2	-	low elevations	coastal scrub, coastal prairie	April to May
Pedicularis dudleyi	Dudley's lousewort	1b	2-1-3	C3c	R	500 - 2000' ?	redwood forest	April to June
Pentachaeta bellidiflora	white-rayed pentachaeta	1b	2-2-3	C2	-	low elevations	open dry rocky slopes; north coastal scrub,	March to May
Perideridia gairdneri ssp. gairdneri	Gairdner's yampah	1b	1-2-3	C2	-	low elevations	wet places	June to July
Sidalcea hickmanii ssp. viridis	Marin checker mallow	1b	3-1-3	C2	-	Big Carson Ridge	chaparral	June
Silene verecunda ssp. verecunda	Dolores or San Francisco campion	1b	2-2-3	C2	-	low elevations	open sunny more or less grassy areas	March to June
Arabis blepharophylla	coast rock cress	4	1-2-3	C3c	-	below 4000'	rocky places, cliffs, coastal scrub	February to April

Table 1. Summary of target sensitive plant species of west-central San Mateo Co.

PLANT TAXON	COM. NAME	LIST	R-E-D	FWS	CDFG	ELEVATION	HABITAT	FLOWER PERIOD
Cypripedium fasciculatum	clustered lady's-slipper	4	1-1-2	C3c	-	?	open rocky woods, redwoods to	April to May
Dirca occidentalis	western leatherwood	4	1-1-3	-	-	below 1500'	wet slopes of rocky hills	January to March
Erysimum franciscanum var. franciscanum	San Francisco wallflower	4	1-2-3	C2	-	low elevations	serpentine, chaparral, coastal scrub	March to June
Fritilaria liliacea	fragrant fritillary	4	1-1-3	C2	-	low elevations	heavy adobe soils, coastal grassland	February to April

LEGEND FOR TABLE 1

Plant Taxon: as listed by Smith and York (1984).

List: refers to the list number on which the plant is included in Smith and York (1984; California Native Plant Society's sensitive plant inventory). 1a: Plants presumed extinct (PE) in California, 1b: Plants rare or endangered in California and elsewhere, 2: Plants rare or endangered in California, but more common elsewhere, 3: Plants about which we need more information, and 4: Plants of limited distribution [a watch list]. Appendix 1: Plants considered, but not included.

R-E-D: rarity (R), endangerment (E), and distribution (D) code from Smith and York (1984) :

<u>Rarity</u> :

1 = Rare, but found in sufficient numbers and distributed widely enough that the potential for extinction or extirpation is low at this time

2 = Occurrence confined to several populations or to one extended population

3 = Occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom seen

<u>Endangerment</u> :

1 = Not endangered

2 = Endangered in a portion of its range

3 = Endangered throughout its range

<u>Distribution</u> :

1 = More or less widespread outside California

2 = Rare outside California

3 = Endemic to California

FWS: C1 = A candidate taxon, Category 1: information sufficient for federal listing by FWS (1985). C2 = Also a candidate, Category 2: information insufficient for formal proposal for listing. C3 = Previously considered, but currently known to be too common for listing.

CDFG: E = Endangered, R = Rare as designated by CDFG (1986).

Habitat, Elevation, Flowering Period: As reported in Munz and Keck (1959), Munz (1968), and/or Abrams and Ferris (1923 - 1951).

B-6

Fisheries Resources of Upper Apanolio Creek, Ox Mountain Sanitary Landfill, Apanolio Canyon Expansion
(Thomas R. Payne & Associates)

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August 25, 1988

Mr. Ralph Osterling
Ralph Osterling Consultants, Inc.
1650 Borel Place, Suite 204
San Mateo, California 94402

RE: Fisheries Resources of Upper Apanolio Creek, Ox Mountain Sanitary Landfill, Apanolio Canyon Expansion

Dear Mr. Osterling:

At your request, we have prepared comments on the question of the status of potentially affected fisheries resources in Apanolio Creek. The background information we have used includes the draft Environmental Impact Statement, additional comment letters from agencies, organizations, and individuals, review of file information, a site visit to the project area and nearby streams, examination of fish in Apanolio and Pilarcitos Creeks, and discussions with agency representatives.

A great deal of the criticism of the proposed project derives from the issue of whether the migratory form of rainbow trout known as steelhead are or are not present in the project area. Different interpretations of the available data are made, most of which tend to express preconceptions of what the resource used to be like or what some would like it to be. Our approach to the issue is to rely on the directly observable information and minimize subjective influences to arrive at an objective description of the existing fishery resources of Apanolio Creek.

There is no question that rainbow trout are present in Apanolio Creek within the area proposed for the sanitary landfill. The species has been found in numerous electrofishing surveys and confirmed during our site visit. According to the American Fisheries Society publication on scientific names of fishes (AFS 1980), rainbow trout are classified as *Salmo gairdneri* Richardson, and sea-run rainbow trout are termed "steelhead" under the same scientific name. Referring to sea-run rainbow trout as "steelhead trout" or giving them sub-species status (i.e. *Salmo gairdneri gairdneri*) is not currently accepted standard scientific nomenclature. All references to the species in the EIS should be changed to the correct terminology regardless of any decision about the presence or absence of the respective forms.

Establishing whether a particular population of rainbow trout contains either resident or sea-run forms (or both) is not difficult, provided that enough sampling effort is made at appropriate times of the year. The most definitive evidence for the presence of steelhead is capture of at least one fish demonstrating sea-run characteristics, such as unusually large size (about fourteen inches or greater for this geographic area), sea lice, or hardened scales. No such fish has been captured during sampling, seen during site visits, or reported from upper Apanolio Creek by local residents.

The second-best indication of steelhead is juvenile fish that express physical signs of smolting (pre-migratory changes) in the springtime, such as loose scales, lack of parr marks, silvery color, black tail and fin margins, or active downstream movement. Fish with these characteristics have not been seen in the project area either, even though the stream was electrofished in March of this year when smolts could be expected to be present. Instead, the sampling by the California Department of Fish and Game found male rainbow trout with expressible milt and female rainbow trout containing mature ova (CDFG 1988), signs which are clearly indicative of a resident population. These reproducing fish were a maximum of 180 mm (7.1 in.) and averaged 133 mm (5.25 in.), the size when at least some would smolt *if* they were steelhead. Although precocious spawning (prior to seaward migration) is known to occur among northern steelhead populations, it is primarily characteristic of a related species, the Atlantic salmon (Saunders 1986), and precociousness occurs exclusively among males of the species (Meerburg 1986). The finding of ripe eggs in female rainbow trout in Apanolio Creek is conclusive evidence that such fish are not steelhead.

A third (and less reliable) indicator of a resident rainbow trout versus a steelhead population is a *difference* in age-class structure. While steelhead populations may contain one to three year classes (Moyle 1976), three year-old (II+) juveniles are uncommon in small California coastal streams (Burns 1971, Cross 1975, Harper 1980), and in more southerly streams many steelhead smolt early in their second (I+) year of life (Moore 1980). Resident rainbow trout, however, commonly reach three years of age and are often older (McAfee 1966). Length-frequency analysis of rainbow trout from the project area shows the presence of three and possibly four year classes, based on size intervals (Figures 1 and 2). Scale analysis by CDFG also revealed three year classes, work which did not include larger individuals previously seen (CDFG 1988). The most consistent techniques currently useful for differentiating juvenile populations of resident and anadromous *Salmo gairdneri* are genetic electrophoresis and otolith (ear bone) analysis (Rybock et al. 1975, Tippets 1978, Winters 1983), neither of which have been performed on the Apanolio Creek trout.

Fourth, differences in abundance either upstream and downstream of a migration barrier or in similar and nearby accessible and inaccessible streams can also point towards resident or migratory populations (steelhead are often more abundant). Lastly, juvenile steelhead will frequently have different coloration and body shapes than resident rainbow trout which can be distinguished with some difficulty. Unfortunately, the data is inconclusive on these latter points, not being as intensive or extensive as necessary for a determination.

One factor that argues against the presence of steelhead in upper Apanolio Creek is the existence of an unladdered irrigation diversion dam (Bongard's dam) located between the project area and Pilarcitos Creek. This dam has been repeatedly examined by fisheries biologists to determine whether or not it is passable for adult steelhead migrating upstream, with inconclusive results. The best estimate of a fish passage specialist with CDFG is that the dam would be passable only during flood events which provide an extreme cascade of water 4 to 5 feet deep (CDFG 1987). Others have concluded that it is passable in most years (USDI 1988).

To reduce the amount of subjective judgment involved in making a determination of passability, we have applied the methods of Powers and Orsborn (1986) to the physical features of the dam. Measurements made of the dam and downstream channel characteristics are illustrated in Figure 3 (Hydrocomp 1988). The dam begins at a spillway 1 foot above a section of stream channel which contains no pools and is filled with chunks of concrete to prevent erosion (Area A). The spillway (Area B) rises at a 10.5 percent slope over a distance of 9 feet, ending at a four-foot high concrete wall. Above this wall is an essentially level apron that is 15 feet long (Area C), tapered on one side, and ends in a concrete wall 4.5 feet tall. Within this wall is a 15-inch diameter steel pipe (located at the same level as the apron) that functions as a sluice-gate for accumulated sediments in the upstream impoundment (Area D). A steelhead would have to leave Area A and reach Area D over a linear distance of 24 feet and a vertical height of 9.5 feet.

There are three alternatives for a fish to pass the dam: 1) jump the entire distance from Area A to Area D, 2) swim the same distance, or 3) jump part of the distance and swim the rest. Assuming a maximum burst velocity of 26.5 feet per second and a condition factor of 1.00, a steelhead is capable of jumping 9.5 feet vertically at a 70 degree take-off angle, but would only travel a distance of about 7 feet at the point of maximum height. Since there is no jump pool at the base of the dam and any water velocity there would subtract from the maximum burst velocity, we conclude that it would be impossible for a steelhead to clear the dam in a single jump. Multiple jumps are also impossible because there is no intermediate pool in the structure for a fish to land, re-orient, and jump again.

Swimming over the dam at high flows is the alternative considered possible in extreme conditions by the CDFG passage specialist. Water velocities over the dam have been evaluated in a report prepared by Hydrocomp (1988). At 150 cfs, water is calculated to leave Area D at 8 fps, land in Area C at 20 fps, and shoot by Area B to land in Area A at 25 fps. At a flow of 300 cfs, these velocities would respectively be 10 fps, 22 fps, and 27 fps. Powers and Orsborn (1986) also provide information on the swimming speed of steelhead in black (non-turbulent) water and a formula for determining the maximum swimming distance. Applying these velocities (average of 20 fps at 150 cfs and 22 fps at 300 cfs) and assuming maximum burst speed, maximum fish condition, maximum time to fatigue, and minimum turbulence, a steelhead could conceivably swim up to 65 feet and therefore make it over the dam. However, in order to do so, a fish would first have to emerge cleanly from the turbulence at the base of the dam in Area A, stay within a 1 to 2 foot stream of free-falling water for up to 22 feet over Area B, negotiate the plunge in Area C where the first falls hits the concrete, and then swim the last 8 feet up a second stream of free-falling water over the top of the dam.

While negotiation of the dam is apparently not impossible according to these calculations, it stretches the imagination to think that passage could actually occur. More realistic swimming speeds, fish condition factors, time to fatigue, and turbulence reduce the total swimming distance to less than the length of the obstruction, even when made in combination with an initial jump. The vertical concrete walls on both sides of the dam also preclude fish from locating lower velocity water and avoiding points of maximum velocity. According to the Hydrocomp calculations, the 4 to 5 foot deep conditions described by the CDFG specialist as required for passage do not occur, even at 300 cfs. For a population of steelhead to be maintained above the dam, migrating adults would require passable conditions during the migration period after holding safely in lower Apanolio or Pilarcitos Creek where there are few pools. The Hydrocomp data indicates that flows above about 10 cfs typically last only 2 to 3 hours, which is an extremely narrow migration window. In addition, the debris movement and turbidity associated with peak floods often impedes salmonid migration, and at least two fish of the opposite sex would have to be above the dam at the same time. All these factors add up to a strong indication that the dam is effectively impassable.

In summary, the available evidence is: 1) no adult steelhead have been seen in upper Apanolio Creek, 2) no steelhead smolts have been captured, 3) sexually mature adult rainbow trout are present, 4) the population structure is more indicative of resident trout than of steelhead, and 5) an impassible barrier appears to exist in the lower creek. Scientific method requires a conclusion that only resident rainbow trout presently occur in the proposed project area until some piece of evidence shows otherwise. Based on this analysis, our recommendation for the EIS is to refer to the existing fish populations in the project area as being composed of resident rainbow trout (*Salmo gairdneri* Richardson). Apanolio Creek above the dam can also be described as historic and potential steelhead habitat, since without the dam steelhead would very probably ascend to the upper reaches of the watershed.

Please contact us if you have any questions about our comments or conclusions.

Sincerely,

Tom Payne

Thomas R. Payne
Principal Associate

attachments

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Figure 1. Length-frequency analysis of rainbow trout captured in Apanolio Creek, San Mateo County, by the California Department of Fish and Game, September 3 and 22, 1986.

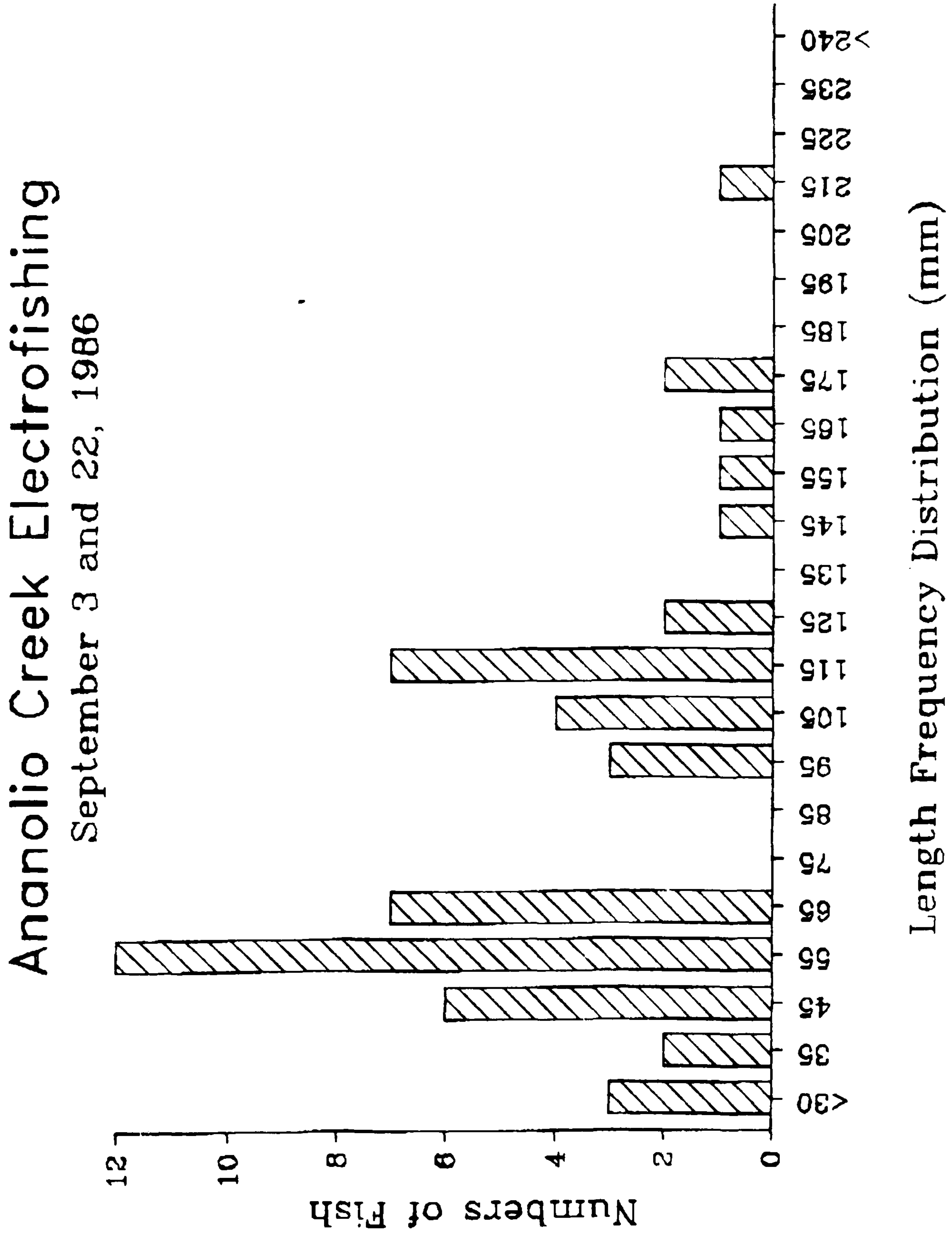
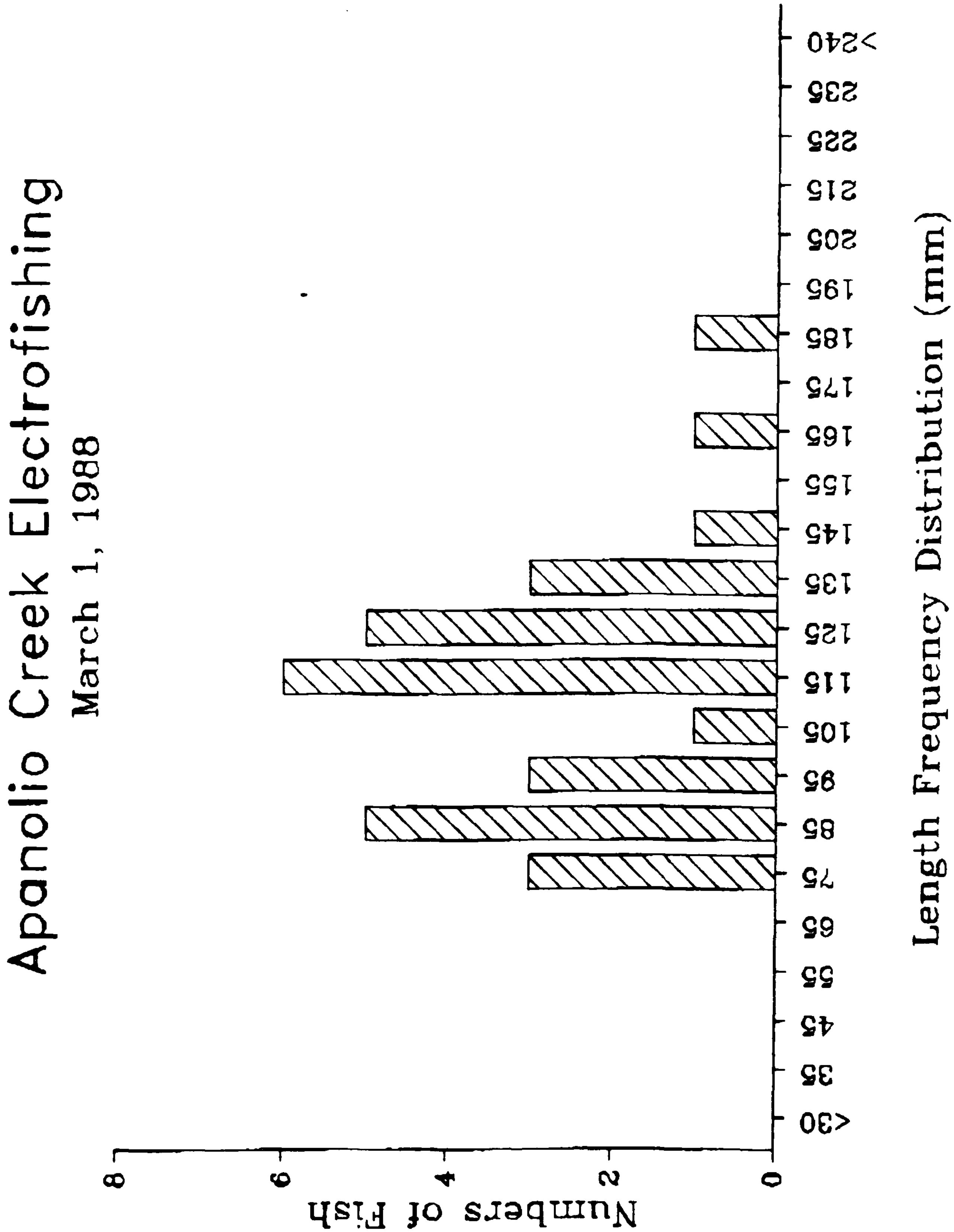


Figure 2. Length-frequency analysis of rainbow trout captured in Apanolio Creek, San Mateo County, by the California Department of Fish and Game, March 1, 1988.



B-7

Benthic Invertebrate Survey of Apanolio, Corinda Los Trancos, and Pilarcitos Creeks, San Mateo County, California
(Thomas R. Payne & Associates)

Benthic Invertebrate Survey
of
Apanolio, Corinda Los Trancos, and Pilarcitos Creeks,
San Mateo County, California

Prepared for:

Ralph Osterling Consultants, Inc.
San Mateo, California

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December 2, 1988

Introduction

The upper portion of Apanolio Creek in San Mateo County, California has been proposed as a site for a sanitary landfill. Part of a fisheries mitigation plan proposes rehabilitation of aquatic habitat of neighboring Corinda Los Trancos Creek, where there is an existing sanitary landfill. The plan requires diverting a portion of Corinda Los Trancos Creek during periods of high discharge (exceeding 3 cubic feet per second (cfs)) into bankside storage ponds for re-release as a supplemental flow into ~~both Corinda Los Trancos and~~ Apanolio Creek during periods of low flow. The U.S. Fish and Wildlife Service has expressed some reservations about the presence of invertebrates in the proposed mitigation area of Corinda Los Trancos Creek which would comprise a portion of the trout food base for the mitigation program. Thomas R. Payne & Associates (TRPA) conducted a qualitative survey of the benthic macroinvertebrate fauna at two sites within each of the two watersheds, plus a site in Pilarcitos Creek, to develop information on the concern.

Study Area

Pilarcitos Creek is a small coastal stream originating in the Whiting and Fifield Ridges (elevation 1100 feet) of the San Francisco State Fish and Game Refuge in San Mateo County. The upper portion of Pilarcitos Creek drains these ridges as well as the northeast slopes of Montara Mountain and the southwest slopes of Cahill Ridge. At an elevation of about 250 feet, Pilarcitos Creek enters a wider floodplain and flows in a southwestly direction into the northern portion of the community of Half Moon Bay where it joins Arroyo Leon Creek and flows northwest to its mouth at Elmar Beach (Figure 1).

Apanolio and Corinda Los Trancos Creeks are adjacent tributaries of Pilarcitos Creek, draining the southeastern portion of Montara Mountain. Apanolio Creek has its headwaters at an elevation of 1300 feet and flows south for 3.7 miles where it joins Pilarcitos Creek about 3 miles upstream of Elmar Beach. Corinda Los Trancos Creek originates at an elevation of 1500 feet and flows south for 2.9 miles where it join Pilarcitos Creek 3.3 miles upstream of Elmar Beach. The upper portion of the Corinda Los Trancos Creek watershed is the site of an active sanitary landfill.

Two sites in Apanolio Creek were sampled for benthic invertebrates (Figure 1). The first site (Site One) was located within the proposed landfill project area at an elevation of about 475 feet, approximately 2.6 miles upstream of the confluence with Pilarcitos Creek. The second site (Site Two) was outside of the proposed project area, 1000 feet downstream of Site One, at an elevation of about 450 feet. The stream at both sites was characterized by shallow riffle/run habitat with a depth of 0.5 to 2.0 inches, and width 1.5 to 2.0 feet, and an estimated discharge of 0.1 cfs. The substrate at the sites was composed exclusively of decomposed granitic sands, with occasional pockets of granitic cobble (3-6 inch material). Both sites contained adundant decaying leaves provided by the red alder (*Alnus rubra*) and willow (*Salix sp.*) within the riparian corridor.

Two sites were sampled in Corinda Los Trancos Creek (Figure 1). The first site (Site Three) was located above the proposed diversion site, 1.4 miles upstream of the confluence with Pilarcitos Creek at an elevation of approximately 440 feet. This area was just downstream of a sedimentation pond which is part of the current landfill operation. Site Three was located in a dense riparian area composed mainly of berry bushes and other woody shrubs. The stream at this site is composed mostly of shallow pool habitat approximately 3 to 4 inches in depth with a width of about 1 foot. The very short areas of riffle between the small pools exhibited an extremely low flow, estimated to be 0.01 cfs. The second site (Site Four) sampled in Corinda Los Trancos Creek was located below the proposed diversion site and within the proposed mitigation zone. Site Four was located approximately 2600 feet downstream of Site Three at an elevation of about 300 feet. The stream at this lower site was characterized by shallow riffle/run habitat, with a depth of 0.5 to 1.5 inches, a width of about 1.5 feet, and an estimated discharge of 0.1 cfs. The substrate was primarily decomposed granitic sands, with some cobble. The banks of the creek were bordered by willow, alder and nettle, with an overstory of eucalyptus trees (*Eucalyptus sp.*).

An additional site (Site Five) was sampled in Pilarcitos Creek about 0.5 mile below Stone Dam Reservoir within the state refuge at an elevation of 420 feet (Figure 1). This area represented a relatively undisturbed section of small coastal creek similar in elevation to the other four sites. The stream habitat at this site was shallow riffle/run, with a depth of 0.5 to 2.0 inches, a width of 2.0 feet, and an estimated discharge of 0.1 cfs. The substrate was similar to the other sites: coarse sands with occasional cobble. The immediate riparian zone was composed mostly of alder and berry, with an overstory of Douglas Fir (*Pseudotsuga menziesii*).

Materials and Methods

On 21 November 1988, Tim Salamunovich of TRPA and Rich Sampson of Ralph Osterling Consultants, Inc., conducted a qualitative survey of the benthic macroinvertebrate fauna at the five study sites in Apanolio, Corinda Los Trancos, and Pilarcitos Creek. A kicknet was used to collect the invertebrates loosened from the sand and cobble substrate after disturbance with feet and hands. Sampling began at the downstream end of the site and continued upstream until about ten linear feet had been sampled. Invertebrates were separated from the substrate and extraneous leaf litter collected in the kicknet in the field. Depending on the amount of decaying organic material loosened during this sampling and the numbers of invertebrates observed in the net, sampling was periodically suspended while all organisms were removed from the net. Once no more organisms were observed, the remaining contents of the net were returned to the stream, and sampling continued to the upstream terminus of the study site. An effort was made to select for substrate and habitat comparability at all five sites. This attempt to standardize the sample sites was successful except for Site Three where no continuous areas of riffle/run could be located. The samples were preserved in isopropyl alcohol and returned to the laboratory for identification and enumeration using a dissecting microscope.

The presence, species composition, relative abundance, diversity, and similarity of the benthic invertebrate communities from the five sites in the three streams were investigated. The Shannon measure of diversity (H), the theoretical maximum diversity (Hmax), and the relative diversity (J), a measure of actual diversity versus maximum potential diversity, were calculated for all five sites based upon the formulae given in Zar (1974). A method of testing for significant differences of diversities between sites was carried out using modification of the Student's *t* test (Hutcheson 1970). An additional index, the coefficient of community, was employed to allow comparison of the benthic invertebrate community similarities between the different sites (Stark 1985). This value ranges from 0 (when two sites have no taxa in common) to 1 (when two sites have all the same taxa in common).

Results

A total of 193 organisms of 18 different taxa was collected from Site One in Apanolio Creek (Table 1). The amphipod, *Anisogammarus*, was the most abundant invertebrate at this site, contributing 42 percent of the total number. The next most abundant organisms were the mayfly nymph, *Ironodes*, and the isopod, *Gnorimosphaeroma*, which accounted for 22 and 12 percent of the total, respectively. Five other taxa contributed between 1 and 7 percent of the total. The Shannon index of diversity (H) for the sample was 0.783. The maximum potential diversity (Hmax) was calculated to be 1.255. Relative diversity (J) was 0.624, meaning that the invertebrate community as measured displayed 62.4 percent of the potential diversity.

A total of 147 organisms representing 15 taxa was collected at Site Two in Apanolio Creek (Table 2). At this site *Ironodes* nymphs were the most abundant invertebrates, accounting for 43 percent of the total collected. *Anisogammarus* and *Gnorimosphaeroma* were the next most plentiful taxa, making up 33 and 9 percent of the total, respectively. Five taxa contributed between 1 and 3 percent of the total. The diversity index (H) for this site was 0.684, while Hmax was 1.176, resulting in a relative diversity (J) of 0.582.

At Site Three in Corinda Los Trancos a total of 11 organisms representing 6 different taxa was collected (Table 3). The extremely shallow nature of the stream at those areas that exhibited some discernable streamflow and the general lack of riffle habitat rendered kicknet sampling of this area highly difficult. The stonefly nymph, *Amphinemura*, was the most abundant organism collected. Two additional taxa were represented by more than one individual, with 3 taxa represented by a single individual. H for this site was 0.713 and Hmax was 0.778, resulting in a relative diversity (J) of 0.916. Members of the hemipteran families, Gerridae and Notonectidae were observed in some of the shallow pool habitat of this section, but were not included in this analysis since this habitat type was not sampled at any of the other sites.

Sampling at Site Four in Corinda Los Trancos was much more efficient than at Site Three. A total of 72 individuals representing 10 taxa was collected (Table 4). The larvae of the dipteran, *Simulium*, were the most abundant taxa collected, contributing 33 percent of the total. *Amphinemura* nymphs and larvae of the caddisfly, *Parapsyche*, were the next most numerous organisms, accounting for 26 and 17 of the total, respectively. Three other taxa contributed over 5 percent of the total. Since Hmax was 1.0, H and J were equivalent values, both calculating to 0.764.

A total of 112 organisms representing 25 taxa was collected at Site Five in Pilarcitos Creek (Table 5). At this site the isopod, *Gnorimosphaeroma*, had the highest relative abundance with 40 percent of the total collected. The next most abundant taxa, the snail, *Gyraulus*, contributed 10 percent to the total. Despite the numbers of isopods in the total count, diversity (H) was 1.038, the highest value of any of the five sites. However, Hmax was also high, 1.398, resulting in a relative abundance (J) of 0.742.

All the Shannon diversity indexes (H) were compared statistically at the 95% confidence level (Table 6). The diversity indexes for Sites One through Four were not found to be significantly different at the confidence level tested. The diversity index for Site Five, however, was found to be significantly different from the other four sites.

The coefficient of community, a measure of invertebrate community similarity, was also computed for all between-site comparisons (Table 7). Although this is not a statistical test whereby significant differences are measured between sites, it can provide insight into community relationships between the sites. Sites one and two, both in Apanolio Creek, showed the highest community similarity index, with a value of 0.43. None of the other similarity values for the other comparisons was greater than 0.30.

Discussion

Kicknet sampling revealed the presence of benthic macroinvertebrates at all five of the sites (Tables 1 through 5). Results did not show a predominance of any one invertebrate taxa at any of the sites that would be indicative of a water quality problem. Stoneflies, a taxon listed by Mackenthum (1969) as a clean water sensitive group associated with good water quality, were present at all of the sites, further indicating a lack of current water quality problems in the sampled sections of the streams.

The patterns of diversity values within stream communities are a function of nutrients, temperature, discharge, sediment, and other factors (Stanford and Ward 1983). Shannon Diversity Values for the sites in Apanolio and Corinda Los Trancos Creeks were not significantly different from each other but were significantly lower than the Pilarcitos site. The community similarity values, all less than 0.5, suggested that the benthic invertebrate communities at each site were more dissimilar to each other than they were similar. The qualitative nature of this study did not provide reasons for these observed differences and the test values may reflect actual differences between the sites or they may be artifacts of the limited sampling. However, the results do suggest that an adequate food base for trout currently exists within the mitigation area of Corinda Los Trancos Creek in areas where the required physical habitat is also present. ~~Any new stream habitat created by the proposed flow augmentation plan should readily be colonized by populations of aquatic invertebrates that reside in areas adjacent or upstream of this habitat.~~

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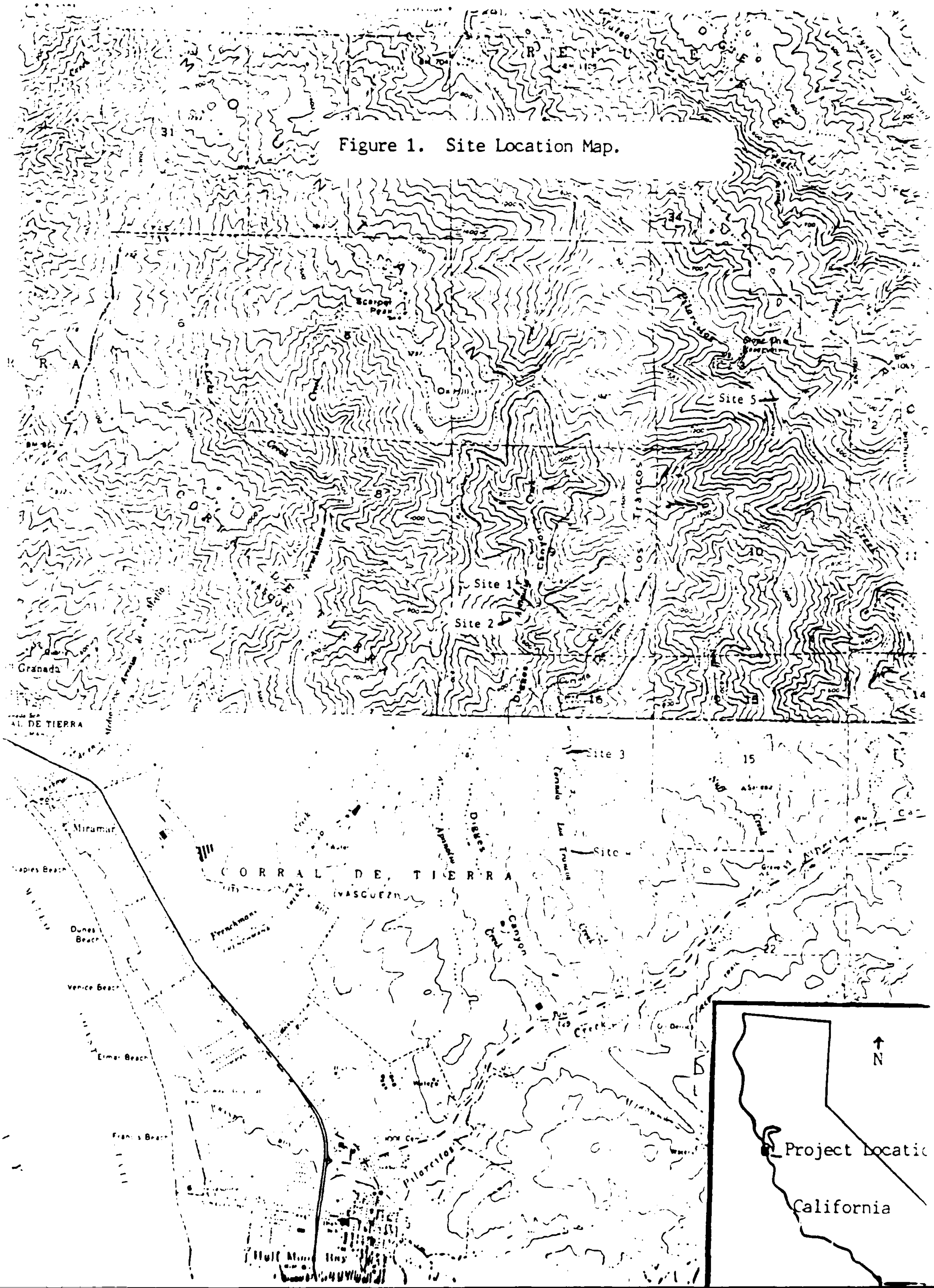

Figure 1. Site Location Map.

Table 1. Taxonomic List of Invertebrates and the Numbers Collected by Kicknet Sampling at Site One of Apanolio Creek, 21 November 1988.

Taxonomic List of Invertebrates	Numbers	% Composition
Phylum Annelida		
Class Oligochaetea (earthworms)	7	3.63
Class Hirudnea (leeches)	1	0.52
Phylum Arthropoda		
Class Crustacea		
Subclass Malacostraca		
Order Isopoda		
Family Sphaeromatidae		
Gnorimosphaeroma lutea	23	11.92
Order Amphipoda		
Family Gammaridae		
Anisogammarus ramellus	82	42.49
Class Insecta		
Order Ephemeroptera (mayflies)		
Family Baetidae		
Baetis sp. nymph	2	1.04
Family Heptageniidae		
Ironodes sp. nymph	43	22.28
Order Plecoptera (stoneflies)		
Family Nemouridae		
Amphinemura sp. nymph	7	3.63
Family Perlodidae		
Isoperla sp. nymph	1	0.52
Family Chloroperlidae		
Sweltsa sp. nymph	13	6.74
Order Trichoptera (caddisflies)		
Family Rhyacophilidae		
Rhyacophila sp. larva	1	0.52
Family Limnephilidae		
Onocosmoecus sp. larva	1	0.52
Hydatophylax sp. larva	1	0.52
Order Coleoptera (beetles)		
Family Dytiscidae		
Agabinus sp. larva	1	0.52
Family Hydrophilidae		
Ametor sp. adult	1	0.52
Family Scirtidae		
Elodes sp. larva	6	3.11
Family Elmidae		
Rhizelmis sp. larva	1	0.52
Order Diptera (true flies)		
Family Tipulidae		
Tipula sp. larva	1	0.52
Family Dixidae		
Dixa sp. larva	1	0.52

The Shannon index of diversity (H) = 0.783
The maximum diversity possible (Hmax) = 1.255
The evenness, or relative diversity measure, (J) = H/Hmax = 0.624

Table 2. Taxonomic List of Invertebrates and the Numbers Collected by Kicknet Sampling at Site Two of Apanolio Creek, 21 November 1988.

Taxonomic List of Inveretebrates	Numbers	% Composition
Phylum Annelida		
Class Oligochaetea (earthworms)	4	2.72
Phylum Arthropoda		
Class Crustacea		
Subclass Malacostraca		
Order Isopoda		
Family Sphaeromatidae		
Gnorimosphaeroma lutea	13	8.84
Family Ligiidae		
Ligia sp.	1	0.68
Order Amphipoda		
Family Gammaridae		
Anisogammarus ramellus	49	33.33
Class Insecta		
Order Ephemeroptera (mayflies)		
Family Baetidae		
Baetis sp. nymph	4	2.72
Family Heptageniidae		
Ironodes sp. nymph	63	42.86
Order Plecoptera (stoneflies)		
Family Nemouridae		
Amphinemura sp. nymph	2	1.36
Family Chloroperlidae		
Sweltsa sp. nymph	3	2.04
Order Trichoptera (caddisflies)		
Family Rhyacophilidae		
Rhyacophila sp. larva	1	0.68
Order Coleoptera (beetles)		
Family Amphizoidae		
Amphizoa sp. larva	1	0.68
Family Dytiscidae		
Hydrovatus sp. adult	1	0.68
Family Scirtidae		
Elodes sp. larva	1	0.68
Family Elmidae		
Narpus sp. larva	2	1.36
Order Diptera (true flies)		
Family Dixidae		
Dixa sp. larva	1	0.68
Family Pelecorhynchidae		
Glutops sp. larva	1	0.68

The Shannon index of diversity (H) = 0.684
The maximum diversity possible (Hmax) = 1.176
The evenness, or relative diversity measure, (J) = H/Hmax = 0.582

Table 3. Taxonomic List of Invertebrates and the Numbers Collected by Kicknet Sampling at Site Three of Corinda Los Trancos Creek, 21 November 1988.

Taxonomic List of Inveretebrates	Numbers	% Composition
Phylum Annelida		
Class Oligochaetea (earthworms)	1	9.09
Phylum Arthropoda		
Class Insecta		
Order Plecoptera (stoneflies)		
Family Nemouridae		
Amphinemura sp. nymph	4	36.36
Order Coleoptera (beetles)		
Family Dytiscidae		
Agabinus sp. larva	1	
Agabinus sp. adult	1	18.18
Hydrovatus sp. adult	1	9.09
Family Hydrophilidae		
Anacaena sp. adult	1	9.09
Order Diptera (true flies)		
Family Chironomidae		
unidentified species A larva	2	18.18

The Shannon index of diversity (H) = 0.713
The maximum diversity possible (Hmax) = 0.778
The evenness, or relative diversity measure, (J) = H/Hmax = 0.916

Table 5. Taxonomic List of Invertebrates and the Numbers Collected by Kicknet Sampling at Site Five of Pilarcitos Creek, 21 November 1988. (continued)

Taxonomic List of Inveretebrates	Numbers	% Composition
Family Limnephilidae		
Hydatophylax sp. larva	5	4.46
Order Coleoptera (beetles)		
unidentified larva	1	0.89
Family Elmidae		
Optioservus sp. larva	1	0.89
Order Diptera (true flies)		
Family Simuliidae		
Simulium sp. larva	6	5.36
Family Chironomidae		
unidentified species A	4	3.57
unidentified species B	2	1.78
Family Dixidae		
Dixa sp. larva	1	0.89
Family Pelecorhynchidae		
Glutops sp. larva	1	0.89

The Shannon index of diversity (H) = 1.038
The maximum diversity possible (Hmax) = 1.398
The evenness, or relative diversity measure, (J) = H/Hmax = 0.742

Table 6. Hutcheson's Modified Student's *t* Test Values for Between Site Comparisons of the Shannon Diversity Derived from Macroinvertebrate Sampling in the Pilarcitos Creek Drainage, 21 November 1988. (* denotes statistical significance at the 95% confidence level)

	Site 1	Site 2	Site 3	Site 4	Site 5
Site 1		1.735	0.859	0.312	3.820*
Site 2			0.351	1.309	5.036*
Site 3				0.610	3.576*
Site 4					3.854*
Site 5					

Table 7. Coefficient of Community Values for Between Site Comparisons Derived from Macroinvertebrate Sampling in the Pilarcitos Creek Drainage, 21 November 1988.

	Site 1	Site 2	Site 3	Site 4	Site 5
Site 1		0.435	0.143	0.217	0.228
Site 2			0.167	0.087	0.290
Site 3				0.231	0.107
Site 4					0.129
Site 5					

B-8

Streamflows and Velocity of Flows at the Bongard diversion Dam in Apanolio Canyon
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STREAMFLOWS AND VELOCITY OF FLOWS AT THE BONGARD DIVERSION DAM IN APANOLIO CANYON

Prepared for:

Browning-Ferris Industries

Prepared by:

Hydrocomp, Inc.
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August 24, 1988

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1.0 INTRODUCTION

Hydrocomp, Inc. studied streamflows and the hydraulics of flow at the Bongard diversion structure downstream from the BFI property line in Apanolio Canyon, and 4120 feet upstream from the highway bridge over Apanolio Creek at U.S. 92, in San Mateo County. The diversion structure has two vertical drops. The upper drop is approximately 4-1/2 feet. A sloping concrete channel or concrete apron 15 feet in length, separates the upper and lower drop structures. The lower drop is four feet. The channel immediately below the lower drop is steep, dropping an additional 2.7 feet in twenty feet.

The diversion structure is a barrier to migrating fish at low flows. Would the structure also be a barrier to fish at higher flows? The questions that were investigated are:

1) What hydraulic conditions would be expected at the diversion structure during high flows.

2) How often would high flows occur, and what are the characteristics of typical storm flows at the diversion structure.

These questions are answered in Sections 3.0 and 4.0.

2.0 BACKGROUND

Streamflows from Apanolio Canyon are not continuously recorded. Periodic measurements have been made from 1985 to date. To calculate streamflows and hydraulic conditions at the diversion structure, data were assembled from USGS geologic maps, from precipitation records at San Francisco Airport WB, and from pan evaporation records at Burlingame, Newark, and Los Banos Detention Reservoir. These data were adjusted as necessary to represent conditions in Apanolio Canyon. Continuous hydrologic simulation modeling was used to calculate hourly streamflows at the diversion structure for the 38-year period from 1948 to 1986 (1,2). Statistical analysis was carried out for these streamflows.

The streamflows at the diversion structure are greater in total volume than are streamflows at the BFI property line. The total Apanolio Canyon drainage area increases from 1.05 sq. mi. at the BFI property line to 1.67 sq. mi. at the diversion structure.

The slope of Apanolio Creek above and below the diversion structure is approximately 20 ft. per 1000 ft., or 2 percent, based on USGS topographic maps. At this slope, using Manning's equation, approximate flow depths and velocities can be found. A Manning's n of 0.10 was assumed since there is heavy vegetation in the creek channel. At an effective channel width of 12 ft., the channel would carry:

Flow Depth	Velocity	Discharge
1 ft.	2.1 ft/sec	25 cfs
2 ft.	2.3 ft/sec	79 cfs
3 ft.	4.3 ft/sec	156 cfs
4 ft.	5.4 ft/sec	255 cfs
5 ft.	6.1 ft/sec	370 cfs
6 ft.	7.0 ft/sec	504 cfs

These data are approximate since the channel cross-section above and below the diversion structure is not known.

There is a 15" diameter orifice in the upstream drop structure. If this orifice were open in the winter season, low flows could pass through rather than over the upstream structure. The capacity of the orifice is about 19 cfs if water is ponded to the crest of the upstream drop structure. With this ponding depth, the velocity of flow through the orifice would be 16 ft/sec. If the total flow increased to 150 cfs, the capacity of the orifice would be about 26 cfs, and its flow velocity would increase to 21 ft/sec.

In this report, 150 cfs, 300 cfs and 400 cfs were selected as representative of high flow conditions.

3.0 HYDRAULIC CONDITIONS AT THE DIVERSION STRUCTURE

Flow characteristics at 150 cfs, 300 cfs and 400 cfs were calculated for the drop structures. The results are shown in Figure 1 for 150 cfs, in Figure 2 for 300 cfs, and in Figure 3 for 400 cfs.

Flow velocities in the water falling from the first 4-1/2 foot drop can be calculated from basic fluid mechanics. Energy losses are small and the approach velocity above the first drop can be reasonably estimated.

Flow velocities between the first or upstream drop and the second or downstream drop, are dependent on the frictional energy losses in this highly turbulent flow. Flow velocities increase again as water falls from the second drop structure. Flows in the channel below the second drop structure will be highly turbulent. A hydraulic jump would occur here, so the flows will entrain air and will have the appearance of a breaking ocean wave. The hydraulic jump would be fragmented due to heavy vegetation and a tree trunk in the downstream channel. Fragmented, boiling, turbulent water would be seen rather than a well formed hydraulic jump. High friction losses, and a moderate channel slope below the hydraulic jump would likely keep the downstream flow velocities subcritical.

FIGURE 1 Estimated Water Surface and Flow Velocities at 150 cfs Discharge

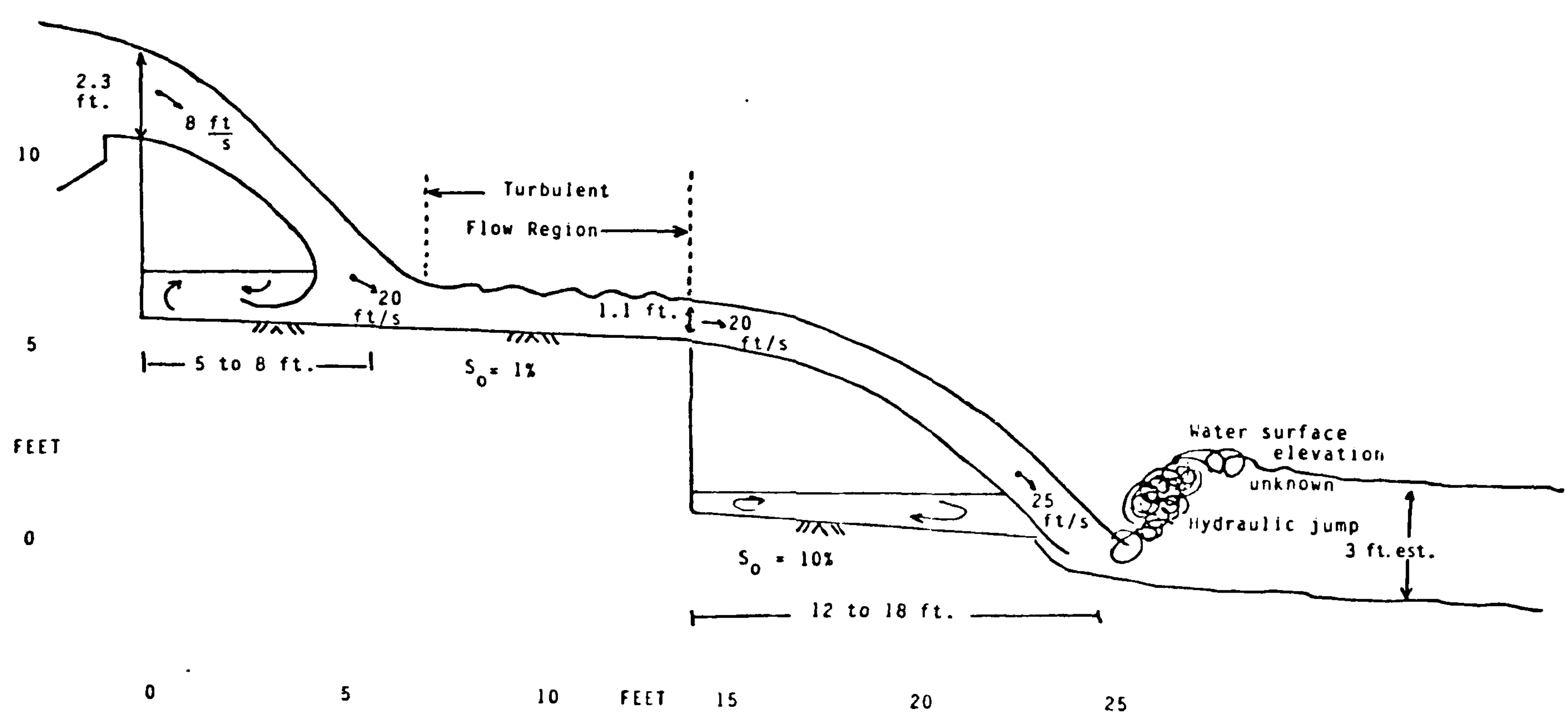


FIGURE 2 Estimated Water Surface and Flow Velocities at 300 cfs Discharge

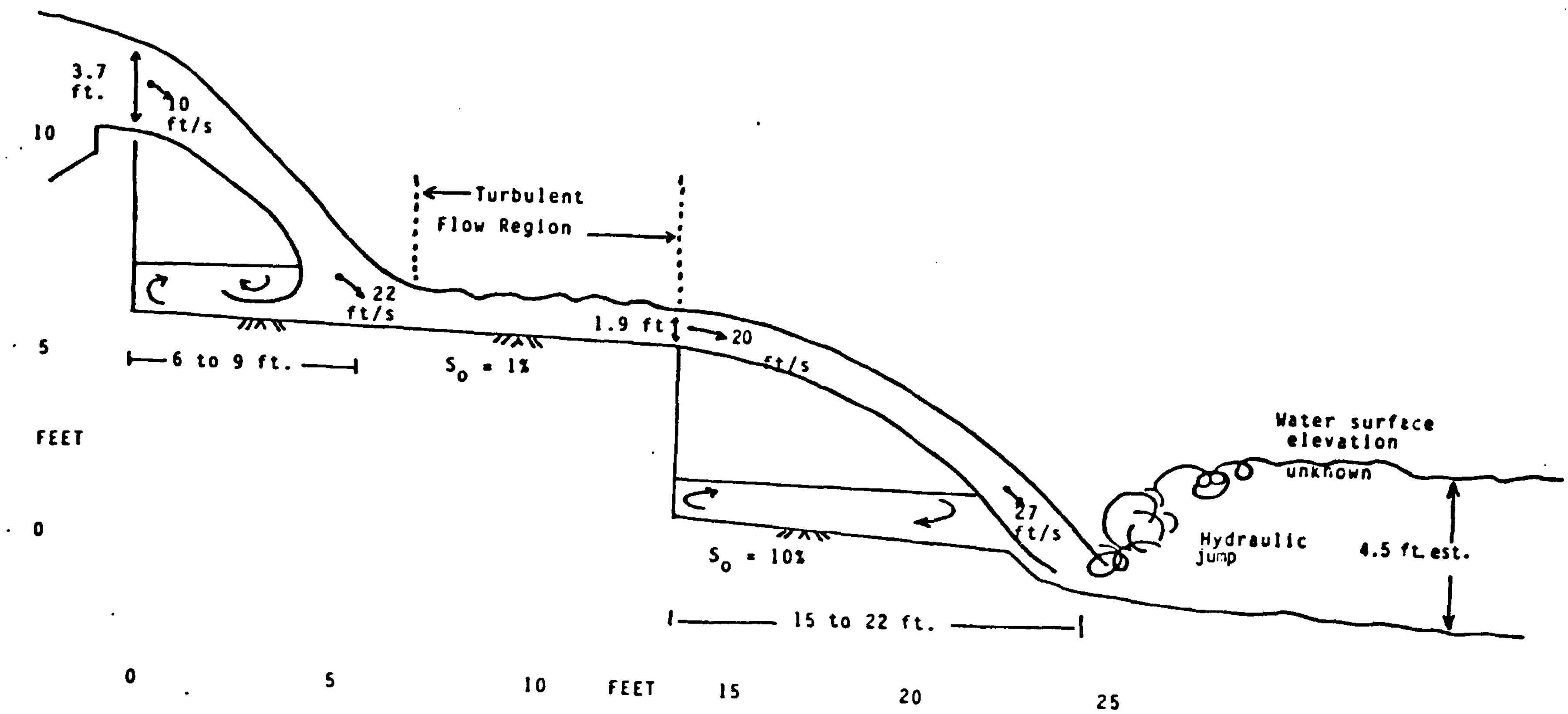
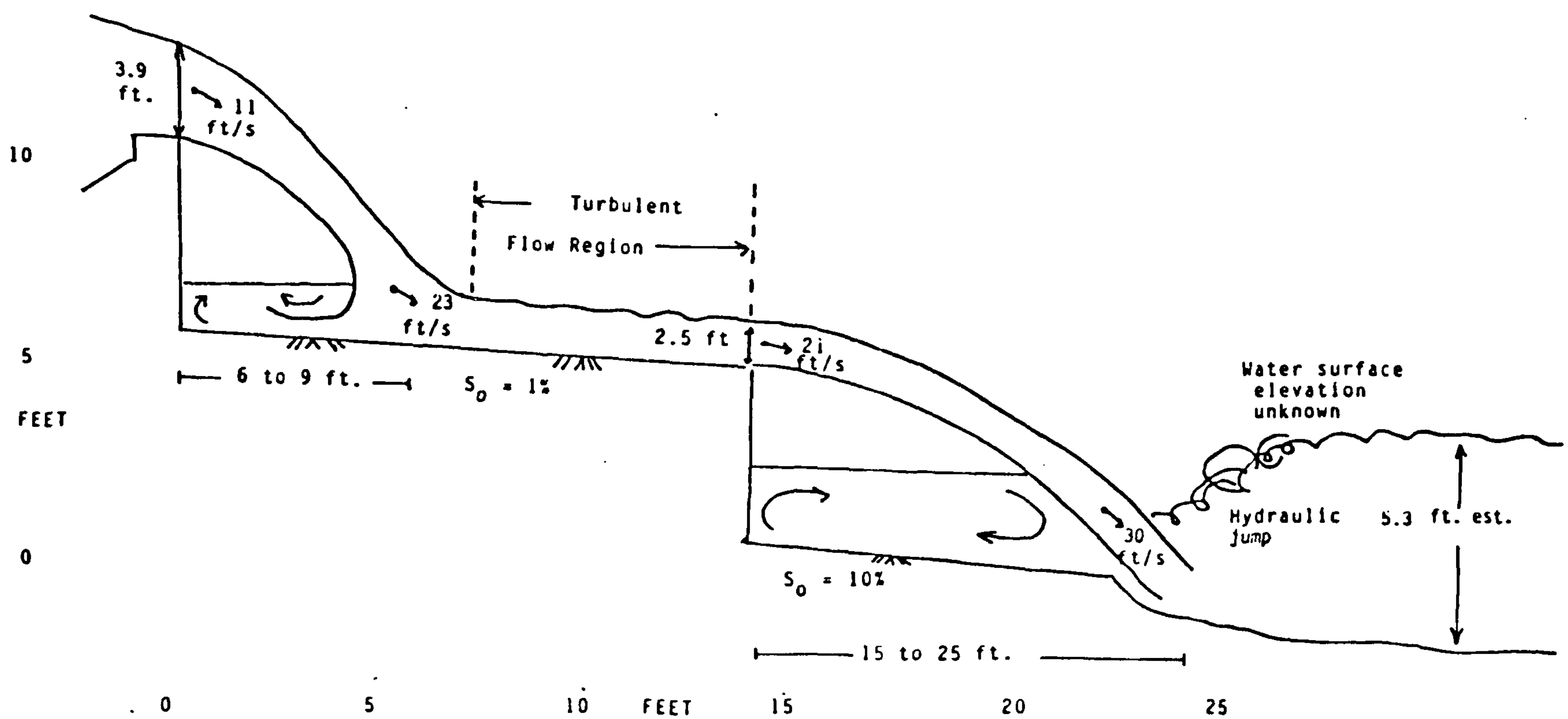


FIGURE 3 Estimated Water Surface and Flow Velocities at 400 cfs Discharge



4.0 FREQUENCY AND MAGNITUDE OF PEAK FLOWS

Flood hydrographs at the diversion structure depend on the rainfall pattern in particular historic storms. A sample of hydrographs simulated at the diversion structure in the 38-year historic period (1948-1986) is shown in Figure 4, a-f. These are hydrograpns for the seven storms that produced the largest peak flows in the 1948 to 1986 period.

A storm event is defined as any flow that exceeds a given level, such as 150 cfs or 300 cfs at the diversion dam, at any time during the storm. The continuous simulated flows at the diversion dam during storm events can be studied statistically. Table 1 was prepared to show the average number of storm events each year for which flows exceeded the given levels for 1, 2, or 3 consecutive hours.

TABLE 1 STORM EVENTS AT THE DIVERSION STRUCTURE

Flow Level	Total Number of Events, 1948-1986	Average Number of Events per Year with Flows in Excess of the Flow level for: 1 hr.	2 hrs.	3 hrs.
150 cfs	76	2.00	1.21	0.61
300 cfs	13	0.34	0.21	0.05
400 cfs	2	0.05	0.05	0.02

Flow Hydrograph

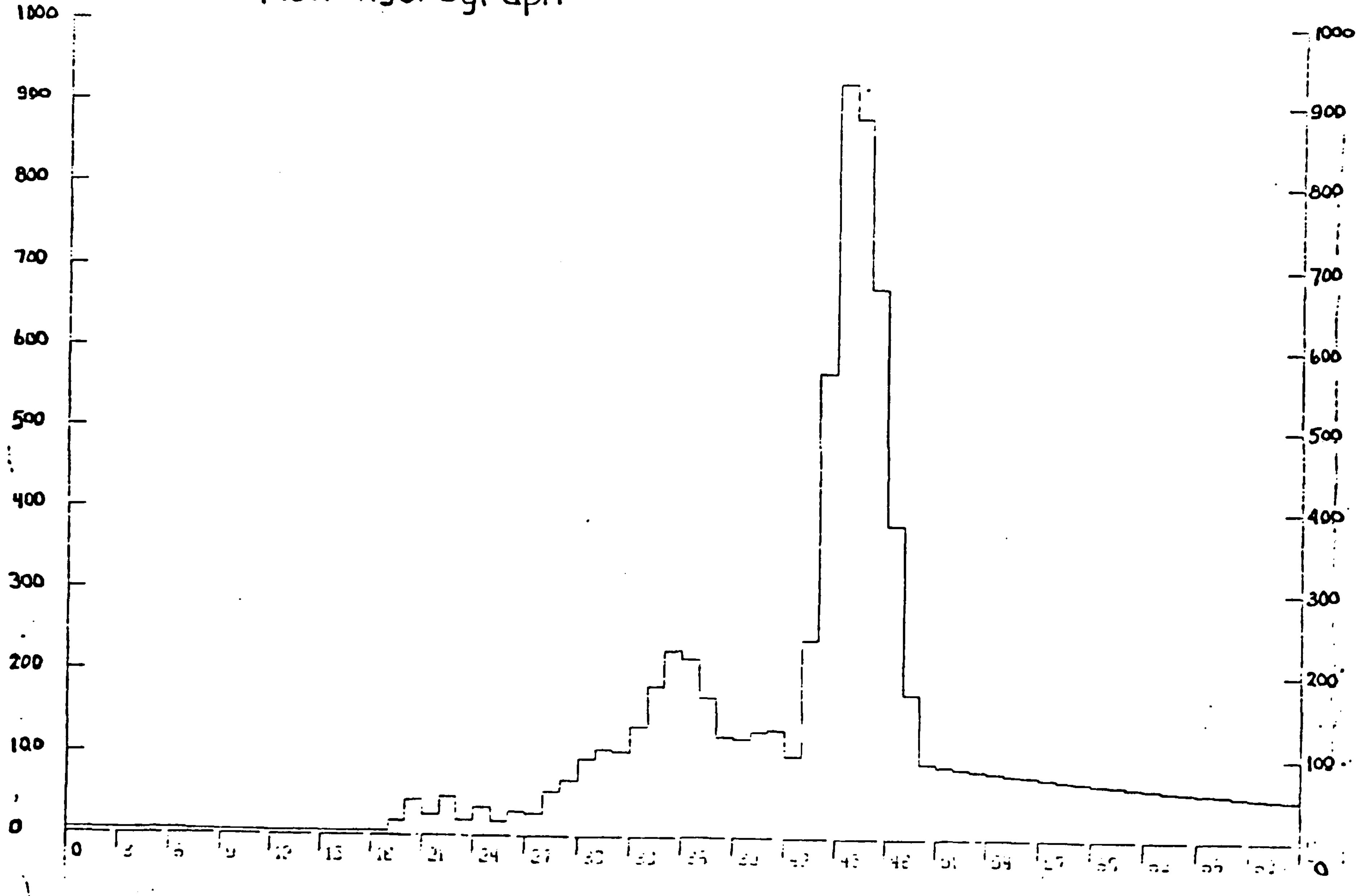


FIGURE 4a Hourly Hydrograph at the Diversion Structure, Apanolio Creek January 4-6, 1982

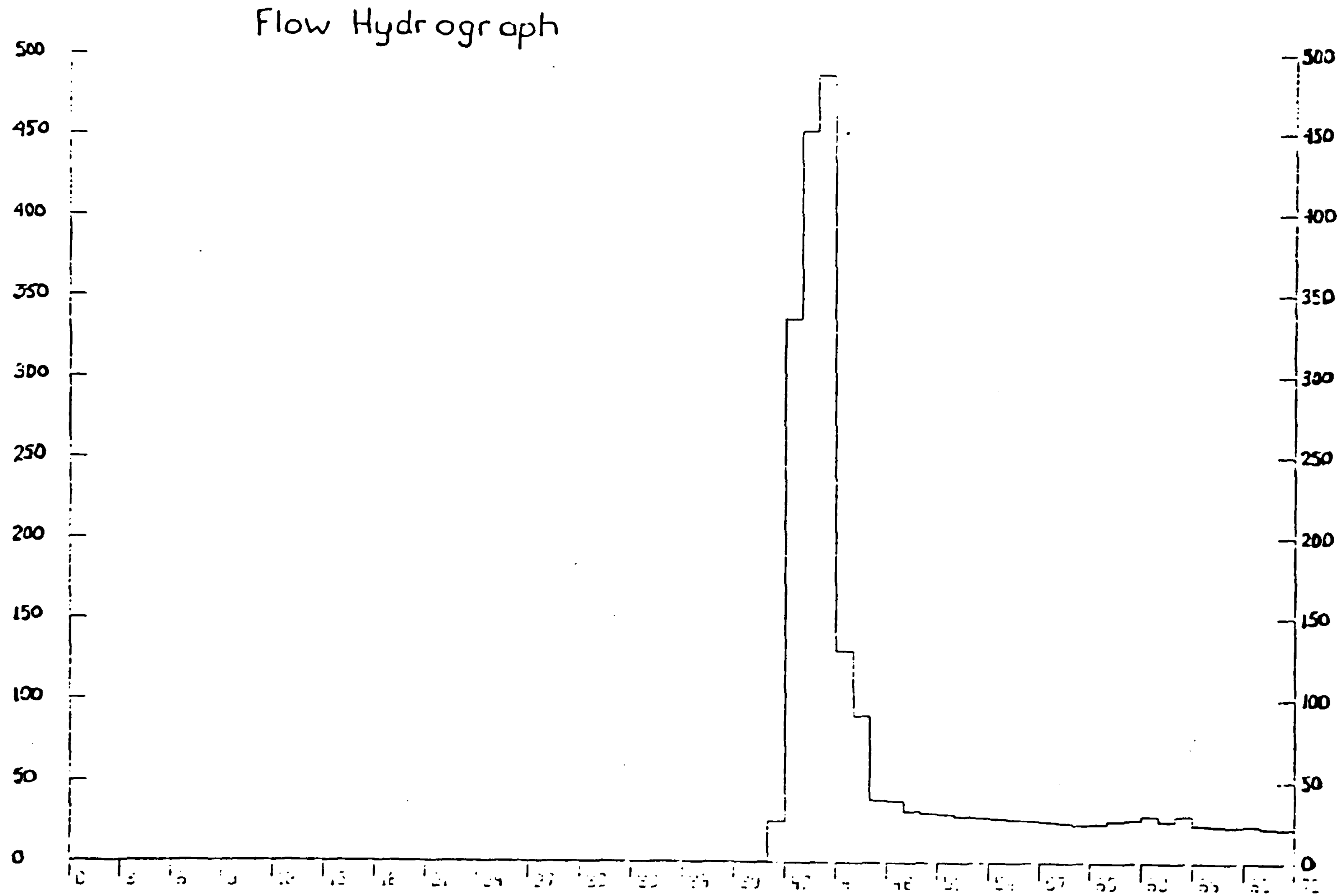


FIGURE 4b Hourly Hydrograph at the Diversion Structure, Apanolio Creek January 20-22, 1964

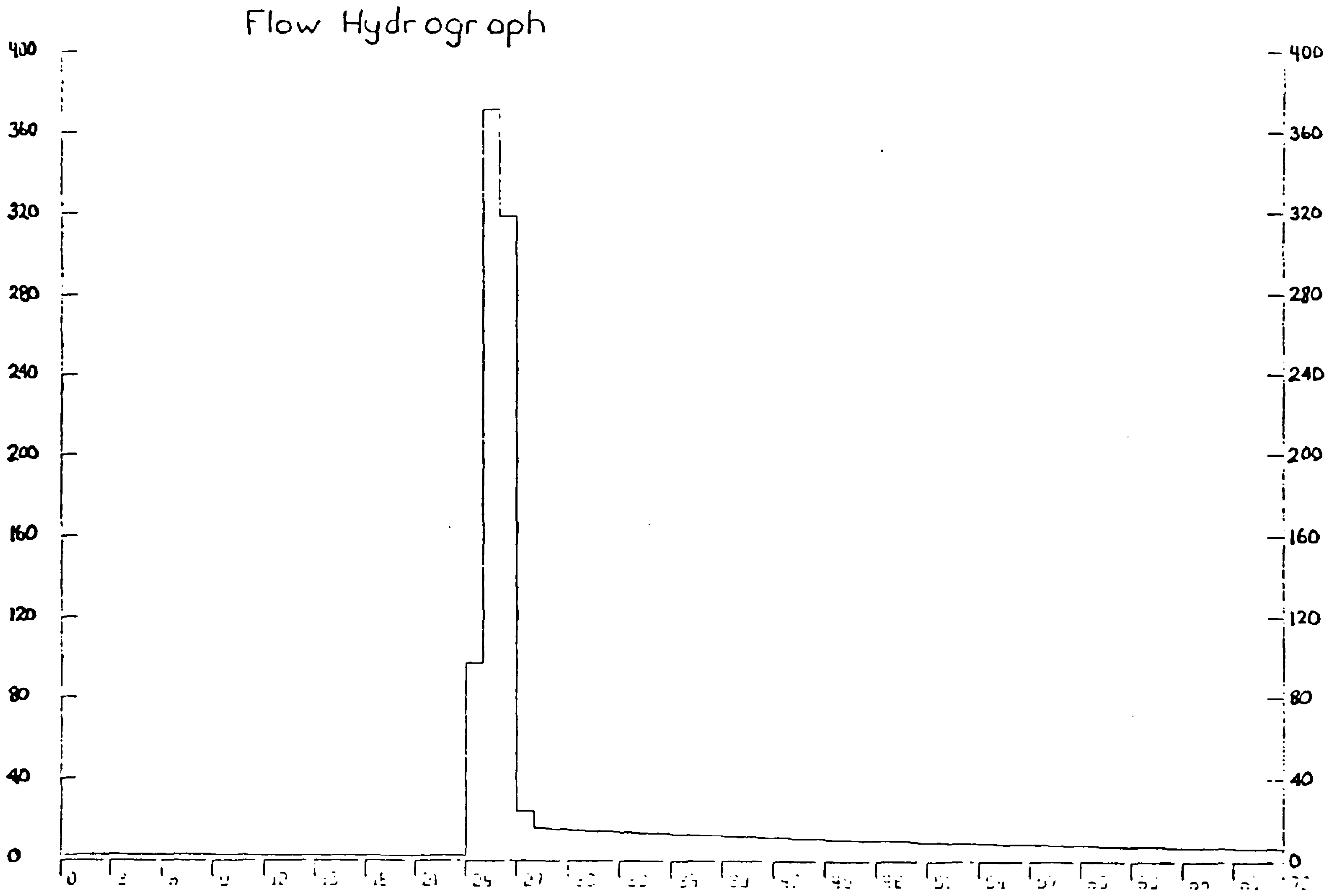


FIGURE 4C Hourly Hydrograph at the Diversion Structure, Apanolio Creek April 26-28, 1978

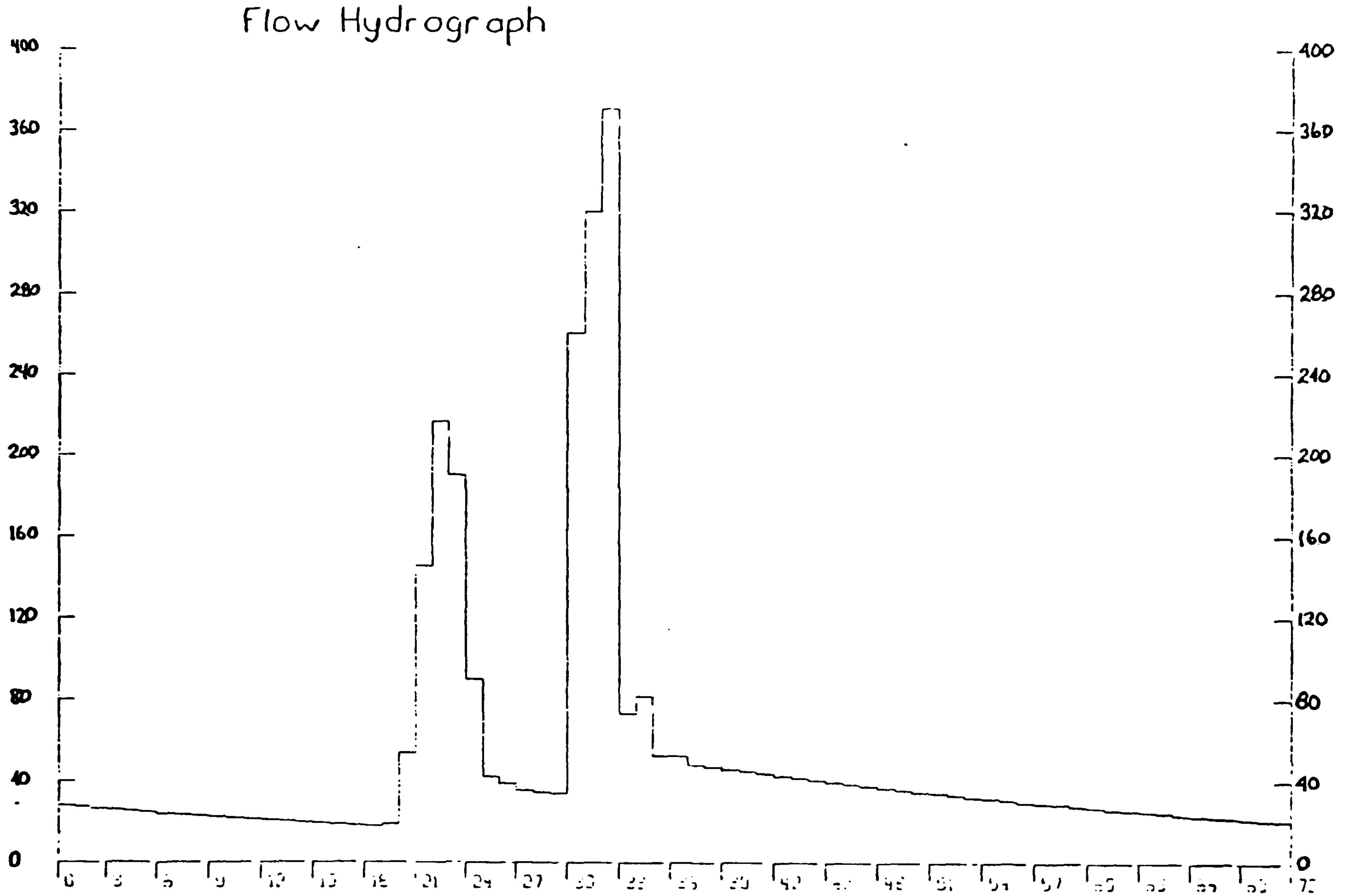


FIGURE 4d Hourly Hydrograph at the Diversion Structure, Apanolio Creek January 18-20, 1973

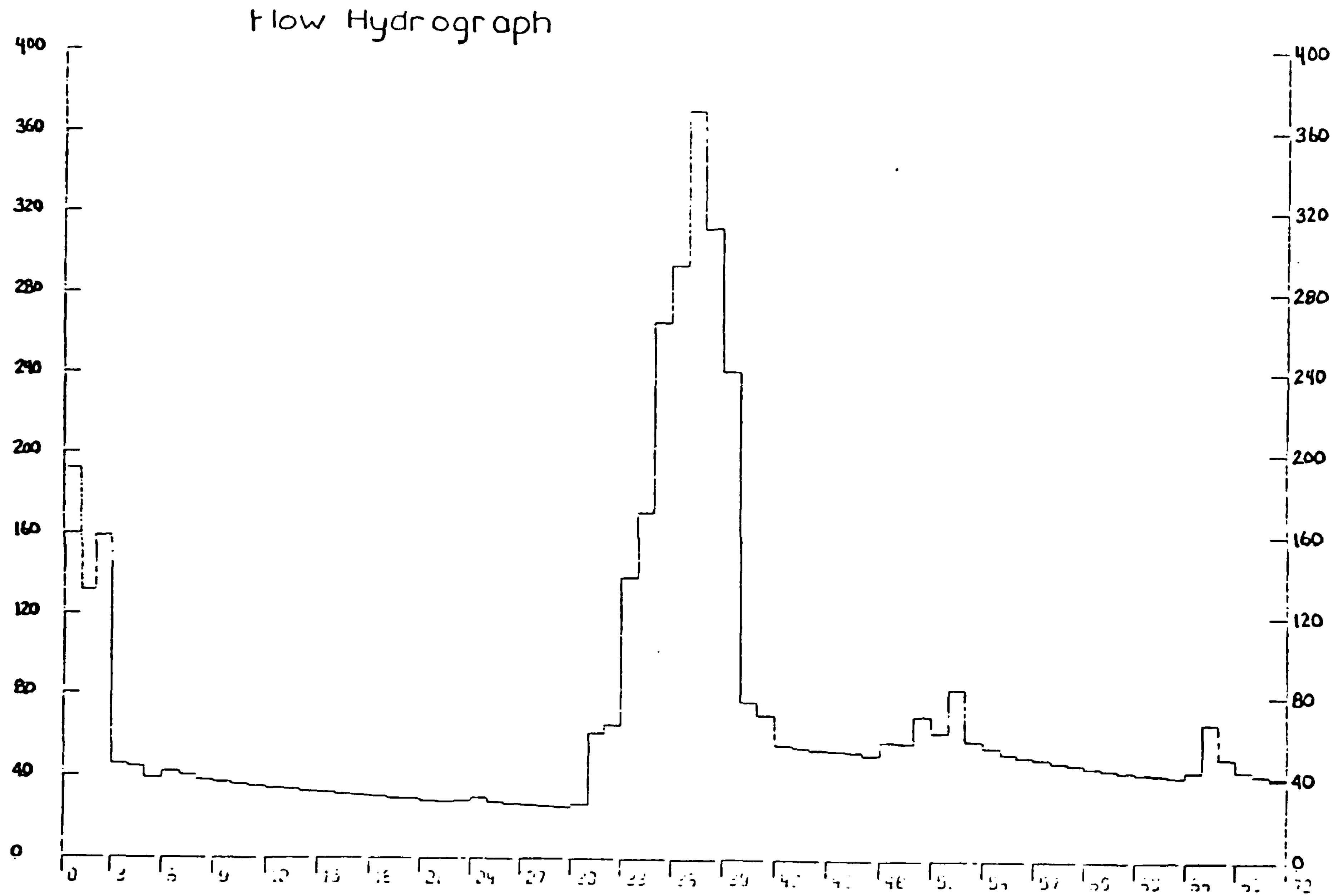


FIGURE 4e Hourly Hydrograph at the Diversion Structure, Apanolio Creek April 2-4, 1958

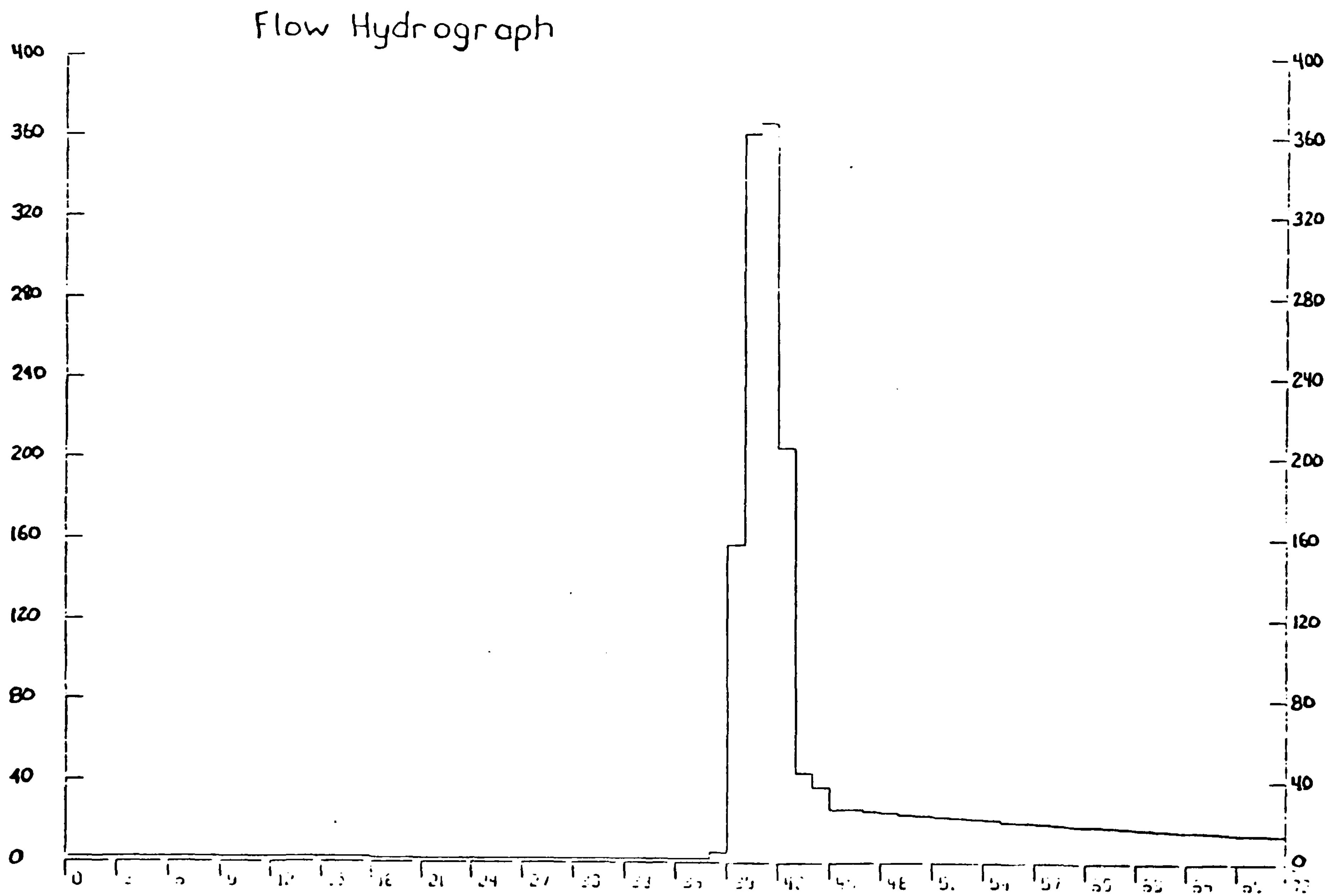


FIGURE 4f Hourly Hydrograph at the Diversion Structure, Apanolio Creek March 21-23, 1975

These data show that there were 13 storms in the 38-year period 1948 to 1986, that had a peak flow in excess of 300 cfs. Flows above 300 cfs occured on average, once every three years. Flows above 300 cfs that continued for two hours occured once every five years. Flows above 300 cfs that continued for three hours occured once every twenty years. There were only two storm events in the 38-year period that had peak flows over 400 cfs, so flows exceeding 400 cfs might occur once in twenty years. Flows above 400 cfs continued for two hours in one storm and for four hours in the other storm.

The highest flow that occurred in recent years was on February 18-19, 1986. The peak flow in this event was less than 300 cfs and a hydrograph for the event was not plotted. The hydraulic conditions at the diversion dam for the peak flow in 1986 would be similar to those shown in Figures 1 and 2.

5.0 CONCLUSIONS

Flow velocities of 20 feet/second or greater would be expected at the diversion structure for all flows of 50 cfs or greater. Extremely high flows, in excess of 400 cfs, occur very infrequently. Two storm events exceeded 400 cfs in the period 1943 to 1986. The duration of peak flows during storms is typically two to three hours.

At extremely high flows, velocities in the diversion structure tend to increase. Flows in the diversion structure could likely increase beyond 400 cfs without greatly changing the basic hydraulics of the flow. It is possible that extraordinary floods of 1500 or 2000 cfs, occuring once in 100 years to 1000 years, might cover the narrow floodplain around the diversion structure.

Fish migrating upstream at high flows would encounter the hydraulic jump that forms below the lower drop structure. They would need to contend with the high velocities in the jet-like flows that come from the lower drop structure.

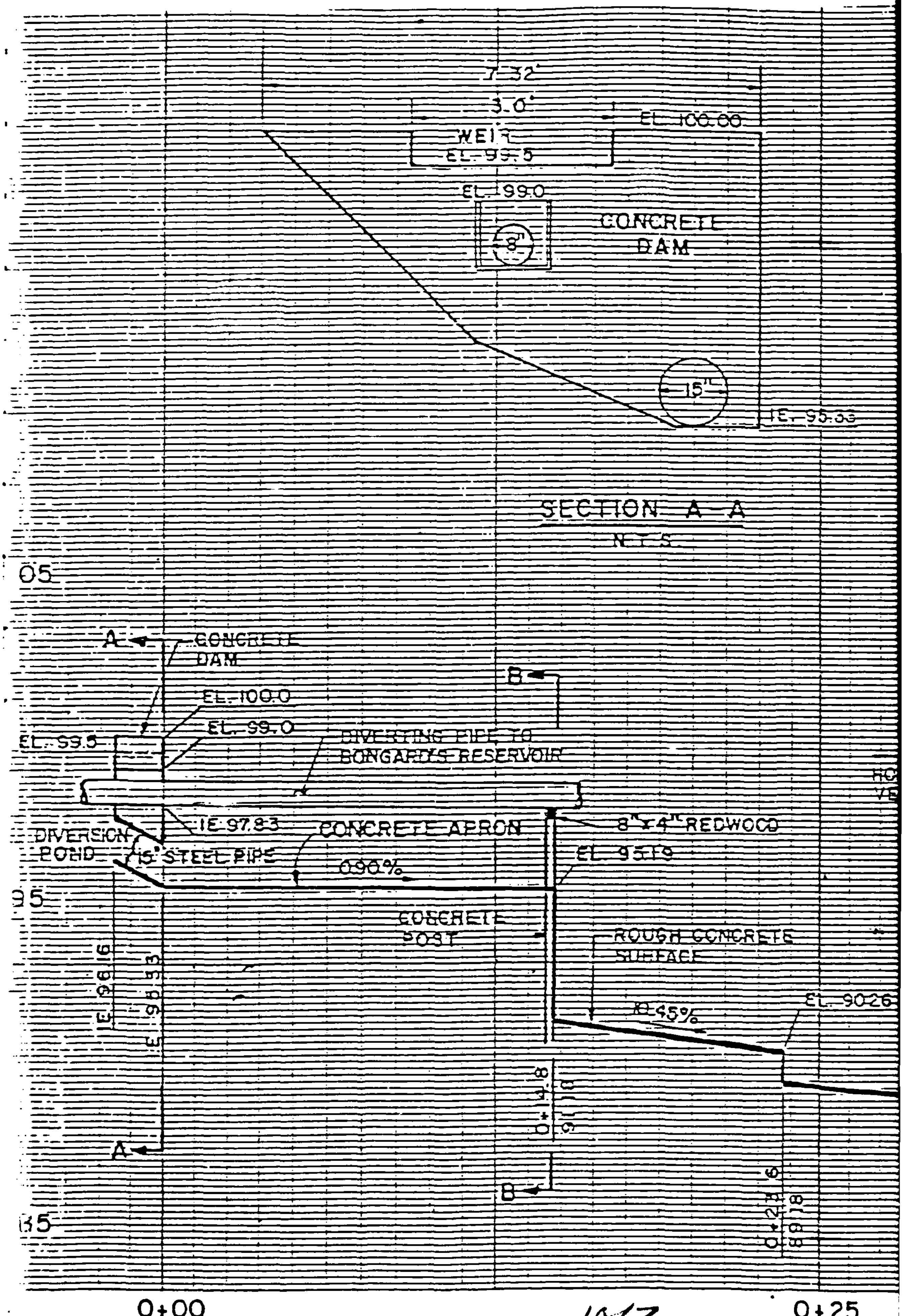
Possible limitations of these calculations are:

1) the position of the hydraulic jump below the second drop structure is a matter of judgment. Figures 1 to 3 are a "best estimate".

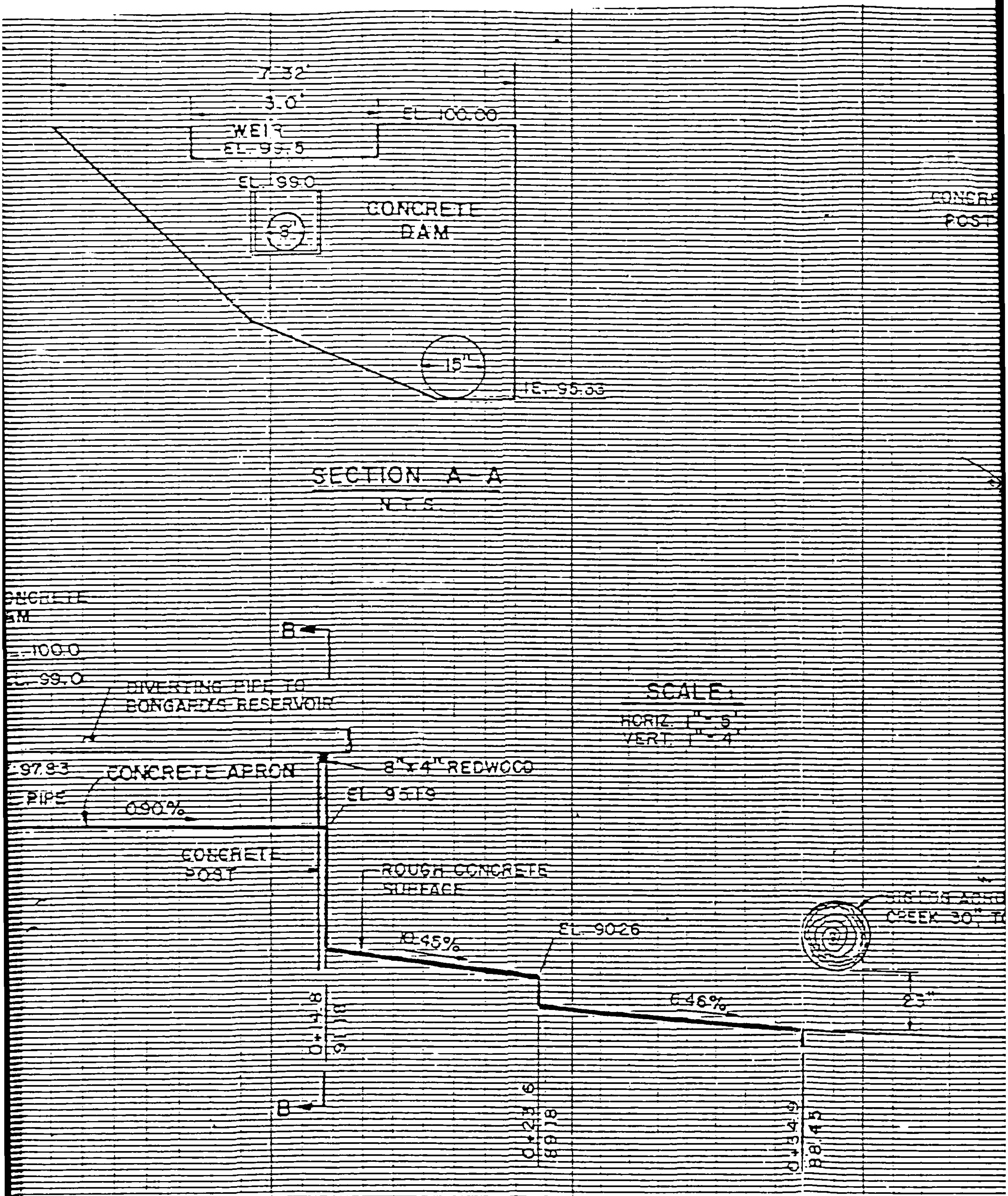
2) energy losses in the contracting flow above the upper drop structure, and on the concrete apron between the two vertical drops are difficult to estimate. Flow velocity differences of plus or minus 1 to 2 ft/sec. might be expected if actual energy losses are different than those assumed. Energy is not lost in the free falling jets that come over the drop structures.

The modeling results in this report represent the conditions that might have been observed at the diversion structure if measurements had been made from 1948 to 1986.

Figure 5 is a sketch of Bongard's Dam and the downstream creek channel.


7.32'
3.0'
EL. 100.00
WEIR
EL. 99.5
EL. 99.0
8"
CONCRETE
DAM
15"
IE. 95.53
SECTION A-A
N.T.S.
A
CONCRETE
DAM
B
EL. 100.0
EL. 99.0
EL. 99.5
DIVERTING PIPE TO
BONGARD'S RESERVOIR
IE 97.83
CONCRETE APRON
8" x 4" REDWOOD
DIVERSION
POND
15" STEEL PIPE
0.90%
EL. 95.19
CONCRETE
POST
ROUGH CONCRETE
SURFACE
IE 96.16
E 95.53
EL. 90.26
0+14.8
91.18
0+23.6
89.18
B
A
0+00
0+25
05
95
85

10/13


7.32'
3.0'
WEIR
EL. 99.5
EL. 100.00
EL. 99.0
8"
CONCRETE
DAM
15"
IE. 95.33
SECTION A-A
N.T.S.
B
DIVERTING PIPE TO
BONGARD'S RESERVOIR
97.83
CONCRETE APRON
PIPE
0.90%
8" X 4" REDWOOD
EL. 95.19
CONCRETE
POST
ROUGH CONCRETE
SURFACE
10.45%
EL. 90.26
6.46%
23"
CREEK 30"
SCALE:
HORIZ.
VERT.
0+1.8
91.18
0+23.6
89.18
0+34.9
88.45
0+25

2 of 3

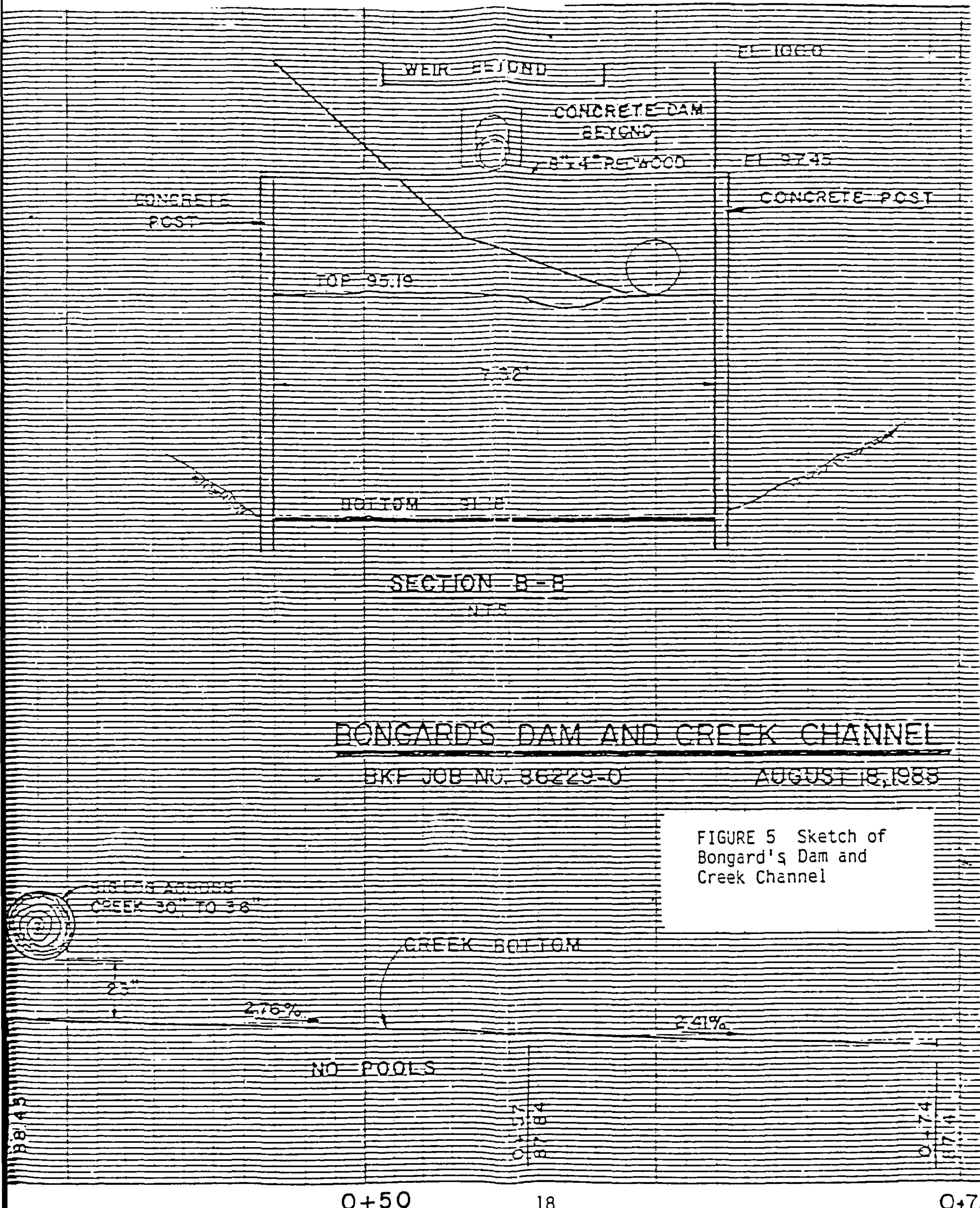


FIGURE 5 Sketch of Bongard's Dam and Creek Channel

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A Spring Survey to Determine the Presence or Absence of the San Francisco Garter Snake (*Thamnophis sirtalis tetrataenis*) in Two Tributaries of Pilarcitos Creek, Half Moon Bay, CA
(Dr. Samuel M. McGinnis)

A SPRING SURVEY TO DETERMINE THE PRESENCE OR ABSENCE OF THE SAN FRANCISCO GARTER SNAKE (*Thamnophis sirtalis tetrataenis*) IN TWO TRIBUTARIES OF PILARCITOS CREEK, HALF MOON BAY, CA.

A Report Prepared For

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By

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INTRODUCTION

In 1987, a study was conducted to determine the presence or absence of the endangered San Francisco garter snake at potential feeding habitat sites in the middle reaches of Apanolio and Corinda Los Trancos Canyons, Half Moon Bay, California. This work employed both trapping and visual survey field methods which totaled over 8,000 trap days. It demonstrated the presence of both the coast garter snake and the Santa Cruz garter snake at the study sites but produced no San Francisco garter snakes. The one shortcoming of this work was that it was initiated in late May which marks the end of the highly active and mobile spring period for this snake.

The purpose of this 1988 study was to continue the survey during this spring period to see if any San Francisco garter snakes (SFGSs) may migrate up either canyon at this time. It also provided an opportunity to study two ponds on private land down stream from the BFI property in Apanolio Canyon which were not surveyed in 1987.

PROCEDURE AND RESULTS

The present study was conducted between 3/15/88 and 6/14/88. The standard funnel trap - drift fence method of trapping employed in the 1987 work was used again here along with twice weekly visual surveys of the trapping sites. Six traplines totaling 24 funnel trap - drift fence units were placed near the southern border of the BFI property in Apanolio Canyon in approximately the same locations which were trapped in the 1987 work. An additional 24 units were installed in the vacinity of two ponds on ranches south of the BFI property (Figure 1). The only site which was trapped in Corinda Los Trancos Canyon was the Sediment Pond (Figure 1). This area received 16 funnel trap - drift fence units. The Tree Frog Pond site which was studied in 1987 had been drained and dredged in the interviening period. Although it was again full of water during this present work, it was void of shoreline vegetative cover and thus deemed unsuitable for snake foraging.

Table 1: Trap days (# of funnel trap - drift fence units x days in use) and number of each species of garter snake captured. (SCGS = Santa Cruz garter snake; CGS = Coast garter snake; SFGS = San Francisco garter snake)

Site	Trap Days	Snakes Captured		
		SCGS	CGS	SFGS
Apanolio (BFI Land)	2,160	1	3	0
Apanolio (pond sites)	2,160	3	11	0
Los Trancos (Sediment Pond)	1,260	1	5	0

Table 1 shows the results of the trapping study. No San Francisco garter snakes were captured or seen during the course of this work. The most abundant garter snake at all three sites is the coast garter. This is due primarily to the good small rodent populations in these areas. Small mice are the preferred food of this species. The low numbers of Santa Cruz garter snakes at all sites may be attributed to two reasons. In Apanolio Canyon their preferred food of small fishes and tadpoles are minimal. Although the two ponds sites had both of these items, the relatively deep water precluded easy capture of them.

The Sediment Pond, on the other hand, had an abundance of Pacific tree frogs and tadpoles, red-legged frogs and tadpoles, California newts and their larva, and small goldfish. However, the relatively light shore vegetative cover plus the heavy use of this pond by gulls and herons apparently negates the potentially rich feeding opportunity found here for aquatically oriented snakes.

DISCUSSION AND CONCLUSIONS

The high number of trap days in both the 1987 and 1988 studies have not yielded any SFGSs. In all other areas studied during the past 8 years by this investigator, such a effort always produced at least a few SFGSs if indeed any occupied the greater habitat site. At both trapping sites there was adequate food for the endangered snake, and another species which has a very similar feeding niche, the SCGS, was present at each. It stands to reason that during the spring period of high activity and movement, these pond sites should have attracted and temporarly held SFGSs if indeed they were in the area. It is therefore concluded that at present no SFGSs exist in the study areas of Apanolio and Corinda Los Trancos Canyons.

As to the possibility of future colonization of these sites by the SFGS, the possibility, though somewhat remote, does exist. During a separate study for the U.S. Fish and Wildlife Service in spring, 1988, two SFGSs were captured in the marsh area at the mouth of Pilarcitos Creek. This finding plus existing reports for a population at Mud Lake near the upper end of the Pilarcitos drainage (McGinnis, 1987) makes a future colonization of these sites at least pausable. Further support for this possibility is the recent finding that SFGSs will migrate distances of at least one mile over relatively high interviening ridgelines in order to explore alternate feeding habitats.

ACKNOWLEDGEMENT

I express my most sincere thanks to Mr. Gilbert Gossett for his hospitality and cooperation during this work.

LITERATURE IN SUPPORT OF THE TEXT

McGinnis, S.M. 1987. The distribution and feeding requirements of the San Francisco garter snake. DFG Interagency Agreement Report, Sacramento, CA.

McGinnis, S.M. 1988. A study to determine the presence or absence of the San Francisco garter snake in the middle and lower portions of Pilarcitos Creek. U.S. Fish & Wildlife Report, Sacramento, CA.

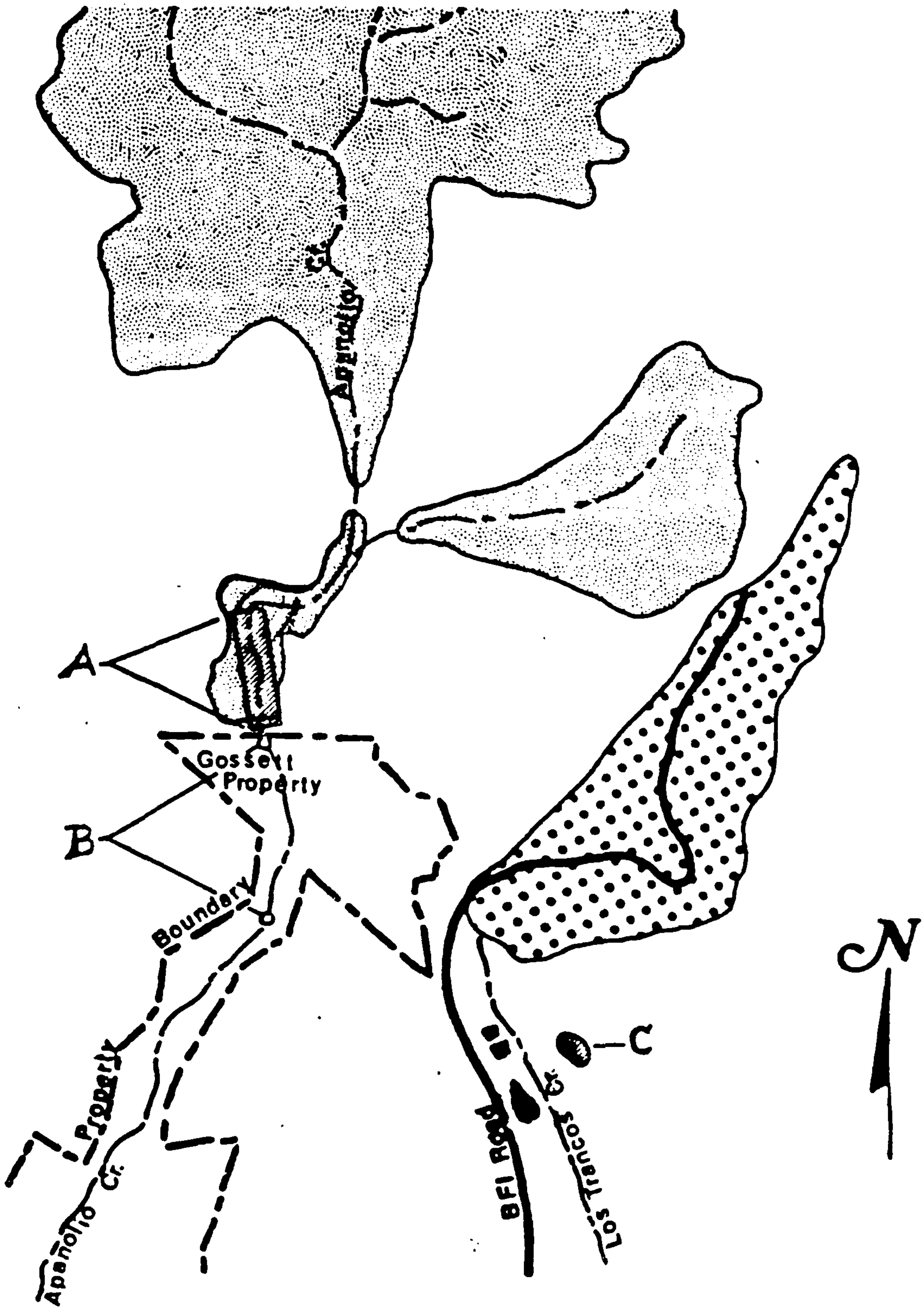

Figure 1. Study areas in the middle sections of Apanolio and Corinda Los Trancos Canyons during spring, 1988. (A) denotes the Apanolio/BFI property site; (B) shows the pond sites on and adjacent to the Gossett Property; (C) indicates the Sediment Pond site. Small stippling shows areas proposed for land fill and sedimentation basins. Large stippling indicates present landfill area. Scale: 1" = 1000'

B-10

Wildlife and Fisheries Mitigation Plan, Ox Mountain Sanitary Landfill, Apanolio Canyon Expansion Site
(Ralph Osterling Consultants)

WILDLIFE AND FISHERIES MITIGATION PLAN

Ox Mountain Sanitary Landfill
Apanolio Canyon Expansion

for

BFI® Waste Systems
BROWNING-FERRIS INDUSTRIES
SAN MATEO COUNTY DISTRICT

by

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MARCH 22, 1989

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INTRODUCTION

Browning-Ferris Industries of California Inc. (BFI) owns and operates the Ox Mountain Sanitary Landfill. The landfill is located near Half Moon Bay, California (Map 1). The existing landfill operation located in Corinda Los Trancos Canyon began in 1976. At that time, expansion into the adjacent Apanolio Canyon was anticipated upon filling of the Corinda Los Trancos site. In 1982, BFI submitted an application for the expansion project and completed an Environmental Impact Report (EIR) in 1984. The EIR was certified by the San Mateo County Planning Commission for development of the Apanolio Canyon portion of the Ox Mountain Sanitary Landfill. A Use Permit, Coastal Development Permit, and Grading Permit have been issued for the project.

In 1986, the U.S. Army Corps of Engineers (Corps) claimed jurisdiction over portions of the project under Section 404 of the Clean Water Act. Corps authorization is required before the project can proceed. BFI submitted an application for a Section 404 Permit in 1987. As a result of the 404 Permit Application, an Environmental Impact Statement (EIS) was required. In accordance with the Corps procedures implementing the Section 404 permit program, this Mitigation Plan is designed to assure no net loss in wetland habitat and in associated fisheries plus wildlife habitat values.

The term mitigation is used here to imply replacement or "full compensation". The terms riparian and riparian/wetland are used to describe a habitat type located between the aquatic ecosystem and the upland ecosystem. Further, this is the area of land and the associated vegetation directly influenced by a body of water, albeit a stream or lake. Burford, 1987, defines a riparian area as, "an area of land directly influenced by permanent water. It has visible vegetation or physical characteristics reflective of permanent water influence. Lake shores and stream banks are typical riparian areas..."

The CDF&G and Warner, 1983 defines riparian as, "pertaining to the banks or other adjacent terrestrial (as opposed to aquatic) environs of freshwater bodies, watercourses, and surface-emergent aquifers (springs, seeps, oases), whose transported waters provide soil moisture significantly in excess of that otherwise available through local precipitation.... a riparian zone is thus a delimited site, a bounded geological area of riparian (moist soil) substrate, upon and within whose boundaries may grow a riparian vegetation..." "The term 'wetland' is to be distinguished in this submittal from 'aquatic' and 'riparian' and is used within the context of section 404 of the Clean Water Act and regulations promulgated thereunder by the U.S. Army Corps of Engineers. See, 33 C.F.R. 328.3."

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For this plan and habitat development, wetland and riparian habitats, including vegetation and hydrology, are combined and discussed as riparian/wetland habitat. Coastal scrub and upland chaparral are also combined and used interchangeably for this project.

The Corinda Los Trancos landfill site is nearing capacity and is scheduled for closure in 1990. BFI plans to expand the landfill operation to the adjacent Apanolio Canyon located immediately west of the Corinda Los Trancos site (Map D-2). The expansion operation will involve the clearing and filling of 285 acres of upper Apanolio Canyon over the next 93 years.

This mitigation plan provides the agencies and the public with an evaluation of the fish, wildlife and associated habitat resources to be affected by the Apanolio Canyon Expansion Project. In addition, this plan provides mitigation measures to address any habitat losses or impacts resulting from construction of the proposed project. Project losses are compared with gains achieved from implementation of the mitigation projects. This plan demonstrates that no net loss of habitat values will result from the combined landfill and mitigation projects.

A thorough effort has been made to meet the general mitigation guidelines used by the agencies charged with resource protection (California Department of Fish and Game Operational Manual Section III-7.79). These guidelines are:

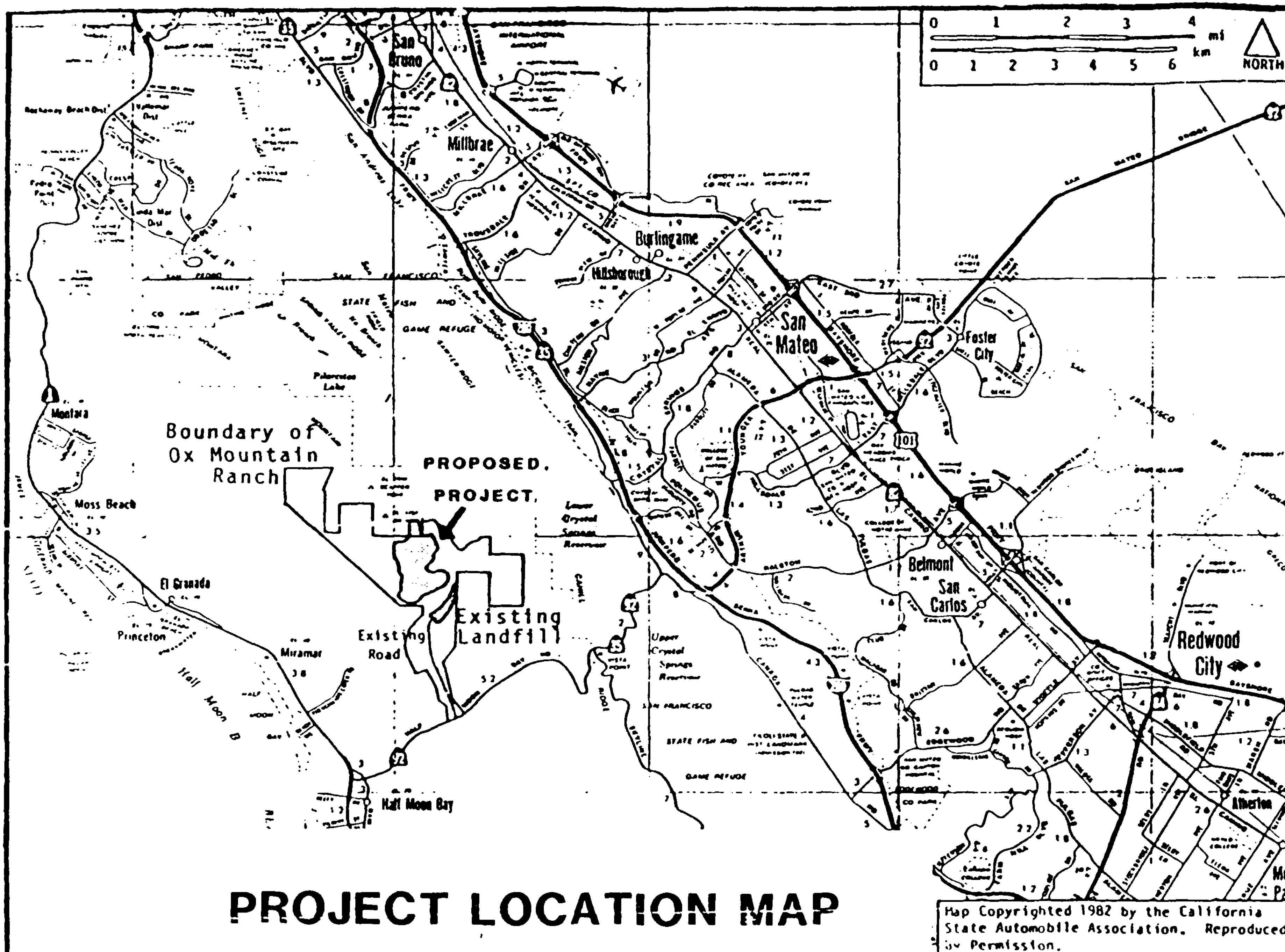
Priority 1 - Replacement of habitat types lost on or adjacent to the project site (in-kind;on-site)

Priority 2 - Replacement of habitat types lost at an alternative site (in-kind; off-site)

Priority 3 - Development of alternative habitat types at the project site (alternative kind; on-site)

Priority 4 - Development of alternative habitat types at other sites (alternative kind; off-site)

Only when within watershed mitigation measures are not feasible does this plan propose projects outside the watershed. The primary reason for project locations outside of the Pilarcitos Creek watershed is the unwillingness of private landowners to sell or lease their properties for proposed fish and wildlife improvements. Another reason for locating projects outside of the watershed is the lack of degraded areas with mitigation potential within the Pilarcitos watershed.



PROJECT LOCATION MAP

MAP 1

SOURCE: 1984 SMCO EIR

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EXISTING AND POTENTIAL BENEFICIAL USES OF WATER

Existing and potential beneficial uses of waters of the State have been identified by the Regional Water Quality Control Board-San Francisco Bay Region (RWQCB). The existing and potential uses identified by the RWQCB include the following:

1. cold fresh water habitat
2. warm fresh water habitat*
3. wildlife habitat
4. fish migration and spawning
5. water contact recreation*
6. non-contact water recreation*
7. municipal and domestic water supply
8. agricultural water supply
9. preservation of rare and endangered species*
10. drainage basin supplies recharge to the creek and aquifer to support the other beneficial uses

* Not applicable in project area

1. Cold Fresh Water Habitat

Cold fresh water fish habitat is found in the 4,649 feet of upper Apanolio Creek within the project area. This is habitat for fish species dependent on cool water temperatures, such as trout. Important elements of cold fresh water habitat include: 1) water temperatures that remain below 60-70 degrees Fahrenheit throughout the summer, 2) instream cover, 3) spawning gravels, and 4) a balanced riffle-run:pool ratio. This habitat and the associated mitigations are discussed in the Wildlife Mitigation Plan.

2. Warm Fresh Water Habitat

Warm fresh water habitat provides habitat to sustain aquatic resources associated with a warm water environment. This habitat type is not present within the proposed project area. The conditions necessary to provide warm fresh water habitat within the Apanolio Creek drainage, both on and off the project site, are not present. No mitigation is proposed.

3. Wildlife Habitat

Upland wildlife within the project area will be impacted by the loss of available water sources along Apanolio Creek. Upland wildlife will also be impacted by the eventual loss of 231 acres of coastal scrub brushland and 43 acres of Douglas fir/coastal scrubland. The existing coastal scrub brushlands are in an over-mature condition. While providing food and cover for the upland wildlife species, the over-mature brushlands do not provide optimum, high quality forage and cover. The height and density of the brush reduces wildlife access and mobility. In addition, the browse and forage quality of the over-mature shrubs do not provide the quantity and quality of food sources found in similar younger vegetation types. This is discussed further in the Wildlife Mitigation Plan.

4. Fish Migration and Spawning

Anadromous fish migration and spawning within the project area is very limited or non-existent. This is due to the downstream diversion structure that impedes steelhead access to the upper 8,448 linear feet of Apanolio Creek. The upper portion of the creek maybe accessible only during extreme flood conditions. A discussion of these uses can be found in the Fisheries Habitat section for Apanolio Creek.

5. Water Contact Recreation

Water contact recreation includes activities such as swimming, boating, water skiing and diving. None of these activities occur within the project area. Access to the upper portion of Apanolio Creek is heavily restricted by the presence of dense streambank vegetation such as blackberries, stinging nettles, and poison oak. In addition, public access on the private property is restricted. Within Apanolio Creek the stream depth and flow conditions necessary for water contact recreation, are very limited. Downstream uses will remain unchanged. No mitigation is proposed.

6. Non-Contact Water Recreation

Non-contact water recreation includes fishing, stream photography and hiking. These activities are prohibited by the same physical and legal conditions cited for onsite water contact recreation. Downstream uses will remain unchanged. No mitigation is proposed.

7. Municipal and Domestic Water Supply

This section is addressed in the Purcell, Rhoades and Associates report titled "The Revised Hydrological Assessment and Water Resources Beneficial Usage Analysis Apanolio Creek Expansion Site" San Mateo County, CA for BFI of California May 16, 1988 (DEIS 1988).

8. Agricultural Water Supply

This section is addressed in the Purcell, Rhoades and Associates report titled "The Revised Hydrological Assessment and Water Resources Beneficial Usage Analysis Apanolio Creek Expansion Site" San Mateo County, CA for BFI of California May 16, 1988 (DEIS 1988).

9. Rare and Endangered Species

As stated in the EIR and DEIS no federal or state listed proposed threatened, endangered, rare, or other sensitive species have been recorded or found on the project site. Offsite populations or potential populations will remain unaffected (DEIS 1988). No mitigation is proposed.

10. Restricted Infiltration and Recharge of the Apanolio Canyon Aquifer and Drainage Basin Recharge

This section is addressed in the Purcell, Rhoades and Associates report titled "The Revised Hydrological Assessment and Water Resources Beneficial Usage Analysis Apanolio Creek Expansion Site" San Mateo County, CA for BFI of California May 16, 1988.

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WILDLIFE MITIGATION PLAN

Construction of the Apanolio Canyon Expansion Project will remove 1) 3.43 acres of Corps defined wetland (DEIS 1988), 2) approximately 7.5 acres of additional riparian habitat, 3) 43 acres of coastal scrub with Douglas-fir and 4) 231 acres of coastal scrub (EIR 1984). Construction will also remove 4,649 feet of resident and potential rainbow trout (*Salmo gairdneri*) fishery.

Area	Acres
Riparian/wetland (wetland 3.43, 7.5 ± riparian)	11
Coastal scrub with Douglas-fir	43
Coastal scrub	231
Project area	285

Table I - Acreage Summary

Vegetation clearing and soil stripping will progress upward through the canyon in stages as the landfill develops. Landfill development will clear approximately 58-75 acres during the first five years. At that time landfill construction clearing will cease. In 1999, construction will resume and clear an average of three acres or less each year through the life of the project. As the landfill is constructed, the completed slopes will be revegetated with annual and perennial species with known wildlife values and shallow rooting depth (Table C-1). Revegetation and erosion control seeding will be scheduled to proceed at the same rate as new land clearing. At any point in time, only the active landfill and the construction area will be unvegetated.

To provide a basis for mitigation and replacement, a habitat value comparison methodology has been used. This procedure will insure no net loss of riparian/wetland acreage or wildlife habitat values when the project and proposed mitigation measures are considered together. Using a habitat value comparison methodology, the habitat value is ranked on a scale of zero (low) to ten (high). The evaluation methodology is described in detail in Appendix B. Similar methodology has been utilized by others for habitat evaluation (Miller et al. 1979, Schroeder 1987).

Since January 1987, BFI and their consultants have investigated potential mitigation sites that could be created or improved to replace the values and acres to be lost. These sites along with a description of the existing conditions, comparative habitat values, a description of the future condition and estimated values after improvement are listed as the following projects.

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PILARCITOS CREEK WATERSHED

Two mitigation projects have been identified for the main Pilarcitos Creek:

Streambank Revegetation

1) A section of Pilarcitos Creek adjacent to Highway 92 (Map D-1) has had the riparian/wetland vegetation removed to ground level. BFI proposes to restore a 480 foot long section along Pilarcitos Creek on the Sare property above Highway 92. BFI has obtained written landowner permission to plant and maintain willow and alder species for riparian/wetland habitat (Figure C-3). The streambanks will be fully revegetated and all debris (tires, barrels, etc.) removed. The current average riparian/wetland width is 10 feet. Final restored widths will be 20 feet after 10 years.

A 1,120 foot long section of Pilarcitos Creek on the V. J. Cozzolino property has been cleared for agriculture. Not included in this project is the stream reach subject to past court action. BFI proposes to revegetate the streambanks and remove all debris. The current average riparian/wetland corridor width is 11 feet. Final restored width will be 20 feet after 5-8 years. In the current condition, the habitat value is a 5 (Table B-11, B-17). The riparian/wetland species will grow to a height of 8 feet or more per year yielding a habitat value of 7 after 10 years. Additional values will accrue to the fishery resource due to increased cover, sources of terrestrial insects, and through the maintenance of lower water temperatures.

Barrier Modification

2) A winter low flow barrier to upstream fish migration currently exists on the downstream side of the Highway 92 bridge crossing over Pilarcitos Creek (Map D-1). This barrier consists of a long sacrete apron with a 3 foot vertical drop structure. During winter low streamflow periods, the water depth flowing over the apron is very shallow. This prevents migrating fish from passing the drop structure during these low flow periods (Figure A-2). As a result, 18,000 feet of stream and steelhead habitat between the Highway 92 bridge and Stone Dam are not fully accessible to steelhead.

To alleviate this impediment, BFI will construct a fish jump pool. This will result in the formation of a large pool 1 to 2 feet in depth on top of the existing apron. Migrating fish will be able to jump from the existing stream pool into the new pool area and pass the existing structure during the entire migration period. A Caltrans agreement with BFI exists for this construction.

The calculated present fisheries habitat value for the 18,000 feet of Pilarcitos Creek above the Highway 92 bridge is a 5. Installation of the jump pool will provide consistent winter access for migrating fish to the upper reaches of Pilarcitos Creek. The first winter following construction of the jump pool, the upper reaches of Pilarcitos Creek will have a fisheries habitat value of 7 (Table B-10).

APANOLIO CREEK WATERSHED

Fisheries Habitat

Construction of the Apanolio Canyon Expansion Project will result in the loss of 4,649 feet of perennial cold water rainbow trout and potential rainbow trout fishery. This stream currently provides habitat for aquatic plants and animals, and in particular, rainbow trout.

Within Apanolio Creek, three irrigation diversion or storage structures impede the upstream and downstream movement of fishlife. The lower Bongard diversion structure constructed, some 52 years ago, is located at mile 0.6 above the confluence with Pilarcitos Creek (Bongard 1986). The upper Bongard reservoir is located at mile 1.6, and the Gossett splashboard dam is located at mile 2.0. The uppermost structure is located adjacent to the southern BFI property line. Observation of these structures over the last two years (September, 1986 through November, 1988) indicates the lower Bongard diversion prevents consistent upstream fish passage (Payne 1988). In addition, the upper Bongard diversion structure has been found to be completely closed during the normal steelhead migration season (March 31, 1987 and March 1, 1988, personal observation, R. Sampson.) During the period September, 1986 through March, 1988, no adult steelhead were observed in Apanolio Creek above or below the Bongard lower dam (personal communications, Bongard & Gossett 1987, Diggs 1987).

On July 15, 1988, measurements of the stream width, depth and general condition of the bottom substrata were made every 100 feet from the south edge of the BFI property (adjacent to Gossett's pond) upstream to the natural rockfall. Six hundred and forty (640) feet of this distance (BFI property line upstream to the proposed sediment dam apron) will remain as a fish producing stream. From this apron to the upstream end of the proposed landfill, 4,649 feet of fish producing stream (and potentially fish producing) will be lost. A natural impassable rockfall is located 5,289 feet upstream from the BFI property line (Wooster 1988).

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Location	Feet
Dam Apron	(378)
Sediment dam to upper fishery limit	(3,676)
Potential fishery limit to rock fall	(595)
Total removed	(4,649)
Remaining fishery below Dam Apron	640
	=======
Total Fishery	5,289

Table II - Fishery Habitat Summary For Project Area

In July 1987, the stream width varied from 1.5 feet to 5.0 feet with an average width of 3.4 feet. Stream depth ranged from 0 to 5.3 inches with an average depth of 2.4 inches (CDF&G, Wooster 1988). Flow for July 1987 was gauged at 0.19 cfs (Hydrocomp 1988).

In July 1988, stream width varied from 1.0 foot to 5.5 feet with an average width of 2.8 feet. Stream depth ranged from 0.25 to 3.0 inches with an average depth of 0.9 inches (CDF&G 1988). Flow for July 1988 was measured at 0.05 cfs (Purcell, Rhoades & Associates 1988).

On September 22, 1986, CDF&G personnel electrofished a 100 foot sample area 600 feet downstream of the proposed sediment basin dam. Using the two pass method, a total of 21 rainbow trout were observed (Table E-1). Using the method of Seber and LeCren (1967), it was estimated there were 1,502 rainbow trout per mile of stream ranging in size from 2.0 to 4.7 inches (fork length). From this data, it was estimated there were 1,324 rainbow trout ranging in size from 2.0 to 4.7 inches (fork length) within the project area of Apanolio Creek.

On October 10, 1986, additional electrofishing was carried out in Apanolio Creek by shocking random locations from the upper creek crossing to the third or upper stream crossing. Numerous rainbow trout were captured. In one pool, 15 trout were captured and counted. In another 100 foot section, 24 trout were captured and counted. Fish sizes ranged from 2.5 to 8.5 inches (fork length).

Additional electrofishing was carried out on September 3, 1987 (Table E-2) and March 1, 1988 (Table E-3). A review of the CDF&G electrofishing field reports (July 8, 1987 and July 15, 1988) indicates that cover and shelter are the limiting factors to the number and size of fish. This conclusion is supported by recorded observations of stream bottom features, water depth, and the movement of natural and man-caused sources of decomposed granite. This conclusion is further reinforced by summer and fall low flows from 1986 through 1987. During this period streamflow never exceeded .25 cfs (Hydrocomp 1988). Low flows, shifting bottom materials, and the lack of pools over 6 inches deep create conditions too unsuitable for holding larger rainbow trout. Under these conditions, the fisheries habitat value of the stream for rainbow trout is a 6 (Table B-8).

Using the three-pass method, additional electrofishing was conducted in November 1988. The three-pass method accurately estimates the fisheries population of a stream. This survey indicated lower populations of the resident rainbow trout. Thirty-one rainbow trout were captured yielding an estimated population of 20 to 30 per mile with a biomass of 1.5 pounds per acre. This indicates a population of 18 to 26 rainbow trout for the project area (WESCO, 1989).

The potential to increase the population is dramatically illustrated in a pool above a sediment dam installed by BFI in September, 1985. Below this structure in an equal distance of stream there was poor cover and water depths of less than 3 inches. Only 2 rainbow trout less than 3 inches in size were captured below the structure. Above this structure, the average stream depth is 8 inches with undercut banks. This section of stream yielded 28 fish ranging in size from 2.8 to 8.3 inches (captured on March 1, 1988, Table E-3). Comparison of this data with the electrofishing completed on September 3, 1987 (Table E-2) indicates this more stable man-made fish shelter may be acting as a refuge for upstream fish as flow is diminished.

BFI proposes two mitigation projects within Apanolio Creek. These are the construction of instream structures to modify and stabilize the channel conditions and the creation of more pool and cover habitat within the stream. Approximately 15 instream fisheries habitat improvement structures are proposed. These small structures will create shallow falls and pools in the undisturbed portions of Apanolio Creek on the BFI property (Figure A-5.) The structures will be placed within Apanolio Creek between the southern BFI property line and the proposed sediment basin structure. As noted, CDF&G has determined that the limiting factor to the size and number of resident rainbow trout is instream cover. These small low flow structures will create needed pool habitat (cover) within Apanolio Creek. Streamflow will be concentrated to scour out 6 to 12 inch deep pools below each structure. This project will raise the fisheries habitat value of this reach of Apanolio Creek to an 8 (Table B-9).

Riparian/Wetland Habitat

Construction of the Apanolio Canyon Expansion Project will eliminate 11 acres of riparian/wetland habitat (EIR 1984). The DEIS (1988) provides a list of the various plant species found within the riparian/wetland areas (Table B-1, DEIS 1988). These areas currently provide habitat for a variety of wildlife species. The heavy concentration of mature red alders (Alnus rubra) found within the riparian/wetland corridor provides nesting, feeding, and resting areas for a variety of wildlife. It is estimated that the present value of the 11.0 acres of riparian/wetland is a 9 (Table B-15).

As a part of the landfill project, a sediment retention basin with 2.11 surface acres will be constructed. This basin will be located 1,018 feet upstream from the southern BFI property line (Map D-2). The purpose of the sediment basin is to trap sediment generated during the initial stages of landfill construction and future landfill operations. This structure will be completed before vegetation clearing and soil stripping activities begin in the upper canyons. The basin will be cleaned on a regular basis to remove trapped sediments and assure full effectiveness. After the first 3 to 5 years of construction, the sediment yield from the landfill will decrease significantly, requiring less frequent and thorough cleaning of the sediment basin. At that time, BFI will reestablish 0.75 acres of riparian/wetland habitat around the perimeter of the sediment basin.

Reestablishment of the riparian/wetland areas will be accomplished and sustained as follows. First, selected plant species identified in Table C-2 will be planted around the perimeter of the sediment basin (Planting Detail, C-3). The dominant and codominant overstory species are red alder and willow. These trees will establish quickly and grow to a height of 8 feet or more per year during the first 5 years (Osterling 1988). The 0.75 acres of riparian/wetland habitat will be fully established within 10 years following planting. This project will have a riparian/wetland habitat value of 6 (Table B-16). To preserve and protect the newly established riparian/wetland area, strict maintenance procedures for sediment removal will be used. These procedures are described in the "Maintenance of Sediment Control Structures" Section.

Upland Habitat

As the landfill is constructed, vegetation will be gradually cleared and soil material stripped from the canyon slopes to provide fill material for the operation. This process will initially clear approximately 75 acres during the first phase of construction. After the first 5 years, the amount of land clearing will decrease to approximately 5 acres or less each year until project completion in 2082. Over the life of the project, a total of 285 acres will be cleared. This includes 11 acres of riparian/wetlands and 274 acres of upland habitats. The upland habitat consists of 231 acres of coastal scrub and 43 acres of coastal scrub with Douglas-fir.

The upland habitat is currently providing food and cover for a variety of upland wildlife species (DEIS 1988). However, the value of this food and cover is decreased as the brushfields are now in an overmature condition. The exclusion of fire from the area during the past 50 years has allowed the brush to grow tall and woody (personal observation, Osterling 1988). This results in decreasing amounts of high quality browse for deer and seed production for birds and other small mammals (Longhurst 1978). In addition, the size and density of the brush makes wildlife access within the brushfields difficult, thereby limiting effective utilization. The current estimated upland habitat value of the upland vegetation is 5 (Table B-24).

BFI will implement a carefully planned and managed prescribed burning program to reestablish the vigor and maintain the diversity of the brushfields (Map D-3). Burning will be on a continuous and rotating cycle based on regrowth, wildlife usage and monitoring results. This cycle will allow for possible reburning on 10 to 20 (or longer) year intervals within the BFI ownership. The overall prescribed burning program will develop a vegetation mosaic with young, old, and intermediate aged plants by burning noncontiguous smaller patches. This vegetation mosaic will provide valuable edge habitat for all species of upland wildlife (Wright & Bailey 1982). Following burning, BFI will plant 43 acres of Douglas-fir on previously disturbed areas away from the project site (Map D-2, Tables C-2,B-28).

Upland wildlife species will benefit from the prescribed burning program due to the increased food supply, improved access and cover. However, deer will probably benefit the most with increased amounts of high quality browse plus access to more acres of browse. Seed eating birds and small mammals will benefit from increased seed production resulting from increased plant vigor. Predator species will also benefit from a population increase of prey species. Predators will also benefit from increased visibility due to the reduction of decadent overstory brush. Burning will reduce the duff and litter layer beneath the brush canopy and allow herbaceous species of grasses and forbs to intermix with the brushland. Nutrient turnover resulting from burning will enhance growth (Biswell 1952).

In conjunction with the prescribed burning program, existing natural springs will be located and developed to provide upland wildlife with upslope sources of water. These potential spring development locations are identified on Map D-4. The potential spring development locations are all outside of the drainage areas of the Apanolio Canyon Expansion Site and the Corinda Los Trancos Landfill. Development of the wildlife watering areas will enhance the important limited element in the wildlife habitat requirements. The primary elements include food, cover, and water.

Optimum spring locations are in areas of 100 acres or more not having existing perennial sources of accessible water (Verner & Boss 1980). The new springs will be developed by drilling horizontal wells to tap the subsurface and near surface flow. Small pools will be created (Figure A-6) to provide accessible perennial water for wildlife.

In addition to the spring development, a 1.0 acre wildlife pond will be constructed on the ridge below Scarper Peak (Map D-4, Figure A-8). The shallow areas around the edge of the pond will be planted with riparian/wetland plant species selected from Table C-2. This planting will create 0.75 acre of riparian/wetland habitat. This habitat will be established in an area where it currently does not exist. It will provide valuable food and cover for reptiles, birds and small mammals.

Implementation of the prescribed burning program and development of the wildlife watering areas and wildlife pond will improve the upland habitat values. Therefore, because the benefits are interactive the beginning of present values of the upland springs habitat should be evaluated as completed burn habitat. Burning will have direct effect on each acre burned. With the combination of these three projects, the upland habitat value will be increased from the existing value of 5 to a value of 8 (Tables B-26, B-27).

Grassland Development

As the Apanolio Canyon Landfill is constructed, the finished faces of the landfill will be seeded with a mixture of annual and perennial grasses, forbs and legumes (Table C-1). The seeding will establish a cover crop to control soil erosion and provide food and cover for birds and small mammals. In addition, brush piles will be selectively placed within the newly established grassland areas to provide cover for quail and small mammals.

The grassland habitat type currently does not exist within the project area and will be of high wildlife value due to diversity. The first season following establishment, the grassland will have a wildlife habitat value of 8 (Table B-29). The ensuing seasons will have equal to or greater values as the crop establishes, sets seed and matures.

CORINDA LOS TRANCOS WATERSHED

Several opportunities exist within Corinda Los Trancos Canyon to improve and develop riparian/wetland habitat. These include an existing pond located above the landfill, the construction of 8 riparian/wetland corridors below the landfill, plus widening and restoring native riparian/wetland habitat along Corinda Los Trancos Creek on the BFI property (Map D-8). In addition, streamflow augmentation will increase the seasonal flows and double the drought year summer low flows.

Riparian/Wetland Revegetation

An existing pond (0.1 surface acres) is located at the head of the Corinda Los Trancos Landfill (Map D-2). Subsurface flow from the pond is diverted away from the landfill via a cutoff wall and lined ditch to avoid the generation of excessive leachate. The existing riparian/wetland vegetation around the pond is sparse and undeveloped. To improve the condition and wildlife value of this pond, BFI will plant selected riparian/wetland plant species (Table C-2, Figure A-7). Within 5-10 years following planting, the habitat values of this small pond will increase from a riparian/wetland habitat value of 5 to a value of 8 (Table E-23). One-quarter (0.25) acres of riparian/wetland habitat will be created by this mitigation project.

Water Temperature Moderation

Runoff from the upper pond is carried away from the landfill via a 1,500 foot long concrete lined drainage channel. Currently it is an open channel with no associated vegetation to provide wildlife cover habitat or shade for water temperature moderation. To create wildlife habitat, BFI will plant ceanothus seedlings along the channel for its entire length (Map D-1). Planting will be on the west side of the channel on natural ground to avoid the potential problem of plant roots penetrating the adjacent landfill cap.

To aid in rapid plant establishment and growth on the rocky planting site, planting holes will be drilled at each planting location. The holes will be 4 inches in diameter by 4 feet deep. Each hole will be backfilled with quality soil material. In addition, establishment irrigation will be provided via a gravity fed drip irrigation system (Figure C-3). Irrigation will be provided for the first three years. The ceanothus shrubs will grow to a height of 5 to 8 feet or more during the first 3 years. These shrubs will provide a full canopy cover over the channel. This will moderate water temperatures and provide cover for reptiles, birds and small mammals.

Establishment of grasses and forbs on the adjacent landfill surface plus the water and cover provided along the drainage channel will be of high value to birds and small mammals. Approximately 0.2 acres of habitat will be created with an uplands habitat value of 7 (Table B-30).

Eight additional riparian/wetland corridors will be developed in the spur drainages adjacent and to Corinda Los Trancos Creek. (Figure A-4, Map D-8).

CORRIDOR	ACRES
RC1	2.40
RC2	1.60
RC3	.60
RC4	1.00
RC5	1.80
RC6	.50
RC7	1.80
RC8	1.60
TOTAL	11.30

Table III - Riparian Corridor Acres

Riparian corridors RC4 and RC7 are not immediately adjacent and contiguous to the Corinda Los Trancos corridor. The remaining 6 proposed corridors will tie directly to the streamside corridor, effectively widening the existing narrow corridor.

Riparian/wetland vegetation species will be planted for development of habitat in the riparian/wetland corridors located in side drainages. Specific attention will be given to the special habitat and food requirements of the riparian /wetland wildlife species identified in the EIR. Riparian/wetland species to be planted include: willow (Salix laevigata), red alder (Alnus rubra), creek dogwood (Cornus californica), giant horse-tail (Equisetum telmateia), big leaf maple (Acer macrophyllum), California Hazel (Corylus cornuta), goose-berry (Grossularia sp.), blue blossom (Ceanothus thyrsiflorus) and salmon-berry (Rubus spectabilis) (Appendix C). Artificial snags and imported logs will be placed at the direction of a qualified wildlife biologist. The snags and logs will benefit those species requiring these elements for den/nesting sites and perches. Although riparian communities will develop around the proposed ponds, no habitat values have been calculated due to highly fluctuating water levels.

Flood flows will be diverted from Corinda Los Trancos Creek into Pond 1. Water stored in these ponds will be used for riparian/wetland area enhancement. Excess water will be directed to Corinda Los Trancos Creek.

Existing Pond Improvement

Currently, two sediment ponds are located adjacent to the shop/service area. Eucalyptus globulus surrounds these ponds on three sides and extends upstream for approximately 600 feet and upslope for approximately 300 feet. This introduced exotic hardwood species does provide some habitat in the way of nesting or perching areas. However, it prevents the establishment of desirable herbaceous and riparian/wetland species beneath. In addition, eucalyptus is not a riparian/wetland species and provides little in the way of food and cover. BFI plans to remove the eucalyptus trees and replace them with native alders and willows to establish habitat more suited for the desired native wildlife. This will increase the riparian/wetland habitat values from a 4 to a 6 (Table B-22).

The west ends of the existing ponds are now periodically accessed to remove trapped sediments. When replanting the areas, the entry strip will be maintained to allow access to the pond and avoid disturbance to the planted riparian/wetland areas. Daytime human activity in proximity to this pond may preclude use by some of the more reclusive wildlife species. However, it will provide good habitat for many species such as frogs, snakes, small mammals, and song birds.

Stream Improvement Projects

The fisheries resource of Corinda Los Trancos Creek is in a degraded condition. This condition is due to low stream flows, poor instream cover, poor stream bottom substrates, and eroding streambanks. Agricultural operations including cattle grazing and farming have removed much of the riparian/wetland vegetation along the top of the banks between Highway 92 and the present landfill. Such vegetation removal aggravates slope instability and erosion.

BFI will implement a habitat improvement program including streambank stabilization, instream fisheries habitat improvements, streamflow, augmentation and establishment of a stable riparian/-wetland vegetation community. These projects will restore the habitat for a steelhead fishery and riparian/wetland habitats on the BFI property in lower Corinda Los Trancos Creek plus the steelhead fishery habitat on the adjacent downstream ownership.

Streambank Stabilization

Currently, Corinda Los Trancos Creek has excessive bank slippage and instability which downgrades the steelhead fisheries potential of the stream. This results from bank undercutting, sedimentation, and lack of stable bank vegetation. These problems will be corrected by recontouring the streambanks where necessary to a stable configuration and stabilizing the slopes. A combination of rip-rap, gabion wing-wall deflectors, and other devices will be installed on a site specific basis to protect the banks from damaging high stream flows (Figure A-11). The upper streambanks will be planted with willow cuttings and alder seedlings for habitat enhancement, erosion control and riparian/wetland development (Figure A-1).

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Instream Fisheries Improvements

In the lower 7,908 feet of Corinda Los Trancos Creek, the stream does not presently support a viable fishery even though water quality, flow and food sources are present. Pool habitat within this section of Corinda Los Trancos is virtually non-existent (Payne, 1988). The section between the proposed diversion located immediately above the access road crossing on Corinda Los Trancos Creek and the mouth at Pilarcitos Creek is a continuous, long, shallow riffle composed primarily of granitic sands. Permanent flows begin approximately 250 feet below the existing BFI shops.

BFI will install 10 or more instream fisheries/stabilization structures (Figure A-5) within Corinda Los Trancos Creek. These small weir structures will create eddy pools on the downstream side as streamflow passes over them. The eddying action of the water will create self-flushing pools and provide valuable cover and pooling for fish.

Table IV contains streamflow data in Corinda Los Trancos. The water resources available for mitigation purposes at the Ox Mountain Landfill site have been studied by Hydrocomp, Inc. (Streamflow Resources at Ox Mountain Ranch, 1989). Hydrocomp investigated storing part of the winter storm runoff of Apanolio Creek and Corinda Los Trancos Creek. This water would be used to maintain pre-development Apanolio Creek summer streamflows. It would also be used for riparian vegetation and wetlands, fishery augmentation and for landfill construction. The analysis shows that the water supply at the Ox Mountain Landfill site is sufficient for mitigation and construction purposes.

	MAY	JUNE	JULY	AUG	SEPT	OCT
ac-ft/month	17.67	10.24	6.47	3.92	2.33	2.79
gpm	129	75	47	29	17	20

Table IV - Average Corinda Los Trancos Streamflows At The 340 Foot Elevation

(Hydrocomp, Streamflow Resources at Ox Mountain Ranch, 1989)

Streamflow Augmentation

Streamflow augmentation will provide increased and consistent fishery flows in the Corinda Los Trancos Creek. The projected augmentation flows are based on the calculated flows currently found at the mid-point of the known fishery within the project area. The parameters for augmentation are as follows (Hydrocomp 1989b):

1. The target flow is determined to be equal to the flow at the midpoint of the fishery in Apanolio Creek. This flow is calculated to be 72% of the flow at the sediment structure. (Map D-2)

2. Augmentation flow is the quantity of water required to increase the Corinda Los Trancos Creek flows to the lesser of the natural average Apanolio fishery flow (1 above) and 50 gpm.

3. In no case will the augmentation flow be less ' an 5 gpm.

A five gpm augmentation flow will approximately double the August 1989 flow as measured at the road crossing near the 340 foot contour in Corinda Los Trancos Creek.

Fishery maintenance is dependent upon habitat, water quality and flows. Habitat mitigation projects including instream structures are discussed in the "Instream Fisheries Improvements" section of this plan. In August 1988, field inspections clearly showed a continuous surface flow through the mitigation area in Corinda. This surface flow is expected to continue with the augmentation flow and the development of the instream structures. The proposed instream structures are relatively small and shallow. Construction of these structures is not anticipated to disrupt the surface/subsurface flow regimes since only the upper portion of the stream bottom will be disturbed. The full existing flow plus the augmentation flow will then remain on the surface for full fishery utilization.

Using an average pool volume of 10 to 20 cubic feet (similar to those found in Apanolio Creek) flows of 5 to 10 gpm will be able to support a viable fishery in Corinda Los Trancos Creek of similar or larger biomass currently existing in Apanolio Creek (Payne 1989).

Spawning Gravel

BFI will supply and place appropriate sizes and quantities of salmonid spawning gravels in Corinda Los Trancos Creek. This will replace any spawning substrate lost in Apanolio Creek. Quantities, size, and frequency of addition will be determined by the results of the monitoring transects in Apanolio and Corinda Los Trancos Creek.

Cattle Exclusion

Cattle fencing will be used to exclude all cattle from the mitigation area on Corinda Los Trancos Creek.

Streambank Revegetation

The riparian/wetland plant community is a critical component of the fisheries habitat. The tree canopy provides shade to moderate water temperatures and provides food and shelter for numerous insects and small invertebrates. These insects provide an important food source for the fishery.

BFI will implement a revegetation program on BFI property for the areas identified on Map D-1. The primary overstory revegetation species include willow and alder. The alders will be planted to provide a high canopy while willows will provide a dense understory canopy. Combination of the two will provide shade for water temperature moderation, root binding of the streambank for stability, and cover for wildlife (Table C-2). Desired herbaceous species will be encouraged following overstory establishment. This will increase the riparian/wetland habitat values from a 7 to an 8 (Table B-21).

Sediment Management

Full sediment management will be achieved in Corinda Los Trancos Creek utilizing the existing sedimentation basins and the proposed ponds. Peak flood flows will be diverted to the proposed pond, PP1 (Map D-8). All deposited silt will be removed as needed from the basin. Removed silt will be placed on the landfill, stabilized and revegetated.

With the efficient removal of upstream silt, stream down cutting may need to be controlled by multiple fishery improvement structures. These structures are proposed for the BFI ownership in Corinda Los Trancos Creek. Each of these structures will provide pooling habitat beneath the structure as well as stream bottom gradient stabilization.

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Mitigation Results

Fishery

Implementation of the mitigation plan in Corinda Los Trancos Creek will significantly improve the present and potential steelhead fishery. Overstory tree canopy cover primarily from the alder and willow plantings will provide shade, bank stabilization, food sources and water temperature moderation. Spawning gravels will provide suitable substrate for spawning, hatching and emergence of the steelhead fry. Streamflow augmentation will provide suitable and consistent flows for steelhead rearing. The instream structures will create pool habitat and shelter from predation for the entire low flow period until winter flows are sufficient for natural migration. A staff gage will be installed at the Highway 92 crossing. Full steelhead fishery access is provided for Corinda Los Trancos Creek. In addition to the fishery in Corinda Los Trancos Creek, offsite benefits may be realized downstream in Pilarcitos Creek due to the increased flow regime.

Habitat

Habitat improvements will more than replace the losses of habitat in Apanolio Canyon. The riparian/wetland corridor system will create 11.3 acres of riparian/wetland habitat in the Corinda Los Trancos watershed. In addition, 1.4 acres of riparian/wetland habitat will be created by widening the existing Corinda Los Trancos Creek riparian/wetland corridor. The combined riparian/wetland habitat created in the Corinda Los Trancos watershed is 12.7 acres.

Conservation and Wildlife Easement

Conservation in perpetuity is critical to the longevity and assurance of full effectiveness of the mitigation programs. Upon completion of the mitigation projects within Corinda Los Trancos, BFI will provide a conservation easement for these projects. These projects include riparian/wetland corridors, fisheries enhancement, streambank stabilization, and riparian/wetland development adjacent to the existing creek channel.

The other fishery mitigation projects outlined in this mitigation plan will enhance the steelhead fishery on San Pedro, Arroyo Leon and Pilarcitos Creeks. Benefits to the steelhead and potential steelhead populations reach well beyond the upper Apanolio and Corinda Los Trancos Creek project areas.

ARROYO LEON WATERSHED

Barrier Modification

A barrier to upstream fish migration currently exists on Arroyo Leon Creek (Maps D-5, D-6). The barrier consists of a culvert outlet with a 4 foot drop onto a concrete apron (Figure A-9). During winter low flow periods, water depth flowing over the apron is too shallow to allow migrating fish access to the culvert. This barrier is preventing consistent access to 18,000 feet of fisheries habitat in upper Arroyo Leon Creek.

To correct this situation, BFI has obtained landowner permission to construct a series of fish jump pools on the downstream side of the culvert outlet. These pools will provide resting areas with suitable low flow depths to allow migrating fish to swim up to and through the existing culvert. After the jump pools are installed, migrating fish will have consistent access to the upper 18,000 feet of Arroyo Leon Creek during the migration period. This will increase the fisheries habitat value of upper Arroyo Leon Creek from a value of 6 to a value of 8 (Table B-14).

SAN PEDRO CREEK WATERSHED

Barrier Modification

Within San Pedro Creek, an opportunity exists to improve utilization of the available fisheries habitat by correcting a winter low flow fish barrier. This barrier is located at the Adobe Street bridge over San Pedro Creek (Maps D-5 and D-7). The stream passes beneath the bridge through a 6 foot wide, 40 foot long smooth concrete channel. During winter low flow conditions, the water sheetflows over the concrete bottom resulting in streamflow too shallow to allow upstream fish migration (Figure A-10).

To correct this situation, BFI has obtained permission from The City of Pacifica to modify the flow pattern. This will create increased low flow water depths and allow migrating fish to consistently pass the Adobe Street bridge. The design is approved by a Registered Engineering Hydrologist to assure that the structures do not impact high stream flow or compromise the safety of the bridge. Correction of this low flow barrier will provide consistent access to an additional 7,000 feet of fisheries habitat above the Adobe Street bridge. This project will improve the fisheries habitat value of San Pedro Creek from a 5 to 7 (Table B-13).

MAINTENANCE OF SEDIMENT CONTROL STRUCTURES

Construction of the sediment retention basin below the proposed landfill will reduce the downstream sediment loads in Apanolio Creek. Resulting sediment levels will be lower than preconstruction levels. Sediment yields for Apanolio Creek with the sediment ponds are calculated as follows:

	Sand	Silt	Clays	Total
Natural (No Sediment Ponds)	281	136	27	444
Project Construction	0	78	77	155
Post Project Construction	0	52	27	79

Table V - Sediment Yield

Source: pers. comm. Hydrocomp 1988
Units are average tons/year

CDF&G has confirmed that the silts and sands are very problematic regarding the aquatic habitat. The suspended clays do not create problems since these particles are carried to the ocean during storm events. Changing the sediment characteristics by reducing the yield of sands and silts by 365 tons per year significantly enhances the aquatic habitat. The increase in clay particles (which remain in suspension) will not create fishery or habitat problems. The conditions where clay particles are created is during stormflows; stormflows will carry the clay particles to the ocean (personal communication, Hydrocomp 1988).

To preserve and protect the newly established riparian/wetland areas, strict maintenance procedures for sediment removal will be used. A predetermined equipment access area will be constructed. Cleaning operations will take place only from that point without damaging surrounding vegetation. The sediment pond edge areas will have minor accumulations of sediment. Primary settlement of solids will occur in the center of the pond where direct flow occurs (pers. comm. Hydrocomp 1988). Sediment will be removed from the central portion of the sediment basin, leaving the outer vegetated areas undisturbed. This practice may require more frequent removal of smaller volumes of sediment, but will maintain the integrity and full usefulness of the created riparian/wetland habitats.

The basin will be maintained on a regular basis. This will ensure adequate sediment holding capacity to retain all sediments moving downstream from the project area. The predicted results will enhance the fishery habitat. reduce the sediment loads in Apanolio Creek and Pilarcitos Creek and have no adverse offsite impacts.

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INSTALLATION, MAINTENANCE AND OPERATION

BFI will pay all costs associated with the installation, maintenance and operation of the mitigation projects. The company is prepared to begin the mitigation implementation immediateiy upon receipt of all required permits. The estimated budget for the project is itemized below:

PROJECT	COST
PILARCITOS CREEK	
Streambank revegetation and bank stabilization	25,500
Barrier modification	10,000
APANOLIO CREEK	
Fisheries habitat	6,500
Instream structures	8,000
Riparian/wetland habitat development	7,000
Upland habitat management	11,500
Grassland establishment and upland game habitat development	32,500
CORINDA LOS TRANCOS CREEK	
Riparian/wetland corridor habitat development	185,000
Water temperature moderation	4,500
Recharge ponds	510,000
Fisheries habitat	5,000
Instream structures	10,500
Spawning gravels	2,500
Bank stabilization	65,000
ARROYO LEON	
Barrier modification	12,000
SAN PEDRO CREEK	
Barrier modification	10,500
MAINTENANCE	
First 5 years	25,000
5 to 20 years	75,000
20 to 80 years	72,000
81 to 100	20,000
MONITORING	
5 years	55,500
ENGINEERING AND CONSULTATION	
Design and consultation	125,900
PROJECT TOTAL	$1,279,400

Table VI - Mitigation Budget

Each of the proposed mitigation projects will be completed in a timely manner consistent with the landfill development. It is anticipated that offsite fisheries projects will be completed within the first year following project approval. The riparian/wetland habitat development projects will also be scheduled for completion during the first year. All mitigation projects will be completed in the first 5 years unless landfill construction and development precludes completion.

CORPORATE GUARANTEE

BFI will prepare a corporate guarantee for $1,279,400 to insure the effectiveness of the mitigation program. Each project in the mitigation program will be evaluated and monitored for 5 years. This will assure that the requirements will be achieved. When each mitigation project is completed and the monitoring team (BFI, RWQCB, CDF&G) verifies its full effectiveness, BFI will be relieved of further responsibility beyond maintenance of the project. The corporate assurance will then be reduced by the appropriate amount as each mitigation project is completed and verified.

MONITORING

This comprehensive monitoring program will meet or exceed CDF&G requirements. Future monitoring will determine the effectiveness of the total mitigation program. BFI in cooperation with the appropriate agencies will monitor upland game improvements using standard methodologies. Permanent photographic points will document the results over the 5-year monitoring period for each of the programs. BFI will maintain a close liaison with the CDF&G to monitor and analyze the results. BFI will submit all the monitoring data to the CDF&G and RWQCB for critical comment and inclusion into appropriate departmental programs. Reports will be submitted on an annual basis to CDF&G Region III Headquarters and RWQCB-San Francisco Bay Region office for comment and dissemination.

FISHERIES

Baseline data has been obtained on the fishery population in Apanolio and Corinda Los Trancos Creeks. BFI, under the direction of a Certified Fisheries Biologist, will conduct electrofishing surveys annually for 5 years to monitor fishery populations, variations and presence in both Apanolio and Corinda Los Trancos Creeks. Periodic and post storm incident checks will be conducted for upper Pilarcitos, Arroyo Leon and San Pedro Creeks. These checks will be made to confirm the presence of adult steelhead above the new fish passages. This monitoring will continue for 5 winters following implementation of the mitigation projects.

RIPARIAN/WETLAND VEGETATION

Permanent photographic points will be established by BFI to record all revegetation projects on an annual basis. Photos will be analyzed to determine percent cover, plant survival and vigor.

Each fall, a plant count will be made to determine actual survival of all plantings. If 50% plant survival is not maintained, new plants will be installed to attain that level. When 90% cover (or more) is achieved and maintained for 3 years no added replanting or monitoring will be required.

UPLAND GAME

Before burning, baseline wildlife population data will be determined by a Certified Wildlife Biologist. After the burning program commences, a census will be conducted annually for the first five years; census data will be taken every other year for the following five years. Track traps will be used to document the effectiveness of the upland springs. Permanent photographic points will be established to document the burn program, vegetative regrowth and wildlife utilization. Vegetative transects utilizing line plot intercept methodology will be established to determine changes in vegetative communities and wildlife utilization of the burn units. Transects will be established following burning; monitoring will continue annually for 3 years for the burn cycle.

SUMMARY

This Wildlife Mitigation Plan has been prepared to assure full replacement of wildlife and fisheries values. The Mitigation Plan addresses the impacts of expanding the landfill into the adjacent Apanolio Canyon.

The proposed landfill will operate for a calculated period of 93 years. During this time, the natural resources of the canyon within the project area will gradually be removed by construction of the landfill. The plan addresses and evaluates each of these natural resources. Additionally, the plan evaluates each of the proposed mitigation projects and demonstrates that each of the resources are replaced. Construction schedules and BFI's commitment will result in most of the mitigation projects being in place before complete removal of the natural resources within the project area.

BFI is committed to complete each mitigation project in a timely and professional fashion. The net wildlife and fisheries habitat values will exceed the present habitat values as a result of the mitigation projects (Tables B-7, B-34, B-35). In addition, BFI will provide corporate financial assurance to back their commitment.

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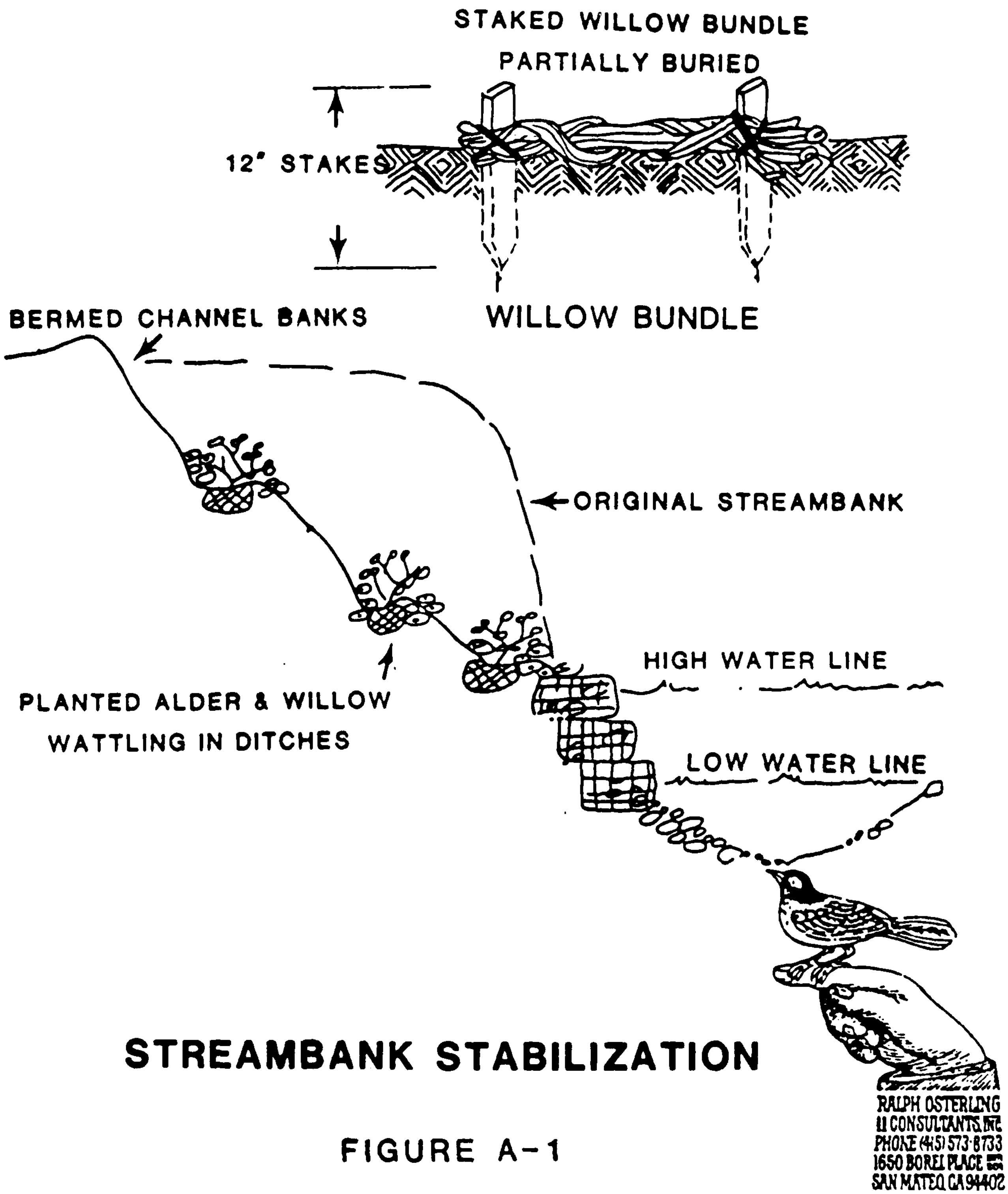
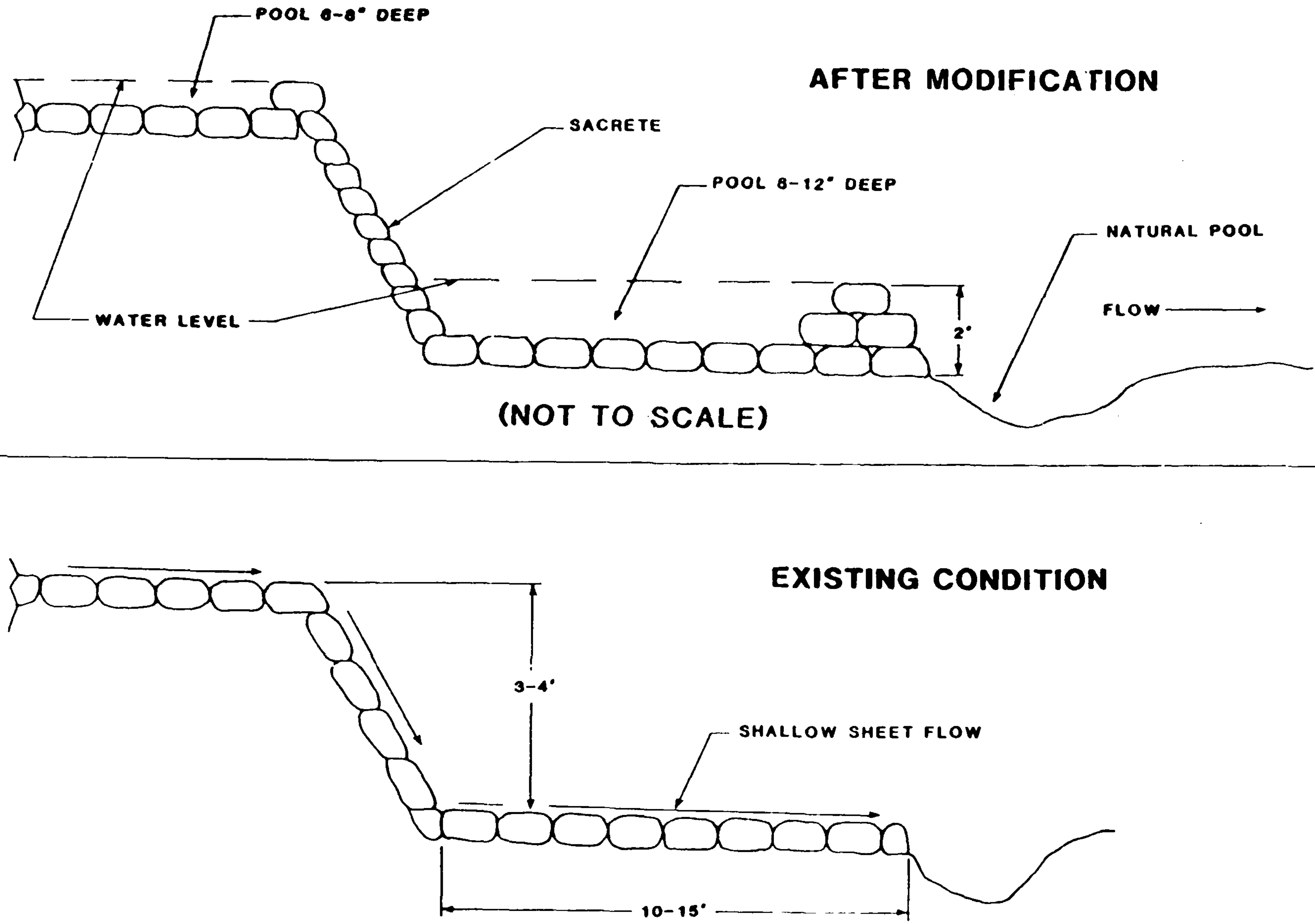
APPENDIX A

FIGURES



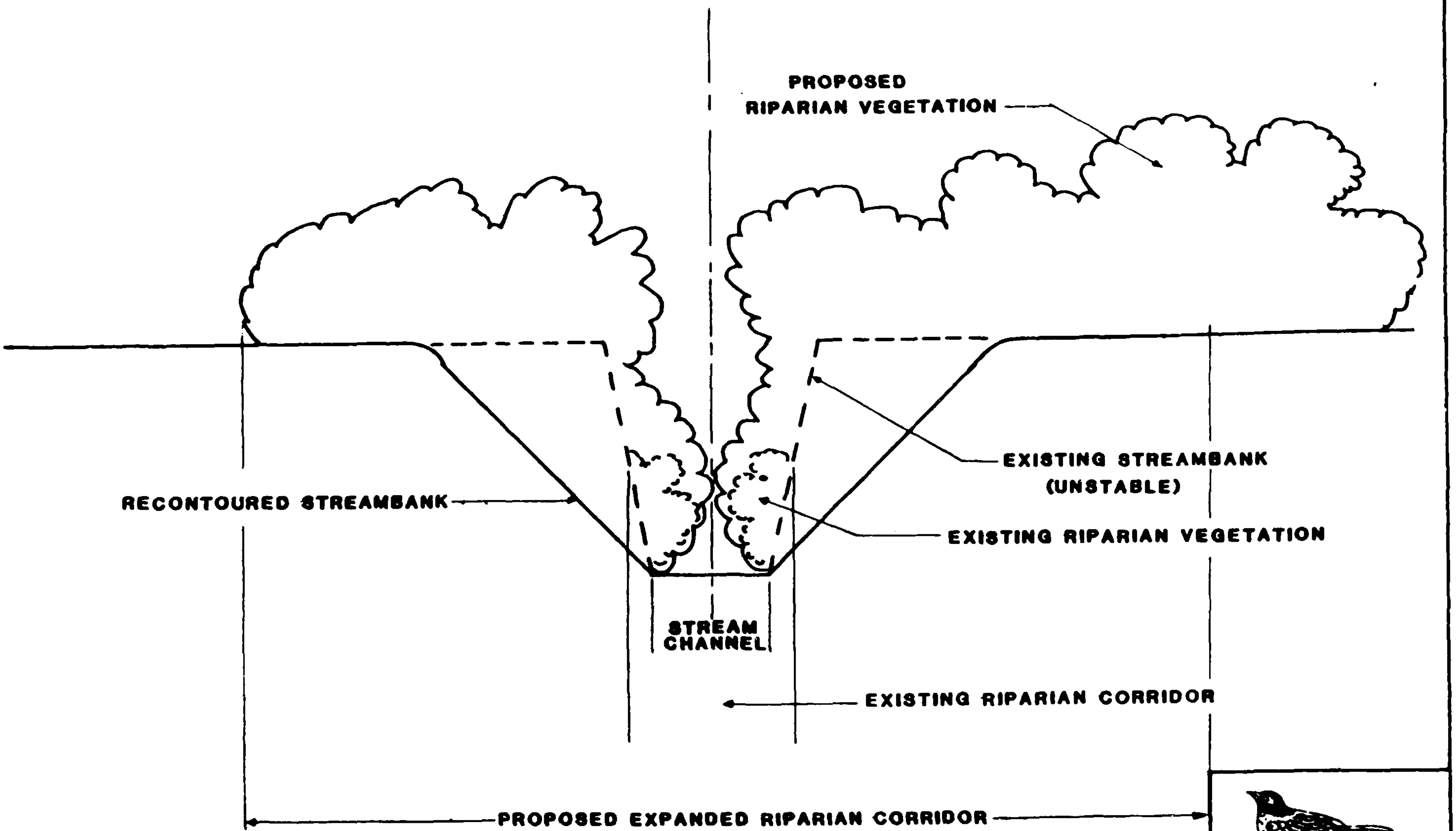
STREAMBANK STABILIZATION

FIGURE A-1



JUMP POOL DESIGN HIGHWAY 92 CROSSING

FIGURE A-2

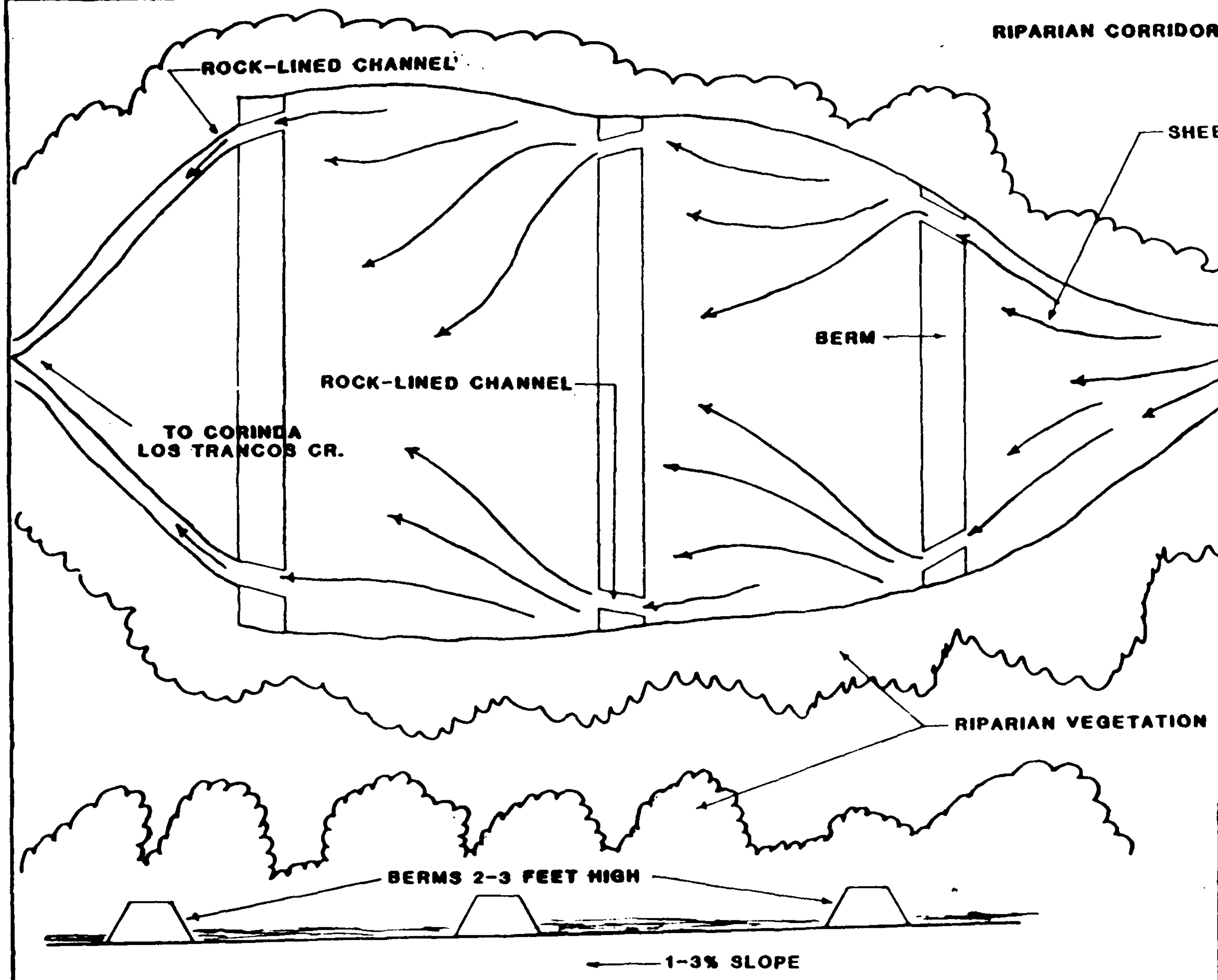


1650 BOREL PLACE
SAN MATEO, CA 94402

CORINDA LOS TRANCOS MITIGATION

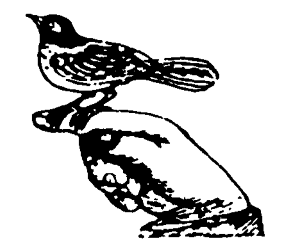
(NO SCALE)

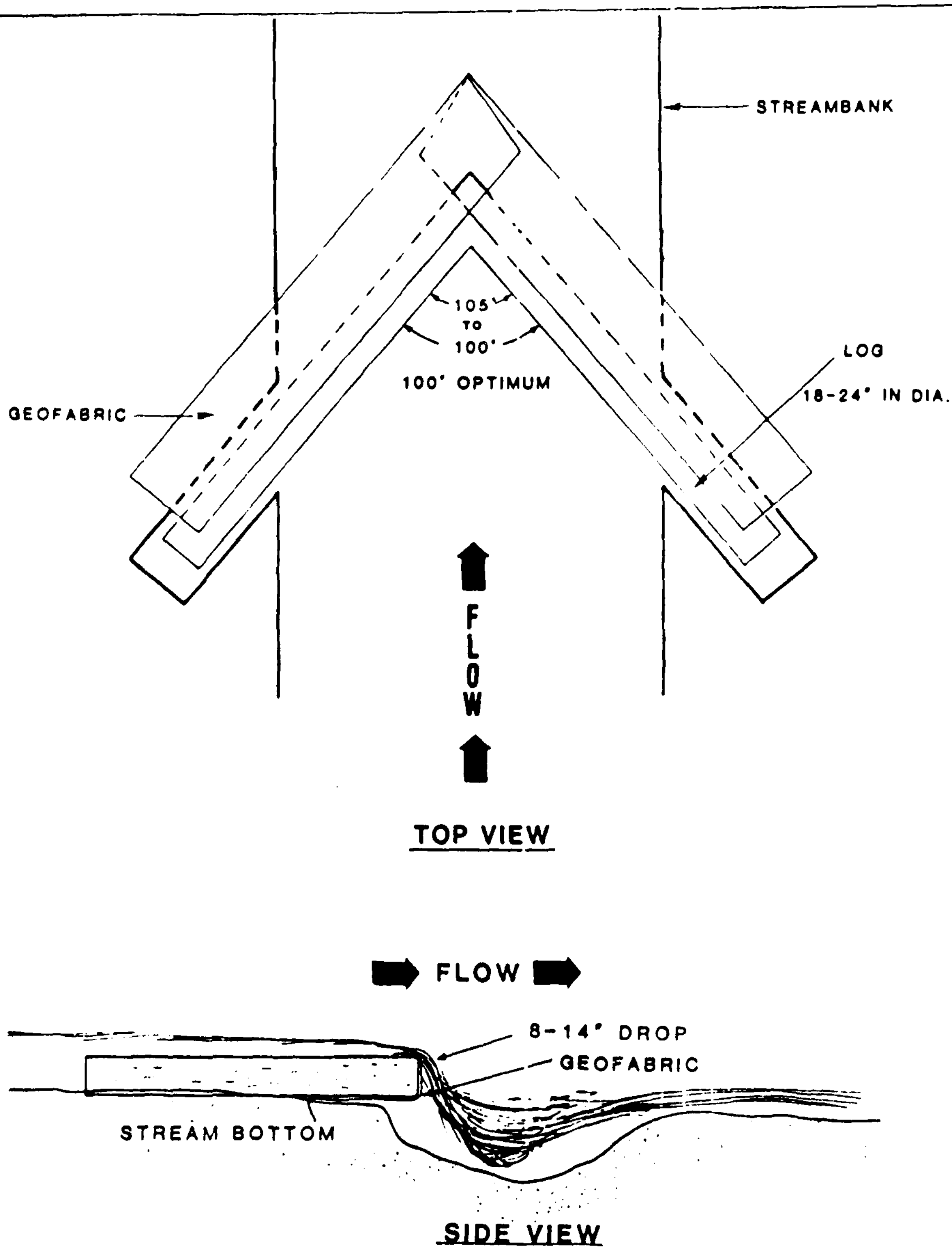
FIGURE A-3



TYPICAL RIPARIAN/WETLAND CORRIDOR

(NO SCALE) FIGURE A-4





INSTREAM FISHERIES STRUCTURE

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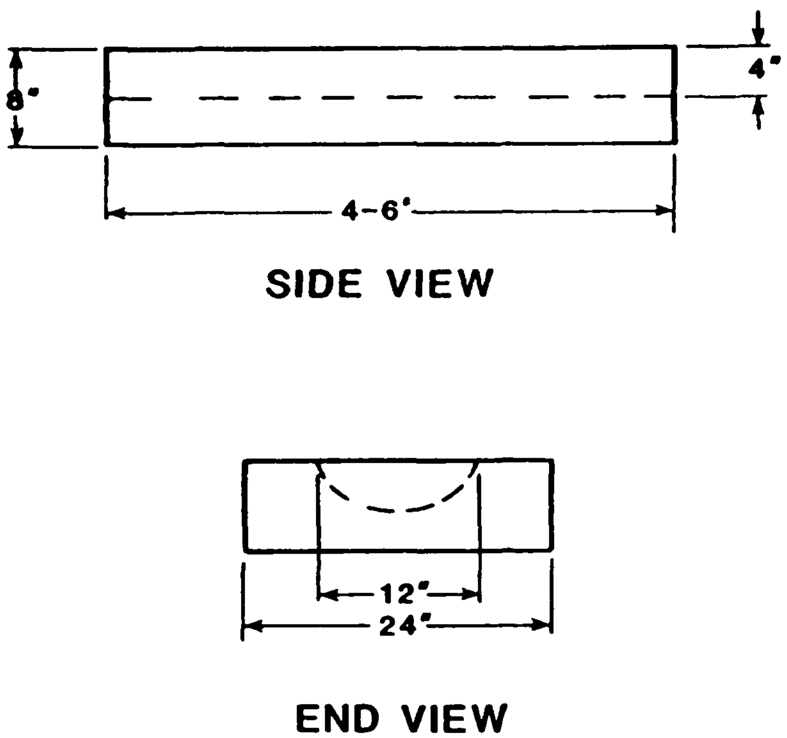
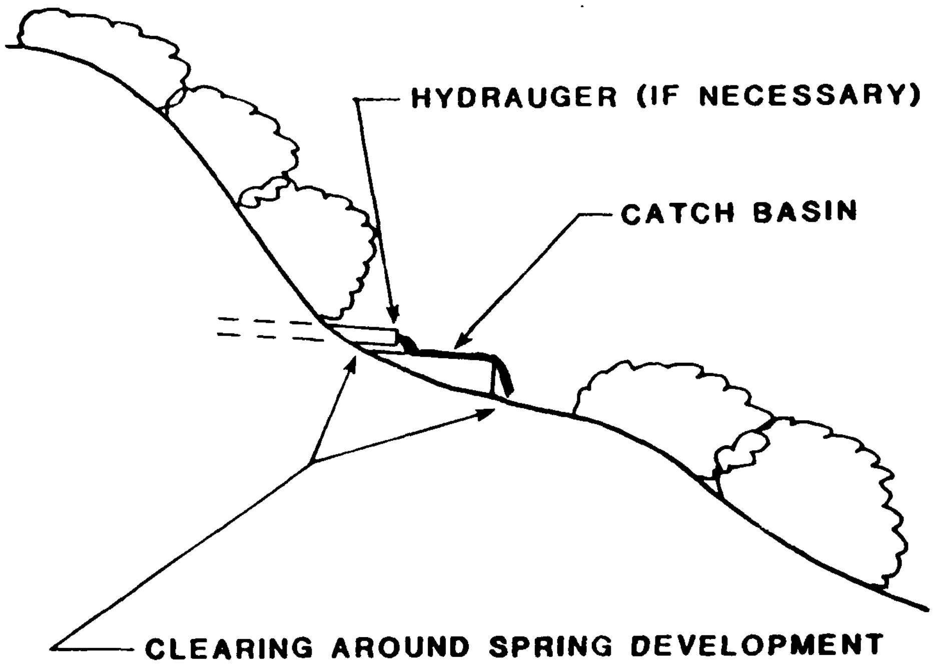
FIGURE A-5



CATCH BASIN DETAILS



PROFILE

UPLAND SPRING DEVELOPMENT

FIGURE A-6

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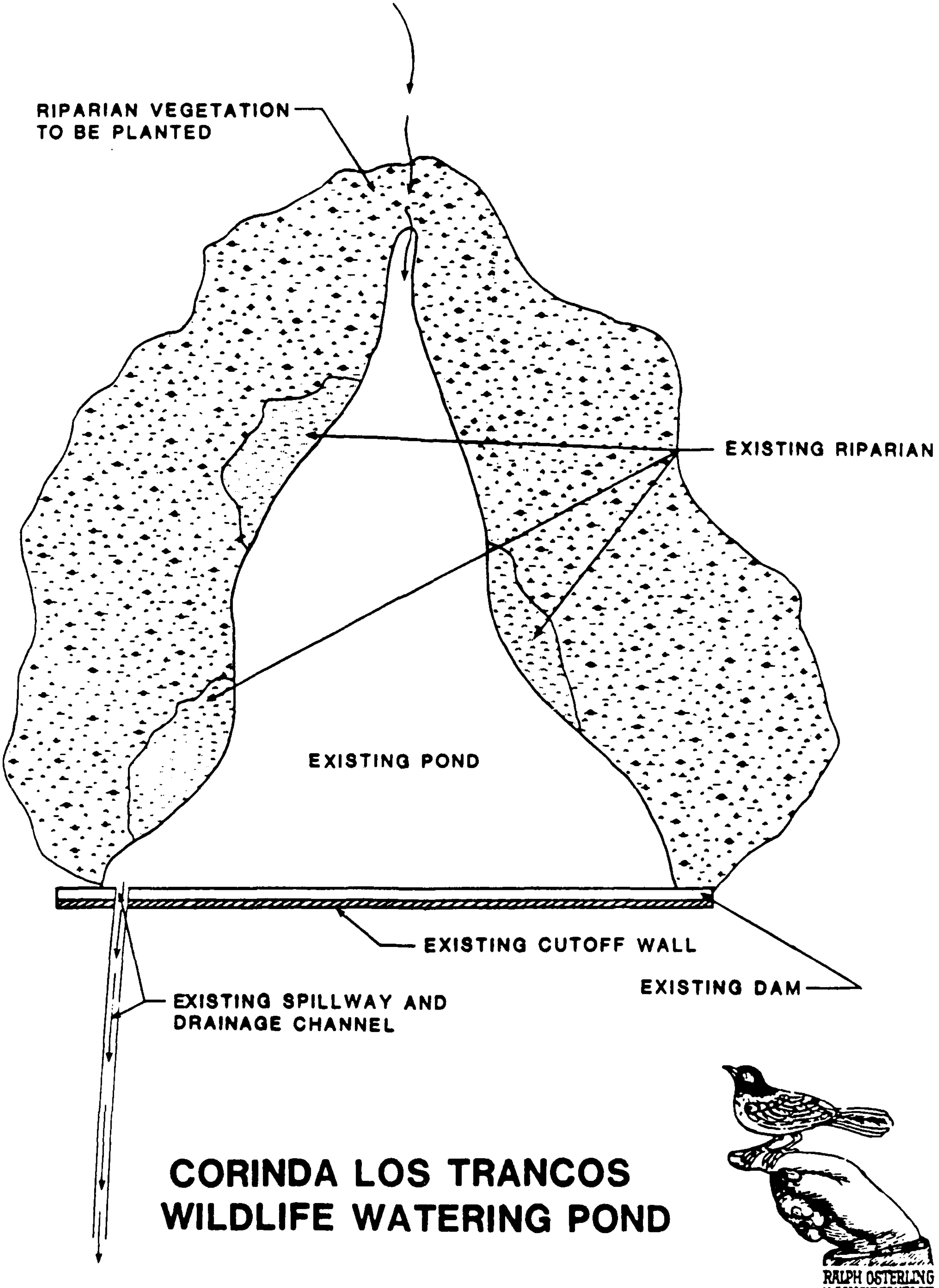

CORINDA LOS TRANCOS WILDLIFE WATERING POND

FIGURE A-7

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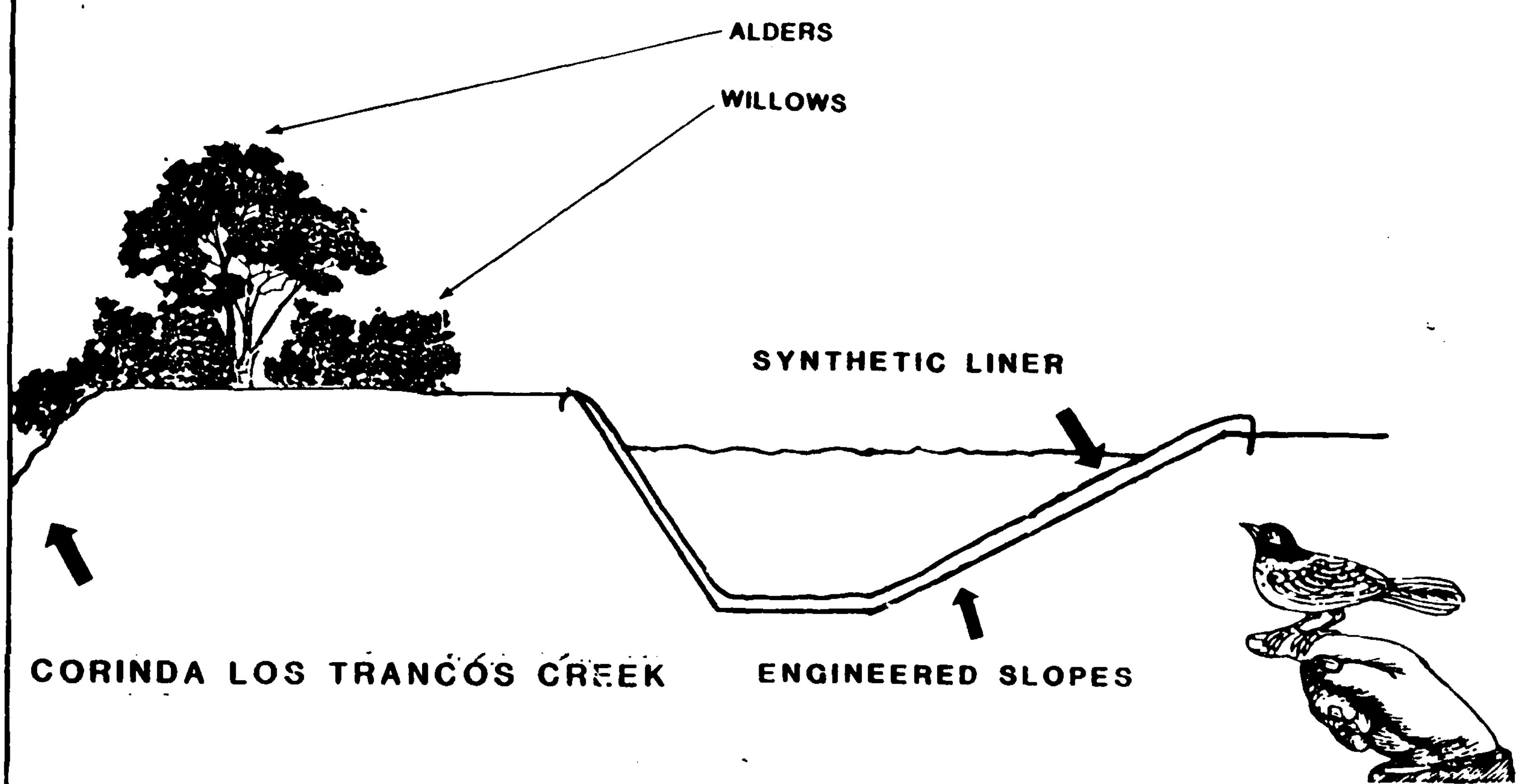
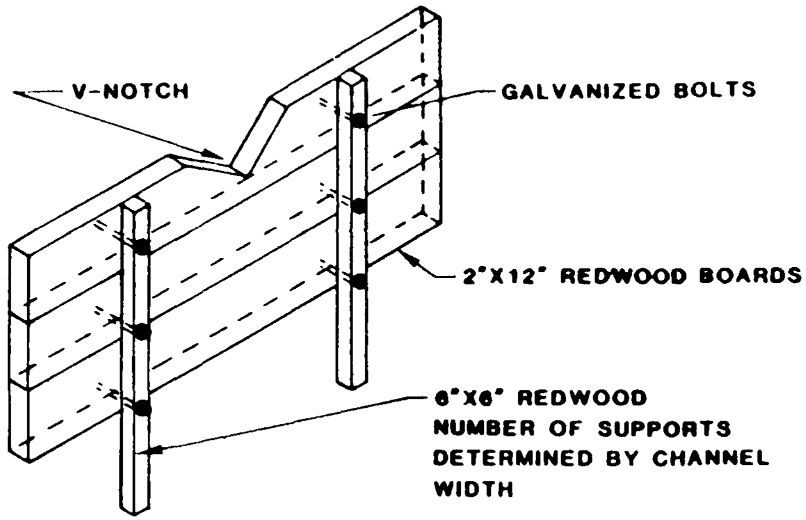
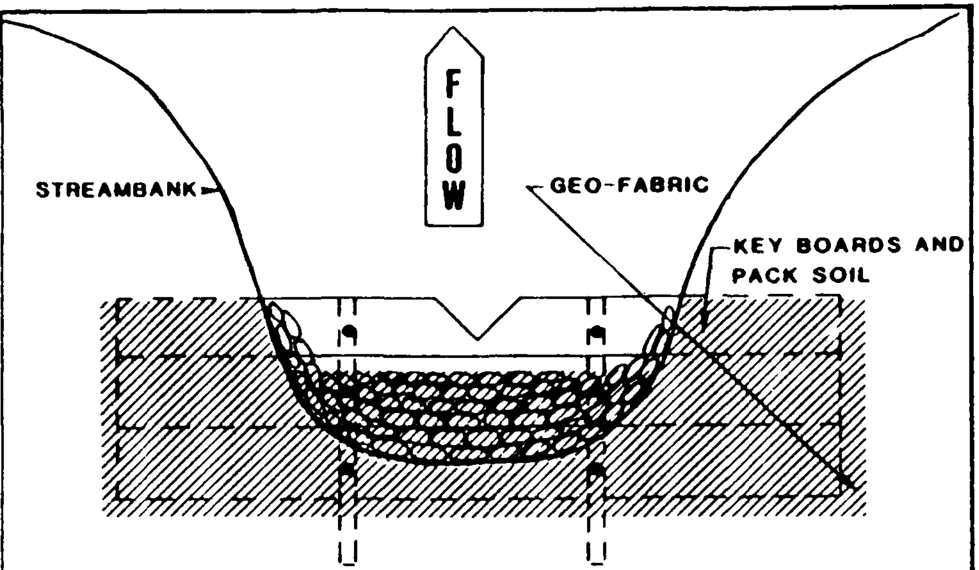
SAN MATEO, CA 94402



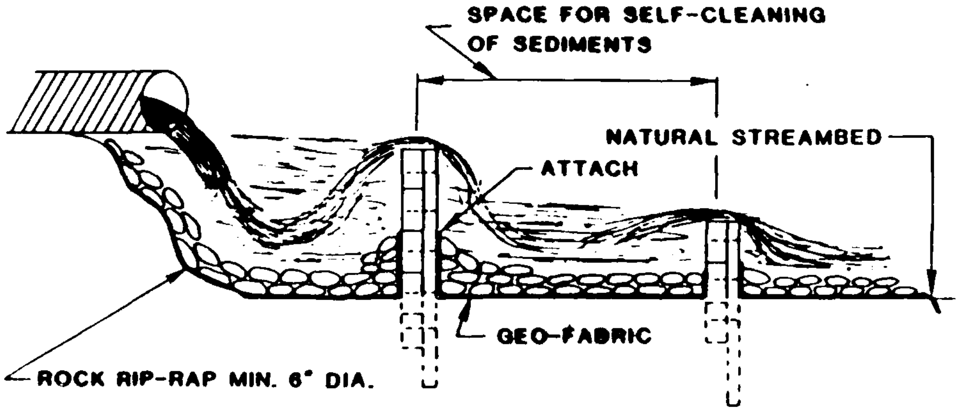
MITIGATION STORAGE POND

FIGURE A-8





SECTION VIEW



SIDE VIEW

ARROYO LEON CREEK FISH PASSAGE STRUCTURE

NOTES:

1. Maximum jump height between pools is two (2) feet.
2. Board ends and bottom board keyed into the streambank (2 feet) and streambottom (1 foot).
3. Field conditions will determine the required number of pools.
4. Geo fabric wrapped around the ends of the boards.
5. Supports set a minimum of three (3) feet into the streambottom.
6. Drawings not drawn to scale.

FIGURE A-9

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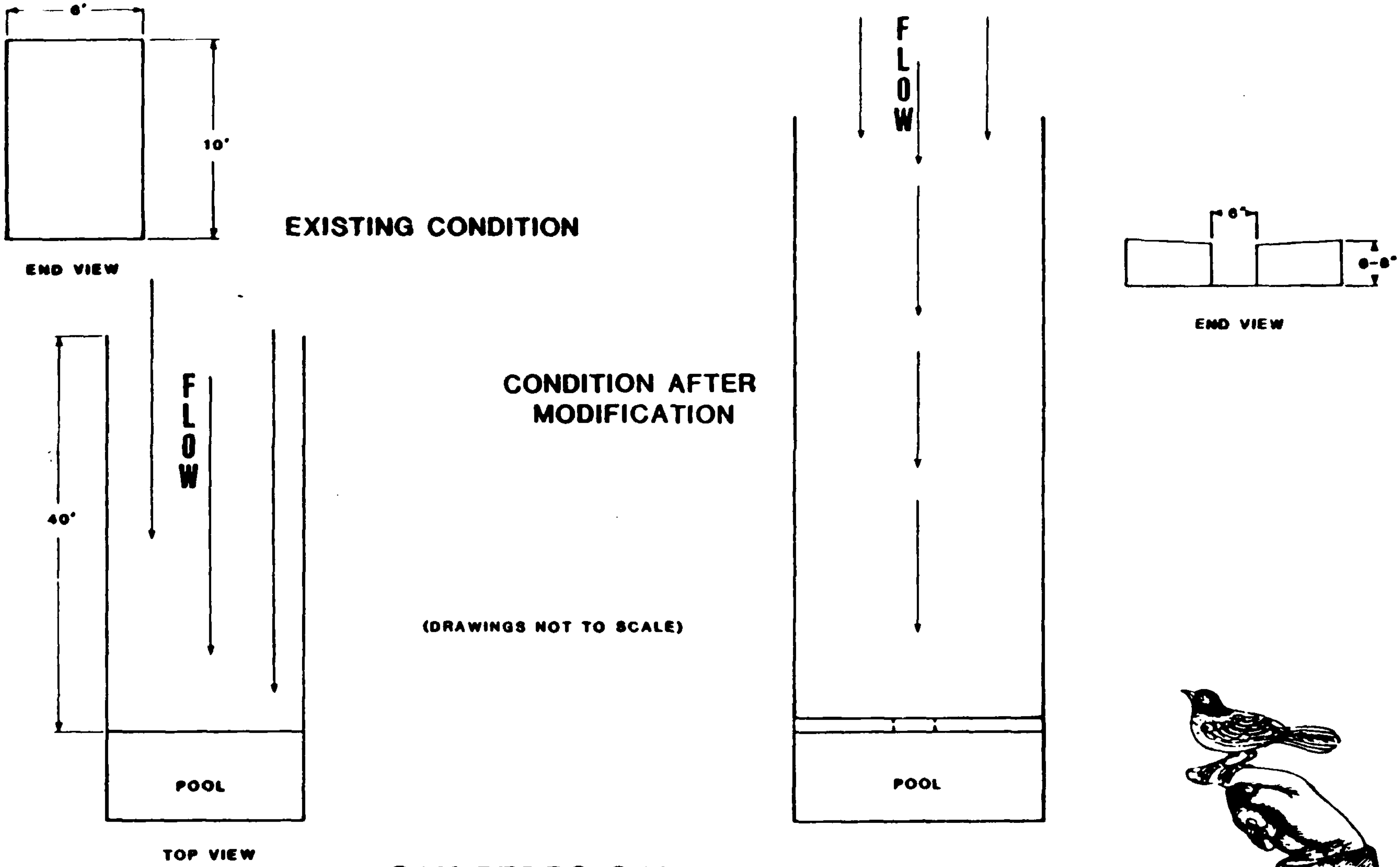

SAN PEDRO CREEK
ADOBE STREET CROSSING

FIGURE A-10

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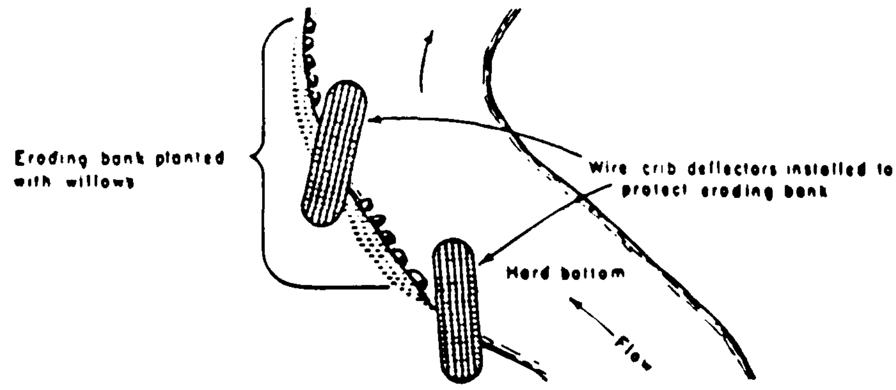
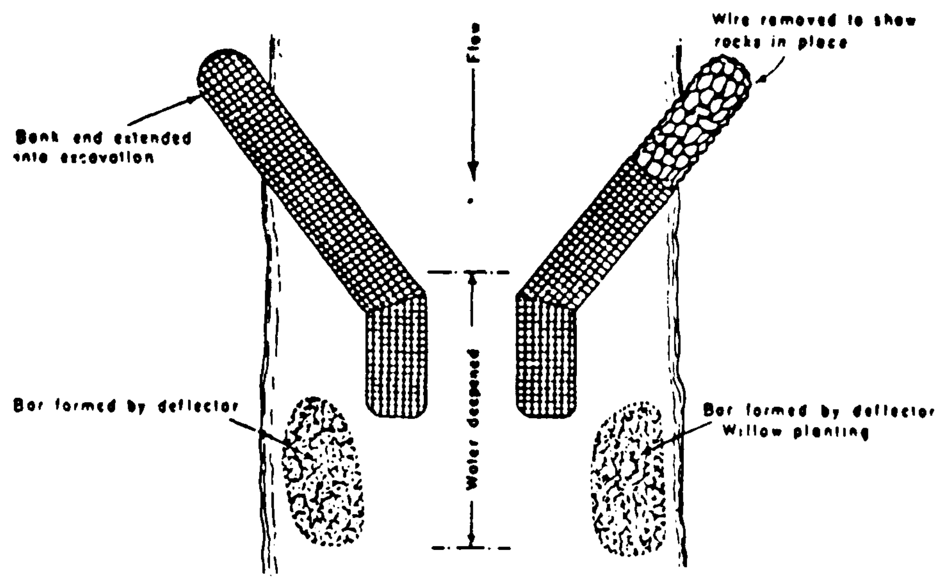


SOME USES OF DEFLECTORS
Plan view



WIRE CRIB WING DEFLECTOR
Plan View
showing two deflectors installed so as to dig hole in middle of stream

Source: USDA Forest Service, Fish Stream Improvement Handbook, 1952

DEFLECTOR DETAIL

FIGURE A-11

APPENDIX B

HABITAT EVALUATIONS

March 22, 1989

APPENDIX B - HABITAT VALUE COMPARISON METHODOLOGY

Regulatory constraints for development of the Apanolio Canyon Landfill Project require that all lost natural resource habitats be mitigated. The Mitigation Plan has identified numerous mitigation projects which will compensate for losses resulting from construction of the project. To evaluate the effectiveness of the mitigation program, a habitat value comparison methodology has been used. This methodology compares existing habitat values to be lost with future habitat values resulting from implementation of the mitigation projects (Miller et al 1979, Schroeder 1987).

This evaluation procedure divides a habitat into several elements. These elements rate the suitability of the site as habitat for the target species. The target species list (Table B-1) consists of wildlife species found in the project area. The evaluation procedure rates the habitat elements on a scale of 0 to 10 as follows:

NONE	POOR	FAIR	GOOD	OPTIMUM
0	1 - 3	4 - 6	7 - 9	10

A value of 0 would indicate that no element for the habitat occurs in this area. This would represent total removal of this habitat by the project for a future value. (Present value represents habitat that must be created.) A 10 represents optimum habitat for that wildlife element.

Fisheries Habitat

Fisheries habitat has been evaluated using four primary habitat elements. Each element is rated by listed criteria. These elements and rating criteria are:

1) spawning gravels
   silt content of the spawning gravels

2) cover or shelter
   shade over the fishery
   instream cover for fish

3) food production
   water flow
   riffle content of the streambed
   substrate

4) upstream access
   annual access for anadromous fish
   access duration

As shown above, each element is used to rate the suitability of the habitat for rainbow trout and steelhead.

The existing conditions of each of the four elements have been evaluated for the project area in Apanolio Creek. In addition, the existing conditions of the elements have also been evaluated for the areas where mitigation projects are proposed. This provides a baseline value for comparison with future values after mitigation.

The ratings for each of the habitat elements are summed and averaged to determine the habitat value units (HVU) per 1,000 feet of stream. The length of stream to be improved is then divided by 1,000 and the result is multiplied by the number of HVUs. The number of HVUs present under existing conditions are subtracted from the number of HVUs after mitigation. This gives the increase or decrease in the overall number of HVUs.

For evaluation purposes a basic habitat description is needed to describe Apanolio Creek in the project area. Apanolio Creek is a perennial trout fishery. Regular anadromous upstream access is not available into the project area. Food production is high due to the perennial flows over the riffle component of 30%. Cover is high due to a diversely vegetated full shade overstory. Spawning quality is fair due to a high silt content in the streambed. Instream cover is poor to fair.

Habitat Values for Riparian/Wetland and Upland Areas

A similar evaluation procedure has been used for the riparian/wetland, and upland habitats. HVUs for riparian/wetland, and upland areas were based on field surveys and a qualitative scaling system. Each habitat was rated for suitability as habitat for the classes of wildlife. Each class is considered an element. They are as follows:

Element	Criteria
Amphibians	Food
Reptiles	Water
Small Mammals	Cover
Large Mammals	
Song Birds	
Raptors	

Each wildlife class uses one or more target wildlife species to rate habitat suitability for each criteria (Tables B-2 through B-6). Each element column has the target species number listed. The target species number corresponds to the species numbers on Table B-1.

The ratings are summed for all the elements and averaged to determine HVUs. The average number of HVUs are multiplied by the number of acres gained or lost to determine a net gain or loss in HVUs. This provides an accurate comparison between the HVUs lost and gained. All elements and habitats are compared on an equal basis.

The riparian/wetland habitats of Apanolio Canyon are described as follows:

The project area in Apanolio Canyon contains 3.46 acres classified as wetlands by the COE. The riparian/wetland corridor straddles Apanolio Creek with an average flow of 0.1 cfs. The overstory is a dense closed stand of red alder. The understory is comprised of dense riparian/wetland ground cover.

Tables B-15 through B-23 evaluate the present and future riparian/ wetland habitat in Apanolio Canyon and the proposed mitigation projects.

A brief description of the upland habitat of Apanolio canyon includes the following:

The project area in Apanolio Canyon contains 231 acres of coastal scrub brushland. This habitat is comprised of over-mature coastal scrub. An additional 43 acres of upland habitat are classified as coastal scrub with scattered Douglas-fir.

Tables B-24, B-25, B-26, B-27 and B-28 evaluate the present and future upland coastal scrub and Douglas-fir habitat in Apanolio Canyon and the proposed mitigation projects.

Tables B-26 and B-27 evaluate the upland chaparral burning and the upland spring development programs. The burning program will be completed before the spring development projects. Therefore, the beginning or present value of the upland springs habitat should be evaluated as completed burn habitat. Burning will have direct effect on each acre burned. Upland spring development will effect not only the actual wetted area but change the wildlife values for the surrounding area. The territorial ranges (Verner & Boss 1980) for the target species is 0.25 acres to 897 acres. This evaluation utilizes a 100 acre average impact area for habitat evaluation purposes.

Comparing present HVUs to post project HVUs the following assumptions were made. 1) All areas cleared for landfill operations will lose all habitat values. These areas will have a future rating of "0". 2) Without the project the future habitat values would not change.

March 22, 1989

Net Project Habitat Value

To determine the habitat value ratings for the project, an in-depth analysis was completed. Clearing limits were determined to calculate the acres of habitat removed over time by the project. Utilizing the fill elevations, the clearing limits were plotted on topographic maps and each area planimetered to determine the total cumulative area cleared during project life.

Each habitat type required a different method of measurement. Fisheries were measured by the length of stream containing fisheries. The length of the Apanolio Creek and Los Trancos fisheries were measured in the field. All other fishery lengths were measured from topographic maps.

Riparian/wetland habitats were measured by multiplying the average width of a riparian/wetland area by the total length. These widths were taken by actual measurements during field surveys (HLA 1986 and 1988 wetlands assessments). Riparian/wetland corridor lengths were measured from topographic maps. The maps used in this study were either orthotopographic maps or topographic maps with treelines indicated.

Areas outside of the riparian/wetland zones except the Douglas-fir forest were considered upland. The Douglas-fir forest area is 43 acres (DEIS 1988).

Using the HVU system and multiplying the acres of habitat or length of fishery by the HVU per unit area, the total HVUs were determined. The total project area HVUs is the baseline of 100 percent. Using the clearing area data and converting areas removed to HVUs removed, the loss of HVUs over time was calculated. This value was converted to percent of the baseline values by dividing the removed HVUs by the total project area HVUs for each habitat type.

All mitigation projects were then grouped by habitat type (Table B-7). These values were converted to percent of the baseline values and were prorated over the time it will take to achieve full value for each project and removal. Net values were determined as follows: Net HVU equals existing HVU plus replacement HVU minus lost HVU (Figures B-31, to B-35).

FOOD AND HABITAT REQUIREMENTS

FOR SELECTED FISH AND WILDLIFE SPECIES

SPECIES NUMBER	SPECIES	HABITAT DESCRIPTION	FOOD	HABITAT TYPE
Aquatic Species				
1	rainbow trout	riffle habitat in cold freshwater streams	insects	cold water stream
2	steelhead	riffle habitat in coastal streams	insects	anadromous coastal fishery
3	sculpin	fast water riffle areas in coastal streams	aquatic insects	freshwater fishery
Amphibians				
4	Pacific treefrog	ponds, lakes, streams, or rivers for breeding	insects	riparian
5	red-legged frog	quiet pools; at least 3 feet deep	insects	riparian
6	rough-skinned newt	ponds, lakes and streams	insects aquatic anthropods	wetland riparian upland
Reptiles				
7	western terrestrial garter snake	permanent streams, rivers ponds, or lakes for feeding	tadpoles, frogs, & fish	riparian, brush
8	gopher snake	Chaparral and riparian deciduous	small mammals (squirrels, mice, gophers, and others)	brush woodland, grassland
Small Mammals				
9	deer mouse	woodland, grassland and brushland	seeds, fruits and nuts	upland grassland woodland
10	dusky-footed woodrat	trees/shrubs; litter for building houses	acorns, fruit, seeds, grasses, forbs, & fungi	upland riparian, woodland

TABLE B-1

RALPH OSTERLING CONSULTANTS, INC

SPECIES NUMBER	SPECIES	HABITAT DESCRIPTION	FOOD	HABITAT TYPE
11	raccoon	suitable den sites and water; found in all habitats generally associated with riparian or wetland areas	crayfish, fish, frogs, small mammals, fruit, seeds, acorns, insects, trash	riparian, woodland
Large Mammals				
12	deer	forests, brushlands, and wooded river bottoms	forbs, green grass, and browse	brush, grassland, woodland
13	mountain lion	suitable dens sites in rock crevices or caves; deer for food	deer, porcupines, rabbits, and rodents	woodland wetland upland riparian
Songbirds				
14	chickadees warblers flycatchers	river groves, willows, poplars, orchards and roadsides.	seeds	woodlands upland riparian wetlands
15	California quail	brush/seedling/sapling stage coastal scrub & mixed chaparral; ranges from annual grasslands through oak woodlands in open-canopied situations	green vegetation, seeds, insects	brush, grassland, woodland
Raptor				
16	great horned owl	oak savannah to mixed conifer	small to medium-sized mammals, small birds, insects amphibians, and reptiles	brush, grassland, riparian, woodland
17	red-tailed hawk Cooper hawk Sharp shinned hawk	large trees or cliffs for nesting and roosting; large openings for foraging; found in most successional stages	small mammals, reptiles	woodland, grassland

HLA DEIS 1988
Verner and Boss. 1980
McGinnis, 1984
Leopold, 1981
Bailey, 1988

TABLE B-1 CONTINUED

RALPH OSTERLING CONSULTANTS, INC.

RELATIVE HABITAT COMPARISONS

FISHERIES

RATING	DESCRIPTION	SPAWNING GRAVELS	COVER OR SHELTER	FOOD PRODUCTION	UPSTREAM ACCESS
0	NO HABITAT	100% SILT	NO COVER	NO FLOW	NO FISH PASSAGE
1-3	POOR HABITAT	>20% SILTS	<50% SHADE <5% COVER NO WOODY PLANTS	<10% RIFFLES	2 YEARS OUT OF 5 ONLY DURING FLOOD FLOWS
4-6	FAIR HABITAT	15 - 20% SILTS	50% SHADE 5 - 10% COVER WOODY PLANTS	10 - 30% RIFFLES	5 OUT OF TEN YEARS 50% OF THE WINTER
7-9	GOOD HABITAT	10 - 15% SILTS	70% SHADE 10 - 20% COVER WOODY PLANTS	30 - 50% RIFFLES	FISH ACCESS MOST OF THE TIME WITH NORMAL FLOWS
10	OPTIMUM HABITAT	<10% SILT	80% SHADE >20% COVER DIVERSE VEGETATION	>50% RIFFLES	PASSAGE 100% OF THE TIME
EVALUATION CRITERIA:		SILT CONTENT	SHADE INSTREAM COVER VEGETATION CONTENT	RIFFLE CONTENT	ANNUAL ACCESS ACCESS LENGTH

TARGET SPECIES: 1,2,3
(SEE TABLE B-1)

TABLE B-2

RELATIVE HABITAT COMPARISONS
RIPARIAN/WETLAND

RATING	DESCRIPTION	CRITERIA	AMPHIBIAN	REPTILES	SMALL MAMMALS	LARGE MAMMALS	SONGBIRDS	RAPTORS
0	NO HABITAT		NO HABITAT	NO HABITAT	NO HABITAT	NO HABITAT	NO HABITAT	NO HABITAT
1-3	POOR HABITAT	FOOD	NONE	NONE	FAIR	NONE	NONE	NONE
		WATER	STORM FLOW	SEASONAL	STORM FLOW	STORM FLOW	STORM FLOW	STORM FLOW
		COVER	NONE	NONE	NONE	NONE	NONE	HEAVY
4-6	FAIR HABITAT	FOOD	POOR	POOR	FAIR	SCARCE	SCARCE	SCARCE
		WATER	SEASONAL	SEASONAL	SEASONAL	SEASONAL	SEASONAL	SEASONAL
		COVER	POOR	POOR	FAIR	POOR	FAIR	MEDIUM
7-9	GOOD HABITAT	FOOD	MEDIUM	MEDIUM	MEDIUM	FAIR	MEDIUM	ABUNDANT
		WATER	PERENNIAL	SEASONAL	PERENNIAL	PERENNIAL	PERENNIAL	SEASONAL
		COVER	FAIR	FAIR	MEDIUM	EDGE	MEDIUM	FAIR
10	OPTIMUM HABITAT	FOOD	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT
		WATER	PERENNIAL	SEASONAL	PERENNIAL	PERENNIAL	PERENNIAL	SEASONAL
		COVER	FULL	FULL	FULL	EDGE	FULL	OPEN
TARGET SPECIES (SEE TABLE B-1)			4,5,6	7,8	9,10,11	12,13	14	16,17

TABLE B-3

RELATIVE HABITAT COMPARISONS
UPLAND CHAPPAREL

RATING	DESCRIPTION	CRITERIA	AMPHIBIAN	REPTILES	SMALL MAMMALS	LARGE MAMMALS	SONGBIRDS	RAPTORS
0	NO HABITAT		NO HABITAT	NO HABITAT	NO HABITAT	NO HABITAT	NO HABITAT	NO HABITAT
1-3	POOR HABITAT	WATER	SCARCE	NONE	NONE	NONE	NONE	NONE
		FOOD	SCARCE	SCARCE	SCARCE	SCARCE	SCARCE	SCARCE
		COVER	NONE	NONE	NONE	NONE	NONE	HEAVY
4-6	FAIR HABITAT	WATER	NEARBY	NEARBY	NEARBY	NEARBY	NEARBY	SCARCE
		FOOD	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM
		COVER	POOR	POOR	POOR	POOR	POOR	MEDIUM
7-9	GOOD HABITAT	WATER	CLOSE	NEARBY	NEARBY	NEARBY	NEARBY	NEARBY
		FOOD	ABUNDANT	ABUNDANT	ABUNDANT	MEDIUM	MEDIUM	MEDIUM
		COVER	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
10	OPTIMUM HABITAT	WATER	ABUNDANT	NEARBY	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT
		FOOD	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT
		COVER	MEDIUM	HEAVY	HEAVY	MEDIUM	HEAVY	OPEN
TARGET SPECIES (SEE TABLE B-1)			4,6	7,8	9,10	12,13	14,15	16,17

TABLE B-4

RALPH OSTERLING
& CONSULTANTS, INC

RELATIVE HABITAT COMPARISONS
DOUGLAS FIR

RATING	DESCRIPTION	CRITERIA	AMPHIBIAN	REPTILES	SMALL MAMMALS	LARGE MAMMALS	SONGBIRDS	RAPTORS
0	NO HABITAT		NO HABITAT	NO HABITAT	NO HABITAT	NO HABITAT	NO HABITAT	NO HABITAT
1-3	POOR HABITAT	WATER	SCARCE	NONE	NONE	NONE	NONE	NONE
		FOOD	SCARCE	SCARCE	SCARCE	SCARCE	SCARCE	SCARCE
		COVER	POOR	POOR	POOR	NONE	NONE	HEAVY
4-6	FAIR HABITAT	WATER	NEARBY	SCARCE	SCARCE	SCARCE	SCARCE	SCARCE
		FOOD	MEDIUM	MEDIUM	POOR	SCARCE	POOR	POOR
		COVER	MEDIUM	POOR	MEDIUM	POOR	POOR	MEDIUM
7-9	GOOD HABITAT	WATER	CLOSE	NEARBY	MEDIUM	NEARBY	POOR	SCARCE
		FOOD	ABUNDANT	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM
		COVER	MEDIUM	MEDIUM	MEDIUM	EDGE	MEDIUM	POOR
10	OPTIMUM HABITAT	WATER	ABUNDANT	NEARBY	ABUNDANT	NEARBY	MEDIUM	NEARBY
		FOOD	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT
		COVER	HEAVY	HEAVY	MEDIUM	EDGE	ABUNDANT	OPEN
TARGET SPECIES (SEE TABLE B-1)			4,6	7,8	9,10	12,13	14,15	16,17

TABLE B-5

RELATIVE HABITAT COMPARISONS
GRASSLAND

RATING	DESCRIPTION	CRITERIA	AMPHIBIAN	REPTILES	SMALL MAMMALS	LARGE MAMMALS	SONGBIRDS	RAPTORS
0	NO HABITAT		NO HABITAT	NO HABITAT	NO HABITAT	NO HABITAT	NO HABITAT	NO HABITAT
1-3	POOR HABITAT	WATER	NEARBY	NONE	NEARBY	NEARBY	NEARBY	SCARCE
		FOOD	SCARCE	SCARCE	SCARCE	SCARCE	SCARCE	SCARCE
		COVER	POOR	POOR	POOR	NONE	NONE	HEAVY
4-6	FAIR HABITAT	WATER	SEASONAL	SCARCE	SEASONAL	NEARBY	SEASONAL	SCARCE
		FOOD	MEDIUM	MEDIUM	POOR	MEDIUM	MEDIUM	POOR
		COVER	MEDIUM	POOR	MEDIUM	POOR	POOR	MEDIUM
7-9	GOOD HABITAT	WATER	PERENNIAL	NEARBY	PERENNIAL	NEARBY	PERENNIAL	SCARCE
		FOOD	ABUNDANT	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM
		COVER	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	POOR
10	OPTIMUM HABITAT	WATER	PERENNIAL	NEARBY	PERENNIAL	NEARBY	PERENNIAL	NEARBY
		FOOD	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT	ABUNDANT
		COVER	HEAVY	HEAVY	HEAVY	EDGE	ABUNDANT	OPEN
TARGET SPECIES (SEE TABLE B-1)			4,6	7,8	9,10,11	12,13	14,15	16,17

TABLE B-6

RALPH OSTERLING
CONSULTANTS INC

HABITAT VALUE COMPARISON SUMMARY

	FISHERY	RIPARIAN/ WETLANDS	UPLAND CHAP.	UPLAND DF	GRASSLAND
HABITAT VALUE UNITS REMOVED BY CONSTRUCTION	(27.89)	(94.60)	(1,155.00)	(243.67)	.00
MITIGATION PROJECT:					
1 PILARCITOS CK. STREAMBANK RESTORATION	3.60	1.36			
2 LOW FLOW BARRIER ON PILARCITOS CK.	27.00				
3 APANOLIO CREEK HABITAT IMPROVEMENT	2.24				
4 PLANT APANOLIO PONDS		4.65			
5 BURN PROGRAM			1,050.00		
6 DEVELOP UPLAND SPRINGS		4.50	500.00		
7 DOUGLAS FIR PLANTING				308.17	
8 APANOLIO GRASSLAND CREATION					2232.50
9 CORINDA LOS TRANCOS WILDLIFE AND STORAGE PONDS		.00			
10 CORINDA LOS TRANCOS CORRIDORS		92.66			
11 CORINDA LOS TRANCOS CREEK RESTORATION	35.10	5.05			
12 CORINDA LOS TRANCOS ABOVE NEW PONDS		1.74			
13 CORINDA LOS TRANCOS UPPER POND		.71			
14 CORINDA LOS TRANCOS DITCH REVEGETATION			1.37		
15 ARROYO DE LEON FISH PASSAGE	27.00				
16 SAN PEDRO CREEK FISH PASSAGE	10.50				
TOTAL RECOVERED	105.44	110.67	1,551.37	308.17	2,232.50
NET GAIN	77.55	16.07	396.37	64.50	2,232.50
NET GAIN IN PERCENT	278.00	16.99	34.32	26.47	100.00

ALL VALUES ARE IN HABITAT VALUE UNITS

TABLE B-7

HABITAT VALUE COMPARISON FOR SALMO GAIRDNERI

LOCATION: APANOLIO CREEK LOST TO CONTRUCTION

TIME TO COMPLETE 5
STREAM LENGTH: 4649

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
SPAWNING GRAVELS	3	0
COVER OR SHELTER	3	0
FOOD PRODUCTION	8	0
UPSTREAM ACCESS	10	0
AVERAGE VALUE	6	0
GAIN OR (LOSS)		(6.00)
GAIN OR (LOSS) IN HABITAT UNITS		(27.89)

TABLE B-8

HABITAT VALUE COMPARISON FOR SALMO GAIRDNERI

LOCATION: APANOLIO CREEK BELOW SEDIMENT POND ON BFI LANDS

TIME TO COMPLETE 1
STREAM LENGTH: 640

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
SPAWNING GRAVELS	3	9
COVER OR SHELTER	3	10
FOOD PRODUCTION	9	10
UPSTREAM ACCESS	2	2
AVERAGE VALUE	4.25	7.75
GAIN OR (LOSS)		3.50
GAIN OR (LOSS) IN HABITAT UNITS		2.24

TABLE B-9

HABITAT VALUE COMPARISON FOR SALMO GAIRDNERI

LOCATION: UPPER PILARCITOS CREEK WITH 92 CROSSING PROJECT

TIME TC COMPLETE 1
STREAM LENGTH: 18000

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
SPAWNING GRAVELS	3	3
COVER OR SHELTER	6	6
FOOD PRODUCTION	7	7
UPSTREAM ACCESS	4	10
AVERAGE VALUE	5	6.50
GAIN OR (LOSS)		1.50
GAIN OR (LOSS) IN HABITAT UNITS		27.00

TABLE B-10

HABITAT VALUE COMPARISON FOR SALMO GAIRDNERI

LOCATION: PILARCITOS CREEK STREAMBANK REVEGETATION

TIME TO COMPLETE 5
STREAM LENGTH: 1600

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
SPAWNING GRAVELS	2	2
COVER OR SHELTER	2	7
FOOD PRODUCTION	4	8
UPSTREAM ACCESS	10	10
AVERAGE VALUE	4.50	6.75
GAIN OR (LOSS)		2.25
GAIN OR (LOSS) IN HABITAT UNITS		3.60

TABLE B-11

HABITAT VALUE COMPARISON FOR SALMO GAIRDNERI

LOCATION: CORINDA LOS TRANCOS CREEK STREAM RESTORATION

TIME TO COMPLETE 3
STREAM LENGTH: 7800

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
SPAWNING GRAVELS	1	8
COVER OR SHELTER	5	10
FOOD PRODUCTION	2	8
UPSTREAM ACCESS	9	9
AVERAGE VALUE	4.25	8.75
GAIN OR (LOSS)		4.50
GAIN OR (LOSS) IN HABITAT UNITS		35.10

TABLE B-12

HABITAT VALUE COMPARISON FOR SALMO GAIRDNERI

LOCATION: SAN PEDRO CREEK AT ADOBE ST. CROSSING PROJECT

TIME TO COMPLETE 1
STREAM LENGTH: 7000

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
SPAWNING GRAVELS	6	6
COVER OR SHELTER	2	2
FOOD PRODUCTION	8	8
UPSTREAM ACCESS	4	10
AVERAGE VALUE	5	6.50
GAIN OR (LOSS)		1.50
GAIN OR (LOSS) IN HABITAT UNITS		10.50

TABLE B-13

HABITAT VALUE COMPARISON FOR SALMO GAIRDNERI

LOCATION: ARROYO LEON CULVERT INLET MODIFICATION

TIME TO COMPLETE 1
STREAM LENGTH: 18000

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
SPAWNING GRAVELS	6	6
COVER OR SHELTER	8	8
FOOD PRODUCTION	6	6
UPSTREAM ACCESS	4	10
AVERAGE VALUE	6	7.50
GAIN OR (LOSS)		1.50
GAIN OR (LOSS) IN HABITAT UNITS		27.00

TABLE B-14

HABITAT VALUE COMPARISON FOR RIPARIAN/WETLANDS

LOCATION: APANOLIO LOST TO CONSTRUCTION

TIME TO COMPLETE 10
AREA (ACRES) 11

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	10	0
SMALL MAMMALS	9	0
LARGE MAMMALS	8	0
SONG BIRDS	10	0
RAPTORS	6	0
AVERAGE VALUE	8.60	0
GAIN OR (LOSS)		(8.60)
GAIN OR (LOSS) IN HABITAT UNITS		(94.60)

TABLE B-15

HABITAT VALUE COMPARISON FOR RIPARIAN/WETLANDS

LOCATION: APANOLIO SEDIMENT POND

TIME TO COMPLETE 10
AREA (ACRES) .75

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	0	8
SMALL MAMMALS	0	7
LARGE MAMMALS	0	6
SONG BIRDS	0	6
RAPTORS	0	4
AVERAGE VALUE	0	6.20
GAIN OR (LOSS)		6.20
GAIN OR (LOSS) IN HABITAT UNITS		4.65

TABLE B-16

HABITAT VALUE COMPARISON FOR RIPARIAN/WETLANDS

LOCATION: PILARCITOS CREEK REVEGETATION

TIME TO COMPLETE 10
AREA (ACRES) .34

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	4	10
REPTILES	4	9
SMALL MAMMALS	4	9
LARGE MAMMALS	4	9
SONG BIRDS	3	9
RAPTORS	8	5
AVERAGE VALUE	4.50	8.50
GAIN OR (LOSS)		4.00
GAIN OR (LOSS) IN HABITAT UNITS		1.36

TABLE B-17

HABITAT VALUE COMPARISON FOR RIPARIAN/WETLANDS

LOCATION: NEW SCARPERS PEAK UPLAND POND

TIME TO COMPLETE 15
AREA (ACRES) .75

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	0	6
SMALL MAMMALS	0	6
LARGE MAMMALS	0	7
SONG BIRDS	0	6
RAPTORS	0	5
AVERAGE VALUE	0	6
GAIN OR (LOSS)		6.00
GAIN OR (LOSS) IN HABITAT UNITS		4.50

TABLE B-18

HABITAT VALUE COMPARISON FOR RIPARIAN/WETLANDS

LOCATION: CORINDA LOS TRANCOS STORAGE PONDS

TIME TO COMPLETE 10
AREA (ACRES) 0

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	0	10
SMALL MAMMALS	0	9
LARGE MAMMALS	0	9
SONG BIRDS	0	9
RAPTORS	0	4
AVERAGE VALUE	0	8.20
GAIN OR (LOSS)		8.20
GAIN OR (LOSS) IN HABITAT UNITS		.00

TABLE B-19

HABITAT VALUE COMPARISON FOR RIPARIAN/WETLANDS

LOCATION: CORINDA LOS TRANCOS RIPARIAN/WETLAND CORRIDORS (ALL)

TIME TO COMPLETE 10
AREA (ACRES) 11.30

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	0	10
SMALL MAMMALS	0	9
LARGE MAMMALS	0	9
SONG BIRDS	0	9
RAPTORS	0	4
AVERAGE VALUE	0	8.20
GAIN OR (LOSS)		8.20
GAIN OR (LOSS) IN HABITAT UNITS		92.66

TABLE B-20

HABITAT VALUE COMPARISON FOR RIPARIAN/WETLAND AREAS

LOCATION: CORINDA LOS TRANCOS CREEK RESTORATION

TIME TO COMPLETE 10
AREA (ACRES) 3.03

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	7	10
REPTILES	7	9
SMALL MAMMALS	8	9
LARGE MAMMALS	7	8
SONG BIRDS	7	10
RAPTORS	4	4
AVERAGE VALUE	6.67	8.33
GAIN OR (LOSS)		1.67
GAIN OR (LOSS) IN HABITAT UNITS		5.05

TABLE B-21

HABITAT VALUE COMPARISON FOR RIPARIAN/WETLANDS

LOCATION: CORINDA LOS TRANCOS CREEK ABOVE PROPOSED WATER DIVERSION

TIME TO COMPLETE 10
AREA (ACRES) .87

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	4	6
REPTILES	5	7
SMALL MAMMALS	4	6
LARGE MAMMALS	4	6
SONG BIRDS	5	9
RAPTORS	4	4
AVERAGE VALUE	4.33	6.33
GAIN OR (LOSS)		2.00
GAIN OR (LOSS) IN HABITAT UNITS		1.74

TABLE B-22

HABITAT VALUE COMPARISON FOR RIPARIAN/WETLAND AREAS

LOCATION: EXISTING UPPER CORINDA LOS TRANCOS POND

TIME TO COMPLETE 10
AREA (ACRES) .25

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	6	9
REPTILES	5	9
SMALL MAMMALS	5	8
LARGE MAMMALS	5	8
SONG BIRDS	3	9
RAPTORS	7	5
AVGERAGE VALUE	5.17	8
GAIN OR (LOSS)		2.83
GAIN OR (LOSS) IN HABITAT UNITS		.71

TABLE B-23

RALPH OSTERLING
CONSULTANTS, INC.

HABITAT VALUE COMPARISON FOR UPLANDS

LOCATION: APANOLIO UPLAND CHAPARRAL LOST TO CONSTRUCTION	TIME TO COMPLETE	90
	AREA (ACRES)	231

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	4	0
REPTILES	7	0
SMALL MAMMALS	5	0
LARGE MAMMALS	5	0
SONG BIRDS	5	0
RAPTORS	4	0
AVERAGE VALUE	5	0
GAIN OR (LOSS)		(5.00)
GAIN OR (LOSS) IN HABITAT UNITS		(1,155.00)

TABLE B-24

HABITAT VALUE COMPARISON FOR UPLANDS

LOCATION: APANOLIO UPLAND DOUGLAS FIR LOST TO CONSTRUCTION	TIME TO COMPLETE	40
	AREA (ACRES)	43

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	5	0
REPTILES	7	0
SMALL MAMMALS	5	0
LARGE MAMMALS	6	0
SONG BIRDS	6	0
RAPTORS	5	0
AVERAGE VALUE	5.67	0
GAIN OR (LOSS)		(5.67)
GAIN OR (LOSS) IN HABITAT UNITS		(243.67)

TABLE B-25

HABITAT VALUE COMPARISON FOR UPLANDS

LOCATION: UPLAND CHAPARRAL BURN PROGRAM

TIME TO COMPLETE 20
AREA (ACRES) 525

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	4	4
REPTILES	7	6
SMALL MAMMALS	5	6
LARGE MAMMALS	5	8
SONG BIRDS	5	8
RAPTORS	4	10
AVERAGE VALUE	5	7
GAIN OR (LOSS)		2.00
GAIN OR (LOSS) IN HABITAT UNITS		1,050.00

TABLE B-26

HABITAT VALUE COMPARISON FOR UPLANDS

LOCATION: UPLAND SPRINGS DEVELOPMENT

TIME TO COMPLETE 30
AREA (ACRES) 600

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	4	5
REPTILES	6	7
SMALL MAMMALS	6	7
LARGE MAMMALS	8	10
SONG BIRDS	8	8
RAPTORS	10	10
AVERAGE VALUE	7	7.83
GAIN OR (LOSS)		.83
GAIN OR (LOSS) IN HABITAT UNITS		500.00

TABLE B-27

HABITAT VALUE COMPARISON FOR UPLANDS

LOCATION: APANOLIO UPLAND DOUGLAS FIR PLANTING	TIME TO COMPLETE 50
	AREA (ACRES) 43

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	0	3
REPTILES	0	6
SMALL MAMMALS	0	6
LARGE MAMMALS	0	9
SONG BIRDS	0	9
RAPTORS	0	10
AVERAGE VALUE	0	7.17
GAIN OR (LOSS)		7.17
GAIN OR (LOSS) IN HABITAT UNITS		308.17

TABLE B-28

HABITAT VALUE COMPARISON FOR UPLANDS

LOCATION: APANOLIO UPLAND GRASSLAND	TIME TO COMPLETE 100
	AREA (ACRES) 285

HABITAT EVALUATION FACTORS	PRESENT VALUE	FUTURE VALUE
AMPHIBIANS	0	3
REPTILES	0	9
SMALL MAMMALS	0	9
LARGE MAMMALS	0	9
SONG BIRDS	0	9
RAPTORS	0	8
AVERAGE VALUE	0	7.83
GAIN OR (LOSS)		7.83
GAIN OR (LOSS) IN HABITAT UNITS		2,232.50

TABLE B-29

HABITAT VALUE COMPARISON FOR UPLANDS

LOCATION: CORINDA LOS TRANCOS DITCH REVEGETATION		TIME TO COMPLETE	10
		AREA (ACRES)	.20

HABITAT EVALUATION FACTORS	PRESENT CONDITION	FUTURE CONDITION
AMPHIBIANS	0	5
REPTILES	0	9
SMALL MAMMALS	0	8
LARGE MAMMALS	0	7
SONG BIRDS	0	8
RAPTORS	0	4
AVERAGE VALUE	0	6.83
GAIN OR (LOSS)		6.83
GAIN OR (LOSS) IN HABITAT UNITS		1.37

TABLE B-30

MITIGATION RESULTS SUMMARY

FISHERY

	FISHERY IN FEET	FISHERY STRUCTURES	BARRIERS REMOVED
HABITAT REMOVED	4649	0	0
MITIGATION PROJECT:			
1 PILARCITOS CK. STREAMBANK RESTORATION	1600		
2 LOW FLOW BARRIER ON PILARCITOS CK.	18000	1	1
3 APANOLIO CREEK HABITAT IMPROVEMENT	640	15	
10 LOS TRANCOS RESTORATION	7800	10	
15 ARROYO DE LEON FISH PASSAGE	18000	1	1
16 SAN PEDRO CREEK FISH PASSAGE	7000	2	2
TOTAL RECOVERED	53040	29	4
NET GAIN	48391	29.00	4.00
NET GAIN IN PERCENT	1,041	100	100

TABLE B-31

MITIGATION RESULTS SUMMARY

RIPARIAN/WETLAND

	RIPARIAN/WETLAND IN ACRES
HABITAT REMOVED	11 *(1)*
MITIGATION PROJECT:	
1 PILARCITOS CK. STREAMBANK RESTORATION	.34
4 PLANT APANOLIO PONDS	1.50
6 DEVELOP UPLAND SPRINGS	.75
9 CORINDA LOS TRANCOS STORAGE PONDS	.00
CORINDA LOS TRANCOS CORRIDORS	11.30
10 CORINDA LOS TRANCOS CREEK RESTORATION	3.03
11 CORINDA LOS TRANCOS ABOVE NEW PONDS	.87
12 CORINDA LOS TRANCOS UPPER POND	.25
TOTAL RECOVERED	18.04
NET GAIN	7.04
NET GAIN IN PERCENT	64.00

ACREAGE OBTAINED FROM HLA 1987 WETLANDS ASSESSMENT OF APANOLIO CANYON AND 1984 EIR

1 ACREAGE OBTAINED FROM 1988 DEIS

TABLE B-32

RALPH OSTERLING & CONSULTANTS, INC.

MITIGATION RESULTS SUMMARY

UPLAND HABITAT

	ACRES		
	CHAP.	D.F. CHAP	GRASSLAND
HABITAT REMOVED (A)	231	43	0
MITIGATION PROJECT:			
5 BURN PROGRAM	525.00		
7 DOUGLAS FIR PLANTING		43.00	
8 APANOLIO GRASSLAND CREATION			285
13 LOS TRANCOS DITCH REVEGETATION		.20	
TOTAL RECOVERED	525.00	43.20	285
NET GAIN	294.00	.20	285
NET GAIN IN PERCENT	127.27	.47	100

A - ALL ACRES REPLACED WILL BENEFIT WILDLIFE

TABLE B-33

HABITAT COMPARISONS
Fisheries

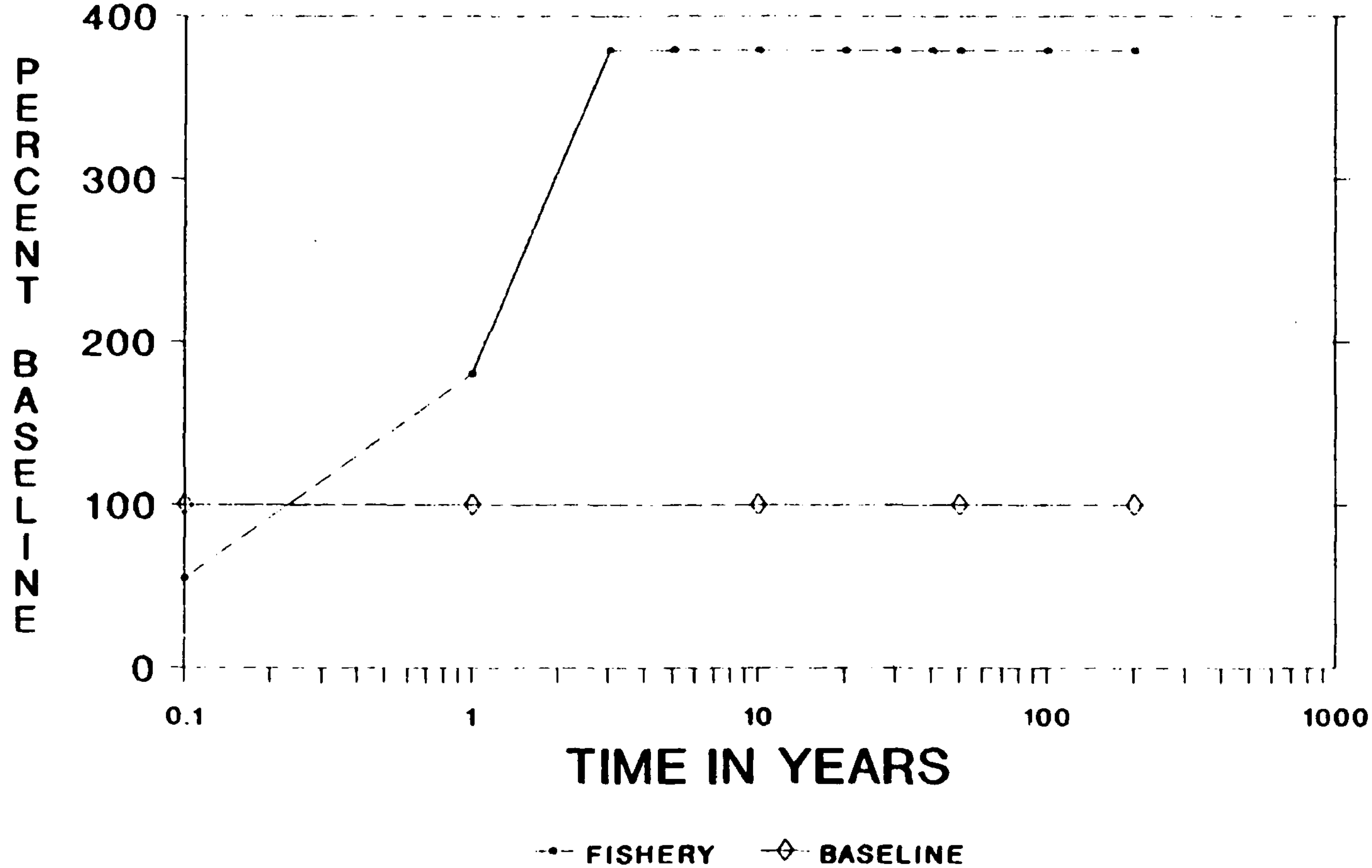


TABLE B-34

RALPH OSTERLING CONSULTANTS, INC.

HABITAT COMPARISONS
Riparian/Wetland
Douglas-fir and Upland

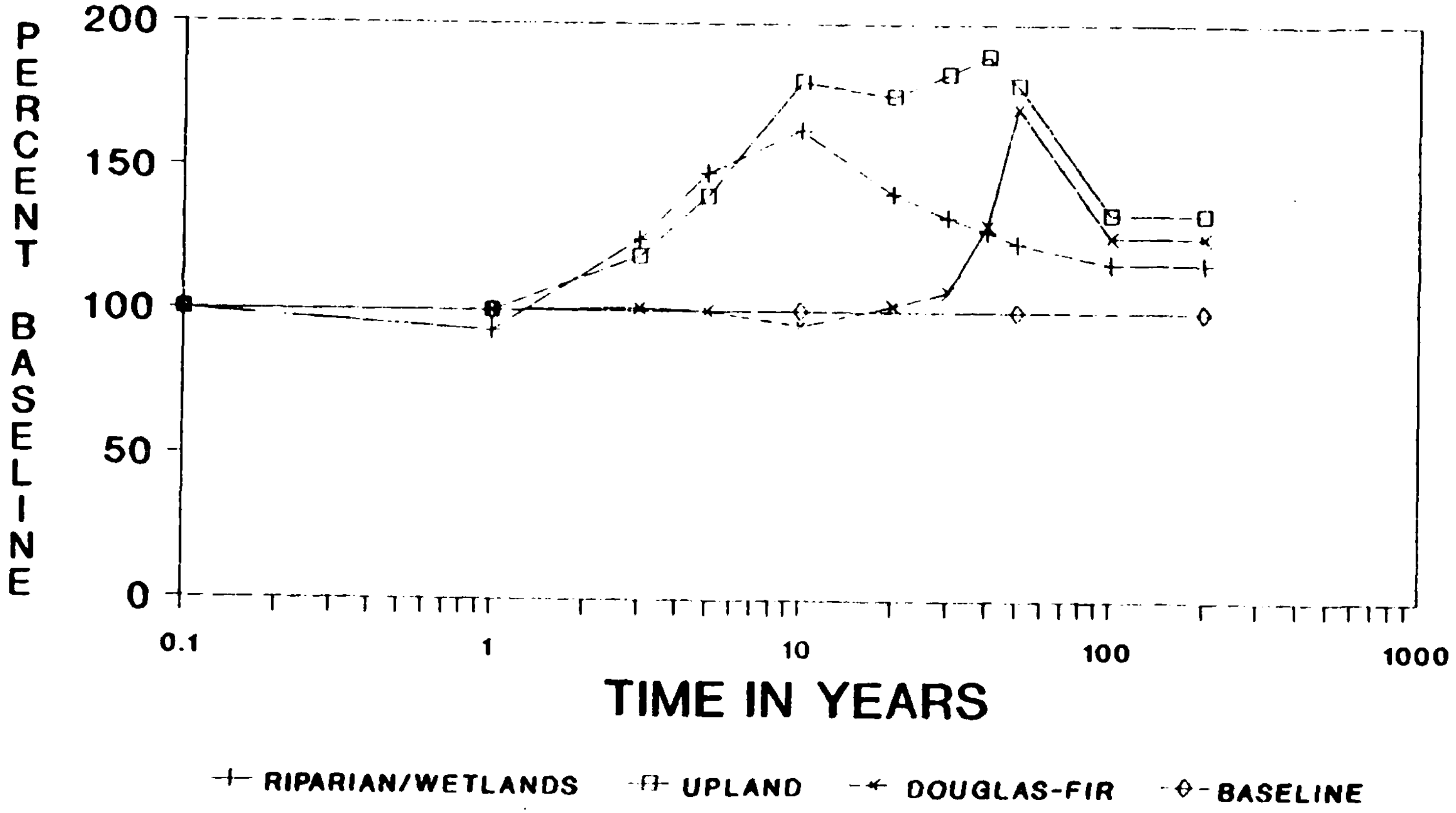


TABLE B-35

RALPH OSTERLING CONSULTANTS INC.

STATE OF CALIFORNIA—THE RESOURCES AGENCY GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF FISH AND GAME
POST OFFICE BOX 47
YOUNTVILLE, CALIFORNIA 94599
(707) xxxxxxx
944-5500

May 5, 1988

Ralph Osterling Consultants, Inc.
1650 Borel Place, Suite #204
San Mateo, CA 94402

Dear Mr. Osterling:

Thank you for the opportunity to comment on the May 4, 1988 report entitled "Wildlife and fisheries Mitigation Plan for Ox Mountain Sanitary Landfill Apanolio Canyon Expansion."

As I stated in my previous letter of January 22, 1988, "these comments are limited to the mitigation plan and are not entended as an endorsement of the proposed project. Further comments on the project will be forthcoming following the Department of Fish and Game (Department) review of the draft EIS and permit actions that may be considered by the U. S. Army Corps of Engineers (Corps), EPA, and the San Francisco Bay Regional Water Quality Control Board. At that time, the Department anticipates that the water dependence and/or alternative analysis and other requirements of these agencies will have been met and the permanent protection of downstream fishery resources from potential project-caused adverse water quality conditions will be guaranteed by the funding, installation, and operation of appropriate waste control and treatment facilities through permit conditions required by these agencies.

With regard to the proposed mitigation for unavoidable impacts to fish and wildlife resources at the project site, the Department's July 7, 1987 correspondence to you stated:

> "Assuming the water dependence and/or alternative analysis requirements of the Corps are met, we will continue to work with BFI to resolve any fish and wildlife resource problems that are involved."
>
> "At the April 27, 1987 meeting convened by the Corps on this project, we were provided with an April 24, 1987 habitat mitigation plan prepared by the applicant's consultant. Most of the proposed measures would resolve long-standing problems for the steelhead fishery within Pilarcitos Creek and adjacent drainages."
>
> "If all the measures can be implemented in a timely manner, we believe the steelhead trout resource of the Pilarcitos Creek drainage and the San Pedro Creek drainage can be markedly improved. This, in turn, would compensate for the projected loss of residualized steelhead trout and rainbow trout and their habitat."

It should be noted that the development of compensation measures has been an ongoing process between the Department and yourself since before January 1987. Several earlier suggestions we made were not incorporated in either plan due to unwilling offsite landowners. As you pointed out in the April 24 plan, "Landowner and governmental agency cooperation is imperative for the successful implementation of this plan. Projects removed from the BFI ownership can only be accomplished with the full cooperation of all involved." Of particular value was the possibility of purchasing riparian water rights so the low summer and fall flows in Apanolio Creek could be increased. Even though this idea appears to be difficult to achieve at this time, we recommend such a mitigation measure be retained in the plan and not be confined to only Apanolio Creek."

The letter also asked that you review additional measures to be combined with those in your December 1987 plan to ensure there is no net loss of acres of fish and wildlife habitat and no net loss of fish and wildlife values.

Review of the May 4, 1988 plan indicates all these additional measures or satisfactory variations of them have been added to the mitigation plan except the issue of instream flows which your report indicates will be reviewed in the EIS by engineering consultants.

I have also reviewed the subjective habitat value comparison methodology that has been used to insure that there will be no net loss of wetlands and/or riparian acreage or wildlife habitat value when the project and proposed mitigation measures are considered together.

I believe this system accurately reflects the biological condition on the areas involved as I have observed them over the last two years.

In summary, assuming measure Number 7 of the January 22, 1988 letter is resolved satisfactorily, I have concluded the May 4, 1988 plan as proposed will ensure there is no net loss of acres of fish and wildlife habitat and no net loss of fish and wildlife values.

Sincerely,

Theodore Wooster

Theodore Wooster
Environmental Services Supervisor
Region 3

TW/sab

APPENDIX C

PLANTING SPECIFICATIONS

RALPH OSTERLING
CONSULTANTS, INC.

March 22, 1989

Erosion Control Seeding and Straw Application

All bare inactive slopes shall be hand seeded or hydroseeded with the following seed mix:

poppy	5%
Blando brome	15%
barley	15%
oats	15%
sweet clover	10%
Burnett	5%
coated rose clover	15%
coated sub clovers	15%
Lana vetch	5%
	100%

Seeding rates will be 60 lbs/acre. Granular fertilizer with a formula of 12-12-12 will be applied at 300 lbs/acre. Where necessary straw will be applied to protect bare areas after regrading. In this case 2000 lbs per acre of straw will be applied evenly over disturbed areas.

Areas designated for hydroseeding shall include 2000 pounds ground wood fiber in place of the 2000 pounds of straw. Soil testing will be completed prior to seeding operations. Should added amendments be required based on these analysis, proper rates shall be applied.

Table C-1

March 22, 1989

Planting Species List

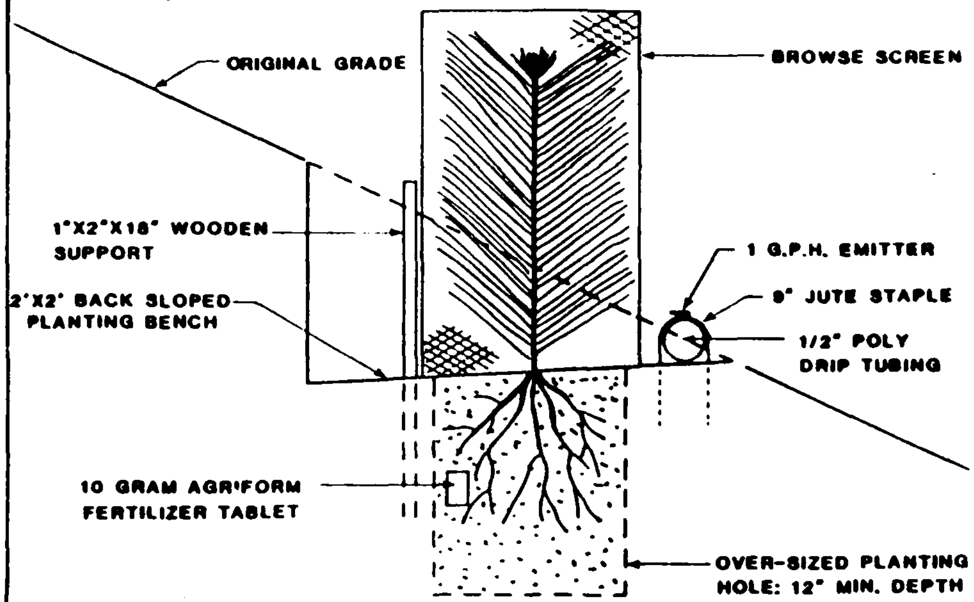
Riparian and Wetland Habitat Planting

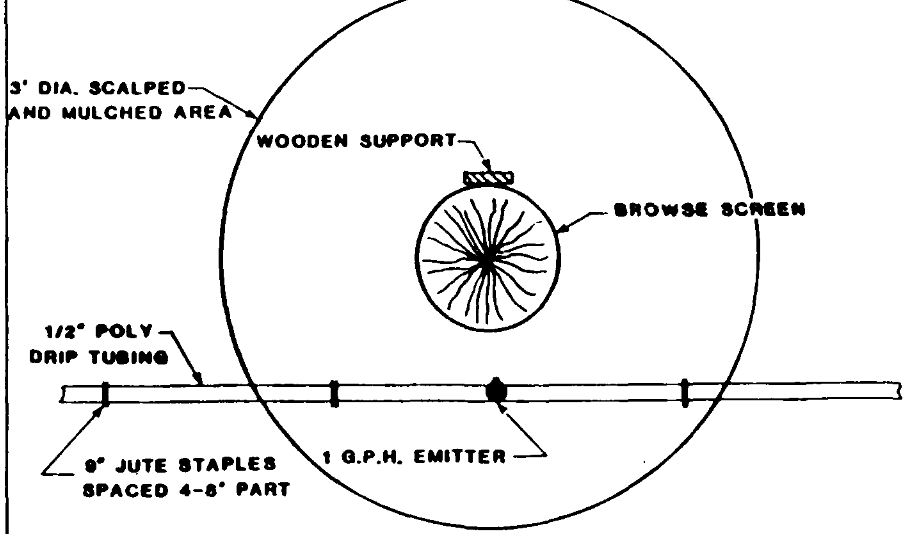
Common Name	Latin Name	Size of Planting Stock
willow	Salix laevigata	cuttings
red alder	Alnus rubra	cuttings or seedlings
big leaf maple	Acer macrophyllum	1 gal. or liner
California hazel	Corylus cornuta	1 gal. or liner
goose-berry	Grossularia sp.	liner
blue blossom	Ceanothus thyrsiflorus	liner
creek dogwood	Cornus californica	liner
giant horsetail	Equisetum telmateia	liner
salmon-berry	Rubus spectabilis	liner

Upland Douglas-fir Planting

Common Name	Latin Name	Size of Planting Stock
Douglas-fir	Psuedotsuga menziesii	1-0 container

Table C-2





Planting techniques will include the following:

1. A minimum 3 foot diameter area around each planting spot will be scalped to bare mineral soil to remove all grass and competing vegetation.

2. A planting bench approximately 2 feet square shall be constructed. The bench will be slightly backsloped to prevent puddling of water around the root collar of the seedling and to act a catchment for rainfall.

3. The seedlings will be planted toward the outer lip of the planting bench. The location of the plant should insure that it will not be inundated by water or buried by soil and rocks moving down slope.

4. The planting hole will be excavated to minimum depth of 12 inches and backfilled with loose friable soil to the proper depth for the planting stock. This will provide a good medium for root growth and infiltration of rainfall and irrigation water.

5. A 10 gram Agriform fertilizer tablet or approved equal shall be placed in each planting hole. The tablet shall be placed to the side of the root wad at approximately one-half of the root depth

6. To reduce weed and grass competition and to conserve soil moisture, each plant will be mulched with asphalt laminated kraft paper, plastic mulch sheets or other suitable material.

Where appropriate, the following drip irrigation specification will be used:

7. One drip irrigation emitter shall be placed 4-6 inches from the plant on the outer edge of the planting bench.

8. The 1/2 inch drip line shall be placed on the outer edge of the planting bench and staked in place with 9 inch jute staples. Staples shall be placed approximately every 4 to 8 feet apart.

9. Sufficient slack shall be left in the 1/2 inch drip line to allow for thermal expansion and contraction.

10. A "Y" type filter with a 250 mesh screen will be used to filter all irrigation water.

TREE PLANTING DETAIL

(NOT TO SCALE)

FIGURE C-3

RALPH OSTERLING
II CONSULTANTS inc
PHONE (415) 573 8713
1650 BOREL PLACE
SAN MATEO CA 94402

March 22, 1989

TREE PLANTING SPECIFICATIONS

All tree planting will be done according to the following specifications:

1) A minimum 3 foot diameter area around each planting spot will be scalped to bare mineral soil to remove all grass and competing vegetation.

2) A planting bench approximately 2 feet square shall be constructed. The bench will be slightly backsloped to prevent puddling of water around the root collar of the seedling and to act as a catchment for rainfall.

3) The seedlings or seed spots will be planted toward the outer lip of the planting bench. The location of the plant should insure that it will not be inundated by water or buried by soil and rocks moving downslope.

4) The planting hole will be excavated to a minimum depth of 12 inches and backfilled with loose friable soil to the proper depth for the planting stock. This will provide a good medium for root growth and infiltration of rainfall.

5) A 10 gram Agriform fertilizer tablet or approved equal shall be placed to the side of the root wad at approximately one-half of the root depth.

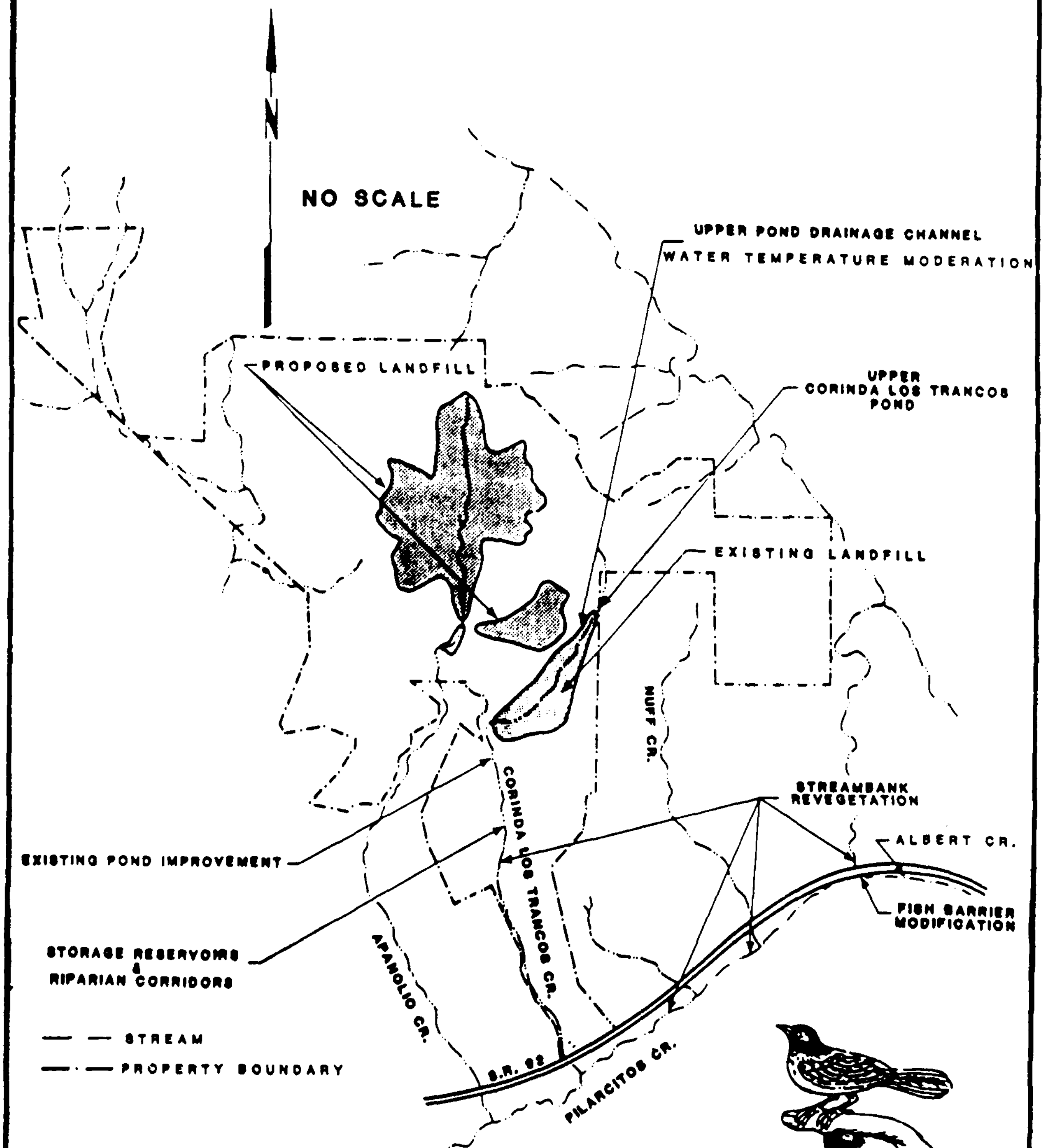
6) A mulching material will be placed around each plant to retard weed growth and conserve soil moisture. Mulching material may consist of asphalt laminated kraft paper, plastic sheets or other appropriate material. Mulching may be deleted when planting within the normally wet areas around ponds and watercourses.

7) Each plant will be provided with browse protection. Screening material shall be either Vexar seedling protectors or aluminum mesh screen.

See Figure C-3 for planting details and dimensions.

APPENDIX D

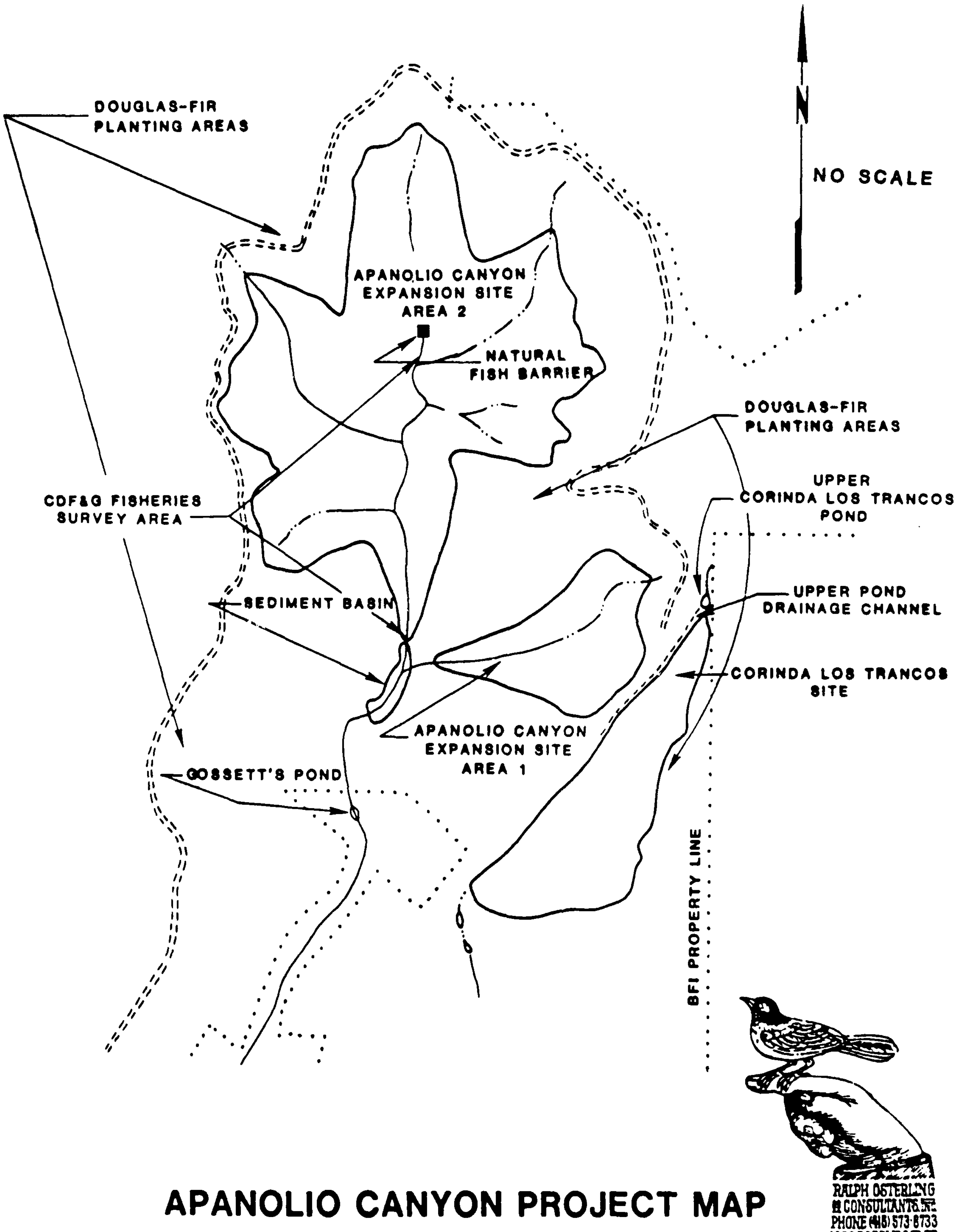
MAPS



PILARCITOS WATERSHED RIPARIAN MITIGATION PROJECTS

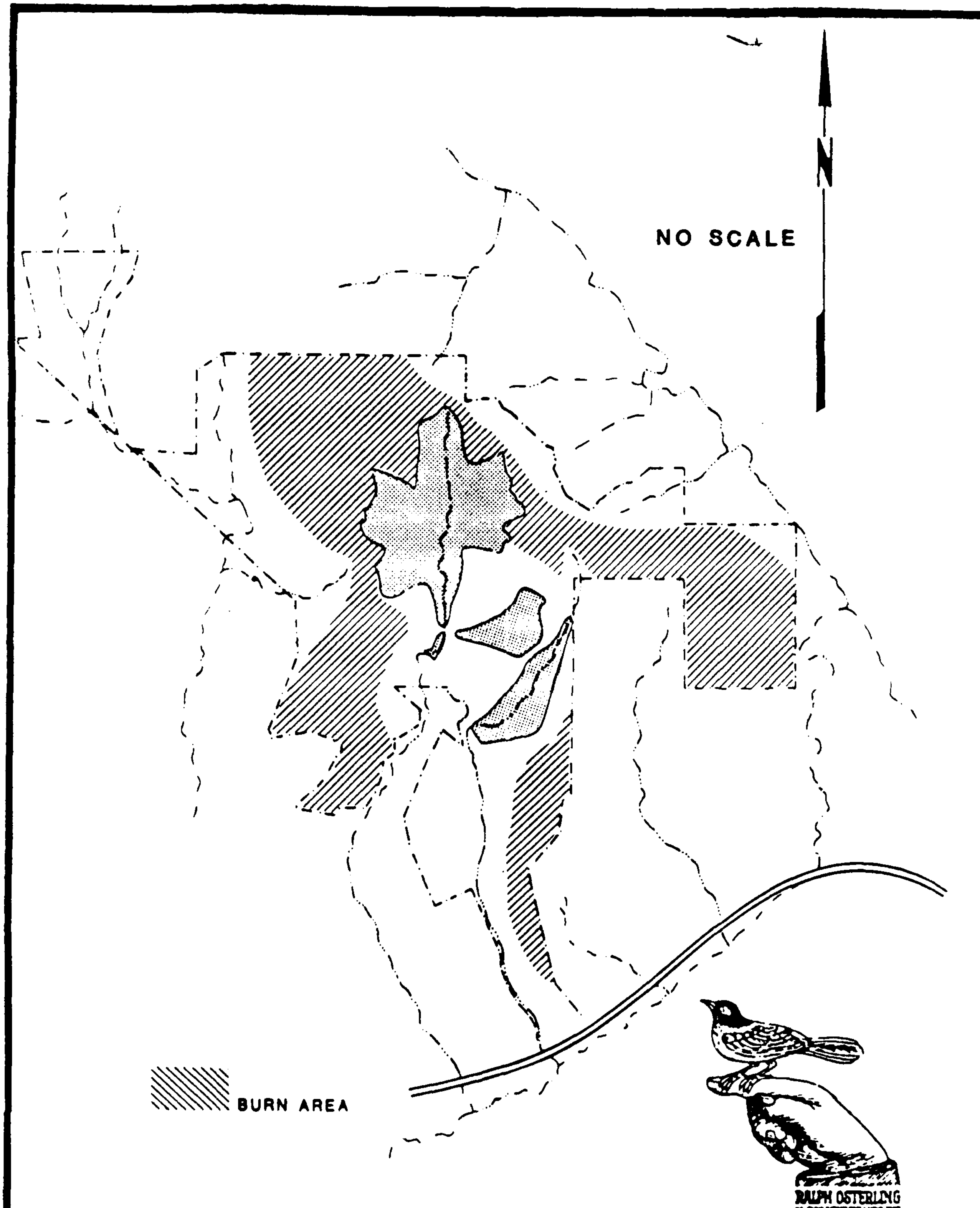
MAP D-1

RALPH OSTERLING
CONSULTANTS, INC.
PHONE (415) 573-8733
1650 BOREL PLACE
SAN MATEO, CA 94402



APANOLIO CANYON PROJECT MAP

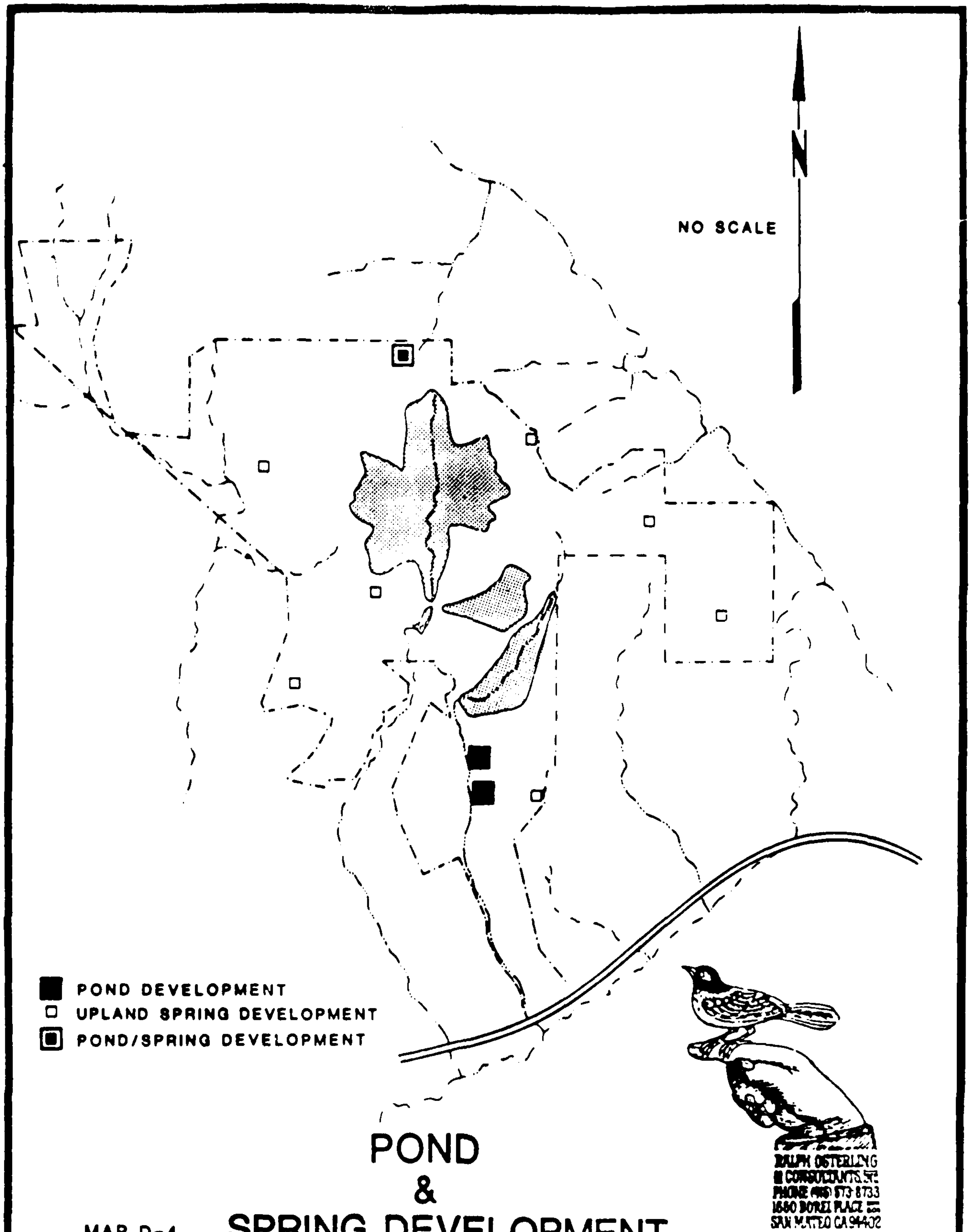
MAP D-2



WILDLIFE BURN AREAS

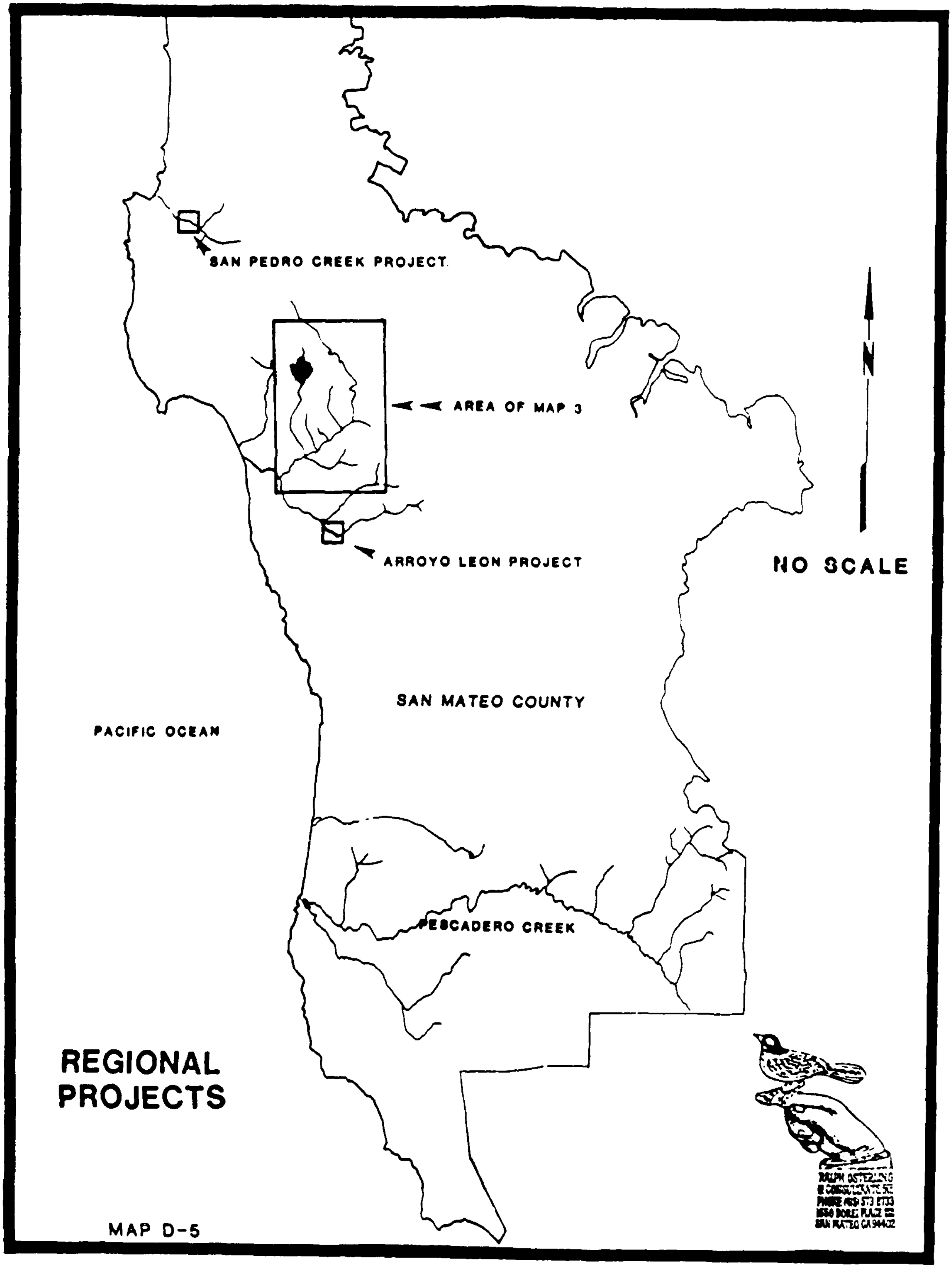
MAP D-3

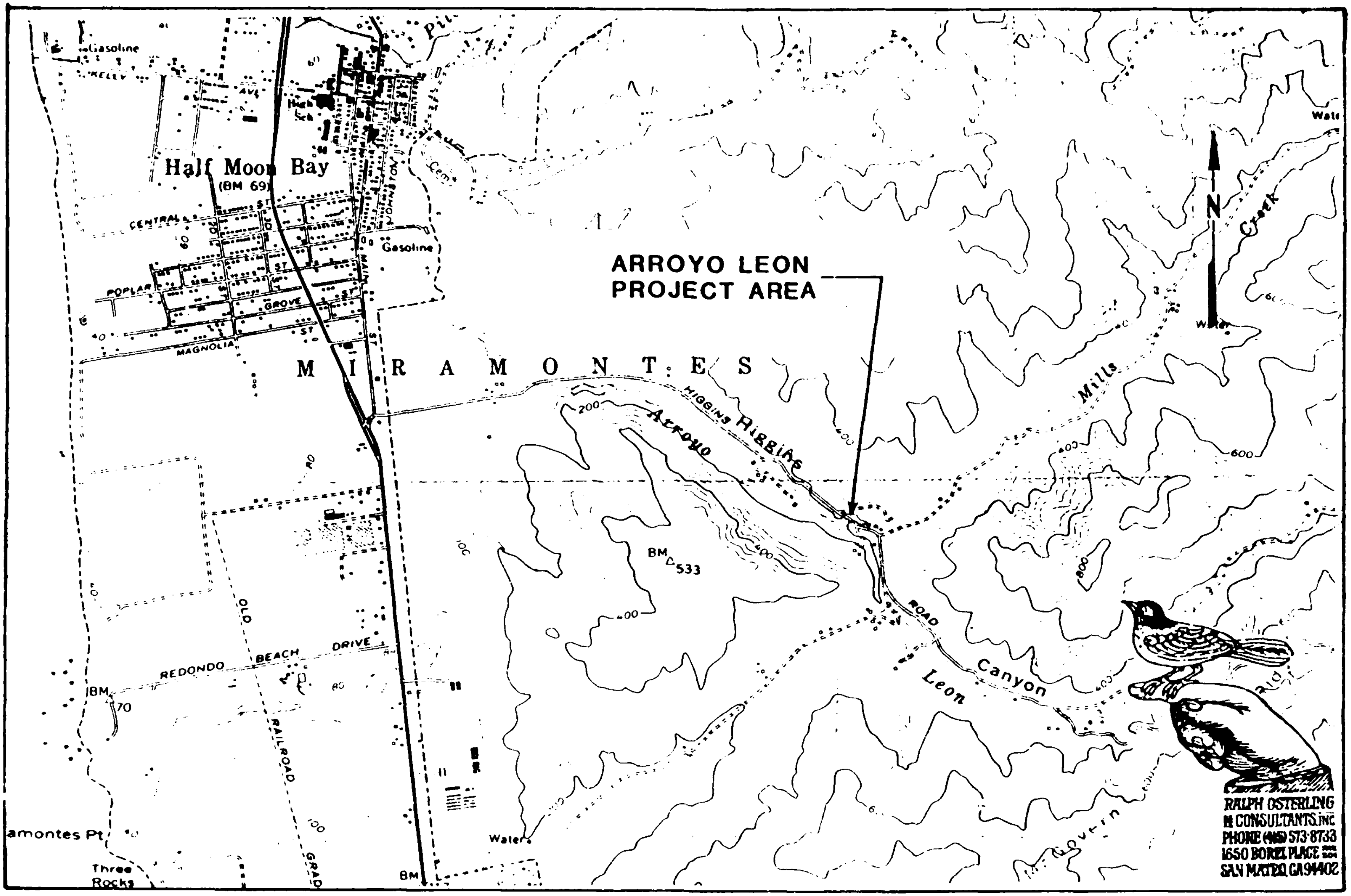
RALPH OSTERLING CONSULTANTS INC
PHONE (415) 573-8733
1660 BOREL PLACE
SAN MATEO CA 94402



POND
&
SPRING DEVELOPMENT

MAP D-4

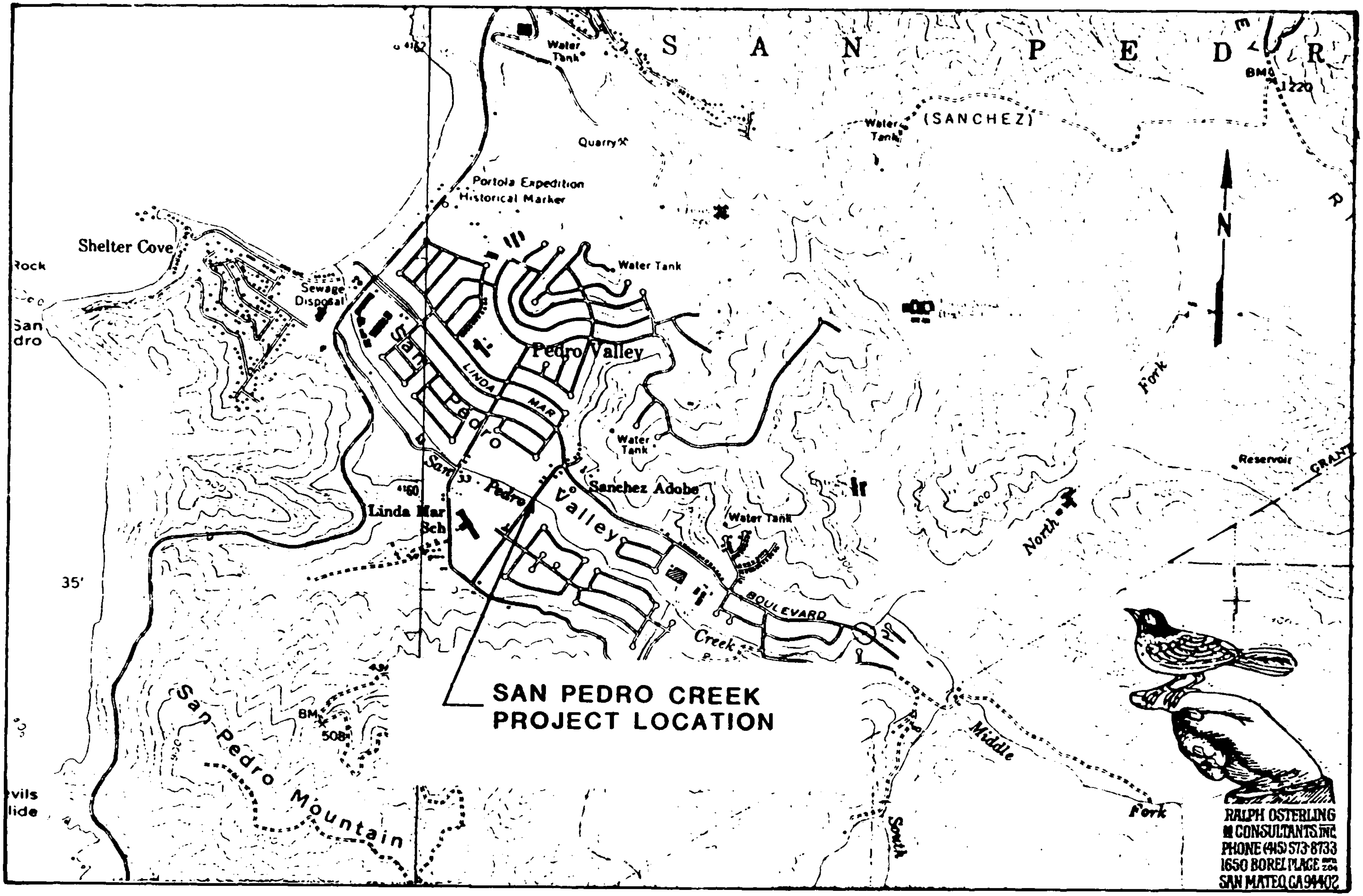

SAN PEDRO CREEK PROJECT
AREA OF MAP 3
ARROYO LEON PROJECT
N
NO SCALE
SAN MATEO COUNTY
PACIFIC OCEAN
PESCADERO CREEK
REGIONAL PROJECTS
MAP D-5



ARROYO LEON PROJECT LOCATION MAP

SCALE: 1"=2000'

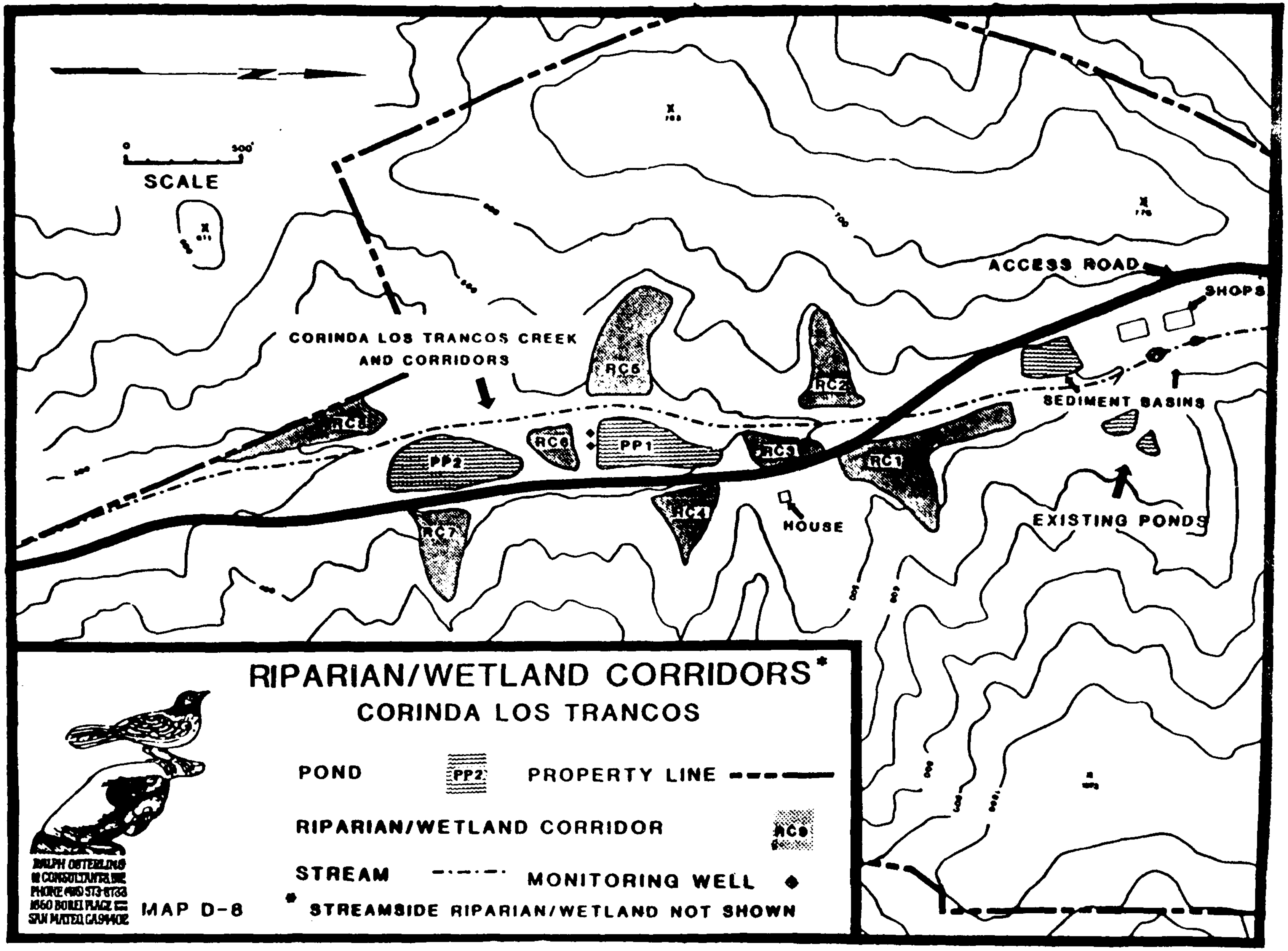
MAP D-6



SAN PEDRO CREEK ADOBE STREET CROSSING LOCATION MAP

SCALE: 1"=2000'

MAP D-7



SCALE
0
300'
CORINDA LOS TRANCOS CREEK
AND CORRIDORS
ACCESS ROAD
SHOPS
SEDIMENT BASINS
EXISTING PONDS
HOUSE
RC1
RC2
RC3
RC4
RC5
RC6
RC7
RC8
PP1
PP2
RIPARIAN/WETLAND CORRIDORS*
CORINDA LOS TRANCOS
POND
PP2
PROPERTY LINE
RIPARIAN/WETLAND CORRIDOR
RC9
STREAM
MONITORING WELL
* STREAMSIDE RIPARIAN/WETLAND NOT SHOWN
MAP D-8
RALPH OSTERLING
CONSULTANTS, INC
1650 BOREL PLACE
SAN MATEO, CA 94402

APPENDIX E

FISHERY SURVEY DATA

RALPH OSTERLING
CONSULTANTS, INC.

March 22, 1989

SALMO GAIRDNERI CAPTURED
SEPTEMBER 22, 1986

FIRST PASS	SECOND PASS
119 mm (4.7")	95 mm
116 mm	69 mm
105 mm	62 mm
104 mm	59 mm
98 mm	49 mm (2.0")
96 mm	
69 mm	
63 mm	
60 mm	
55 mm	
55 mm	
53 mm	
49 mm	

Electrofishing data from a 100 foot section of Apanolio Creek 600 feet downstream from the first BFI sediment dam (measurements are in fork length)

TABLE E-1

March 22, 1989

<u>SALMO GAIRDNERI</u> CAPTURED
SEPTEMBER 3, 1987

56 mm		210 mm	(8.3 INCHES)
26 mm	SAC FRY	174 mm	(6.8 INCHES)
55 mm		173 mm	
26 mm	STILL ABSORBING YOLK	168 mm	
55 mm		112 mm	
26 mm		100 mm	
54 mm		104 mm	
52 mm		151 mm	
51 mm		144 mm	
46 mm		129 mm	
45 mm		128 mm	
44 mm		119 mm	
42 mm		118 mm	
34 mm		115 mm	
32 mm		113 mm	
		60 mm	
		60 mm	
		58 mm	
		56 mm	
		TOTAL	19

Electrofishing data from ± 200 feet of Apanolio Creek downstream of the 2nd upstream sediment dam and data from the 30 foot pool behind the 2nd upstream sediment dam. Measurements are in fork length.

TABLE E-2

March 22, 1989

SALMO GAIRDNERI CAPTURED
MARCH 1, 1988

7.1"	Male	4.7"
6.3"	Male	4.5"
5.8"	Male	4.2"
5.4"		3.6"
5.4"	Male	3.6"
5.3"		3.3"
5.1"		3.3"
5.0"	Male	3.3"
4.8"		3.3"
4.8"		3.2"
4.8"	Male	2.9"
4.7"	Male	2.9'
4.7"		2.8"
4.7"		

TOTAL 28 FISH

Electrofishing data from the 6 foot by 30 foot pool in Apanolio Creek behind the 2nd upstream sediment dam on BFI property. Measurements are fork length.

TABLE E-3

WESCO WESTERN ECOLOGICAL SERVICES COMPANY, INC.

January 26, 1989
OST 8804

Mr. Ralph Osterling
Ralph Osterling, Inc.
1650 Borel Place, Suite 204
San Mateo, CA 94402

Re: Results of Electrofishing Survey of Apanolio Creek

Dear Ralph:

As part of your biological investigations of Apanolio Creek near Half Moon Bay, Western Ecological Services Company, Inc. (WESCO) was contracted to eletroshock pool habitat and representative sections of approximately 5,200 feet of the upper half of Apanolio Creek [Figures 1 and 2 (to be submitted under separate cover)]. WESCO performed the sampling on November 16 - 18, 1988 under flow conditions estimated at 0.75 - 1.5 cfs. Professionally accepted methodologies employed and the result of our sampling are described in the following sections.

METHODOLOGY

On November 16, two WESCO biologists walked the entire length of the stream within the study area to select representative 100-foot sample sites and identify all pool habitat for sampling. The 100-foot sites were numbered one through five in ascending order beginning at the lower end of the study area. Pool sites were also numbered in ascending order from No. 100 to 119 for a total of 20 individual pools. The pools electrofished were typically three to six feet in length under base flow conditions with the longest pool being 15 - 18 feet in length. When electrofished, the sampling began in the riffle below a pool and ended in the next upstream riffle. This resulted in several extra feet of stream being sampled above and below each pool.

Prior to electrofishing, each 100-foot sampling station received a 1/8-inch mesh block net at its upper and lower boundary. A Smith-Root backpack electrofisher was then employed to make three passes of the stream section. During each of three passes, captured fish were removed from the stream and held in separate holding tanks until they could be enumerated, weighed, measured, and released. This technique, known as a three-pass depletion

14 GALLI DRIVE, SUITE A · NOVATO, CALIFORNIA 94949 · TELEPHONE (415) 883-6425

method, is described in the Handbook of Computation for Biological Statistics of Fish Populations (Bulletin of the Fisheries Resource Board of Canada, 119:146-147) by W.E. Ricker (1958) and is the technique most often used by the California Department of Fish and Game for estimating fish populations in streams.

RESULTS

A total of 31 fish were captured; all of them were rainbow trout (*Salmo gairdneri*). Four trout were collected from the 100-foot sampling stations and 27 fish were from the individual pool habitats. The four trout collected in the 100-foot section were taken from small pools within a section that was mostly riffle habitat. Twenty-two percent of the captured trout were 55 - 90 mm fork length.

Only the pool habitat of the study area yielded fish. Because the electrofishing effort sampled all pool habitat three feet or greater in length (one foot or greater at the base flow existing prior to the rains), the total fish population of the study area is estimated to be approximately 31 rainbow trout ranging in length from 55 - 155 mm fork length. This is equivalent to 20 trout per kilometer (30 trout per mile). The 31 captured trout had a combined biomass of 245 grams. Assuming an average stream width of three feet, this results in a trout biomass estimate of 1.7 kilograms per hectare (1.5 pounds per acre). Because all fish were captured on the first of the three passes per site, we are unable to calculate confidence intervals for these population estimates. However, this also indicates that all fish were captured from the sampling sites.

Photographs of the sample sites are available (slides). Please contact me if you have any questions.

Sincerely,

WESTERN ECOLOGICAL SERVICES COMPANY, INC.

Scott Cressey

Scott Cressey
Principal/Senior Fisheries Biologist

SC/cmf

Enclosures: Previously submitted map and field sheets

C-1

San Mateo County letter to U.S. Army Corps

Board of Supervisors

BOARD OF SUPERVISORS
ANNA G. ESHOO
MARY GRIFFIN
TOM HUENING
TOM NOLAN
WILLIAM J. SCHUMACHER

COUNTY OF SAN MATEO

EUNICE M. BRECHT
CLERK OF THE BOARD

COUNTY GOVERNMENT CENTER • REDWOOD CITY • CALIFORNIA 94063 (415) 363-4566

October 16, 1987

Colonel Galen H. Yanagihara, District Engineer
Attention: Dr. Barney Opton
Army Corps of Engineers
211 Main Street
San Francisco, CA 94105

Dear Dr. Opton:

For 25 years, San Mateo County has anticipated the use of Apanolio Canyon as a long-term disposal facility for our solid waste, and incorporated that expectation into our General Plan and Solid Waste Management Plan. In 1962, the Board of Supervisors conducted a waste disposal study to find suitable landfill sites in the County. At that time, landfills were located adjacent to San Francisco Bay in areas which would not be considered appropriate today. The 1962 study assessed 21 potential locations for solid waste disposal within the County, and selected the Ox Mountain Ranch which includes Apanolio and Corinda Las Trancos Canyons as the most suitable landfill site. In 1965, a Cities/County site selection committee recommended, based on the long-term capacity available at Ox Mountain, that a regionwide facility to serve all cities in the County would be preferable to developing multiple smaller sites to serve each geographic area of the County. Consequently, in 1965, the San Mateo County Planning Commission approved a use permit, grading permit and quarry permit for a landfill facility at Corinda Los Trancos Canyon, and indicated that Ox Mountain Ranch was the prime site selected by the 1962 site selection survey. The eventual use of the Apanolio Canyon portion of the Ox Mountain Ranch as a landfill was acknowledged and anticipated by the Planning Commission at that time but approval was deferred until the actual need for the site was imminent.

As Bayside landfills continued to fill and Corinda Los Trancos Canyon was prepared for landfill activity, the County prepared a Solid Waste Management Plan for all waste disposal within its boundaries. This Plan, adopted by the Board of Supervisors in 1976 and revised in 1983, is the principal planning document prepared, pursuant to State law, to manage solid waste disposal in San Mateo County. The Solid Waste Management Plan provides assurance to the cities of San Mateo County that solid waste capacity will be available to accommodate the projected needs of the County over the long term.

The basic goal of the Plan, which builds on the 1962 site selection survey and the recommendation of the City/County selection committee, is to provide for management of solid waste in the most efficient and economical manner, while protecting the public health, encouraging the reduction of waste generation, and supporting the maximum amount of resource recovery. One of the specific objectives of the Plan is to provide long-term landfill disposal capability for non-recoverable wastes. To achieve its goals and objectives, the Plan established three key policies:

1. That Apanolio Canyon be developed for landfill purposes;

2. That solid waste transfer and processing facilities indicated in the Plan be approved by the Cities of Daly City, South San Francisco, San Bruno and San Carlos; and

3. That governmental agencies promote resource recovery efforts by the private sector, including waste separation at the source and at transfer facilities, methane recovery, energy recovery through waste conversion, and reclamation of completed landfill sites.

The Plan anticipated that the Menlo Park "Marsh Road Landfill Site," which had opened in 1960, would close in 1984 and that solid waste disposal would begin at Ox Mountain. To provide for local collection of waste and to reduce the transportation impacts of hauling to Ox Mountain, the Plan provided that refuse collected from the Bayside cities would be taken to satellite transfer stations, compacted, put in large trucks and hauled to Ox Mountain. These satellite transfer facilities are currently operating in Daly City, South San Francisco, San Bruno and San Carlos.

Solid waste collection throughout San Mateo County is provided by six collection companies, one of which is Browning-Ferris Industries (BFI). All collection companies operate pursuant to franchises granted by cities, sanitary districts or the County. According to the franchises, it is the responsibility of the collector to locate a disposal site. Five of the six collection companies representing 18 of the 20 cities in the County make use of the Ox Mountain landfill, which is owned by a subsidiary of BFI and operated pursuant to an operating agreement with the County Board of Supervisors.

The disposal fees established by the Board of Supervisors for Ox Mountain are the same for all collection companies, thus encouraging the local disposal of solid waste at the site identified in the Solid Waste Management Plan. This agreement, approved in 1976, is the administrative mechanism which binds together the County, the cities, and the private sector in fulfillment of the goals and objectives of the Solid Waste Management Plan. The operating agreement has always stated that the County consider use of Apanolio Canyon as a future long-term disposal facility. Without the use of Apanolio Canyon, 25 years of cooperative effort in local land use planning will be destroyed as the individual collection companies search for alternate disposal facilities.

In 1976, the California Coastal Zone boundaries were established in San Mateo County and the Ox Mountain Ranch was included within these boundaries. The Corinda Los Trancos landfill and the future expansion area in Apanolio Canyon were included in the Land Use Plan prepared pursuant to the California Coastal Act. The California Coastal Commission certified the Local Coastal Program for San Mateo County in 1980. The County subsequently designated a zoning district for the site which allows waste disposal as a conditionally permitted land use.

In anticipation of the closure of the Corinda Los Trancos landfill in 1989, BFI obtained, in 1984, a Use Permit and Coastal Development Permit from the San Mateo County Planning Commission. The permit found that the project was in conformance with the plans, policies and requirements of the Local Coastal Program. This permit was appealed to the Coastal Commission by concerned property owners living near the expansion area. The Coastal Commission found that the appeal raised no substantial issues. In August 1986, the County Planning Commission issued a Grading Permit for 17,000,000 cubic yards of excavation to develop Apanolio Canyon. No appeal of this permit was filed with the Coastal Commission. In December 1986, the California Solid Waste Management Board approved a permit to develop Apanolio Canyon for disposal of solid waste and found the project to be consistent with the certified Solid Waste Management Plan.

Even though it should be abundantly clear after 25 years of consistent, concerted and cooperative local effort that Apanolio Canyon is the preferred alternative for long-term solid waste disposal in the County, the County Departments of Public Works and Planning, between March and July 1987, have reevaluated the sites considered in 1962, assessed the feasibility of out-of-County disposal at existing landfills, and looked for additional sites within the County. The criteria used to reevaluate these sites included an array of environmental, engineering and economic factors. Of the 21 sites considered as potential landfill facilities in 1962, nine are located along the Baylands and four are adjacent to active earthquake (Holocene) faults, thus eliminating 13 sites for environmental reasons.

Two of the remaining sites have been acquired as parkland, one by the State of California and one by the Golden Gate National Recreation area. Four sites have been developed for residential and commercial projects, which preclude their use as landfills. One site is constrained by poor access and a capacity of only five years, which eliminates this alternative from consideration. The remaining site of those originally considered in 1962 is the Ox Mountain Ranch, site of the existing landfill.

The out-of-County facilities considered but rejected as viable alternatives included Altamont Canyon in Alameda County, Newby Island in the City of San Jose and Kirby Canyon also located in San Jose. The Altamont landfill is utilized by Alameda County and the City and County of San Francisco, which recently signed a 20-year contract with the Alameda Solid Waste Authority to deliver waste to Altamont. This agreement took six years to negotiate. The Alameda Solid Waste Authority maintains 50 years of capacity at Altamont for the needs of the citizens of Alameda County. The recent commitment for 20 years of disposal to San Francisco precludes additional contracts for long-term disposal of waste from other jurisdictions. Use of the Altamont landfill would involve an estimated annual increase in cost to County ratepayers of approximately $6 to $8 million. Consequently, this site was rejected because of the lack of additional capacity to accommodate San Mateo County waste, the increase in annual cost and the long lead time necessary to obtain permission to use the facility.

There are two landfills located in Santa Clara County--Newby Island, operated by Browning Ferris Industries (BFI), and Kirby Canyon, operated by Waste Management, Inc. Both sites are in the City of San Jose. At current rates of disposal, there are only 27 years of capacity left within Santa Clara County, 80 percent of which is located at Newby Island and Kirby Canyon. San Jose currently has a ban on the importation of solid waste from outside the city limits. However, as a result of litigation against the ban, a settlement to lift the restriction could take effect as early as next year and Kirby Canyon could become available for use by other Santa Clara County communities.

Also, Santa Clara County is currently circulating for approval a policy amendment to the County Solid Waste Management Plan which would establish the guidelines for approving amendments to the Plan to allow the importation of solid waste from communities outside of Santa Clara County. Approval of this policy change would require the approval of a majority of the cities containing a majority of the incorporated population, the County Board of Supervisors and the State Waste Management Board. If the San Jose ban is lifted and if the Santa Clara County policy on importation approved, San Mateo County could make application to bring its waste to Santa Clara County. It is estimated that this application process would take a minimum of one year. However, we have been informed by the City of San Jose that it is unlikely that we could make much progress on such an application until solid waste capacity is found for the seven cities of north Santa Clara County. These cities, led by the City of Sunnyvale, are seeking a site to dispose of 18 1/2 million tons of solid waste. They estimate that this would take care of the needs of the seven northern cities for 25 years.

While Kirby Canyon cannot solve the long-term disposal needs of San Mateo County, it has been suggested as an interim solution. The current solid waste situation described above makes this outcome highly problematical within the next two years. That being the case, Kirby Canyon does not appear to offer a realistic alternative to the permitting of Apanolio Canyon. Newby Island is constrained by the same factors as Kirby Canyon, including an existing 30-year contract with the City of San Jose and a 20-year contract with the City of Milpitas to dispose of solid waste, and consequently would not appear to be a viable alternative at the present time. Needless to say, both sites also involve substantial increases in annual expenditures by San Mateo County ratepayers over the currently existing rates. Kirby Canyon presently charges $16.30 per ton at the gate and San Jose has added $2.00 per cubic yard in place to that cost to fund its recycling program. Ox Mountain, on the other hand, currently charges $6.35 per ton at the gate and $1.15 per ton surcharge to fund solid waste activity for a total of $7.50 per ton.

The existing landfill at Corrinda Los Trancos has at the most two years of capacity remaining, with one year of construction necessary to prepare Apanolio Canyon for operation as a landfill. To find interim or long-term disposal outside of San Mateo County could not be accomplished within this timeframe. For any of the sites discussed above to accept solid waste would involve amendments to existing ordinances and solid waste plans, and the preparation of environmental documentation (CEQA) prior to contract negotiation. The contract negotiations could take considerable time and be carried on in an atmosphere of inequity with one party threatened with severe public health impacts for failure to reach agreement on contract terms.

In reevaluating the sites previously considered for land fill locations, we also looked for new sites within the County that might provide an alternative to Apanolio Canyon. The only area which appeared to offer potential is Nuff Canyon located directly east of Corinda Los Trancos. This site, while constrained by its designation as a significant regional mining resource by the California Mines and Geology Board, is worthy of further consideration and should be included in the final array of alternatives considered in the Environmental Impact Statement. At the present time, Nuff Canyon is not owned by BFI and I understand that the site is not available for acquisition until such time as mining economics prove undesirable. However, should the site become available for solid waste disposal, the engineering and environmental studies necessary to determine the feasibility of this site, together with subsequent amendments to the Solid Waste Management Plan and permit approvals, would undoubtedly take more time than is available before capacity is reached at Corinda Los Trancos.

The Apanolio Canyon landfill offers a solid waste disposal site which is unconstrained by major impacts on land use, traffic, aesthetics, cultural resources, growth-inducement, economics, noise, air quality, or public safety and nuisance. The landfill will incorporate the best available engineering design to protect downstream beneficial uses from any significant degradation of water quality and include a remedial contingency plan to protect the public from the consequences of failure of the engineering design. The Ox Mountain Ranch was acquired and designed solely for solid waste disposal operations in San Mateo County. The Apanolio Canyon portion of the Ox Mountain Ranch is the preferred site for solid waste disposal in San Mateo County, and has been repeatedly confirmed by 25 years of public discussion and action by the County Board of Supervisors, City Councils of San Mateo County, and various regulatory agencies.

Sincerely,

Tom Nolan

Tom Nolan, President
Board of Supervisors

TM:PMK:WRR/pb - P1E10024

C-2

Alameda County letters to San Mateo County

U... ?

ALAMEDA COUNTY SOLID WASTE MANAGEMENT AUTHORITY
399 Elmhurst Street, Hayward, California 94544
(415) 670-5400

January 21, 1988

Mr. Paul Koenig
San Mateo County Environmental Agency
County Government Center
Redwood City, CA 94063

Dear Paul:

This is confirming the points of our recent discussion concerning the process and criteria to support amendment to the Alameda County Solid Waste Management Plan to permit importing and disposing of municipal solid waste in a landfill in Alameda County.

The elements of the amendment application and process includes the following:

1. Application must include the name and signature of the landfill owner. Additional applicants may be a party to the application.

2 The specific form and content of the application will be provided by the Authority at the time the application is to be submitted.

3. The Authority must assure conformance with the state and local interests concerning the local general plans, zoning, environmental assessments and the County Solid Waste Management Plan before resolving any final action on an amendment.

4. Local planning and zoning issues must be resolved by the local agency having jurisdiction of the facility before the Authority will take any final action on an amendment.

5. The Authority will consider the proposal at noticed public hearings for the environmental assessment and the plan amendment.

6. The Authority action will be referred to the interested local agencies and public and private groups for review and response during the hearing process. Local agency ratification is required subsequent to the authority action prior to submitting to the California Waste Management Board for their approval.

7. The process is expected to require approximately seven to ten months depending on the content of the application. This assumes no major delays resulting from the public hearings. This includes the time periods prescribed in the state statutes for processsing the environmental documents. Other permits may be processed concurrently with the Authority plan amendment program.

The Authority will consider any proposal for cooperative solutions between adjacent jurisdictions of waste management problems. It is impossible to obtain any authority response to an amendment by the Authority prior to proceeding through the entire amendment process since many variables will weigh in the final decision on any proposal.

The criteria used in the evaluation of any proposed amendment will include but not be limited to the following:

(1) Compliance with the policies and objectives in the Alameda County Solid Waste Management Plan and the solid waste management plan of the importing agency.

(2) Full mitigation by the project proponent for impacts resulting from the proposal.

The Amendments permitting San Francisco waste disposal at the Altamont Landfill can be used as a guide in this matter.

(3) The provisions of our plan concerning the need to provide 50 year on-going landfill capacity in public ownership for the disposal of Alameda County Waste is described in the attached plan extract.

This provision must be met fully to support any plan amendment.

(4) Resource recovery programs within your county must meet or exceed the programs being implemented in Alameda County during the period of use by an importing jurisdiction.

(5) Other issues which arise during the review and public hearing process must be resolved to the satisfaction of the Authority.

(6) The cost for processing an amendment is the actual cost to the Authority to accomplish the necessary evaluation and hearings. These costs are at the expense of the proponent.

The above should be regarded as a general description of the requirements to process an amendment in Alameda County. A work program, costs and schedule to process an amendment, will be developed and agreed upon between the applicant and the Authority before any processing is begun.

I hope the above information meets your needs at this time.

Please contact me if you have any questions.

Very truly yours,

William H. Fraley
Secretary, Waste Management Authority

ALAMEDA COUNTY WASTE MANAGEMENT AUTHORITY
?99 Elmhurst Street, Hayward, California 94544
670-5400

February 26, 1988

Paul Koenig, Director
Environmental Services Department
San Mateo County
County Government Center
Redwood City, CA 94063

Dear Paul:

I was reviewing my letter of January 21, 1988 to you concerning criteria to support an amendent to the County Solid Waste Management Plan to permit importing waste from out of County for disposal in an Alameda County landfill.

Item No. 3 on page 2 of my letter discusses the policy in the Alameda County Plan that importation of waste for disposal in Alameda County will be considered after a clear demonstration that sufficient fully permitted landfill capacity exits in Alameda County to serve our needs for a minimum 50 year continuous period.

My letter did not emphasize the need to have the landfill capacity "permitted". This was an important point that I thought should be brought to your attention.

I call your attention to Page II - 8 Section 3 (c) where the specific language in our plan is indicated.

The Executive Summary of our Plan is enclosed for your use. It contains all but the appendices of our plan. If you have need of the background material, please do not hesitate to contact me.

Very truly yours,

William H. Fraley

William H. Fraley
Secretary, Waste Mangement Authority

WHF:gr
cc: Clem Shute, Authority Counsel

1892A

C-3

Santa Clara County letter to San Mateo County

IGC

SANTA CLARA COUNTY
INTERGOVERNMENTAL COUNCIL

County Government Center
East Wing, Eleventh Floor
70 West Hedding Street
San Jose, CA 95110
408 299-2424

Established by Charter to address joint jurisdictional issues, and to develop cooperative relations between local agencies

January 5, 1988

Tom Nolan
Supervisor Fourth District
County Government Center
Redwood City, California 94063

Dear Tom:

In response to your inquiry regarding San Mateo County's ability to acquire solid waste disposal capacity in Santa Clara County, let me give you some background on current solid waste planning in Santa Clara County.

The number one issue identified in the current Santa Clara County Solid Waste Management Plan is "lack of long term disposal capacity for most cities in Santa Clara County."

AB1462, by former County Supervisor now assemblyman, Dominic Cortese, is giving us added impetus to address the capacity issue in the coming months as we approach the next revision of our plan. As you know, the bill requires identification of remaining capacity in each county and a specific program for disposal of waste presently being disposed of at landfills with less than eight years projected capacity. In our county, the landfill in the city of Santa Clara will close in 1992 and Sunnyvale's landfill in 1994. In addition, Los Altos, Los Altos Hills, and Cupertino have disposal agreements with the Mountain View landfill which will expire in 1994. Mountain View has made it clear that those contracts cannot be extended due to diminishing capacity at its landfill.

Since the current plan was approved in mid-1985, the cities and the County have been working diligently to find ways of sharing capacity with each other in a manner that creates a "win-win" situation for the exporting city and the receiving city. The challenge is complicated by that fact that the capacity that must be shared is privately owned. The IGC Solid Waste Committee is currently developing amendments to the Plan to resolve these issues. Until the amendments are approved and contracts negotiated, we do not know how much additional capacity will exist.

At present the only landfills in the County with potential for excess capacity are Newby Island and Kirby Canyon, both of which are located in the City of San Jose. San Jose currently has an ordinance which bans the importation of solid waste into the city limits for disposal. The ordinance has been challenged on legal grounds and is currently under litigation. Until a resolution is reached, San Jose will not permit importation.

Anticipating the eventual resolution of the above issues and recognizing the gravity of the regional solid waste situation, the IGC solid waste committee is working on an amendment to the County Solid Waste Management Plan adding a procedure for processing requests for importation. The process for approving this amendment includes an environmental review (2 months minimum), review by the IGC (1 month), approval by the Board of Supervisors and the cities (4 months), and approval by the California Waste Management Board (1-3 months), a minimum total of eight months.

The procedure, while still being formulated, will require a plan amendment for each importation proposal. Plan amendments must be approved by a majority of the cities (8) containing a majority of the incorporated population (one of the cities must be San Jose), the County Board of Supervisors, and the California Waste Management Board. Each importation proposal, therefore, will have to be approved in the same manner as the original procedure-governing amendment discussed above. Therefore, it will be a minimum of sixteen months before the importation procedure is in place and a specific importation proposal has been approved.

I hope this information is useful to you. Please contact me if you have any further questions. Best wishes for the new year.

Sincerely,

Dianne

Dianne Mckenna
Chairperson, IGC Solid Waste Committee

DM:sr:rz

cc: Senator Rebecca Morgan
Roger James, Executive Director, California Regional Water Quality Control Board

C-4

Site Selection Criteria Information

Landfill Site Selection Criteria Information

The following is a brief summary of the selection criteria definitions used in the 1963 and 1987 site selection studies. The definitions are presented in the order they occur in Chapter 3, Table 3.2-1.

Physical/Engineering

Ultimate capacity of site (Life-span):

> The ultimate capacity of each of the sites discussed in the 1963 report varied widely depending on their location. In general, these sites, with the exception of the combined Brisbane bayfront site and Corinda Los Trancos (presently near capacity), have usable lives of less than 13 years (BFI, 1987). The 1987 study identified site life-spans as varying from 19 years to 91 years with average placement efficiencies ranging from 94,000 tons per acre to 223,000 tons per acre.

Depth of fill possible:

> The 1963 report used this criterion as it related to canyon and tideland siting of a landfill. Depth of fill referred to a generalized average in calculating capacity in a canyon; whereas in tideland/wetland areas depth of fill included material penetrating into Bay mud as well as compacted refuse above and below the water line. The 1987 report referred to depth of fill as it related to capacity and efficiency of possible canyon landfill sites.

Acreage required:

> The 1963 study determined acreage required to be the value obtained by dividing the need capacity (in cubic yards) by the assumed depth of fill. The result would then be converted to acres. The required acreage identified for the various landfill scenarios developed in the 1963 report varied widely depending on the capacity and siting of the landfill (e.g., canyon size, wetland available) and the service area in question. The acreages required in each of the canyon sites analyzed in the 1987 report were also an important siting criterion in that increased available acreage would extend the lifespan of the landfill site.

Environmental

Proximity to urban development:

Because of the perceived negative association with landfills and public health concerns about disease transmitted by insects and vermin attracted to open dumps of the past, sanitary landfills should be located distant from residential and commercial development when possible. Expected future developments must also be considered as well as present conditions. Both the 1963 and 1987 reports discussed this issue in the siting criteria.

Compatibility with surrounding land uses:

Siting of a landfill must take into consideration the nature of the surrounding land uses and possible conflicts that may arise due to incompatible uses. The 1963 report used the example of how heavy industrial establishments may provide less conflict than public or commercial land uses or residential use. The 1987 report also addressed this issue and discussed as well the applicability and use of the San Mateo County Open Space and Conservation component of the General Plan in determining a balance between conservation and productive use of the natural resources and environmental quality of the county.

Natural and artificial barriers:

Barriers may be necessary to separate the landfill from surrounding areas. Canyon areas would be sufficient to minimize contact with nearby land uses; however, artificial barriers would have to be developed if there is inadequate separation. Barriers could include construction of berms, fences, landscaping and/or purchase of extra buffer space. The 1963 report addressed this issue. The 1987 report evaluated sites in canyon areas generally geographically isolated from other areas and also discussed methods of containment as is necessary under California Administrative Code (CAC), Title 23, Chapter 3, Subchapter 15.

Probability of community resistance:

The probability of community resistance is not possible to forecast, however the level of controversy can be minimized if community opinions are considered during preliminary site selection. The 1963 report acknowledged the nature of this criteria and difficulty in its quantification. The 1987 report incorporated community resistance in the siting criteria in that the landfill siting depended on local support as well as evaluation of environmental concerns.

Development relative to bayside and coastal wetlands:

Since the 1963 report, a number of local, state and federal regulations have been developed which preclude placement of a landfill in bayside and coastal wetlands. Therefore, sites on these types of areas were not deemed feasible in the 1987 report whereas the 1963 report considered wetlands as viable landfill options.

Proximity to Holocene faults:

Class III landfills cannot be located on known Holocene faults. Structural features of the landfill must be designed to withstand the maximum probable earthquake. The 1987 report identified that there are no known Holocene faults in any of the sites, whereas the 1963 report did not address the topic of Holocene faults.

Water quality:

Landfills must be separated from aquifers because of the potential degradation of groundwater by leachate from the landfill. Groundwater degradation may occur if natural geologic materials beneath the landfill are too porous, the engineered barriers are not sufficiently impermeable, or if there is not adequate distance between drinking water and leachate source to allow for biological and/or chemical degradation of the leachate. Water quality issues were discussed in the 1987 siting report because the engineering and design of landfills currently are under the jurisdiction of Subchapter 15 as administered by the Regional Water Quality Control Board and California Department of Health Services. The 1963 document did not address the issue of water quality.

Economic

Acquisition costs:

For the purpose of consistency, the 1963 study assumed that the landfill property would be purchased. According to this report, cities and counties could obtain funds for park land under the Federal Open Space Program. Because lands acquired in this manner must be used for recreation in perpetuity, such funds could be used to help purchase lands that could be used for disposal sites, landscaped, and made into recreational open space. Acquisition costs were combined with development costs in the final analysis of the 1963 report. Acquisition and development costs were taken into consideration in the 1987 landfill siting report.

Development costs:

Development costs in the 1963 report included site preparation costs such as fencing, dikes, site grading, drainage facilities, utilities, engineering design and consulting fees. Similar costs were considered in the 1987 studies.

Average haul costs:

The average haul costs in the 1963 report were based on a ton-mile hauling cost of $0.10 from the future population sphere of the service area to the disposal site. The average haul costs in the 1987 report were based on $0.10/ton/mile rate, additionally costs must include tipping fees, ranging from $8.50-$15.60/ton plus outside agencies fees of $3.50-$6.50/ton.

D-1

Draft Contingency Remedial Action Plan
(Purcell, Rhoades & Associates)

Purcell, Rhoades & Associates

Consultants in the Applied Earth Sciences

2504 Technology Drive
Hayward, CA 94545
(415) 732-9890
Please Reply to This Office

1041 H[illegible]k Avenue
Pleasant Hill, CA 94523
(415) 932-1177
Please Reply [illegible]

No. 2-0116/6870-15(A)
August 16, 1988

Browning-Ferris Industries of California, Inc.
225 Shoreway Road
P.O. Box 1068
San Carlos, CA 94070

Attention: Mr. Lino Valbusa

SUBJECT: Draft Contingency Remedial Action Plan - Apanolio Canyon Expansion Site, Ox Mountain, San Mateo County, California

Gentlemen:

The attached Draft Contingency Remedial Action Plan has been compiled from numerous letters, reports, memorandums, studies and data analyses relating to the engineering and geologic/hydrogeologic studies undertaken for the Apanolio Canyon Expansion Site.

Section 2596(4) of the Subchapter 15 requirements states the following:

> "(4) Dischargers shall submit proposed construction and inspection procedures to the regional board for approval.
> (b) Operation Plans
> (1) Dischargers shall submit operation plans describing the waste management unit operation which shall include:
> (A) a description of proposed treatment, storage, and disposal methods;
> (B) contingency plans for the failure or breakdown of waste handling facilities or containment systems, including notice of any such failure, or any detection of waste or leachate in monitoring facilities, to the regional board, local governments, and water users downgradient of waste management units; and
> (C) description of inspection and maintenance programs which will be undertaken regularly during disposal operations and the post-closure maintenance period."

The Contingency Remedial Action Plan discusses the inspection and maintenance procedures for surface and groundwater systems and defines the "triggering actions or situation" which would cause the implementation of the plan. The Contingency Remedial Action Plan is

Bruce G. Purcell, C.E.G.
Irving D. Anfeldt, C.E.G.

Daniel F. Rhoades, P.E.
Bruce I. M[illegible]

not be be considered a substitute to a verification program as described in Article 5, or a corrective action program as described in Section 2558 of Subchapter 15. However, as part of the Contingency Remedial Action Plan, courses of action are proposed to mitigate impacts to water quality and quantity in the case of any system failure, and for augmentation of summer stream water flows and groundwater replenishment levels in lower Apanolio Canyon.

If you have any questions regarding the subject plan, please do not hesitate to contact the undersigned.

Very truly yours,

PURCELL, RHOADES & ASSOCIATES

John F. Hicks, P.E.
Civil Engineer 31759
Project Manager

Bruce J. Murphy
Director, Environmental Services

pl

DRAFT CONTINGENCY REMEDIAL ACTION PLAN
APANOLIO CANYON EXPANSION SITE
OX MOUNTAIN
SAN MATEO COUNTY, CALIFORNIA

FOR

BROWNING-FERRIS INDUSTRIES
OF CALIFORNIA, INC.

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DRAFT CONTINGENCY REMEDIAL ACTION PLAN

Inspection and maintenance of the waste management facilities and containment systems, along with water quality and quantity sampling and measurements, are the cornerstone of the contingency remedial action plan requirements. The major areas of the plan are summarized as follows:

I. Surface water and surface drainage systems;

II. Subsurface water systems including storm drains, monitoring wells, groundwater and leachate collection facilities; and

III. Downstream water quality and quantity including lower Apanolio Canyon aquifer levels.

I. SURFACE WATER AND SURFACE DRAINAGE SYSTEMS

A. Facilities

1. Retention ponds, all flow paths and potential erosion areas leading to pond.

2. "V"-ditches, cross-drains and all surface flow devices.

3. Drop inlet structures and all surface flow devices.

4. Energy dissipator and all connections to the structure.

5. Sedimentation basin including all connecting facilities.

6. Roller Compacted Concrete (RCC) sedimentation dam, outlet structure and stilling basin.

7. Exit pipe facilities, main drain and lateral surface water drain.

8. Existing slopes. (Monitor in accordance with erosion control plan to control sediment impact.)

9. All leachate storage facilities including loading and processing area. (Verify no surface runoff or pipe leakage and 100% containment of collected leachate.)

10. Surface water monitoring stations. (Flow measurement stations and specified surface water quality sampling stations.)*

* Surface water quality analysis and quantity measurements to be performed quarterly or as directed by the Regional Water Quality Control Board (RWQCB) in Waste Discharge Orders.

B. Maintenance, Monitoring and Reporting Requirements

The above listed surface water and drainage facilities are to be inspected and maintained, with documentation for annual reports and as needed, with supplemental documented inspections to be performed:

1. After a 50-year or greater storm.

2. After a local seismic event of magnitude 5.0 or greater as measured on the Richter scale.

3. After any contiguous brush fire greater than 50,000 square feet (±), or where erosion impact would occur.

4. For the Five-Year Engineering Review.

C. Triggering Action

The contingency remedial plan would be triggered:

1. As established by Local Enforcement Agency (LEA), San Mateo County, RWQCB, etc., based on predetermined variation from an accepted norm such as capacity standard or performance limits, including Water Quality Protection Standards (WQPS).

2. By automatic action based on events such as earthquakes, 50-year storms, accidents, etc., which would mandate implementation of contingency control procedures.

D. Notification

1. The following agencies will be notified in the case of a triggering event or condition:

   a. LEA, San Mateo County.

   b. RWQCB, San Francisco Region.

c. Waste Management Board.

d. Other governmental agencies and parties.

- o Federal: EPA; Fish and Wildlife, etc.
- o State: Coastal Commission; Dept. of Fish and Game, etc.
- o County: Supervisors; Board of Health, etc.
- o Local: City of Half Moon Bay, etc.
- o Private individuals or groups: Downstream water user; Sierra Club, etc.

2. The parties responsible for performing the notification and working with the appropriate agencies for determining action are:

   a. Operator - Browning-Ferris Industries of California, Inc. (BFI).

   b. Consulting Engineers and their agents.

   c. Government agencies (where controlling inspection review and approvals).

E. Verification and Corrective Action Program Options

1. Operator to implement approved verification and corrective action programs under direction of LEA and other responsible agencies.

2. Corrective action programs for damage to surface water and drainage systems might consist of: in-situ repair of lined perimeter "V"-ditches; construction of new perimeter drains and ditches; penstocks to deliver water to lower sedimentation basin; replacement or repair of weirs or other flow measurement devices.

II. SUBSURFACE SYSTEMS

A. Facilities

1. Drop inlet structures and all connections to the structures.

2. Energy dissipator and all connections to the structure.

3. All exit pipe facilities, main drain and lateral sub-subsurface water collection system..

4. Leachate collection system.

5. Monitoring wells for water quality sampling and aquifer level measurements.

B Maintenance, Monitoring and Reporting Requirements

The above listed subsurface facilities are to be inspected and maintained, with documentation, for annual report and as needed, with supplemental documented inspections to be performed.

1. After 50-year storm events.

2. After seismic event of magnitude of 5.0 or greater measured on the Richter scale.

3. For the Five-Year Engineering Review.

Monitoring of subsurface water will be performed quarterly at designated groundwater monitoring wells and will be performed as set forth in monitoring program approved by RWQCB.

The underground storm drain facilities and groundwater collection system will be inspected by TV for annual report.

C. Triggering Action

1. Trigger actions are to be established by the LEA, RWQCB or other agency based on a predetermined variation from an accepted norm, such as background WQPS and capacity standards.

2. Automatic triggering would be based on established events, such as a 50-year storm event, seismic event of 5.0 magnitude or greater on the Richter scale, accident, etc.

D. Notification

1. The following agencies will be notified in the event of failure or damage to facilities or degradation of groundwater:

   a. LEA, San Mateo County.

   b. RWQCB.

   c. Waste Management Board.

   d. Other governmental agencies and parties.

      - o Federal: EPA; Fish and Wildlife, etc.
      - o State: Coastal Commission; Dept of Fish and Game, etc.
      - o County: Supervisors; Board of Health, etc.
      - o Local: City of Half Moon Bay, etc.
      - o Private individuals or groups: Downstream water user; Sierra Club, etc.

2. The parties responsible for performing the notification and working with the appropriate agencies for determining action are:

a. Operator - BFI, both designated on-site and corporate individuals.

b. Consulting Engineers and their agents.

c. Government agencies (where controlling inspection review and approvals).

E. Verification and Corrective Action Program Options

1. In the event that the contingency plan is triggered by some failure or damage to the subsurface facilities or if contaminants are found in the groundwater, the Operator will perform a study on the problem and will work with the appropriate governing agency to determine a corrective action plan.

2. In the case of damaged underground conduits, corrective programs may include in-situ repair or replacement with internal pipe sleeves. If required, surface water would be rerouted around the landfill with "V"-ditches to the sedimentation basin.

3. In the event of leachate production above predetermined levels, the following corrective action programs are possible.

   a. Holding tank daily monitoring with volume reporting on predetermined basis, diversion occurring to pond or on-site treatment system when routine 3000-gallon daily tanker-truck or equivalent standard capacity level is exceeded.

   b. Treatment plant adequate for on-site leachate treatment up to 80% of plant capacity: requires diversion to on-site aeration pond treatment facility to trigger further control as needed.*

   c. Pond (aeration) adequate for treatment with volume control triggered when 75% pond capacity is reached.

   d. Discharge line directed to suitable disposal point, e.g., Half Moon Bay treatment plant, when above proves uneconomic or where aeration pond approaches sustained 75% capacity condition.**

e. Place lower grout curtain below sedimentation pond with extraction and withdrawal pipe for leachate plume containment based on monitoring well quality standards deviation and as directed by appropriate agency.

* See Appendix A for letter report from Purcell, Rhoades & Associates to the RWQCB, "Evaluation of Proposed Leachate Collection and Removal System (LCRS) and Leachate/Contaminated Groundwater Treatment Systems, Area 2, Apanolio Canyon Extension Site, San Mateo County, California", dated May 10, 1988.

** In the event it became necessary to construct a pipeline to the Half Moon Bay Sewage Treatment Plant for disposal of contaminated water, an appropriate pipeline alignment would be developed with respect to existing facilities, topography, land ownership, etc. The LEA, San Mateo County, would assist in the establishment of easements for the construction of the pipeline on the property not owned by BFI to ensure the public health, safety and welfare.

III. DOWNSTREAM WATER QUALITY AND QUANTITY

A. Facilities

1. Weirs for flow measurements with transducer and data loggers.

2. Wells.

3. Rain gauge stations.

4. Surface water monitoring stations.

5. Riprap downstream of sedimentation dam.

B. Maintenance, Monitoring and Reporting Requirements

1. Streamflow rates will be monitored by the Operator and reported to the appropriate government agencies quarterly, along with precipitation records.

2. Surface water quality will be monitored quarterly and reported to the appropriate governing agency (RWQCB, etc.).

3. Lower canyon aquifer levels will be measured quarterly and reported to the appropriate governing agency.

4. Lower canyon groundwater quality will be monitored and reported annually.

5. Riprap below the stilling basin will be inspected with documentation: annually; after storm events; after seismic events greater than magnitude 5.0 on the Richter scale; and in the case of any slides or accidents.

C. <u>Triggering Action</u>

1. Streamflow rates in the Apanolio Canyon are currently being continuously monitored. Background water quality and quantity standards have been established and will be related to rainfall and other natural contributing factors, such as sediment load from storm events, etc.

2. After construction of the proposed landfill, a reduction in summer streamflows is anticipated. Streamflow measurements will reveal whether or not summer flows are actually effected. If summer streamflows do indeed decrease below calculated "preconstruction" expected flow rates, the Operator shall provide sufficient augmentation flow to ensure maintenance of normal flow rate. (Normal meaning anticipated flow

rates based on precipitation records and resultant measured streamflows in preconstruction condition.) Please see Appendix B, letter report from PRA to BFI, "Proposed Ponds and Wells in Corinda Los Trancos Canyon for Streamflow Augmentation in Apanolio Creek", dated August 15, 1988.

3. Degradation of groundwater or surface water would be detected by laboratory analysis to compare laboratory results to established preconstruction water quality standards. Should contamination or leachate be detected, a comprehensive verification study would ensue, leading to a corrective action program.

D. <u>Notification</u>

1. The following agencies will be notified in the event of failure or damage to facilities or degradation of groundwater:

   a. LEA, San Mateo County.
   b. RWQCB.

c. Waste Management Board.

d. Other governmental agencies and parties.

- o Federal: EPA; Fish and Wildlife, etc.
- o State: Coastal Commission; Dept of Fish and Game; etc.
- o County: Supervisors; Board of Health, etc.
- o Local: City of Half Moon Bay; etc.
- o Private individuals or groups: Downstream water users; Sierra Club, etc.

2. The parties responsible for performing the notification and working with the appropriate agencies for determining action are:

a. Operator - BFI, both designated on-site and corporate individuals.

b. Consulting Engineers and their agents.

c. Government agencies (where controlling inspection review and approvals).

E. Verification and Corrective Action Program Options

1. In the event of lower than normal aquifer levels or streamflow rates, augmentation flow and groundwater replenishment would be delivered from ponds and/or well fields in Corinda Los Trancos Canyon via a pipeline and surface drainage routes to the sedimentation pond in Apanolio Canyon (see letter report, Appendix B, referenced in III.C.1 above).

2. In the event of the discovery of contamination or leachate in Apanolio Creek or the lower canyon aquifer, per Subchapter 15 regulations, a thorough verification program would be initiated. Subsequently, possible corrective action programs might include:

   a. Diversion and treatment of waters in Apanolio Creek.

b. Construction of barriers (subsurface and surface) to prevent migration of leachate or contamination from the landfill site.

c. Replacement of water beneficial uses by the construction of a pipeline from the Coastside County Water District (CCWD) supply to service downstream users.

3. In the event it becomes necessary to provide an alternative drinking water source for residents of Digges Canyon from CCWD, the following procedure would be followed:

a. Identify the magnitude of the contamination problem. This step would be the responsibility of BFI, RWQCB and LEA representatives.

b. If one of the appropriate contingency options involved CCWD, there would be a review of the problem by BFI, LEA and CCWD representatives.

c. Thereafter, an application for EMERGENCY PERMIT to utilize the priority land use provisions of the emergency contingency capacity (equivalent to 1000 connections for Phase I) would be filed with the County of San Mateo.

d. The Emergency Permit would be obtained within 10 days and construction activity could commence.

e. Within 30 days, the applicant would be required to file a report for the action with the County of San Mateo.

f. Thereafter, the applicant would apply for a permanent right for the use of water. (See Appendix C for copies of correspondence between the Operator, its Engineer and the CCWD).

CONCLUSION

The draft Contingency Remedial Plan has not been intended to cover every possible course of corrective action in the case of any system failure. Rather, it indicates the thoroughness of the inspection and monitoring programs which will be in place at the proposed landfill and offers examples of the types of remedial actions which could be used to mitigate any failure of the engineering and containment facilities. It should be noted that the landfill operation and engineering facilities are subject to a through 5-year review in addition to annual inspection and reporting. Quarterly monitoring of water quality will give the operator and the regulatory agencies time to implement a corrective action program years before any polluted groundwater would be able to migrate down canyon. This is due to the isolative location of the project and the low permeability of the underlying bedrock.

All of the corrective action programs outlined in this report are proven technologies and relatively simple and quick to implement if the need arises.

BFI Waste Systems
BROWNING-FERRIS INDUSTRIES
San Mateo County District

RECEIVED
FEB 8 1988
BRIAN KANGAS FOULK
REDWOOD CITY

January 29, 1988

Mr. Robert Rathborne
Coastside County Water District
766 Main Street
Half Moon Bay, CA 94019

RE: **OX MOUNTAIN SANITARY LANDFILL**
APANOLIO CANYON EXPANSION SITE
SAN MATEO COUNTY, CALIFORNIA

Dear Mr. Rathborne:

As part of the development of the Apanolio Canyon landfill it is necessary to provide protection for potential health and safety impacts associated with degradation of the ground and surface waters of the area below the proposed landfill. We have reviewed the water demand associated with domestic, agricultural and stock watering purposes in Digges Canyon between the project site and State Route 92.

The reported beneficial uses of water from Apanolio Creek are irrigation of pasture or crops, stock watering and domestic use. Domestic consumption of water is relatively minor compared to agricultural use in most rural settings and stock watering also requires relatively small volumes of water.

The amount of land currently being irrigated in Digges Canyon is 29 acres. Using aerial photographs and topographic maps, the amount of land suitable for agriculture along Apanolio Creek was estimated to be 116 acres. With an average irrigation demand of 2 acre-feet/year for field crops, the quantity of water needed for irrigation of the entire canyon would be 232 acre-feet/year.

In addition, domestic demand would be equivalent to 7 residential hook-ups. Assuming a usage of 300 GPD/unit, the annual demand would amount to 7 X 300 X 365 = 766,500 gal/year or 2.4 acre-feet/year.

January 29, 1988

In formulating a contingency plan for the landfill it is necessary to explore alternate sources of water, should the need arise. Accordingly, we respectfully request that you review the water utilization demands outlined herein with respect to your ability to service this area should the contingency plan ever be implemented. A implementation of the contingency plan would only occur when the Regional Water Quality Control Board and the County of San Mateo agreed that a response was necessary to protect the health, safety and welfare of those living in Digges Canyon. We would appreciate a response which details timeframe and cost parameters.

Please feel free to contact me for additional information requests/input which you require to respond to our inquiry.

Thank you for your continuing cooperation.

Very truly yours,

Lino Valbusa
District Manager

LV:cb

cc: Dan Day, BFI San Mateo
Ed Kubit, BFI San Mateo
Ned Washburn, Washburn Kemp
Tony Gschwend, Brian Kangas Foulk
Bill Rozar, San Mateo County Planning Department

RECEIVED

MAR 3 1988

BRIAN KANGAS FOULK
REDWOOD CITY

February 26, 1988

BFI Waste Systems
Attn: Mr. Lino Valbusa
225 Shoreway Rd.
P. O. Box 1068
San Carlos, CA 94070

RE: OX MOUNTAIN SANITARY LANDFILL
EMERGENCY WATER UTILIZATION

Dear Lino:

This letter is in response to your letter of January 29, 1988 regarding the above referenced subject. As I indicated at our meeting, the District will cooperate with BFI in the implementation of its emergency water utilization plan to the extent that it can legally do so, although the Board of Directors has the final say in all policy matters.

It is my understanding from your letter that BFI and the Regional Water Quality Control Board are interested in developing a plan to utilize water from the CCWD system to replace well water from existing or future wells in Apanolio Canyon and surface water from Apanolio Creek, in the event that water from either or both of those sources becomes contaminated as a result of the sanitary landfill activities at the Ox Mountain Disposal Site. Further, there are two specific types of water uses to be considered which are: 1) Domestic, and 2) Floriculture/Agriculture-Stockwatering.

The letter indicates that the domestic demand would be equivalent to 7 residential hook-ups. Is the intent of the emergency plan to provide 7 residences in close proximity to the Ox Mountain Disposal Site, now served on wells or surface water, with CCWD water in the event of surface or well water contamination? If this is the case, it will be necessary to identify the owners/occupants and addresses of those seven residential structures. It is possible that the District already serves some or all of those residences in the area of concern.

If it turns out that BFI's request is to serve customers not already on the system who reside outside the District's boundary, an amendment to the San Mateo County Local Coastal Plan may be necessary. During our discussion, I recall that you mentioned having discussed that possibility with Bill Rozar at the County planning office. Once all the relevant facts are gathered, it may be a good idea to meet with Christine Gouig, County Planning Director, and representatives of the Regional Water Quality Control Board to determine the appropriate course of action.

Water service by CCWD for new customers, who request service for floriculture/agriculture use but who are outside the District boundary, is prohibited by the County LCP. Again, an LCP amendment would probably be required to allow CCWD to serve these areas under the appropriate circumstances.

If the constraints of the LCP and other relevant rules and regulations are overcome, additional water service for domestic use would probably become available during Phase II of the LCP buildout period which will be 1992 or later. Water for agriculture/floriculture may be available sooner than that time if, in the County planning staffs' opinion, that water is being used for priority land use purposes and all other constraints have been removed.

Please do not hesitate to call or stop by, Lino, if you would like additional information or would like to discuss this matter further.

Very truly yours,

Robert R. Rathborne

Robert R. Rathborne
General Manager

cc: Ray McDevitt

Brian Kangas Foulk

Consulting Engineers
540 Price Avenue
Redwood City CA 94063
415/365-0412
FAX 415/365-1260

May 4, 1988

Job No. 86229-0

Coastside County Water District
766 Main Street
Half Moon Bay, CA 94019

Attn: Mr. Robert R. Rathborne
General Manager

Re: Ox Mountain Sanitary Landfill
Apanolio Canyon Expansion Site
Emergency Water Utilization

Dear Bob:

We have reviewed your letter of February 26, 1988 and offer the following clarification regarding existing residential demand:

A. RESIDENCES SERVED BY CCWD:

1. Ron Bongard
12460 San Mateo Road
Half Moon Bay, CA 94019

2. Ron Bongard (Rental Unit)
12470 San Mateo Road
Half Moon Bay, CA 94019

3. Ron Bongard (Rental Unit)
12490 San Mateo Road
Half Moon Bay, CA 94019

4. Robert Digges
12344 San Mateo Road
Half Moon Bay, CA 94019

B. RESIDENCES NOT SERVED BY CCWD:

1. Gilbert Gossett
156 Digges Canyon
Half Moon Bay, CA 94019

2. Gilbert Gossett
180 Digges Canyon
Half Moon Bay, CA 94019

3. Bill Marsh
   108 Digges Canyon
   Half Moon Bay, CA 94019

4. Alex Cozzolino
   (Old house which has no address)
   Mailing address:
   141 Kelly Avenue
   Half Moon Bay, CA 94019

5. John Susa
   (Just starting construction and expects to have a Digges Canyon address by the end of summer)
   Mailing address:
   754 Commercial Avenue
   South San Francisco, CA 94080

6. Karl Faigle
   (Trailer which has no address)
   Mailing address:
   PO Box 858
   Half Moon Bay, CA 94019

7. Dennis Marsh
   132 Digges Canyon
   Half Moon Bay, CA 94019

Therefore, of the eleven current and proposed residential uses in the Lower Apanolio Canyon, four (4) residences are currently served by CCWD and the emergency plan should provide for the equivalent of seven (7) additional residential hook-ups.

A report entitled "Revised Hydrogeological Assessment and Water Resources Beneficial Usage Analysis-Apanolio Canyon Expansion Site, Ox Mountain" by Purcell, Rhoades & Associates dated April 15, 1988 indicates the potential to ultimately construct a maximum of 22 residential units in the Planned Agricultural District (PAD) zoned area. Thus, eleven (11) additional residential units could ultimately be developed in the Canyon.

The same report estimates the current floriculture/agriculture demand to be 152 acre-ft/yr, with an ultimate utilization of 305 acre-ft/yr, assuming 106 farm acres planted in vegetables and a doubling of nursery and greenhouse space to 10 acres; however, this outcome may be unlikely. Thorough investigation of aerial photos and recent farming trends indicate an increase in the planting of christmas trees rather than field flowers with christmas trees requiring little or no irrigation. In addition, no areas in the canyon are currently devoted to vegetable crops and the high cost of structure erection may make expansion of the greenhouse space infeasible.

After you have had an opportunity to review the information transmitted herein, it would be a good idea to meet with representatives of the County of San Mateo to discuss the next steps which would be required to allow CCWD to serve the anticipated demands if the emergency plan requires implementation.

Thank you for your continuing cooperation.

Very truly yours,
BRIAN KANGAS FOULK

Anthony J. Gschwend
Vice President

AJG:cgs

cc: Lino Valbusa - BFI
Dan Day - BFI
Ed Kubit - BFI
Ned Washburn - Washburn & Kemp
Paul Koenig - San Mateo County Planning Department

D-2

Leachate Collection and Removal System (LCRS) and Leachate/Contaminated Groundwater Treatment Systems
(Purcell, Rhoades & Associates)

Purcell, Rhoades & Associates

Consultants in the Applied Earth Sciences

2504 Technology Drive
Hayward, CA 94545
(415) 732-9890
Please Reply to This Office ☒

1041 Hook Avenue
Pleasant Hill, CA 94523
(415) 932-1177
☐ Please Reply to This Office

May 10, 1988
No. 2-0116/6870152

California Regional Water Quality Control Board
1111 Jackson Street, Room 6000
Oakland, CA 94607

Attn: Mr. Ken Theisen

Subject: Evaluation of Proposed Leachate Collection and Removal System (LCRS) and Leachate/Contaminated Groundwater Treatment Systems, Area 2, Apanolio Canyon Expansion Site, San Mateo County, California

Gentlemen:

This letter report presents an evaluation of the Proposed Leachate Collection and Removal System (LCRS) to be installed within the canyon bottom of the Apanolio Canyon Expansion Site, San Mateo County, California. The evaluation of the LCRS consists of an analysis of infiltration and leachate production in the area using standard water balance techniques and a comparison of the volumes generated with the holding capacity of the current design to be used for the LCRS. Results of this analysis demonstrate that the system meets and exceeds the requirements of the liquid holding capacity in accordance with Section 2543 (b) of Subchapter 15. This requirement states that the LCRS must be sized to handle twice the daily projected leachate volume generated.

ESTIMATING LEACHATE VOLUME USING THE WATER BALANCE METHOD APANOLIO CANYON LANDFILL

Purcell, Rhoades & Associates has made an estimate of potential leachate production at the site utilizing the water balance method developed by Thornthwaite and Mather (1955). The water balance method is a type of mathematical accounting process which considers precipitation, evapotranspiration, surface run-off, and soil moisture storage, all of which have a bearing on the extent of how much infiltration can be expected to occur after a rainfall. Since infiltration is the major contributor to leachate generation, knowing how much infiltration can be expected under a given set of site conditions is critical to the analysis.

Three factors of critical importance in a water balance calculation are precipitation, evapotranspiration and surface water run-off. Soil moisture storage is important in short term studies because a cover soil that has exceeded its field capacity (the maximum amount of water a soil can retain in a gravitational field without downward percolation) becomes a source of infiltration to the refuse. However, in a long term study, change in soil moisture may be neglected since it fluctuates up and down, whereas the precipitation, actual evapotranspiration and run-off terms all increase

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because they are cumulative over the extended time period.

The amount of water that can be added to solid waste, before it reaches field capacity, depends upon the moisture content of the waste at the time of placement in the landfill. Moisture content at time of placement is not a constant, but a function of waste composition, density and climatic conditions. As a general rule, moisture content of a typical waste at the time of placement has been found to range from 10 to 20 percent by volume (Fenn et al, 1975).

MOISTURE CONTENT OF REFUSE[a]
(Average Values)

	Percent by Volume	Equivalent inches H_2O/ ft of refuse	Equivalent gallons H_2O/ yd^3 of refuse
Placement	10-20%	1.8"	30
Field Capacity	25-35%	3.6"	60
Saturation[b]	---	6.6"	100

a. Adapted from Fenn et al. 1975
b. Based on a 0.4 porosity for refuse

As the Table indicates, refuse has a large capacity to absorb moisture before leachate is produced. Leachate production will not occur at rates equal to infiltration of rainfall until saturation is exceeded, a condition above field capacity.

A second important variable, actual evapotranspiration, represents the amount of water present in the soil that is lost to the atmosphere from a given area through direct evaporation from the soil and transpiration from plant tissues. When soil moisture is at or near field capacity, evapotranspiration occurs at its maximum potential rate. However, as soil moisture approaches the wilting point (the moisture content below which moisture is unavailable for withdrawal by plants), the amount of water available begins to restrict the rate of evapotranspiration, resulting in reduced actual water losses.

The third parameter of major importance is surface run-off, i.e. that portion of rainfall which will run off the site in lieu of entering the cover soil. Variables affecting run-off include intensity and duration of rainfall, existing soil moisture, soil permeability, slopes, and type of vegetative cover. Runoff includes surface interflow runoff and the active groundwater flow.

Details on the actual calculations involved in using the water balance method are presented in the Appendix to an October 1975 EPA report (EPA-SW-168). In brief, the basic equation for determining the amount of percolation anticipated at the given site is as follows:

$$PERC = P - R/O - ST - AET$$

where,

PERC = Percolation, i.e. the liquid that permeates the refuse.

P = Precipitation for which the mean yearly value is used.

R/O = Surface run-off

ST = Soil moisture storage, i.e. moisture retained in the soil after a given amount of accumulated potential water loss or gain has occurred.

AET = Actual evapotranspiration, i.e. actual amount of water loss during a given period.

Percolation through the final cover would be calculated assuming the following:

1. No contribution is made to the leachate from groundwater sources.

2. Site precipitation is 34.6 inches/year (Hydrocomp 1988).

3. Total run-off is 18.28 inches/year. (Hydrocomp 1988).

4. Actual evapotranspiration equals 15.3 in./yr. (Hydrocomp 1988).

5. Change in soil moisture storage of the cover can be neglected since the period of the study is large.

Percolation = precipitation - total runoff - actual evapotranspiration.

= (34.6 in./yr.) - (18.28 in./yr.) - (15.3 in./yr.)

= 1.02 in./yr.

Percolation through the interim cover would be calculated in a similar manner to that of the final cover. The only factor that would change would be total runoff which would decrease.

Hydrocomp (1988) calculated a percolation rate of 6.8 in/unit area of crown. They also calculated a total volume of percolation for 74 acres of crown and 45 acres of bench, under interim cover conditions, of 45.7 acre-ft/yr or 28.3 gpm.
To determine the moisture storage capacity of the refuse, assume that the field capacity of refuse is 3.6 inches H_2O per foot (Fenn, 1975). Assume moisture content of refuse at placement is 1.8 inches water per foot.

Remaining moisture absorptive capacity of refuse at placement equals:

(3.6 inches) - (1.8 inches) = 1.8 inches water per foot refuse.

The absorptive capacity of the refuse emplaced per year, exposed to annual precipitation is: 1 foot refuse X 1.8 inches/ft. = 1.8 inches water absorptive capacity per year per foot of refuse.

Assuming one 10 ft lift per year added to the crown area, leachate production under interim cover conditions would equal:

(6.8 in. percolation/yr) - [(1.8 in. absorptive capacity/ft refuse)
x (10 ft refuse)] = -11.2 in/yr
= 0 in/yr

Thus, leachate will not occur during construction of the landfill except by the process of channeling.

Maximum leachate flow from the entire landfill, occurring after the refuse lifts have reached field capacity, would be calculated as follows:

1.02 in of percolation/yr x 1 ft/12 in x 285 acres x 43,560 ft^2/acre

= 1,055,241 ft^3 leachate produced/yr

= 7,893,203 gallons leachate/yr

= 24.2 acre ft/yr

= 15 gallons per minute.

Maximum leachate flow from Area 2 would equal:

1.02 in of percolation/yr x 1 ft/12 in x 235 acres x 43,560 ft^2/acre

= 870,111 ft^3 leachate produced/yr
= 2,384 ft^3 leachate/dy
= 20 acre ft/yr
= 12.4 gpm

The LCRS plan is presented in the January 29, 1988, Apanolio Canyon plan set by Brian Kangas Foulk. It consists of a drain incorporating a 2 foot thick blanket of drainrock. Liquid from the system will drain to a holding facility at the bottom of the landfill.

The Area 2 leachate collection blanket will be approximately 77,920 ft^2 in area. This drainrock gravel envelope will have 36% void space.

Ignoring the extra volume provided by any leachate collection pipes present, the pore space volume of the gravel envelope would be calculated as follows:

$0.36\ (77{,}920\ ft^2 \times 2\ ft) = 56{,}102\ ft^3$

The total leachate storage volume in the gravel blanket would therefore be $56{,}102\ ft^3$ or 1.29 acre-ft.

The maximum calculated rate of leachate production is 12.4 gpm or $2{,}384\ ft^3/dy$.

The proposed leachate collection system would therefore provide leachate storage for the following time period:

$56{,}102\ ft^3$ storage/$2{,}384\ ft^3$ leachate produced/dy = 23.5 days

The storage time period of 23 days provides a factor of safety of 11 times the required volume.

LEACHATE TREATMENT AND RECYCLING PROGRAM

Various leachate treatment and recycling systems would be applicable to the Apanolio Canyon Expansion Site situation and will be reviewed herein.

Since landfill leachate will change in composition, as the refuse fill material ages, the treatment system must adapt to the age specific composition of the leachate. For example, a young leachate, defined by Chian (1976) as emanating from refuse fill less than five years in age, could have BOD and TOC values that are two orders of magnitude greater than old leachate, from a fill greater than ten years old. Young leachate could also have COD values, three orders of magnitude greater than old leachate.

Chian has evaluated the effectiveness of various treatment processes upon leachate of various ages. Since leachate parameters may differ significantly on a day to day basis, a ratio of the different parameters will supply a more accurate characterization of the leachate. The leachate parameter ratios most commonly analyzed are COD/TOC and BOD/COD. Chian (1976) has conducted a study of the effectiveness of various physical, chemical and biological processes in treating leachate. The leachate samples were characterized by age and several other parameters. Results are shown in Table 1.

This report will only discuss treatment systems for young leachate, since this degradation product will be produced during the first part of the life of the landfill. Examination of Table 1 reveals that biological treatment processes are the most effective in processing a young leachate. Typical biological treatment processes applicable to the Apanolio Canyon situation include:

Recycling leachate through the landfill

Facultative lagoon
Activated Sludge Package Treatment Systems

Various other systems may be applicable such as the oxidation ditch, the rotating biological contacter or possibly conveying part of the leachate to a wastewater treatment plant.

A package activated sludge system sized to treat the 12.4 gpm maximum leachate flow could be easily installed at the site. Processing units would connect to the leachate collection/holding facility and include the following units:

Leachate pump
Holding tanks
Aeration tank
Clarifier
Filtration (as needed)

An important consideration in utilizing an activated sludge package plant such as this would be the incoming concentration of heavy metals in the leachate. If the concentration is very high, a unit may need to be installed to remove metals. For example a coagulation and settling unit could be installed before the aeration unit. Maintenance required by this system would be higher than on most of the other alternatives.

In the event of groundwater contamination, various package systems are available to remediate the problem. A packed column air stripper could be easily installed at the site to remove volatile organics. Carbon adsorption package units are also readily available to remove contaminants that air stripping will not remove. If water in any of the groundwater subdrain pipes becomes contaminated, it would be a simple matter to route it into the treatment system.

If leachate contamination migrates into the groundwater subdrain flow or groundwater flow down gradient of the site, subdrain diversion piping and/or extraction wells could be installed to remove the water and route it into the groundwater treatment system. Considering that the groundwater flow volume will be relatively small, and that the valley is very narrow, contaminant recovery should not be difficult. Current groundwater flow from alluvial and decomposed granodiorite sources is approximately 15 gpm. The post-construction groundwater flow should be less than this. However, using this 15 gpm value as a conservative estimate, the package treatment system could easily treat the flow. An alternative treatment system for contaminated groundwater would consist of pumping the groundwater into a holding tank and aerating it. If contaminants are primarily volatile and in low concentration, as are typical of leachate plumes, this system should work rather well.
Contaminated surface water, if it occured, could be treated in the same manner. The treatment system would have to be somewhat larger, as possible higher end flows could range from 500-750 gpm (Purcell, Rhoades & Associates

1988).

Since water could be treated to the point that it is ultra-pure, it is technically feasible to discharge it to the stream, assuming that the necessary discharge permits could be obtained. The alternative would be to pipe the water to the wastewater treatment plant. This alternative is also technically feasible, though much more involved than the former.

In summary, the leachate flow from the Apanolio Canyon site could be readily treated by various biological treatment systems, some of which like the activated sludge package system, could be quickly and easily installed at the site. Similarly, contaminated groundwater could be treated in a package air stripping column. Package activated carbon units are also readily available if required.

If you have any questions concerning this evaluation, please feel free to contact our office.

Very truly yours,

Michael E. Heckathorn
Environmental Engineer

Reviewed by:

John E. Hicks, P.E
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Bruce J. Murphy
Director of Environmental Services

adg

cc: Lino Valbusa, BFI
Ed Kubit, BFI
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Bill Rozar, County of San Mateo

REFERENCES

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Fenn, D.G., 1975 Water Balance Method for Predicting Leachate Generation from Solid Waste Disposal Sites. EPA 530/SW-168 U.S. Environmental Protection Agency, Washington D.C.

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TABLE 1

PROPOSED RELATIONSHIP BETWEEN COD/TOC, BOD/COD, ABSOLUTE COD AND AGE OF FILL TO EXPECTED EFFICIENCIES OF ORGANIC REMOVAL FROM LEACHATE

CHIAN (1976)

Character of Leachate				Effectiveness of Treatment Process						
COD/TOC	BOD/COD	Age of Fill	COD In Milligrams Per Liter	Biological Treatment	Chemical Precipitation (Mass Lime Dose)	Chemical Oxidation	O_3	Reverse Osmosis	Activated Carbon	Ion Exchange Resins
>2.8	>0.5	Young (<5 yr)	>10,000	Good	Poor	Poor	Poor	Fair	Poor	Poor
2.0-2.8	0.1-0.5	Medium (5 yr-10 yr)	500-10,000	Fair	Fair	Fair	Fair	Good	Fair	Fair
<2.0	<0.1	Old (>10 yr)	<500	Poor	Poor	Fair	Fair	Good	Good	Fair

D-3

Apanolio Creek Streamflow Augmentation Plan

Hydrologic calculations predict that the stream flows in Apanolio Creek will increase slightly during the winter months and decrease slightly during the latter summer months as a result of the project development. Ultimately these calculations indicate that the late summer flow reduction will be on the order of 40% after full project development. This percent decrease will be less during the phased development over the 99 year estimated site life since the actual flow decrease is directly proportional to area of project development.

BFI proposes to provide augmentation flow to the Apanolio creek during the projected summer low flow periods. The water for this augmentation flow will come from various sources: The groundwater collection system; Wells and/or hydraugers upgradient to the proposed landfill; and Ponds proposed to be built in Corinda Los Trancos Canyon. Hydrologic and geohydrologic investigations support the adequacy of the above water sources for the proposed augmentation flow.

As discussed above, actual augmentation flow requirements for Apanolio Creek will vary according to the progress of landfill development and natural rainfall. The following formula for calculating the required augmentation flow was developed by Hydrocomp, Inc.:

Augmentation Flow = Measured Flow x [(Total area/natural area)-1]

Measured flow = streamflow entering the sedimentation basin at any point during landfill development

Total area = the total watershed area, or 673 acres at the Browning-Ferris Industries of California, Inc.

Natural area = the undisturbed land area in the watershed

For example, at ultimate development when the undisturbed area is 400 acres out of 673 acres, the augmentation flow would be:

Measured flow x [(673/400)-1], or 0.68 x measured flow

Thus, the anticipated summer flow reduction will be fully augmented, thereby restoring the natural flow regime of Apanolio Creek throughout the dry summer months.

D-4

Apanolio Canyon Lower Aquifer Recharge Plan

No. 2-0116/6870-15A
December 9, 1988

An injection well system has been designed for the recharge of 12 gpm of water into the shallow groundwater basin of Lower Apanolio Canyon. This system takes into account 1) the relatively low design recharge rate, 2) the semi-confined nature of the alluvium, and 3) the need to cause as little disruption as possible to normal land use.

The major limiting factor on the design of injection wells in an unconfined aquifer is the thickness of the unsaturated zone above the water table. An adequate space must be available for the full development of a cone of impression on top of the water table. During the pump testing that was conducted on March 8, 1988, initial depth-to-water measurements ranged between 6.5 and 12.5 feet in the various observation wells. As a worst case scenario, the attached design assumes an unsaturated thickness of 6 feet.

Based upon a Transmissivity of 3,000 gpd/ft, a Storage Coefficient of 0.005, and a Theis cone of impression after 1 year of pumping, several well numbers and spacings were considered. The result of the analysis indicates that the following design should provide the necessary recharge of groundwater:

Number of Wells:	4
Recharge Rate:	3 gpm each
Minimum Spacing:	50 feet
Optimum Spacing:	100 feet
Minimum Casing Diameter:	4-inch
Screen Type:	high efficiency wire-wound or louvered well screen

The wells will not be placed in a "clustered" configuration, and will be screened from the bottom of the alluvium to minimally 4 to 5 feet above the shallow water table. The wells will be installed downstream from the RCC sedimentation weir.

D-5

Application for Exemptions - Technical Information
(Purcell, Rhoades & Associates)

Purcell, Rhoades & Associates

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No. 2-0116/3449-16
January 29, 1988

Regional Water Quality Control Board
San Francisco Bay Region
1111 Jackson Street,d Room 6000
Oakland, CA 94607

Attention: Mr. Roger B. James, Executive Officer

SUBJECT: Response to Regional Water Quality Control Board Letter of July 20, 1987 - Application for Exemptions, Apanolio Canyon Expansion Site, Ox Mountain, San Mateo County, California

Gentlemen:

This letter addresses the comments and request for technical information which forms the basis of an exemption application required by the Regional Water Quality Control Board (RWQCB) in their July 20, 1987 letter to complete the Report of Waste Discharge (ROWD). New technical information which has been made available from comprehensive field and office studies conducted during the latter half of 1987 indicates that a demonstration of compliance with these Subchapter 15 sections can be achieved. Based on the demonstrations of compliance with the regulations stated in this letter, Purcell, Rhoades & Associates is of the opinion that exemptions of the regulations may not be necessary. Concurrence of the approach presented in this letter by the RWQCB may result in approval of the upcoming tentative Waste Discharge Requirements (WDR) as amended.

If you have any questions regarding this letter, please feel free to call us.

Very truly yours,

PURCELL, RHOADES & ASSOCIATES

Daniel J. Rhoades, G.E. 716
Principal

Bruce J. Murphy
Director of Environmental Services

pl

cc: Mr. Lino Valbusa, BFI

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INTRODUCTION

This response is in reply to a July 20, 1987 correspondence from Mr. Roger B. James, Executive Officer, Regional Water Quality Control Board (RWQCB), San Francisco Bay Region to Mr. Lino Valbusa, Vice President, Browning-Ferris Industries of California, Inc. setting forth the necessity for the Application for Exemption to certain areas of concern for the proposed Apanolio Expansion project. Pursuant to Section[1], 2510(b), this report serves as an application for exemptions and/or demonstrates compliance with several of the requirements and sections of Subchapter 15 for the proposed Class III Apanolio Canyon Sanitary Landfill Expansion, Ox Mountain, San Mateo County, California.

The basis of the RWQCB's request for this exemption application is predicated on the RWQCB's interpretation that certain natural site conditions and the Report of Waste Discharge (ROWD)[2] did not meet the minimum Subchapter 15 standards for the Class III waste disposal facility. The time consideration was over the life of the site and

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[1]References hereafter are to sections of Title 23, Chapter 3, Subchapter 15 of the California Administrative Code.

[2]Technical reports submitted to date for the Report of Waste Discharge (ROWD) can be found in the references.

into the closure and post-closure period, which would be possibly in excess of 100 years, and thus the review of data submitted to date to the RWQCB appeared to be incomplete in certain requirements of Subchapter 15. As part of the July 20, 1987 RWQCB letter, the alternate site analysis is currently being prepared and will be submitted by Harding-Lawson Associates in a separate document incorporated as part of the Draft Environmental Impact Statement (DEIS).

A major portion of this report will provide a discussion of the proposed modification to the site design and current site conditions disclosed by recent comprehensive studies which demonstrates that those sections requiring exemptions meet the intent and purpose of those sections, and consequently will be in compliance with the regulations. The preliminary geotechnical investigation and landfill design submitted as part of the ROWD dated May 21, 1986 for the sections in question were the general basis of the review for the July 20, 1987 RWQCB letter and at the date of the July 20, 1987 letter, it appeared that certain exemptions would probably be necessary. Subsequently, new data and technical interpretations are now available for the seismicity, groundwater condition and proposed landfill design to demonstrate compliance with Subchapter 15. A review of the applicability and exemption process with citation of those Subchapter 15 sections requiring compliance may be helpful to review and are listed with our comments as follows.

APPLICABILITY, COMPLIANCE AND EXEMPTION PROCESS

New Class III and existing Class II-2 landfills are required to be sited where specific factors (Section 2533(b)) will ensure no impairment of beneficial uses of surface water or of groundwater beneath or adjacent to the landfill. However, Section 2510(b) contains an exemption process to the construction and prescriptive standards contained in Subchapter 15 which states the following:

"(b) unless otherwise specified, alternatives to construction or prescriptive standards contained in this subchapter may be considered. Alternative shall only be approved where the discharger demonstrates that:

(i) the construction or prescriptive standard is not feasible as provided in the Subsection (c) of this section, and

(2) There is a specific engineered alternative that

(A) is consistent with the performance goal addressed by the particular construction or prescriptive standard, and

(B) affords equivalent protection against water quality impairment.

(C) To establish that compliance with prescriptive standards in this subchapter is not feasible for the purposes of Subsection (b) of this section, the discharger shall demonstrate that compliance with a prescriptive standard:

(1) Is unreasonably and unnecessarily burdensome and will cost substantially more than alternatives which meet the criteria in Subsection (b) of this section; or

(2) Is impractical and will not promote attainment of applicable performance standards."

Regional boards shall consider all relevant technical and economic factors including, but not limited to, present and projected costs of compliance, potential costs for remedial action in the event that waste or leachate is released to the environment, and the extent of groundwater resources which could be affected.

Thus, modifications to the requirement of an exemption application appear to be affected by either:

1. Updated technical data and analysis meeting approval of the RWQCB submitted after the issuance of the July 20, 1987 RWQCB letter demonstrates compliance with the sections in question and thus an exemption is not warranted; or that

2. The specific engineered alternatives are consistent with the performance goal addressed by the particular construction or prescriptive standard and affords equivalent protection against water quality impairment.

The demonstration of alternatives to construction or prescriptive standards which follows is intended to present technical evidence and to illustrate and explain, especially with examples, each specific section or item proving compliance with the regulation.

SPECIFIC AREAS WHERE NEW TECHNICAL INPUT HAS IMPACT

As outlined in the July 20, 1987 letter from the RWQCB, the following list of the four prescriptive standards that the application for exemption would satisfy as set forth in the letter are as follows:

> "1. Section 2530(c): requiring all new landfills to be sited, designed, constructed and operated to ensure that all wastes will be a minimum of five feet above the highest anticipated elevation of the underlaying groundwater.
>
> 2. Section 2547: requiring all Class III landfills to be designed to withstand the maximum probable earthquake without damage to the foundation or to the structure that controls drainage, leachate, erosion and gas.

3. Section 2540(c): requiring that Class III landfills have containment structures that are capable of preventing degradation of the water of the State. You have not yet submitted any information that demonstrates that the proposed design scenario would ensure the integrity of the foundation and containment structures during a seismic event and thereby prevent degradation of waters of the State.

4. Sections 2550, 2555, 2556 and 2595: requiring the establishment of a detection monitoring program that will detect leachate from the landfill."

In addition to demonstrations that the proposed design and/or the planned engineered alternative meet the above quoted regulatory requirements and performance standards set forth in Sections 2533(a) and 2533(b) to ensure no impairment of beneficial uses of surface water or of groundwater, this exemption application should be reviewed in conjunction with key portions of the detailed alternative site analysis currently being submitted as part of the DEIS for the proposed project. The technical data which have been previously submitted to the RWQCB will be referenced to provide the basis of the technical evidence and documentation supporting the various discussions which follow.

Proposed Site Design and Compliance with Section 2530(c), Groundwater Separation Siting Criteria

A. Prescriptive Standard

Section 2530(c) states that:

> "All new landfills, waste piles, and surface impoundments shall be sited, designed, constructed, and operated to ensure that wastes will be a minimum of 5 feet above the highest anticipated elevation of underlying groundwater. Existing landfills, waste piles, and surface impoundments shall be operated to ensure that wastes will be minimum of 5 feet above the highest anticipated elevation of underlying groundwater. For new and existing land treatment units, the base of the treatment zone shall be a minimum of 5 feet above the highest anticipated elevation of underlying groundwater and dischargers shall not be entitled to exemption under Subsections 2510(b) of this subchapter."

B. Prescriptive Standard and Proposed Site Conditions

Section 2530(c) is a general requirement for landfills, waste piles and surface impoundments requiring 5 feet of separation between the waste and groundwater. It specifically states that there can be no exemptions under Section 2510(b) for new land treatment units. This would infer that an exemption can be obtained under Section 2510(b) (equivalent protection) for all of the other named waste management units including expansion of existing permitted facilities.

The rationale for location of a Class III waste management unit is defined under Section 2533(a). This sections states that waste management units "shall be located where site characteristics provide adequate separation between nonhazardous solid waste and waters of the State." Some Class III waste management units in the State have been permitted to be constructed without liners at locations in soil over groundwater beneficial resources. Typically, they were at locations where the usable groundwater was over 100 feet below the surface. The RWQCB findings at these sites were that "other factors will ensure no impairment of beneficial uses of surface water or of groundwater beneath or adjacent to the landfill." In addition, Section 2533(b)(2) states: "Where consideration of the factors in Subsection (b)(1) of this section indicates that site characteristics alone do not ensure protection of the quality of groundwater or surface water, Class III landfills shall be required to have a single clay liner with permeability of 1×10^{-6} cm/sec or less."

Our interpretation of the aforementioned regulations indicates that if there is less than 5 feet of material between the base of the landfill and the underlying groundwater, this deficiency can be properly corrected or mitigated by sound engineering using a low permeability clay liner. This has been the case at other permitted landfills in this region and other locations within this State where the base of the waste is below the surrounding potential groundwater, seeps or more permanent non-usable water levels. Furthermore, the clay liner with an "inward gradient" has been approved by the RWQCB as the equivalent protection for water quality.

Regarding the requirement that wastes will be a minimum of 5 feet above the highest anticipated elevation of the underlying groundwater, it is not clear in Subchapter 15 that this must be a natural condition. The above regulatory language in itself states that a landfill can be designed, constructed and operated to ensure the 5 feet of separation.

Therefore, an "exception" to Section 2530(c) would not appear to be required if the 5 feet of separation is maintained artificially. Compliance with the performance goal addressed by the following specific construction design of the groundwater collection system and subgrade barrier/clay liner which affords equivalent protection against water quality impairment is discussed below.

C. <u>Compliance with Construction and Prescriptive Standards</u>

The proposed design and construction of the Apanolio Canyon site contains the assurance that there will always by at least 5 feet of material placed as engineered fill between the waste and the underlying groundwater, and that the basic design incorporates certain inherent contingencies which perform as backup systems or advance notice detection monitoring systems to ensure that there will be no impairment of beneficial uses. These designs have been previously submitted to the RWQCB as various reports prepared by Purcell, Rhoades & Associates (PRA; May 21, 1986, October 14, 1986, May 20, 1987), with the latest report of December 31, 1987 including certain modifications based on newly analyzed technical data in the areas of seismicity and groundwater.

As described and graphically illustrated in our most recent report on the subgrade barrier and clay liner dated January 29, 1988, all soil and weathered bedrock material will be removed exposing the hard, unweathered granitic bedrock at the base and side slopes of the canyon. The removed on-site material will also be used for daily cover and construction needs over the life of the site. Within the final bedrock surface at the bottom of the canyon, a structural storm drain conduit system will be installed to route storm water beneath the landfill discharging through energy dissipator structures. Groundwater beneath the landfill will be collected by a minimum 1-foot thick blanket of drainrock along the center line of the canyon bottom and extending up to a minimum 20% grade side slope intercept, or as high up the side slope as possible. Above the canyon floor on adjacent hillsides, water seepage originating from bedrock fractures will be isolated and collected through a series of tightline horizontal drains (hydraugers) which will route the flow either toward the bottom groundwater collection system within the underdrain or as an independent pipe system out toward the front of the landfill to the nearest external surface "V"-ditch. As designed, the groundwater collection system will be free-flowing by gravity and a head of water building in the system is not anticipated. Thus, transient seepage of groundwater into the waste would not occur with the planned design concept.

The minimum 5-foot separation between groundwater and the waste will be achieved through the construction of a minimum 5-foot thick subgrade barrier and overlying 1-foot thick clay liner. As illustrated in the final Brian, Kangas and Foulk (BKF) design drawings for the site, a minimum 5-foot thick subgrade barrier consisting of on-site engineered fill will be installed over the final bedrock surface. On top of this fill, a minimum 12-inch thick clay lining consisting of on-site soils and an admix of bentonite will be completed which meets the construction standards for clay liners specified in Subchapter 15.

All of the aforementioned systems have been designed with conservative and careful studies in consideration of the demonstrated concern to the protection of waters of the State after the initial 1986 ROWD report. The subgrade barrier and clay liner will be designed and constructed in accordance with the most recent PRA report entitled, "Subgrade Barrier/Clay Liner Design and Specifications Report", January 29, 1988, which accompanies the response to the RWQCB's letter of May 29, 1987. In addition, a static and dynamic stability analysis recently conducted for the proposed site ("Stability Analysis, Static and Dynamic Loading Conditions", January 29, 1988), which included a discussion of the integrity of the subgrade barrier/clay liner, demonstrated that those structures will be able to withstand the maximum probably earthquake (MPE) and not rupture or fail.

In conclusion, it is our opinion that the proposed installation of the minimum 5-foot thick subgrade barrier, plus 1-foot thick clay liner system beneath the landfill, meets the performance goals and standards set forth in Sections 2530(c) and 2533. The incorporation of a comprehensive groundwater control system beneath the subgrade barrier will also ensure that water does not come into contact with the waste and that the beneficial use of waters are not impaired.

Proposed Site Design and Compliance with Sections 2540(c) and 2547, Seismic Design

A. Prescriptive Standards

Section 2547(a) - "Class III waste management units shall be designed to withstand the maximum probable earthquake without damage to the foundation or to the structures which control leachate, surface drainage, erosion or gas."

Section 2540(c) - "Class III landfills shall have containment structures which are capable of preventing degradation of waters of the State as a result of waste discharges to landfills if site characteristics are inadequate."

The above prescriptive standards were identified by the RWQCB in their July 11, 1986, and May 29 and July 20, 1987 correspondences as being issues (standards) which could not be resolved based upon review of the proposed site design adn when compared to the minimum requirements of Subchapter 15. This concern was addressed by the RWQCB for the initial ROWD (PRA, May 23, 1986, Page 33) which identified the possibility of cracking at the junction of the landfill with the native slope during a large, near-source earthquake. However, the RWQCB recognized that additional comprehensive seismic and stability work in progress by the Applicant's Consultant could provide additional data upon which a revised site design in compliance with Subchapter 15 requirements might be reviewed and approved.

To demonstrate compliance with the aforementioned prescriptive standards, a discussion of our latest report entitled, "Stability Analysis, Static and Dynamic Loading Conditions, Apanolio Canyon Expansion Site", dated January 29, 1988 prepared by PRA and Dr. Suki Singh, Professor of Civil Engineering, Santa Clara University, San Jose, California will be addressed.

B. <u>Compliance with Construction and Prescriptive Standards for Seismic Design</u>

PRA has conducted a comprehensive seismic slope stability analysis of the final landfill design including all major containment systems for the Apanolio Canyon Expansion Site. The results and conclusions of this latest report included a review of the more comprehensive SHAKE computer program and the impact of a MPE on the site design.

The seismic stability report also addressed the assumptions, field and laboratory data used in determining the engineering properties of landfill material, analyzed potential critical slope conditions at various interfaces within the landfill material and at the boundary with the subgrade barrier/clay liner, and evaluated displacements of the landfill using design input motions from various accelerograms. On the basis of a critical examination of existing data, either from direct testing or from back-calculations of the field behavior of refuse from published reports, it was possible to develop reasonably conservative strength parameters for use in the seismic stability analysis whereby the following conclusions were reached in the report:

"1. The computed minimum factor of safety under static loading conditions ranged from 1.59 to 2.63 for a final slope of 3:1 (H:V), using the conservative strength parameters. These values of the safety factor indicate that the proposed slope will perform satisfactorily under the static loading conditions and that the overall stability of the landfill is adequate.

2. The dynamic analysis (SHAKE program) was performed using an accelerogram representative of the MPE for the San Andreas fault of 0.5g. In addition, a very conservative "worst case" condition of a maximum acceleration value of 0.6g was also analyzed. The response of the 520-foot high column of the landfill was evaluated using the one-dimensional response analysis computer program SHAKE and acceleration time histories were computed at several heights within the fill. The considerable reduction or attenuation of the seismic motions as they propagate upward through the landfill can be clearly seen in Figures 6a and 7a of the report. The filtering out of the high frequency wave lengths is also evident from an examination of the time histories of accelerations for different heights shown in the report as the motions travel upward. Reduction in the maximum dynamic shear stresses can also be noted in Figures 6a and 7a. These results demonstrate the effect of high damping, including the light unit weight of the refuse material in absorbing a significant amount of energy.

3. The computed earthquake-induced displacements were on the order of about 0.25 feet for the final slope of 3H:1V obtained by using our best judged conservative strength parameters for the refuse material.

4. On the basis of the analyses results and performance of several landfills subjected to strong shaking during the 1971 San Fernando earthquake and the 1987 Whittier earthquake, it is concluded that the final slope gradient at the Apanolio Canyon site will perform satisfactorily and will be adequately stable under the design earthquake condition.

5. An analysis of the leachate collection and removal system, storm water underdrain and the subgrade barrier/clay liner system, taking into account ground curvature during high accelerations, axial stresses and lateral earth pressures, indicated that there will be negligible effort on the various structures

during a MPE event and that the overall integrity of the system will be maintained."

Compliance with Sections 2550, 2553, 2555 and 2595, Detection Monitoring Program

A. Prescription Standards

Sections 2550, 2553, 2555 and 2595 all require the "establishment of a detection monitoring program that will detect leakage from the landfill." Section 2550, 2553 and 2555 are contained in Article 5, "Water Quality Monitoring for Classified Waste Management Units" while Section 2595 is discussed within Article 9, "Compliance Procedures".

The regulatory standards cited above stipulate that a water quality monitoring network be installed based on siting, design, construction and operation standards that are intended to detect leakage from the site so as to prevent adverse impacts on water quality. Specifically, concerns were raised by the RWQCB in the July 20, 1987 letter which read, "Additionally, since the proposed groundwater monitoring programs will not monitor all the fractures that may be pathways for leachate migration, it does not appear that a detection monitoring program that meets the intent of Subchapter 15 can be developed." These concerns were also expressed in the May 29, 1987 RWQCB letter which stated that "it therefore does not appear technically feasible to monitor all potential paths of leachate migration. It therefore does not appear technically feasible to design an adequate detection monitoring program required by Section 2556."

B. Prescriptive Standard and Proposed Site Conditions

In consideration of the above concerns expressed by the RWQCB in the site design, the following discussion will demonstrate that the "detection monitoring system" proposed by the operator meets the intent of the cited sections and will perform in an adequate manner to detect possible changes in water quality as a result of impacts from the landfill. Much of this explanation will reference recent conclusions on the analysis of the site hydrogeologic conditions including well testing within the existing monitoring system which was not available to the RWQCB at the time the July 20, 1987 letter was issued.

A hydrogeologic study has been conducted within the proposed landfill boundary and lower Apanolio Canyon by PRA dated January 29, 1988 entitled, "Hydrogeologic Assessment and Water Resources Beneficial Usage Analysis, Apanolio Canyon Expansion Site" submitted along with the response to the May 29, 1987 RWQCB letter. The report addresses many topics including the hydrogeologic characteristics of the proposed facility, the quantity of groundwater and the direction of groundwater flow beneath the site to establish a basic understanding of water movement at the project. A major intent of the study was to predict and intercept potential pathways for contaminant migration. Consequently, with this information, horizontal and vertical placement of detection monitoring wells along the downgradient perimeter of the site can be proposed.

Groundwater at the site occurs in the alluvium, in weathered to fresh bedrock, and to a limited extent in colluvium. Generally, there seems to be reasonably good hydrologic connection between the various units. This is evidenced by the continuity of groundwater levels between nearby wells and by the preliminary results from one pump test performed (Well MW-1B). In rarer instances, bedrock and overburden sustain sufficiently different water levels on the order of several feet (MW-7A and MW-7B) that they behave as two separate aquifers, at least locally.

Water in the bedrock occurs and moves slowly downgradient almost exclusively in fractures. These fractures tend to be more open in the shallow subsurface bedrock due to weathering and stress release; however, they appear to close up rapidly with depth where weathering ceases and lithostatic pressures are greater. The bedrock consists primarily of granodiorite, although metamorphic rocks are present in isolated bodies. One well (MW-5A) is completed in metamorphic rock.

Examination of the core material indicates that the rock mass is highly fractured, especially toward the surface and frequently with several open hairline fractures per foot of core. Fractures mapped in outcrops (PRA, Figure 1A, March 20, 1987) characteristically show a great deal of scatter in their orientations, however, a statistically dominant orientation occurs for vertical fractures with a N10°W trend. This trend aligns approximately with the axis of the canyon, and is the major surface and groundwater flow direction. The fractures occur in sets which would create anisotropy in the hydraulic conductivity of the rock.

Evidence of significant water movement is readily recognizable in cores and geologic logs by the degree of weathering present, and in slightly weathered to fresh rock by iron oxide staining of the fractures. The zone of highly weathered rock average 10 feet (range 4 to 24 feet) in thickness and is generally completely water saturated. The exception to this is along the

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ridgetops where the thickness of highly weathered bedrock in borings is 50 to 90 feet and where the geologic materials are not saturated. The slightly weathered bedrock, which shows limited evidence of water movement, averages 9 feet (range 1 to 22 feet) in thickness. Beneath those depths, the fractures in the unweathered bedrock appear to be so closed as not to hold or transmit significant amounts (pumpable) of water. Evidence from several deep angle hole borings, slug tests and numerous deep (200 feet) horizontal drains (hydraugers) at Corinda Los Trancos, including one hydrauger which was drilled 500 feet through a ridge, demonstrated that extremely low volumes of water is encountered in deep unweathered bedrock.

The PRA hydrogeologic report also made a determination of the hydraulic conductivity transmissivity, storage coefficient, groundwater gradient and velocity of the various geologic units as required by Article 5 of Subchapter 15. Additional groundwater information will be forthcoming under a separate report in the near future regarding the results of pump tests in two wells located in lower Apanolio Canyon.

While the aforementioned groundwater characteristics of each geologic material is important in the logical placement of a detection monitoring system, the location rationale of such a system must be predicated on an understanding of the direction and movement of groundwater. Consequently, using water level measurements from the various monitoring wells established to date at the site (MW-Series wells, B-Series wells, DH-Series wells and RD-1/RD-2 Series wells), an equipotential map was constructed. This map showing equivalent elevations of water also established the hydraulic gradient and direction of groundwater movement.

Interpretation of the equipotential map (PRA, January 29, 1988) indicates that along the slopes and valleys the water levels follow the topography, yet in a more subdued manner. Since flow lines are orthogonal to the equipotential lines, groundwater will flow down the gradient to the valleys in the bedrock, reflecting in a generalized way the surface drainage. Groundwater flow is eventually routed into the canyon bottom and will exit along the topographic low within the creek bottom. This is why Apanolio Creek can have low streamflow during summer periods when no detectable precipitation has occurred for several months. The hydraulic gradient varies greatly over the site, just as the topography does. In the side canyons and the upper portion of the project site, the hydraulic gradient is nearly 0.12. Near the site boundary, the hydraulic gradient in the main canyon is 0.04.

C. Compliance with Construction and Prescriptive Standards

In view of the above information which has been recently prepared (PRA, January 29, 1988) and based on the new comprehensive field data collected to date, it is apparent that a detection monitoring system can be located to adequately detect potential leakage from the landfill. Thus, the rationale for the location of groundwater monitoring wells downgradient from the toe of the landfill would be to place the wells in the topographic bedrock low within the center line of the canyon. Again, the equipotential map demonstrates that a flow line from beneath the landfill will travel and move through the area undirectionally, and thus a monitoring well positioned there would detect any contamination in the groundwater that is likely to pass through the area. In addition, contaminated groundwater from the landfill is likely to form a plume which will spread out due to dispersion and be transmitted in several fracture systems simultaneously. Therefore, although we agree that a bedrock well can only monitor horizontally a narrow set of fractures, it is most likely that leachate will be found dispersed in several fractures vertically and not preferentially confined to one fracture that could bypass the monitoring well. In addition, since the site aquifer is not connected to an adjacent watershed aquifer due to the very low permeability barrier in the natural bedrock within the ridges, it appears most improbably that any leachate leakage will be transmitted against the site hydraulic gradient and bypass the detection monitoring system.

As a result of the previous discussions, the recommended first-line detection monitoring system should be installed in the area below the landfill and between the toe berm and the proposed ground curtain (see PRA Grout Curtain Report dated January 29, 1988 for exact location). We further recommend that the wells be located within the center line and topographic low between these structures, and constructed within unweathered bedrock as paired or multiple-screened wells not exceeding 20 feet in screen length. The bottom of the well should extend some 5 feet deeper than the bottom of the grout curtain. Other downgradient wells currently monitored (MW-1A, MW-1B) and future proposed wells (MW-3A, MW-3B) to be located near the property boundary, will add additional detection monitoring system support and supplemental data. The monitoring well placed 40 feet downstream from the grout curtain for verification of the grout curtain performance may also be included into the detection system located at the toe of the landfill.

In conclusion, we believe that a detection monitoring system can be installed which will logically be positioned both horizontally and vertically to be in the potential path(s) of leachate migration in bedrock downgradient of the landfill, and that the leak detection system will achieve the construction and performance standards by Sections 2550, 2553, 2555 and 2595 of the regulations. In addition, since the site design incorporates various engineered structures to impede subsurface flow from leaving the site (deep grout curtain), a built-in contingency system will enhance natural conditions to limit contamination migration. These systems, and acting individually or in concert, should result in minimizing or eliminating the probability of waste or leachate from coming in contact with groundwater. Sampling of water quality from the groundwater collection system on a regular schedule will additionally perform as a detection monitoring system. The monitoring and inspection requirements of the total facilities on a programmed basis in conformance with the operation manual and contingency plan, will provide further assurance of predetection capabilities prior to the development of unforeseen problems.

D-6

Geotechnical Study and Specifications, Subgrade Barrier and Clay Liner System
(Purcell, Rhoades & Associates)

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January 29, 1988
Job No. 2-0116/3449-15

Regional Water Quality Control Doard
San Francisco Bay Region
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Oakland, CA 94607

Attention: Mr. Ken Theisen

Subject: Geotechnical Study and Specifications
Subgrade Darrier and Clay Liner System
Apanolio Canyon Expansion Site, Ox Mountain
San Mateo County, California

Gentlemen:

This report presents the findings, conclusions and recommendations of our geotechnical study for the subgrade barrier and clay liner system at the proposed Apanolio Canyon Expansion Site. The purpose of this combined system is to provide adequate separation and containment of the waste produces from potential contact with groundwater that naturally occurs at the site.

The recommended liner system consists of a 5 foot thick subgrade barrier and a minimum 1 foot thick clay liner constructed of compacted on-site native soil with a high swelling sodium or approved calcium bentonite material used as an admix in the construction of the clay liner. It is our opinion that the clay liner will have a hydraulic conductivity of 1 X 10^{-6} cm/sec or less provided the recommendations presented in this report are followed.

If you have any questions, please contact us at your convenience.

Very truly yours,

Daniel J. Rhoades, G.E. 716
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1.0 INTRODUCTION

1.1 Location

The site for the proposed liner system is in Apanolio Canyon, which is located approximately three miles northeast of Half Moon Bay in an undeveloped area north of State Highway 92, as shown on Figure 1. The landfill site consists of Area 1 and Area 2 (See Figure 2) approximately 100 and 200 acres, respectively within the Montara Mountains of San Mateo County, California.

1.2 Purpose and Scope of Project

The purpose of this report is to evaluate the physical and chemical characteristics of on-site soils in order to provide recommendations for design and construction specifications for the Liner System. The liner system is designed to provide adequate separation of the waste material from the groundwater and will prevent the migration of any constituents of the waste liquid (leachate) from the Apanolio Canyon expansion landfill site into adjacent geologic materials and groundwater during disposal operations, closure and post-closure maintenance period. The liner system was designed based upon soil design parameters from our field and soil laboratory data. Minimum design and construction standards are established in Sections 2540, 2541, and 2542 of Subchapter 15, Title 23 of the California Administration Code.

The construction of the liner system includes, but is not limited to, the 12 inch thick clay liner placed upon or an integral part of a 5 foot thick subgrade barrier. A leachate collection and removal system is placed upon the top portions of the final clay liner/subgrade barrier layer, generally along the centerline of the canyon and extending laterally where feasible upon each canyon wall side. This report only addresses the design and construction of the clay liner and subgrade barrier. The proposed liner system is constructed in stages after the main storm water conduit system and groundwater control system is installed. The liner system starts at the toe of the landfill, along the canyon bottom and then progresses upon adjacent side slopes progressively in stages as the refuse increases in elevation.

2.0 LINER SYSTEM CRITERIA

2.1 General

This design report addresses the design and construction of the impermeable engineered fill system underlying the proposed sanitary disposal site. According to Subchapter 15 regulations, Class III (non-hazardous solid waste) landfill is required to have a single clay liner minimum 12 inches in thickness, with a permeability of 1×10^{-6} cm/sec or less if site characteristics alone do not provide adequate separation of the waste material from the groundwater to ensure protection of the quality of groundwater. A schematic profile of a liner system is presented as Figure 3.

2.2 Subgrade Barrier

Objectives of the subgrade barrier will be to serve as a long term structurally stable base for the clay liner and all overlying materials; to attenuate constituents in liquids from a contingency plan viewpoint that might leak through the clay liner; and to minimize the rate of any potential leakage through breaches in the clay liner. The foundation for the subgrade barrier is defined as non-yielding bedrock.

Attenuation of constituents is best achieved by assuring that the compacted soil is homogeneous and that proper quality control measures are implemented during construction. Preventing the formation of cracks by preventing desiccation of the barrier during or after placement and reducing the number of large pores by reducing clod size and optimizing compactive procedures are ways to enhance the attenuative capacity of the barrier.

The rate of seepage through the subgrade barrier can be minimized by reducing the hydraulic gradient of the leachate and reducing the hydraulic conductivity of the compacted soil. The hydraulic gradient is also minimized by reducing the depth of standing leachate in the collection system by providing a uniform side slope to the center drain and a uniform longitudinal slope to the final discharge point. The use of an impermeable synthetic liner (60 mil minimum) below the centerline pipe placed on the clay liner and constructing a thick compacted soil layer below the clay liner will reduce the possibility of any construction imperfections penetrating through the total depth of compacted soil below the one area where the leachate is concentrated, at the centerline of the canyon.

The subgrade barrier is constructed of engineered fill using approved on-site native soil. The fill is moisture conditioned to over-optimum and compacted to densities ranging from 90% to 100% relative compaction as per ASTM D1557-78 test procedures. The thickness of the subgrade barrier shall be no less than 5 feet in thickness as measured perpendicular to the base of the barrier which is founded on non-yielding bedrock conditions.

2.3 Clay Liner

To ensure that an impermeable barrier exists below the leachate collection system, a single clay liner with a permeability of 1 X 10^{-6} cm/sec or less shall be constructed for the protection of the quality of groundwater or surface water. To obtain a permeability of 1 X 10^{-6} cm/sec,the on-site soil should be admixed with high swelling sodium bentonite or equivalent at an approved application rate. Final permeability performance standard shall control and where consistent passing tests verify that a calcium based bentonite will provide equal performances,the calcium bentonite may be used as an equivalent soil admixture for the liner program. The liner shall be a minimum of one-foot thick and shall be installed at a minimum relative compaction of 90 percent.

Materials used in the clay liner shall have appropriate chemical and physical properties to ensure that the liner does not fail to contain waste because of pressure gradients (hydraulic head and external hydrogeologic forces); physical contact with leachate; chemical reactions with soil and rock, climatic conditions, the stress of installation and daily operation. A separate study currently on-going will provide test results verifying the long-term resistance to the above areas of concern.

Earthen materials used in the clay liner shall consist of a mixture of clay and other suitable fine-grained soils which have at least 30 percent of the material, by weight, passing the No. 200 Sieve (U.S. Standard Sieve) and the material shall be fine-grained soils with a significant clay content and without organic matter within the "SC", "CL", or "CH" classes of the Unified Soil Classification System.

The permeability shall be determined primarily by appropriate field test methods in accordance with accepted civil engineering practice. The results of laboratory tests with both water and leachate, and field tests with water, shall be compared to evaluate how the field permeability will be affected by leachate. Appropriate compaction tests may be used in conjunction with laboratory permeability tests to determine field permeabilities.

3.0 FIELD BULK SOIL SAMPLING PROGRAM

In order to make an assessment of the suitability of the soil units for construction of the liner system, disturbed bulk samples were obtained from the field for laboratory testing. Bulk samples were obtained to a depth of six feet at random and representative locations during February 1987 for the purpose of laboratory soil testing. The sample locations are presented in Figure 4, which was presented in the Appendix of the "Supplemental Response to the Completeness Checklist and Attached Comments for the Report of Waste Discharge (ROWD)" dated March 20, 1987 prepared by Purcell, Rhoades & Associates. A 50 pound bulk sample was collected of each soil unit by power auger and hand shovels at each of the sample locations. Bulk samples obtained were tested in our laboratory for physical properties as described in the following sections.

4.0 LABORATORY TESTING PROGRAM

4.1 General

The bulk samples were tested to evaluate the physical properties of the soils for their suitability in construction of the liner system. The laboratory soil testing included grain size analysis, plastic and liquid limit (Plasticity index), maximum dry density and optimum moisture content, and falling head permeability tests of remolded and insitu samples. The results of these tests are shown in Figure 5 and 6 and Tables 1 through 6. Other tests included the permeability of soil/bentonite admix at varying percent of bentonite and the permeability of water and leachate.

The results of the laboratory testing were used in the design and development of the construction standards for the clay liner and subgrade barrier. Index properties (i.e. passing No. 200 Sieve) of the soils determined in the laboratory may be used as guidelines for the quality assurance/quality control program in the field during construction. The percent of fines may be used to find the rate of application for bentonite in the field. More specific results of the laboratory soil testing used in the design will be discussed in the following sections:

The ASTM testing procedures followed for the laboratory soil testing is as follows:

ASTM D422-63	Grain Size Analysis
ASTM D424-	Plastic Limit
ASTM D423-	Liquid Limit
ASTM D1577-78	Maximum Dry Density and Optimum Moisture (Modified Proctor)
ASTM D2434-68	Permeability Test (Falling Head)
ASTM D2216-	Water Content

4.2 Native Soil

The results of the falling head permeability test of remolded samples compacted to 90 percent relative compaction as per ASTM D1557-78 were used in designing the subgrade barrier and clay liner. The permeability (cm/sec) of remolded topsoil samples ranged from 2.16 X 10^{-8} to 5.34 X 10^{-5} cm/sec and is generally less than the permeability of the colluvium that ranged from 2.16 X

10^{-8} to 9.54 X 10^{-5} cm/sec. (See Tables 5 and 6). The average hydraulic conductivity of the collected samples were 3.64 X 10^{-7} cm/sec.

In order to correlate the hydraulic conductivity with the percent of soil passing the No. 200 Sieve, 18 colluvium samples were plotted as shown on Figure 7. The plot indicates a direct relationship between the proportion of fines and hydraulic conductivity. Figure 7 shows that hydraulic conductivity is greater than 1 X 10^{-6} cm/sec when the soil is compacted to 90 percent relative compaction and contains less than 26.2 percent fines by weight.

The soils tested for plasticity showed a plasticity index of less than 12. The plasticity index including colluvium and topsoil ranged from 4 to 12. The plasticity index for colluvium is slightly less than for topsoil (See Tables 1 and 2).

Most of the samples collected were a silty sand material with 10 to 50 percent passing the No. 200 Sieve (See Figures 5 and 6). The range of the maximum dry density and optimum moisture for these silty sand samples were 104.5 pcf at 19.5 percent to 134.0 pcf at 8.0 percent (See Tables 3 and 4).

4.3 Composite of Soil/Bentonite Admix

The hydraulic conductivity of on-site soil with a sodium bentonite (200 MESH) admixture was tested for purpose of designing the clay liner. Two samples (2S and 19G) were selected and tested for hydraulic conductivity with varying percent by weight of added sodium bentonite. The results are shown on Table 8. The samples were remolded and compacted to 90 percent relative compaction as per ASTM D1557-78. The results show that increasing rates of bentonite decreases the permeability of the remolded compacted sample. The permeability of the samples were also tested using a leachate solution. The tests showed that for sample 2S with 3.5% bentonite, the permeability decreased from 2.57 X 10^{-6} cm/sec to 2.28 X 10^{-6} cm/sec when leachate solution was used. For sample 19G with 5% bentonite the permeability increased from 9.30 X 10^{-7} cm/sec to 9.49 X 10^{-7} cm/sec when leachate was used. It appears that the permeability is a function of the percent by weight of bentonite added, percent fines passing No. 200 Sieve, percent relative compaction and not the type of liquid waste (leachate) migrating through the soil.

Six samples from three locations (13P, 8I and 6I) were tested by American Colloid Company to find the recommended application rate of sodium bentonite to attain a permeability of 1 X 10^{-6} cm/sec. The results are shown on Figure 8. The topsoil and colluvium was tested from each sample location. The application rate in pounds per square foot was determined to attain a permeability of 1 X 10^{-6} cm/sec for a 6-inch layer compacted to 90 percent of Standard Proctor. The Standard Proctor at 90% relative compaction is approximately 85% relative compaction based on the modified proctor, ASTM D1557-78. This provides a conservative estimate of the application rate to accommodate certain unknowns in field placement. The application rate correlates with the percent of fines passing the No. 200 Sieve. The necessary application rate decreases with an increase in the percentage of fines.

5.0 HYDRAULIC CONDUCTIVITY

Expected variance of hydraulic conductivity values between field and laboratory test methods may be a result of the different method of compaction used in the field and in the laboratory; climatic variables; sample selection; and larger cross sectional areas of field test samples.

Therefore, field hydraulic conductivity tests are essential to verify the requirement of having a permeability of 1 X 10^{-6} cm/sec or less. Field tests on the actual compacted soil may cause delays in construction and would be costly if the field permeability did not meet the recommended minimum permeability. It is recommended that a test fill section be constructed using the same on-site soil type, compaction equipment, and construction procedures for the full scale facility to document that the proposed materials and construction procedures meet the required performance standards. Both field and laboratory hydraulic conductivity tests should be used in the design and construction quality assurance program. Appropriate field density tests of the compacted soil may be used in conjunction with field permeability tests to evaluate field permeability.

The calculated rate of seepage of water through the one foot thick clay liner having a permeability of 1 X 10^{-6} cm/sec is 0.0424 gallons per day per unit area. This value is for a maximum hydraulic head of one-foot within the leachate collection system.

The rate of seepage through the subgrade barrier underlying the clay liner is dependent on the slope of the liner, the leakage through the clay liner and permeability of the subgrade barrier. For purposes of calculation, and as a worse-case situation it is assumed that a breach exists in the clay liner. The calculated rate of seepage through five feet of subgrade barrier with a permeability of 1×10^{-6} cm/sec and having a two foot hydraulic head is 0.02968 gal/day. The rate of seepage through one foot of clay liner ($k = 1 \times 10^{-6}$ cm/sec) and five feet of subgrade barrier compacted to 90 percent relative compaction having a permeability of 9.54×10^{-5} cm/sec (lowest value from laboratory testing) is 0.1318 gal/day per ft^2. This value is less than one gallon per day for a unit area.

6.0 RECOMMENDATIONS

6.1 Material

Materials suitable for the construction of the subgrade barrier and clay liner are available within the onsite native soils, subject to approval by the geotechnical engineer. The soils prior to placement and compaction should have at least 30 percent passing No. 200 Sieve by weight. Stones and soil clods shall not be larger than 4-inches in any dimension. All organic matter should be removed from the soil material.

6.2 Subgrade Barrier

The subgrade barrier is designed separately for the bottom of the landfill and the adjacent side slopes. The bottom section must provide high strength foundation support for the leachate collection system and also stability of the landfill. The strength of the foundation should resist the overburden pressures. All foundation support must be uniform in strength with a minimum acceptable strength of 5 kips per square foot (k.s.f.). The degree of compaction will depend on the overburden pressure but should not be less than 90 percent relative compaction. A strength value of 5 k.s.f. is established for 90 percent relative compaction of Modified Proctor, 5 to 10 k.s.f. for 95% relative compaction and 10 to 20 k.s.f. for 100% relative compaction. The subgrade barrier should have a minimum thickness of five feet and its surface sloped a minimum of 5 percent towards the center. The engineered fill subgrade barrier should be founded on non-yielding bedrock.

The subgrade barrier on the adjacent side slopes should be founded on non-yielding bedrock and be benched or excavated into the bedrock as determined in the field. The minimum thickness of the subgrade barrier should be five feet perpendicular to the non-yielding bedrock. The final slope of the subgrade barrier should be no steeper than 2:1 (horizontal:vertical). Where steeper slopes are required, the geotechnical engineer will provide supplemental field recommendations that will include additional keyways or benches and overfilling, followed by trimming of excess material to the final exterior slope gradient. All engineered fill should be compacted to a minimum of 90 percent relative compaction as per ASTM D1557.

6.3 Clay Liner

The clay liner will be constructed on the surface of the subgrade barrier. The clay liner will be placed on the bottom and adjacent slopes of the landfill. The bottom clay liner should have a minimum 5 percent slope towards the center and constructed as described in the technical specifications.

The clay liner will be constructed of on-site soil having no less than 30 percent fines and approved by the engineer. The clay liner should be compacted to a minimum of 90 percent relative compaction as per ASTM D1557 test methods and the final thickness, must not be less than one foot. Sodium bentonite or an approved calcium bentonite material passing field acceptance tests based upon final permeability testing should be added at an approved application rate to produce a permeability of 1×10^{-6} cm/sec or less.

7.0 CONSTRUCTION REQUIREMENTS

Construction of the liner system should be supervised and approved by a registered Geotechnical Engineer or a Certified Engineering-Geologist. Construction inspection should include, but not be limited, to the following:

Excavation of soil and weathered bedrock

Preparation of soil

Placement and compaction of subgrade barrier

Preparation of soil/bentonite admix

Placement and compaction of clay liner

The clay liner subgrade barrier shall be constructed in stages depending upon the annual infilling of the canyon landfill. An erosion control plan is a separate part of the landfill construction grading control limitations and must be reviewed and incorporated into the cleaning and grading aspects of this work.

All work must be done in conformance with the technical specifications included as an Appendix to this report.

"INTR1230" - Disk #6

REFERENCES

Purcell, Rhoades & Associates, "Supplemental Response to the completeness Checklist and Attached Comments for the Report of Waste Discharge (RWQD), "Proposed Apanolio Canyon Expansion Site, Ox Mountain, San Mateo County, California for California Regional Water Quality Control Board, March 20, 1987.

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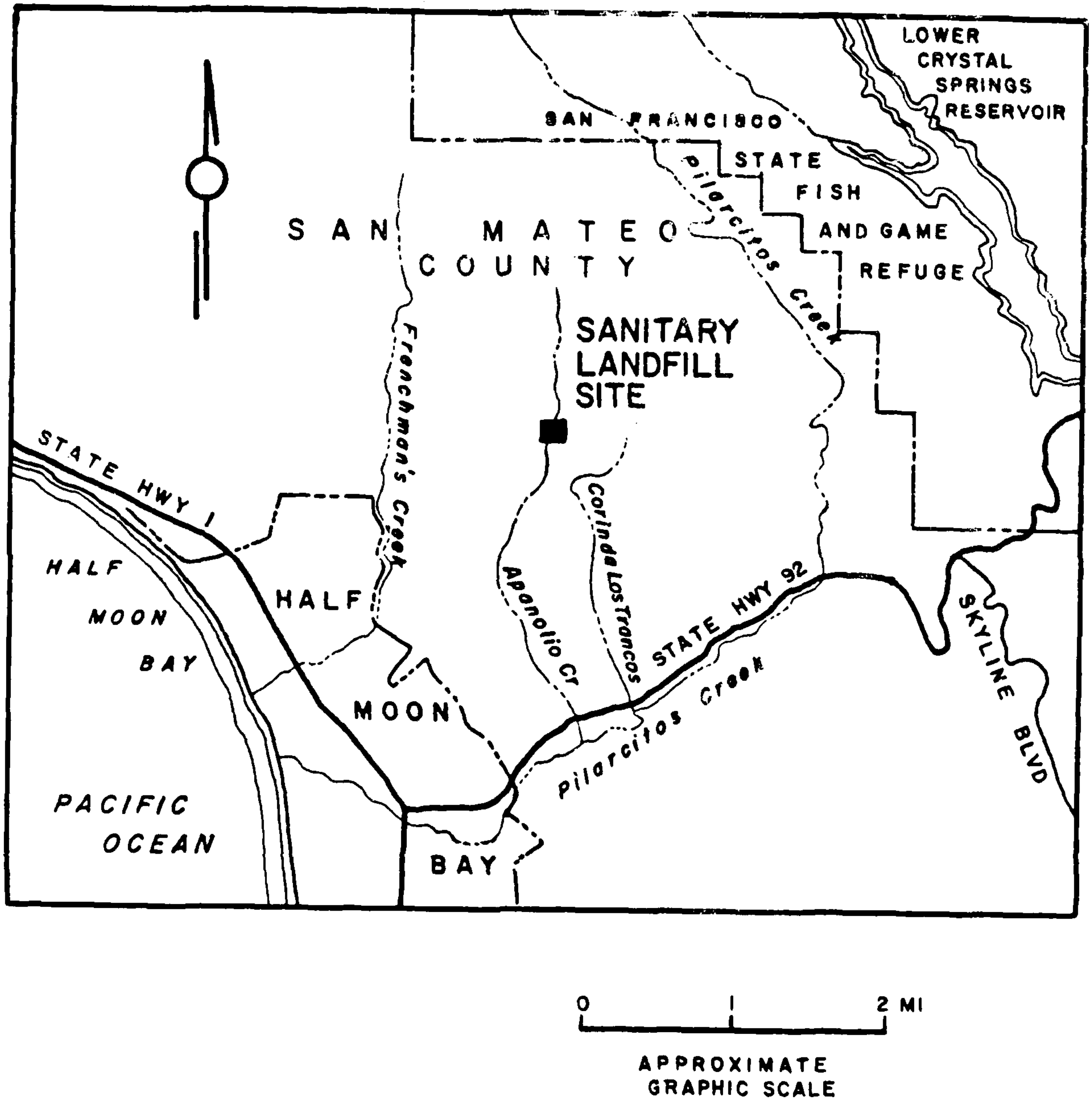
Daniel, D.E. (1984), Predicting Hydraulic Conductivity of Clay Liners. Journal of Geotechnical Engineering, Vol. 110, No. 2 p. 285-300.

Griffin, R.A. et al. (1984), Migration of Industrial Chemicals and Soil-Waste Interactions at Wilsonville, Illinois. In Proceedings of the Tenth Annual Research Symposium on Land Disposal of Hazardous Waste (EPA 600/9-84--007) USEPA Municipal Environmental Research Laboratory, Cincinnati, OH 45268.

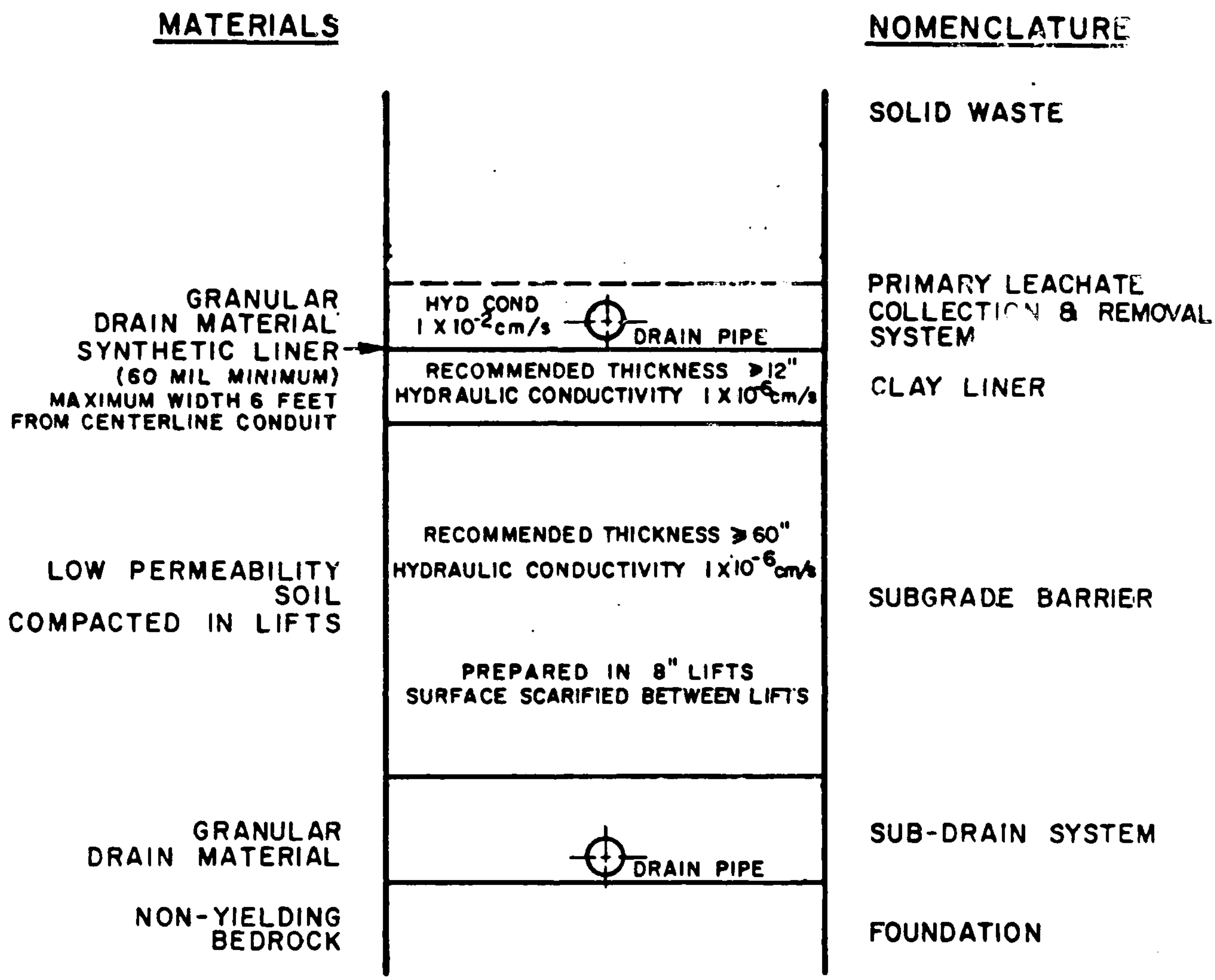
Herzog, B.L. and W.J. Morse (1984), A Comparison of Laboratory and Field Determined Values of Hydraulic Conductivity at a Waste Disposal Site. In: Proceedings of the Seventh Annual Madison Waste Conference, University of Wisconsin-Extension, Madison, Wisconsin, pp 30-52.



PURCELL, RHOADES & ASSOCIATES Foundation Engineering • Soil Engineering • Geology	SANITARY LANDFILL SITE	FIGURE
JOB NO. 3449 - 15 / DATE		1
DRAWN BY R. BRACKETT / APPROVED BY	Apanolio Canyon Expansion Site San Mateo County, California	

FIGURE 2 - LANDFILL AREAS 1 AND 2

SEE BACK POCKET FOR FULL-SIZE DRAWING OF FIGURE 2



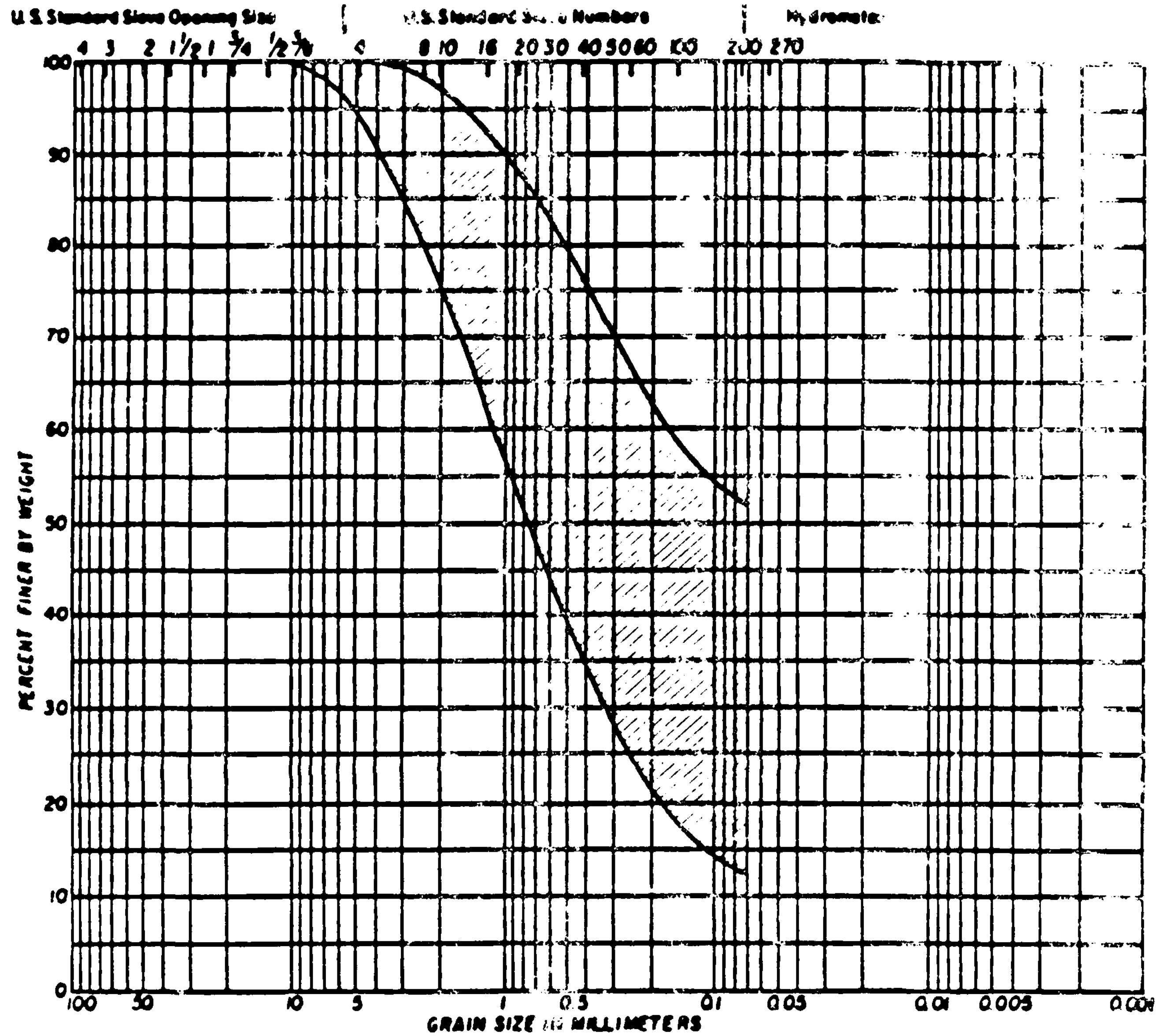
SCHEMATIC PROFILE

PURCELL, RHOADES & ASSOCIATES
Foundation Engineering • Soil Engineering • Geology

JOB NO. 3449-15	DATE	LINER SYSTEM FOR LANDFILL	FIGURE 3
DRAWN BY	APPROVED BY	Apanolio Canyon Expansion Site San Mateo County, California	

FIGURE 4 - SOIL SAMPLING LOCATION MAP

SEE BACK POCKET FOR FULL-SIZE DRAWING OF FIGURE 4



ASTM Designation: D 422-63

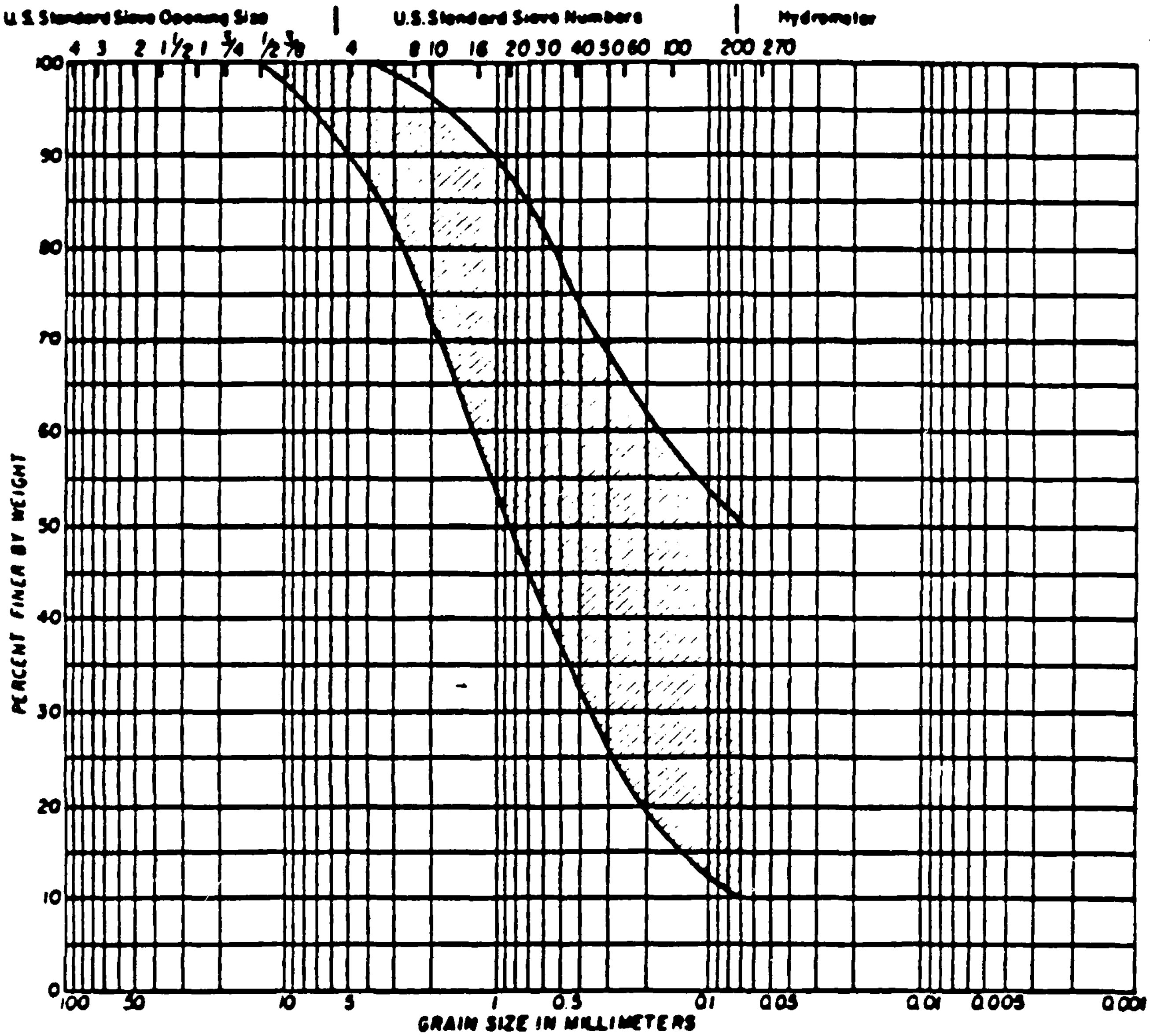
COBBLES	GRAVEL		SAND			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE		
3"		*4	*10	*40	*200	0.005	

Symbol	Sample Source	Classification

NOTES:

PURCELL, RHOADES & ASSOCIATES Foundation Engineering • Soil Engineering • Geology		GRAIN SIZE ENVELOPE FOR TOPSOIL Apanolio Canyon Expansion Site San Mateo County, California	FIGURE 5
JOB NO. 3449-15	DATE		
DRAWN BY R. BRACKETT	APPROVED BY		

FORM 21-1-87



ASTM Designation: D 422-63

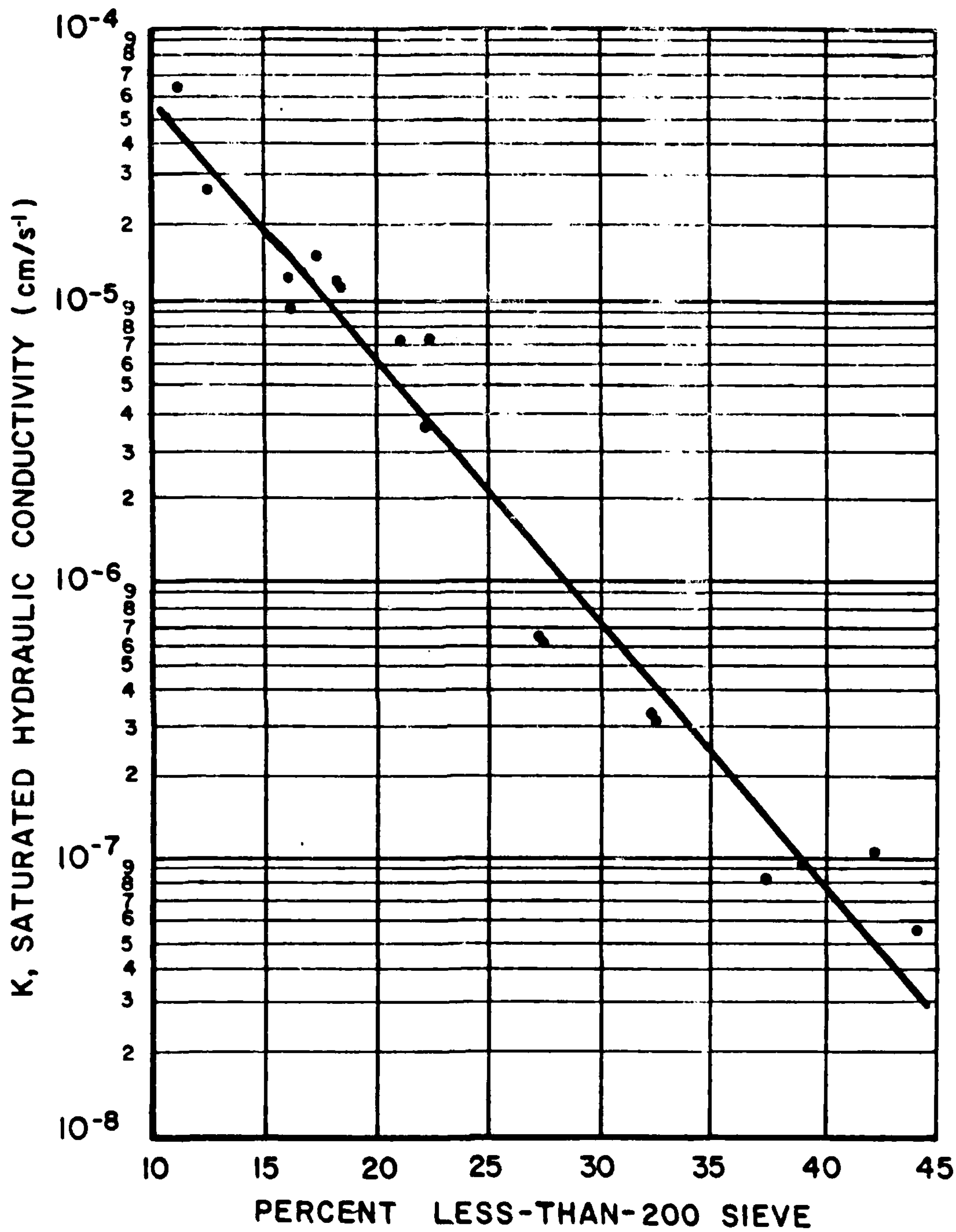
COBBLES	GRAVEL		SAND			SILT	CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE		
3"		#4	#10	#40	#200	0.005	

Symbol	Sample Source	Classification

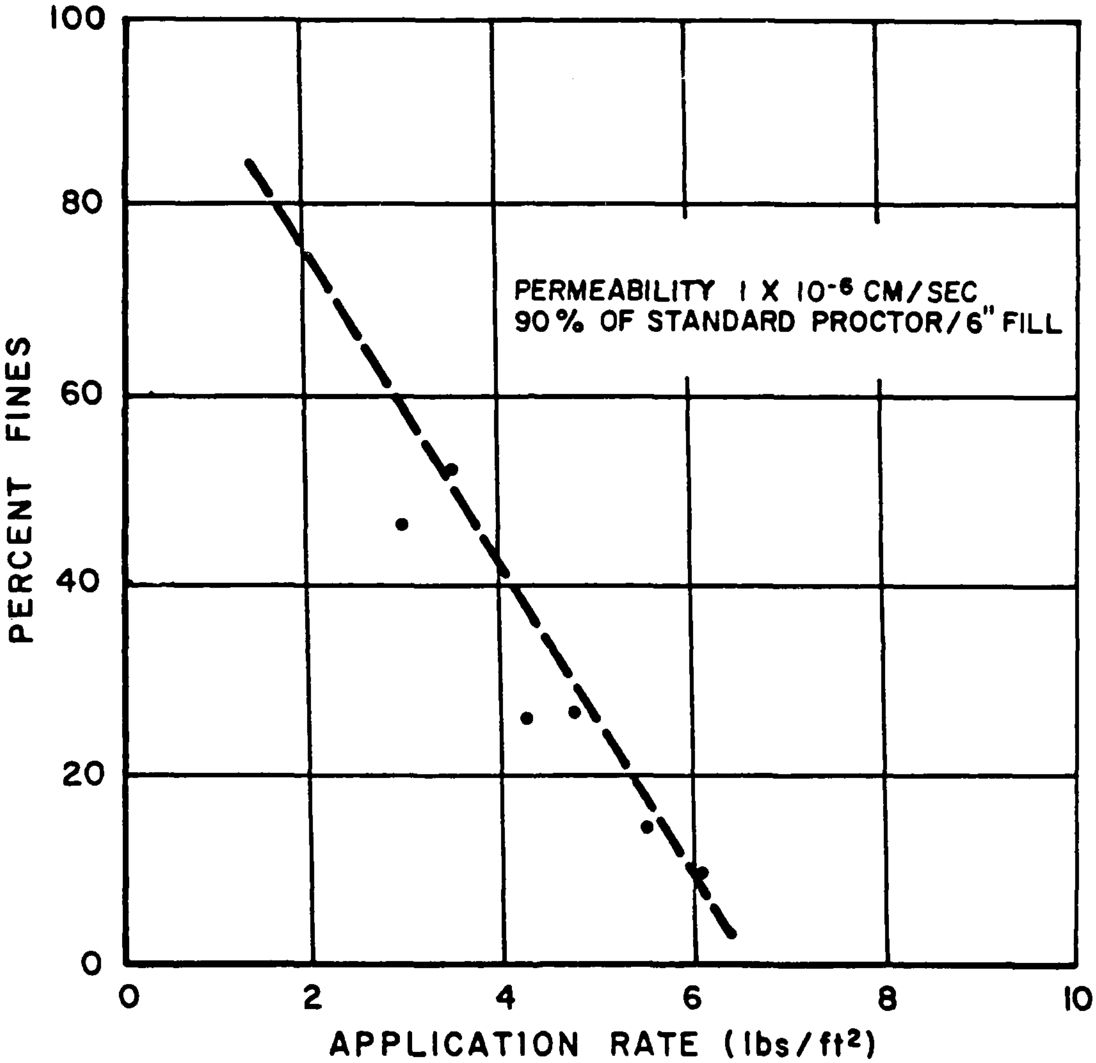
NOTES:

PURCELL, RHOADES & ASSOCIATES Foundation Engineering • Soil Engineering • Geology	GRAIN SIZE ENVELOPE FOR COLLUVIUM	FIGURE 6
JOB NO. 3449-15 / DATE		
DRAWN BY R. BRACKETT / APPROVED BY	Apanolio Canyon Expansion Site San Mateo County, California	

FORM 21-1-67



PURCELL, RHOADES & ASSOCIATES Foundation Engineering • Soil Engineering • Geology	RELATIONSHIP BETWEEN LESS-THAN-200 SIEVE AND SATURATED HYRAULIC CONDUCTIVITY Apanolio Canyon Expansion Site San Mateo County, California	FIGURE 7
JOB NO. 3449-15 / DATE		
DRAWN BY RDB / APPROVED BY		



PURCELL, RHOADES & ASSOCIATES *Foundation Engineering • Soil Engineering • Geology*		APPLICATION RATE OF BENTONITE Apanolio Canyon Expansion Site San Mateo County, California	FIGURE 8
JOB NO. 3449-15	DATE		
DRAWN BY RDB	APPROVED BY		

TABLE 1

SUMMARY OF PLASTICITY TEST DATA FOR TOPSOIL

APANOLIO CANYON EXPANSION SITE

Sample No.	Soil Classification	Natural Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
9C	SM	22.7	41	30	11
13B	ML	27.1	38	27	11
19E	SM	20.7	37	28	9
19G	SM	22.4	33	25	8
19J	SM	22.8	37	33	4
21C	SM	21.6	29	21	8
24K	SM	20.0	38	28	10
2S	SM	28.4	42	30	12
15J	SM	23.7	33	26	7

TABLE 2

SUMMARY OF PLASTICITY TEST DATA FOR COLLUVIAL SOIL

APANOLIO CANYON EXPANSION SITE

Sample No.	Soil Classification	Natural Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
2C	SM	21.9	37	28	9
4N	SC	16.5	28	18	10
4P	SM	16.3	27	20	7
4T	SM	16.0	25	22	3
9C	SM	19.9	30	21	9
13C	SC	19.7	25	18	7
13P	SM	18.7	25	19	6
26J	ML	--	28	22	6

TABLE 3

SUMMARY OF COMPACTION TEST DATA FOR TOPSOIL

APANOLIO CANYON EXPANSION SITE

Sample No.	Soil Classification	Natural Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)
2P	SM	20.0	14.5	114.0
2S	SM	28.4	15.5	112.0
6I	SM	27.0	14.5	114.0
8I	SM	13.9	8.0	134.0
15J	SM	23.7	13.5	116.0
19G	SM	22.4	14.5	116.0
19M	SM	18.1	12.0	124.0
26I	SM	30.4	19.5	104.5
9C	SM	22.7	17.0	109.0
13P	ML	27.1	17.5	108.0
15F	SM	24.9	15.0	117.0
17B	SM	21.0	14.5	117.5
19E	SM	20.7	14.5	116.0
19G	SM	22.4	14.5	116.0
19J	SM	22.8	14.5	117.5
21C	SM	21.6	14.0	119.0
22M	SM	19.0	13.5	118.5
24K	SM	20.0	13.5	119.0
29K	SM	19.2	13.5	120.5

TABLE 4

SUMMARY OF COMPACTION TEST DATA FOR COLLUVIAL SOIL

APANOLIO CANYON EXPANSION SITE

Sample No.	Soil Classification	Natural Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)
2P	SM	11.6	11.0	124.0
2S	SM	21.9	15.2	115.0
3K	SM	14.5	10.0	128.5
3M*	SC	21.0	12.0	119.0
4N	SC	16.5	11.5	122.0
4P	SM	16.3	12.0	121.0
4T	SM	16.0	12.5	119.0
4R*	SM	14.3	10.0	129.0
5P	SM	9.4	10.5	125.0
7J	SM	15.4	10.5	128.0
8I**	--	9.5	9.0	133.0
10K	SM	12.2	10.0	129.0
11J	SM	11.0	12.0	124.5
15J	SM	13.7	12.5	121.0
17K	SC	14.8	12.5	123.0
19G	SM	14.2	10.5	128.0
19M	SM	10.2	10.0	133.0
21C	SM	18.3	12.0	126.0
24K	SM	15.8	13.0	124.0
26I	SC	22.2	9.5	131.0
29K	SM	12.3	16.5	113.5
6I	SM	16.7	12.0	124.0
9C	SM	19.9	13.5	119.0
13C	SC	19.7	12.5	121.0
13P	SM	18.7	12.5	121.5
15F	SM	10.6	8.5	132.0
17B**	SM	16.7	12.0	123.5
19E	SM	14.4	11.5	127.5
19J	SM	14.2	13.5	121.5
22J	SM	12.8	10.0	127.0
22M**	SM	12.9	11.0	127.0
26J	ML	--	14.5	118.5

*Alluvium.
**Decomposed granodiorite.

TABLE 5

SUMMARY OF FALLING HEAD PERMEABILITY TEST

FOR REMOLDED SAMPLES IN TOPSOIL

APANOLIO CANYON EXPANSION SITE

Sample No.	Soil Classification	90% Maximum Dry Density (pcf)	Permeability (cm/sec)
2P	SM	102.6	3.8159×10^{-6}
2S	SM	102.1	7.266×10^{-7}
6I	SM	102.6	6.462×10^{-7}
8I	SM	119.7	5.340×10^{-5}
15J	SM	104.4	1.0281×10^{-7}
19G	SM	104.4	8.118×10^{-8}
19M	SM	111.6	6.462×10^{-7}
26I	SM	94.1	1.0822×10^{-7}
9C	SM	98.1	3.7814×10^{-8}
13P	ML	97.4	2.1614×10^{-8}
15F	SM	105.4	3.2445×10^{-7}
17B	SM	105.7	8.118×10^{-8}
19E	SM	104.4	3.7855×10^{-8}
19G	SM	104.4	8.118×10^{-8}
19J	SM	106.0	6.491×10^{-8}
21C	SM	107.1	3.7855×10^{-8}
22M	SM	106.7	9.5477×10^{-6}
24K	SM	107.1	9.201×10^{-8}
29K	SM	108.5	6.946×10^{-7}

TABLE 6

SUMMARY OF FALLING HEAD PERMEABILITY TEST

FOR REMOLDED SAMPLES IN COLLUVIUM

APANOLIO CANYON EXPANSION SITE

Sample No.	Soil Classification	90% Maximum Dry Density (pcf)	Permeability (cm/sec)
2P	SM	111.6	6.4933×10^{-5}
2S	SM	103.5	6.454×10^{-7}
3K	SM	116.1	1.434×10^{-5}
3M*	SC	107.1	1.0281×10^{-7}
4N	SC	110.9	5.408×10^{-8}
4P	SM	109.0	9.201×10^{-8}
4R*	SM	116.0	7.1707×10^{-6}
4T	SM	107.0	1.0282×10^{-7}
5P	SM	112.5	1.1457×10^{-5}
7J	SM	116.0	6.946×10^{-7}
8I	SM	119.7	9.5395×10^{-5}
10K	SM	116.1	7.1608×10^{-6}
11J	SM	112.0	2.7248×10^{-5}
15J	SM	109.0	3.8106×10^{-6}
17K	SC	110.7	1.1934×10^{-5}
19G	SM	115.2	7.1608×10^{-6}
19M	SM	119.7	1.1457×10^{-5}
21C	SM	113.4	3.2445×10^{-7}
24K	SM	111.6	8.118×10^{-8}
26I	SC	117.9	3.2476×10^{-7}
29K	SM	102.0	9.5477×10^{-6}
6I	SM	111.6	7.27×10^{-7}
9C	SM	107.1	6.494×10^{-8}
13C	SC	109.0	3.2406×10^{-8}
13P	SM	109.0	3.7814×10^{-8}
15F	SM	118.8	7.1707×10^{-6}
17B**	SM	111.2	3.493x10-6
19E	SM	114.8	1.1075x10-5
19J	SM	109.4	3.518×10^{-7}
22J	SM	114.1	1.1457×10^{-5}
22M**	SM	114.3	1.1934×10^{-5}
26J	ML	106.4	2.1594×10^{-8}

*Alluvium.
**Decomposed granodiorite.

TABLE 7

SUMMARY OF FALLING HEAD PERMEABILITY TEST

FOR IN-SITU COLLUVIAL SAMPLES

APANOLIO CANYON EXPANSION SITE

Sample Location	Soil Classification	Natural Moisture Content (%)	Saturated Moisture Content (%)	Permeability (cm/sec)
9C	SM	22.7	34.3	7.573×10^{-7}
13P	SM	21.9	26.3	2.7043×10^{-7}
19E	SM	13.7	20.8	9.5543×10^{-7}
22M	SM	10.0	22.2	1.464×10^{-4}

TABLE 8

SOIL/BENTONITE ADMIX

APANOLIO CANYON EXPANSION SITE

Sample No.	Percent of Passing No. 200 Sieve	Percent by Weight of Bentonite	Remolded at 90% Maximum Density (pcf)	Permeability (cm/sec)
2S-1	33.0	0	103.5	6.04×10^{-6}
2S-2	33.0	2	103.5	3.97×10^{-6}
2S-3	33.0	3.5	103.5	2.57×10^{-6}
2S-4	33.0	5	103.5	1.14×10^{-6}
2S-5	33.0	3.5*	103.5	2.28×10^{-6}
19G-1	27.7	0	115.2	5.35×10^{-6}
19G-2	27.6	3.5	115.2	1.78×10^{-6}
19G-3	27.6	5	115.2	9.30×10^{-7}
19G-4	27.6	6.5	115.2	7.62×10^{-7}
19G-5	27.6	5*	115.2	9.49×10^{-7}

*Permeability tested using leachate.

Job No. 3449-15

APPENDIX A
SPECIFICATIONS FOR SUBGRADE BARRIER AND CLAY LINER SYSTEM
APANOLIO CANYON EXPANSION SITE, OX MOUNTAIN
SAN MATEO COUNTY, CALIFORNIA
FOR
BROWNING-FERRIS INDUSTRIES

1.0 PROJECT DESCRIPTION

1.1 Location

The site for the proposed liner system is located in Apanolio Canyon approximately three miles from Half Moon Bay. The proposed Apanolio Canyon Expansion Site will be located within approximately 285 acres of the upper portion of the steep-sided Apanolio Canyon.

1.2 Scope

The work to be performed under this contract and as described in these Specifications is comprised of construction of a liner system for the proposed Apanolio Canyon Expansion Site. Work items include, but are not limited to, clearing and grubbing; excavating earth and weathered bedrock for foundation of the subgrade barrier; preparation, placement and compaction of subgrade barrier; preparation of soil/bentonite admix; and placement and compaction of soil bentonite clay liner. The work shall be performed as indicated on the Drawings, as stated in these Specifications, or in keeping with modifications made by the engineer to suit field conditions. This work shall include the furnishing of all labor, materials, tools, equipment and other items necessary for the manufacturing, installation and construction of the items herein described and/or shown on the contract drawings. This specification also includes construction of a fill test section for the purpose of field permeability testing to check the construction installation and procedures and to verify the permeability of the liner system.

The contractor shall comply with all permit conditions imposed by regulatory agencies.

1.3 Definitions

1. Owner - refers to Browning-Ferris Industries of California, Inc., and its duly appointed representatives.

2. Contractor - includes the construction company and all subcontractors hired to complete all specified construction items.

3. Soils Engineer or Engineer - Purcell, Rhoades & Associates and its representatives. Work performed by the Engineer shall include both the field and office services.

4. Drawings - the construction drawings for this project as listed in the Attachments, subject to revisions as required.

5. Subgrade Barrier - the compacted earthen impermeable layer providing foundation support.

6. Clay Liner - the soil/bentonite impermeable layer to prevent the migration of leachate into the groundwater.

7. Leachate - liquid that has percolated through solid waste and has extracted dissolved or suspended materials from it.

8. Foundation - includes all non-yielding bedrock beneath the subgrade barrier.

9. Survey Datum - will be provided by the owner.

2.0 PRE-CONSTRUCTION PREPARATION

2.1 Clearing, Grubbing and Stripping

The area to be excavated for the construction of the liner system shall be cleared, grubbed, and stripped of all trees, stumps, brush, roots, organic soils, and debris. Organic soils recovered during the stripping operation shall be stockpiled in areas designated by the Engineer for use as daily sanitary cover. All other materials from the clearing and grubbing shall be stockpiled at a suitable location as directed by the Engineer at the contractor's expense. The clearing, grubbing and stripping of the higher adjacent side slopes will be done in stages as the height of the refuse increases in elevation. This work will be done under a separate contract. The initial clearing, grubbing and stripping will commence in Area 2 at the toe of the landfill and proceed upstream in increments.

2.2 Construction of Haul Roads

With the approval of the engineer, the contractor shall construct any temporary haul roads that are necessary to move equipment to and from sites for excavation, construction, backfilling, compacting, material disposal and stockpiling. Construction and removal of temporary haul roads as approved by the Engineer shall be at the expense of the Contractor.

2.3 Dewatering of Foundation and Creek Re-routing

The contractor shall be responsible for maintaining the foundation area for the subdrain and subgrade barrier in a workable condition that is amenable to the efficient performance of his schedule operations during excavation of the soils and weathered bedrock, foundation treatment and placement, installation and construction of the subgrade barrier and subdrain system. It is expected that the main conduit system will be in place at the centerline of the canyon with additional side slope excavation required for this barrier installation. Due to the nature of the overburden soils in the channel, sheet piling cofferdams and/or pumps and piping, sumps and well points may be necessary, subject to approval by the Engineer when working upgradient from the entrance to the subgrade conduit system. The contractor shall be responsible for re-routing the creek so as not to disturb the normal flow of the creek and turbidity of the water.

Prior to initiating any performance of work on pre-construction preparation, the contractor shall submit the proposal for his method of controlling water in the excavations and re-routing the creek for approval by the Engineer. Payment for dewatering and re-routing shall be under the appropriate bid schedule item.

3.0 EXCAVATIONS

3.1 General

The contractor shall perform all required excavations, including dewatering, creek re-routing and clean-up work to prepare the non-yielding foundation areas for the placement of the subgrade barrier and subdrain system. The required excavations shall be made to the lines and elevations shown on the Drawings, except where it may be determined by the Engineer, after foundations are exposed that materials in the foundation areas are not suitable and additional excavation is ordered.

3.2 Common Excavation

Common excavation shall include the removal of overburden below the stripping level by the use of conventional earth moving equipment and disposal or stockpiling within the basin area as approved by the Engineer. Common excavations includes soil and weathered bedrock that can be ripped with a Caterpillar D-9 dozer with standard two prong rippers. Ripper refusal is thus met at the weathered/fresh bedrock boundary. Materials up to 50+ feet in epth along ridge top and underlying mid-canyon slopes could potentially be excavated.

The lower slopes and the canyon floor along Apanolio Creek may be excavated from 20 to 40 feet beneath the surface before reaching refusal. Excavation areas shall be graded and properly maintained to ensure adequate drainage where required.

Excavation in the channel for installation, placement and construction of the subdrain and subgrade barrier may require dewatering. Due to the steepness of adjacent side slopes and thickness of overburden soil, excavation along the canyon floor may be protected from sloughing or slide movement during construction.

Uniform strength for the non-yielding foundation as determined by the Engineer will be required before placement, installation and construction of the subdrain system and subgrade barrier. Localized refusal encountered at a shallow depth may require further rock excavation to provide a more uniform surface for placement of the barrier materials.

3.3 Rock Excavation

Rock excavation is not anticipated except in localized areas. The foundation for the subdrain system shall be founded on fresh bedrock of uniform high bearing support. Where further rock excavation is deemed necessary for the construction of a uniform foundation, the contractor shall claim payment for such rock excavation under the appropriate supplementary bid schedule item.

3.4 Landslide Excavations

Excavations of landslide material within known and suspected landslide areas, depending on the location and effect of the slide debris relative to site operations, must be removed in conjunction with refuse infilling or surface drainage conveyance structure construction. For certain locations where landslide debris may affect site operations, such areas will be subjected to an approved landslide repair by removal and reconstruction of potentially unstable slopes under the direction of a licensed Civil Engineer specializing as a Geotechnical Engineer or an Engineering Geologist.

3.5 Use and Disposal of Excavated Materials

Suitable materials removed during common excavations shall be used as compacted engineered fill for the construction of the subgrade barrier and clay liner. Unsuitable excavated material shall be removed from the site or disposed of in a manner approved by the Engineer. Excavated materials intended for use as the clay liner shall be stockpiled and segregated as to kind of material so that appropriate tests can be conducted by the Engineer to establish the application rate of the sodium bentonite or an approved calcium bentonite material. The soil materials so intended shall be maintained in well-drained areas and in a manner approved by the Engineer. Temporary stockpile areas where indicated on the drawings may be modified in the field by the Engineer.

Remaining select excavated material not designated for the clay liner shall be stockpiled for use as the subgrade barrier. The material shall be tested by the Engineer to establish application of soil admix and/or compacted density requirements. Work areas for the mixture of soil and admix shall be maintained in well drained areas and in a manner approved by the engineer.

3.6 Erosion Control

The contractor shall be responsible to mitigate excessive erosion during the excavation stage. A sediment management and general control program shall be followed as proposed by Hydrocomp, Inc. in their "Storm Runoff and Sediment Management at the Apanolio Canyon Landfill" report dated January, 1988.

4.0 SUBDRAIN PREPARATION

4.1 General

Prior to placement, installation and construction of the subdrain system, the foundation shall be inspected and approved by the Engineer and shall conform to the Specifications as described in this section. Placement, installation and construction of the subdrain system is not part of this contract.

4.2 Cleaning and Dewatering

Exposed rock surfaces in the foundation for the subdrain system and subgrade barrier shall be cleaned thoroughly prior to any placement of construction material. The contractor shall maintain the foundation area in a dewatered condition throughout the excavation phases. Under no circumstances shall seepage water, mud or soil be allowed to remain on the foundation surface while the subdrain system and subgrade barrier construction materials are being placed on the foundation, as monitored by the Engineer at the site.

4.3 Foundation

The final excavated foundation will be surveyed by the owner to identify elevations of the subdrain system and areas to receive compacted engineered fill to create a uniform high strength bearing support. Survey data will be included in the construction records.

5.0 ENGINEERED FILL

5.1 Materials for Subgrade Barrier

Excavated materials that are approved by the Engineer for the subgrade barrier shall be stockpiled in such a manner to prevent segregation of the soil. Approved material shall have 30 percent or more fines passing the No. 200 Sieve. The material shall be free of all vegetation and no more than 3 percent organic matter. Cobbles and soil clods shall be no greater than 4-inch in dimension. The maximum dry density and optimum moisture of the material shall be evaluated and the moisture content of the soil shall not be higher than 3 percent of that at which the required compacted density can be attained.

If the subgrade barrier material requires an admix to obtain a required strength, the earth material shall be properly prepared with 3 percent soil cement. The soil cement mixture shall be properly mixed to obtain a uniform compacted strength. Work area for the mixing operation shall be approved by the engineers.

5.2 Materials for Clay Liner

Excavated materials that are approved by the Engineer for the clay liner shall be stockpiled in such a manner to prevent segregation of the soil. Approved material shall have at least 30 percent fines passing the Standard U.S. No. 200 Sieve. The material shall be free of all vegetation, organic matter, and excessively large cobbles, and soil clods which would penetrate through the thickness of the clay liner. The largest allowable cobble, or soil clod in the clay liner shall have no dimension greater than 1/3 the thickness of the clay liner, i.e. all the soil must be able to pass through a screen opening equal to 1/3 the thickness of the clay liner. Moreover, material coarser than +gravel (material retained on a No. 4 mesh) shall not comprise more than 20 percent, by weight, of the soil.

The native soil material shall be mixed at the approved application rate with sodium bentonite or approved equal to be used in the construction of the clay liner. The mixing operative shall be done in an approved work area and the soil/bentonite shall be thoroughly mixed.

5.3 Dumping, Spreading, and Leveling

The contractor shall submit his proposal for equipment and methods to be used for dumping, spreading and leveling the engineered fill material for approval by the Engineer. Placement of engineered fill material shall proceed by mechanical means in a systematic, orderly and continuous manner. No hydraulic placement or dumping in water will be allowed. Placing and spreading shall be done in successive and approximately horizontal layers so that a uniform, homogeneous engineered fill results. The material shall be leveled with a bulldozer or other approved equipment prior to compaction to obtain a surface free of depressions, and it shall be placed and compacted in lifts not to exceed six inches in compacted thickness. Where the fill is placed against irregular bedrock walls and may not be accessible to conventional compactors, it shall be compacted in lifts not to exceed four inches in compacted thickness by hand operated power tampers, small vibratory compactors, or other means approved by the Engineer to produce the required degree of compaction.

If the compacted surface of any layer of material is determined by the Engineer to be too smooth to bond properly with the succeeding layer, it shall be loosened by scarifying or other approved methods and moisture conditioned as necessary before the subsequent lift is placed. Any material placed in the fill that is not from the approved stockpile, or that the Engineer considers to be deleterious, may be ordered removed from the fill and replaced with suitable material at the expense of the contractor.

5.4 Moisture Control

Prior to and during compaction, the fill material shall have a uniform moisture content throughout each layer. Material requiring moisture conditioning shall be brought to within required moisture limits in the stockpile area whenever practical. The contractor is advised that the material may require discing or other treatment to reduce the moisture content. In the event that additional water is required in the material, it shall be added while the material is in the stockpile area. Wetting of material in the fill shall be subject to approval by the Engineer. The contractor shall take appropriate measures to keep the stockpile, or stockpiles, of fill material well drained.

If any placed engineered fill material becomes too wet for suitable compaction, or becomes excessively wet after compaction, the wet fill shall be reworked by discing or other approved methods to permit aeration and drying until the moisture content of the layer is uniform and reduced to the specified limits for compaction. Excessively wet material that cannot be moisture conditioned in-place shall be removed at the contractor's expense.

The moisture content shall not be less than the optimum moisture nor more than three percent over the optimum moisture as determined by ASTM D1557-78, subject to the Engineer's approval.

5.5 Compaction Requirements for Subgrade Barrier

Compaction of the subgrade barrier shall proceed in a systematic, orderly and continuous manner. Choice of compaction equipment shall be made by the contractor and approved by the Engineer. The use of a heavy sheepsfoot roller may be used for compaction of the subgrade barrier in large fill areas.

Fill material shall be compacted immediately after the material has been placed, spread, and found to be correct in moisture content and other required conditions. Subgrade material shall be compacted to a minimum of 90 percent relative compaction, based on ASTM D1557-78. A minimum compaction of 95 to 100 percent relative compaction per ASTM D1557-78 will be required in those areas shown on the approved drawings. All subgrade barrier fill material shall be compacted to a minimum of 100 percent relative compaction for surcharge load conditions in excess of 10 kips per square foot (k.s.f.) (for ultimate waste depths greater than 250 feet) and 95 percent relative compaction required for surcharge loads ranging from 5 to 10 k.s.f. (for ultimate waste depths of 125 up to 250 feet). Ninety percent relative compaction shall be used elsewhere for load conditions less than 5 k.s.f or as directed by the Engineer. Laboratory tests for determining maximum compacted dry density will be performed by the engineer as appropriate during stockpiling of excavated materials the Engineer deems suitable for construction of the subgrade barrier. The Engineer will specify which materials shall be stockpiled for fill material as samples of excavated materials are selected and approved. Suitable materials of different maximum densities, as determined by ASTM D1557-78, shall be stockpiled separately from one another as the Engineer shall so direct.

5.6 Compaction Requirements for Clay Liner

Compaction of clay liner material shall proceed in a systematic, orderly and continuous manner. The soil/bentonite mixture shall be compacted to a minimum of 90 percent of the maximum density as defined by ASTM D1557-78 Modified Proctor Test, using a vibratory smooth roller, a smooth steel wheel roller, or a sled type compactor, compaction with a sheepsfoot roller will not be allowed unless test sections prove its adequacy and performance of the final clay liner to the satisfaction of the Engineer. Laboratory tests for determining maximum compacted dry density will be performed by the Engineer as appropriate during preparation of the soil/bentonite mixture.

5.7 Material Testing

The Engineer shall conduct whatever field tests are considered necessary to ensure satisfactory field compaction, so as to ensure adequate support for the loading to be anticipated in that portion of the subgrade barrier, and to control undue settlement therefrom. The cooperation of the contractor shall be required to permit the field tests to be conducted in an expeditious manner. The results of all tests shall be made available to the contractor, but the Engineer's evaluation of the tests shall be final.

Moisture content for the material in the backfill shall be determined by the procedure described in ASTM D2216-80. The laboratory method for determining maximum compacted dry density shall be ASTM D1557-78. The in-place density of the compacted backfill shall be tested by the sand cone method, ASTM D1556-82, ASTM nuclear or rubber balloon methods, as approved by the Engineer.

6.0 SUBGRADE BARRIER CONSTRUCTION

6.1 Scope

To serve as a long term structurally stable base for all overlying structures or materials, to attenuate constituents in leachate and to minimize the rate of leakage through breaches in the clay liner, a subgrade barrier is required to founded on non-yielding bedrock or equivalent material. The work covered by these specifications consists of furnishing all labor, equipment, and materials and performing all operations required for construction of the subgrade barrier as shown on the Drawings.

6.2 Soil Admix

To construct a subgrade barrier with high strength bearing support where directed by the Engineer, the subgrade barrier material shall be thoroughly mixed with 3 percent by weight of portland cement. Pre-batched material or on-site blended mills may be used. The cement shall be added to the blended on-site approved soil and mixed in place using road graders or disc harrows, water shall be added, and then spread and compacted. Homogeneity of the material shall be obtained by using a batch process where soil is mixed, then blended with cement in proper proportions, and then water added to obtain a moisture content at or 3 percent above optimum moisture content.

6.3 Non-Yielding Bedrock

The subgrade barrier shall be founded on non-yielding bedrock defined for the base of the canyon as fresh bedrock that can not be excavated using a caterpillar D-9 dozer with standard two-prong rippers. For the side flanks of the canyon, the Engineer or Engineering Geologist shall specify the depth to non-yielding bedrock that may consist of dense weathered bedrock suitable for placement of non-yielding benches or keyways to support the barrier fill.

Excavation beyond the limits of non-yielding bedrock shall be directed by the Engineer, if additional excavation is deemed necessary the contractor shall excavate to the final approved depth as directed by the Engineer.

6.4 Placement

Placement of the subgrade barrier shall continue after construction of the subdrain and groundwater systems. Placement of the subdrain and groundwater control systems will be done under a separate contract with an option of including all non-yielding storm water control support system fill included as part of that separate contract.

No subgrade barrier material shall be placed on any foundation surface until the bedrock surface has been surveyed and approved by the Engineer. Following approval of the foundation surface, the contractor shall commence placing and spreading the subgrade barrier material. The material shall be spread in lifts not exceeding 8-inches in thickness and compacted to the minimum required compaction.

The bottom canyon shall be filled in first to the lines and grades of the drawings. Placement of the subgrade barrier on the adjacent side slopes will commence when the finished grade of the canyon floor is reached. The subgrade material shall be spread in lifts not exceeding 8-inches in thickness and compacted to the required compaction. The material shall be spread wide enough to permit sufficient compaction by the compaction equipment with an overfill of material used on side slopes beyond the minimum required 5' compacted thickness. The surface of the subgrade barrier on the side slopes shall be cut back, and the Engineer shall provide supplemental field recommendations based on the conditions encountered. The finished perpendicular distance from the surface of the barrier fill to the non-yielding bedrock surface shall be a minimum of 5 feet thick. The subgrade barrier will be constructed incrementally upward along the adjacent side slopes to the elevation shown on the drawings.

The subgrade barrier will be constructed on the side slopes in increments approximately 25 feet in vertical height as the refuse increases in elevation. Construction of the final one foot clay liner system may be performed as part of this contract based on the construction methods proposed or as a separate contract if not placed as an integral part of the barrier fill process.

6.5 Degree of Compaction

The subgrade material shall be compacted to at least 90 percent relative compaction as per ASTM D1557-78 (Modified Proctor Test), for loads less than 5 k.s.f. Where surcharge loads reach 5-10 k.s.f., the required compaction shall be 95 percent relative compaction (ultimate waste depth ranging from 125-250 feet) with 100 percent relative compaction required where surcharge loads reach values greater than 10 k.s.f. (ultimate waste depth greater than 250 feet).

6.6 Perimeter V-Ditch

A temporary perimeter ditch shall be constructed in bedrock around the tems or to safe discharge points as approved by the Engineer. The perimeter ditch is to prevent the flow of surface water from the upslope area to enter the landfill area. The temporary perimeter ditch may be used as a bench to carry flows in a tight line from hydraugers to the final disposal in the main groundwater collection system. Installation and construction of the tight drains and hydraugers are to be performed under a separate contract.

7.0 SODIUM BENTONITE

7.1 Scope

A clay liner shall be constructed consisting of a compacted 12 inch minimum layer of acceptable on-site soil mixed with a sealant consisting of a free flowing, chemically treated, high swelling sodium based Wyoming type bentonite, specifically processed as a soil sealant for the containment of municipal wastes. Any alternate sealant material must conform to the permeability field testing portion of this specification with all preliminary supporting test data as set forth under Section 7.3 signed by a registered Civil Engineer and submitted to and approved by the Engineer, prior to bid. The final acceptance field premability tests for any alternate sealant shall be performed in accordance with Section 9.0 to 9.3 of this specification.

The final acceptance field permeability tests for any alternate sealant shall be performed in accordance with Section 9.0 to 9.3 of this specification.

7.2 Product Description

HIGH SWELLING bentonite is defined as the ability of two grams of the base bentonite, when mechanically reduced to -100 mesh to swell in water to an apparent volume of 16.0 cc's or more when added a little at a time to 100 cc's of distilled water contained in a graduated cylinder.

THE COLLOID CONTENT of the base bentonite shall exceed 85% and is measured by evaporating the suspended portion of a 2% solution after 24 hours of sedimentation in a glass graduated cylinder or breaker.

DRY FINENESS of the soil sealant shall be:

15% maximum retained on a 20 mesh screen
15% maximum passing a 200 mesh screen

THE BARREL YIELD of the treated bentonite shall be a maximum of 75 with a maximum viscosity of 15 centipoise (30 dial reading) when 27.5 grams of the treated bentonite is mixed into 350 mls of deionized water for 20 minutes. Viscosity shall be tested with a Fann viscometer Model #35A.

7.3 Performance

HIGH EFFICIENCY is defined as the ability of the bentonite to generate impermeability with a 2-inch layer of washed beach sand containing 30-35% voids when admixed into the sand at a rate of 2.5 lbs. per square foot and compacted, at optimum moisture to 90 percent maximum density as defined by the Standard Proctor Test, ASTM-D698. Under the same conditions, an ordinary bentonite would require an application of 5.0 lbs per square foot.

"IMPERMEABILITY" is defined as a permeability coefficient of 1 X 10^{-6} cm/sec or less.

Any bentonite offered as an equivalent must meet the contamination resistance criteria defined as the ability of the bentonite, when prehydrated with fresh water for a minimum of 72 hours, and tested at the rate of 2.5 lbs. per square foot mixed into a 2-inch layer of beach sand, as stated above, to maintain impermeability for a minimum of 200 days after introduction of a solution containing 3 percent ammonium chloride into the testing device.

8.0 CLAY LINER

8.1 Scope

To prevent the migration of leachate from the sanitary landfill into the lower barrier fill and potential contact with the groundwater, an impermeable clay liner is required beneath the leachate collection system. The clay liner shall be constructed beneath the entire landfill area and placed as an integral part and upon the lower barrier fill. The work covered by these specifications consists of furnishing all labor, equipment, and materials and performing all operations required for construction of the clay liner as shown on the drawings.

The contractor shall work only on an area that can be completed in one working day. Completion shall be defined as scarifying exposed subgrade barrier, soil moisture adjustment, spreading of the bentonite, the mixing of the soil with the bentonite, placement of the soil bentonite mixture in lifts, and the compaction of the soil bentonite layer.

Where mixing and stockpiling of the material occurs with placement as an integral part of the barrier fill, the quality control, performance and final acceptance standards of these specifications will control.

8.2 Soil/Bentonite Admix

The material for the clay liner shall be on-site soil approved by the Engineer that contains at least 30 percent fines passing the No. 200 Sieve. Prior to application of the bentonite, the Engineer shall recommend an application rate which will provide the required minimum permeability of 1 X 10^{-6} cm/sec or less. The bentonite shall be thoroughly mixed with the on-site soil in a process approved by the Engineer.

8.3 Placement

part of the barrier fill and within the top 12-inches of the subgrade barrier or placed in lifts onto the exposed surface of the subgrade barrier.

The clay liner shall be constructed on the exposed subgrade barrier surface after temporary drainage is constructed along the perimeter of the work area. When the clay liner is placed as a separate item upon the subgrade barrier, the subgrade barrier should be overfilled such that when final compaction is achieved, the minimum 1 foot of compacted clay liner and the minimum 5 foot of barrier fill is uniformly located over all areas in the canyon. Water should be added to the soil or dried if too wet before applying the bentonite to yield an optimum moisture content of the soil bentonite mixture as defined by ASTM D1557.

The bentonite shall be spread uniformly across the surface of the scarified subgrade barrier at the specified application rate, using an agricultural seed or lime spreader or other equipment as approved by the Engineer. Premeasured tarpaulin or drop cloths spread in different locations shall be weighed after spreading material over them to insure that the proper application rate is being applied. The bentonite may also be applied at the appropriate application rate by distributing 100 lb. bags of the material in marked grid patterns. Each square of the grid should be of the proper square footage to be covered by any multiple of 100 lb. bags of the material in marked grid patterns. The bags should be broken open and the material may be spread evenly within each grid square, using hand rakes.

The bentonite shall be thoroughly mixed in place such that the final compacted depth of 12-inches is achieved. An adjustable rotary tiller or similar mixing equipment is recommended. The contractor shall propose the equipment to be used and shall be approved by the Engineer.

The soil/bentonite mixture can also be mixed in a pugg mill, mixing drum or equivalent type equipment using the approved stockpiled soil and approved application rate of bentonite. The soil bentonite mixture shall be moisture conditioned to optimum moisture as defined by ASTM D1557. The stockpiled soil bentonite mixture shall be placed in loose lifts not to exceed 8-inches in thickness. The clay liner shall be placed in two lifts with each lift compacted to a minimum of 90 percent relative compaction per ASTM D1557.

Where compaction equipment cannot be utilized, hand apply and hand compact a mixture of 1 part bentonite to 4 parts soil (by volume), blended along the edges of all construction appurtenances. Moisture treatment shall be added to facilitate compaction as set forth above.

8.4 Degree of Compaction

The soil/bentonite mixture shall be compacted to a minimum of 90 percent of maximum dry density as defined by ASTM D1557. (Modified Proctor Test), using a vibratory compactor, a smooth wheel steel roller or a sled type compactor.

Compaction with a sheepsfoot roller will not be allowed unless performance testing indicates uniform compaction and acceptable permeability test verification for the alternate equipment proposed by the contractor.

9.0 FIELD TEST SECTION

9.1 Scope

The contractor shall be responsible for the construction of a field test section using the soil/equipment and procedures to be used in construction of the compacted subgrade barrier and clay liner. The test section shall be used to verify that the specified density, moisture content and hydraulic conductivity values can be consistently achieved in the full scale facility. Construction control of the test section shall be strict and well documented by the Engineer.

9.2 Construction of Test Section

The test section shall be constructed using the same earthen materials, soil/bentonite mixture, compaction equipment, and exact procedures to be used in construction of the full scale facility. All parts of the QA/QC program shall be followed to monitor and document construction of the test section.

The test section shall be constructed at least four times wider than the widest piece of equipment to be used for the full scale liner. The test section shall be long enough to allow construction equipment to reach normal operating speed before entering the area to be used for testing. The test section shall be constructed upon the barrier system and consist of three six-inch thick lifts of compacted soil. When testing for permeability, after proper seating of the the test ring, 12 inches of compacted and bentonite treated material shall be located below the interior soil surface of the test ring.

9.3 Field Testing

The construction of the test section shall be used to determine the final acceptance of the placement procedures used based on the relationship of the moisture content, density and hydraulic conductivity values obtained in the field to compaction method used, number of passes of the compaction equipment; mixing method; compaction equipment speed; and uncompacted to final compacted lift thickness.

A set of index properties shall be used to monitor and document the quality of construction. These index properties shall include at least the following:

a) Hydraulic conductivity (undisturbed samples);
b) In place density and moisture content;
c) Maximum clod size;
d) Particle size distribution (percent passing No. 200 Sieve; and
e) Atterberg limits

Data from these tests shall be used as standards for comparison with field test values obtained on samples from the full scale liner tested to indicate acceptance of the inplace field permeability conditions.

10.0 FIELD PERMEABILITY TESTING

1.1 Scope

Field permeability tests are required to verify that the permeability of the compacted clay liner is 1 X 10^{-6} cm/sec or less. The adequacy of the clay liner for impermeability shall be tested prior to placing municipal solid waste over the soil/bentonite layer. The testing shall be conducted by the Engineer for the owner. The contractor shall allow the Engineer to conduct the field permeability test after construction of the clay liner. The contractor shall construct a level test pad in the clay liner as directed by the Engineer to perform the field permeability test. A minimum 12" thickness of treated soil shall be located below the inner ring of all infiltrometer tests.

10.2 Procedure

The initial field permeability testing and acceptance of the clay liner shall be conducted utilizing the double ring infiltrometer. The double ring infiltrometer testing procedure shall be in strict accordance with ASTM D3385.

The test shall be for a period of at least one day or longer if necessary, measured at scheduled time intervals the volume of water lost from each infiltrometer ring. The infiltrometer rings should be refilled each day to maintain a constant head during the timing interval in conformance with the ASTM D3385 procedure.

The infiltration rate at the constant head pressure used for the test shall be determined from calculations which relate the volume of water during each measured time interval at the constant head to the infiltration rate (cm/hr).

Testing shall initially be done on the basis of one permeameter test for every 20,000 square foot of landfill bottom area, and one permeameter test for every 1,000 lineal feet for each 25 foot vertical side slope work area, or as otherwise specified by the Engineer. After a minimum of 10 consecutive acceptable test areas in each area of concern, the field testing program may be reduced 50 per cent with revision to the initial testing program when 9 acceptable tests out of 10 consecutive tests is not achieved. After initial compliance and methods have been demonstrated by consistent passing tests, the testing methods may be modified by the Engineer for the use of the empirical rapid single ring infiltrometer test in conjunction with acceptance tests based on in-place density and moisture content correlation.

10.3 Excessive Permeability

If the permeability of the tested clay liner is greater than 1 X 10^{-6} cm/sec when tested in accordance to the above section, the contractor shall rework the clay liner to produce the required 1 X 10^{-6} cm/sec or less permeability for the area of concern.

The soil-bentonite layer shall be upgraded by adding more contaminant resistant bentonite, remixing, and recompacting. The contractor shall rework the clay liner in accordance with requirements previously specified and the cost to rework the clay liner shall be borne by the contractor.

After completing the soil-bentonite reworking, the Engineer shall again test for permeability as previously specified. All work required by this paragraph shall be conducted by the Engineer and the related cost shall be borne by the contractor in lieu of the owner.

10.4 Approval

Within five days after completion and approval of the soil-bentonite layer, it shall be covered to a depth of at least 12 inches by the leachate collection system. The granular leachate cover shall be as shown in the contract drawings.

The soil-bentonite layer shall be checked for moisture content and if found below optimum moisture, the liner shall be hydrated with fresh water 48 hours prior to introducing municipal wastes. Adequate activation of the containment resistant additive is normally accomplished by mixing the bentonite with the soil at optimum moisture. Additional activation and swelling occurs during the 48 hour hydration with fresh water, which should be applied to the soil-bentonite layer by sprinkling from a water truck, flooding, or from natural rainfall.

11.0 QUALITY CONTROL/QUALITY ASSURANCE

11.1 Scope

To assure that a liner system meets or exceeds all projected design criteria, drawings, and specifications, a quality control/quality assurance (QC/QA) program is necessary. The program shall be used to monitor and document the quality of materials used in the construction of the liner system. The QC/QA program will include the areas of responsibility of personnel following the QC/QA program; qualifications of QC/QA personnel; specific observations and the tests during construction to verify that materials and equipment will perform to specifications; sampling program design; and documentation of QC/QA program.

11.2 Areas of Responsibility

It is the responsibility of the contractor to ensure that the as-built liner system meets the project specifications. Purcell, Rhoades & Associates will be the Consulting Geotechnical Engineer to perform the necessary tests and observations on the behalf of the owner to verify that the liner system is constructed in conformance with the technical requirements of the specifications and the spirit of the design concept needed to provide containment integrity.

The designated QC/QA Officer will be responsible to direct field testing programs for qualified engineering technicians for compaction, bentonite content, uniformity and layer thickness. A copy of all test analysis data and daily report of observation will be submitted to the officer for compilation and preparation of monthly progress reports to the owner and the respective agencies for their files.

11.3 Qualifications of QC/QA Personnel

The QC/QA Officer will have a minimum of 5 years technical experience on large earthwork projects, placement of soil/bentonite layers and drainage projects. The Officer shall have an educational background and work experience as a licensed Geotechnical Engineer, Engineering Geologist or Hydrogeologist. The Officer will also be experienced in acting as liason between contractors and Review Agencies.

11.4 Field Observations & Testing

1. Clearing and Grubbing - visual inspection that all trees and stumps are removed from the work area.

2. Stripping - remove all organic matter within top 6 inches and removed from the work area. Observe stripping operation including inspecting the ground surface after stripping and approval of the stripping as complete.

3. Common Excavation,- observe excavation of the topsoil, colluvium and weathered bedrock

4. Stockpiling - direct all soils suitable for subgrade barrier and clay liner based on visual inspection to be stockpiled and tested with approval based on:

- gradation
- moisture/density
- moisture content
- organic content
- plasticity
- stockpile soils suitable for subgrade barrier and clay liner separately. Prevent the segregation of soil during stockpiling.

5. Foundation - inspect the bedrock surface as prepared for placement of subgrade barrier fill and approve based on:

- free of water, mud or soil
- bedrock non-yielding
- no seepage of water out of bedrock
- bedrock surface free of voids or cracks, or excessive fractures

- approval and modification by a Registered Engineering Geologist where appropriate in all areas including seepage areas, excessive fractures or other anomalies observed.

6. Construct subdrain line - separate QC/QA program including a placement of non-yielding engineered fill in all areas where conduit will not be enclosed in fresh bedrock.

7. Subgrade barrier - constructed of select material including inspection of:

   - placement of soil
   - lift thickness
   - method and equipment for spreading
   - soil uniformity
   - soil gradation tests
   - number of passes of compaction equipment
   - moisture density testing of compacted lifts
   - number and locations of field density tests
   - approval

8. Inspect the preparation of the soil/bentonite mixture - using select approved on-site soil and inspecting and verifying the :

   - application rate of approved bentonite
   - method of application
   - check percent of bentonite added

- compaction curve of mixture
- optimum moisture of soil before adding bentonite

9. Inspecting the operation for approval of the mix in-place or pugg mill - approval of the mixing soil bentonite mixture based on:
   - type of equipment for mixing
   - soil bentonite mixture uniformity
   - percent of bentonite in soil
   - approval

10. Inspect the placement of soil/bentonite mixture basing acceptance upon:
    - method of spreading
    - inspection for absence of clods, organics, cobbles
    - lift thickness
    - uniformity of placement
    - moisture control
    - approval

11. Inspecting the compaction of the clay liner including:
    - type of compaction equipment
    - number of passes
    - field moisture density tests
    - compacted lift thickness
    - field permeability tests
    - Final approval

11.5 Sampling Program Design

The sampling program shall include collection of disturbed bulk and undisturbed tube soil samples. Sampling shall be done of the select on-site soil stockpiled for the clay liner and subgrade barrier. Approximately 30 pound bulk samples shall be collected from the stockpile for every 500 cubic yards of material stockpiled. Soil samples shall be placed in a plastic bag with a cloth outer bag, sealed and labeled in accordance to the chain of custody requirements for delivery to the soil laboratory for final soil testing.

If the stockpile material is found to be too heterogeneous as determined by visual observation or by laboratory testing, the stockpile shall be remixed to obtain a uniform soil mixture. Thirty pound bulk samples shall be collected for every 500 cu. yds. of remixed stockpiled material and the samples tested for the appropriate properties.

11.6 Documentation of QC/QA Program

A final written report will be prepared by Purcell, Rhoades & Associates to document the work performed by the contractor installing the liner system, the procedures and methods of constructing a test liner system after its completion, physical data acquired and the conformance to the project specifications. The written report shall include an appropriate grid system map reference guide for the location of all approved test areas.

12.0 MISCELLANEOUS

12.1 Final Site Conditions

The leachate collection drain rock system shall be placed upon the clay liner in conformance with the approved plan. Where drain rock is not placed upon the clay liner due to steep side slopes, a minimum one foot thick cushion of loose soil shall be placed next to the liner to protect the clay liner from damage when the initial waste material is placed. This item may or may not be part of this contract at the option of the owner.

13.0 MEASUREMENT AND PAYMENT

13.1 Partial and Final Payments

Monthly estimates shall be prepared by agreement of the contractor, the owner, and the Engineer based on the progress made up to the last calendar day of each month and on the measurement and payment Specifications that follow. The contractor shall submit an invoice each month for the established quantities and shall be paid the total amount due less 10 percent retention.

After completion of the work, approval by the Engineer, and acceptance by the owner, the final payment including the 10 percent retainage shall be made. Final payment will be based on as-built cross sections prepared by the

Engineer; the contractor shall receive duplicates of these cross sections.

13.2 Measurements and Payment by Work Item

Measurement and payment will be based on appropriate quantities and units as listed on the Summary of Construction Quantities which will be provided and approved by the Engineer. All costs not specified under this section of the Specifications shall be itemized on the contractor's invoice. The Engineer shall recommend full or partial payment of submitted costs on a per item basis.

Preparation of temporary haul roads shall be at the contractor's expense. Permanent access roads for the owner shall be provided under separate contract. Payment shall be made only for work approved by the Engineer and performed within limits shown on the Construction Drawings.

1. Clearing and Grubbing

Clearing and grubbing shall be measured by the number of square yards satisfactorily cleared as described in Sub-Section 2.1. Payment for clearing and grubbing shall be as shown in the appropriate item in the bid schedule.

2. Stripping

Measurement for stripping shall be by the cubic yard of material satisfactorily stripped and stockpiled, as determined by surveys. The average depth of material to be stripped is estimated to be approximately six inches.

Payment for stripping shall be as shown in the appropriate item in the bid schedule.

3. Common Excavation

Common excavation shall be measured in cubic yards from the surveyed ground surface to the final depth of the cut. Ground surface is defined as the elevation after stripping.

Payment shall be made at the applicable contract price per cubic yard. The unit price shall include all costs of excavating, hauling, disposing, and stockpiling. The unit price shall not include stripping, overexcavation, or replacement of suitable materials in over-excavated areas.

4. Engineered Fill

Measurement of the engineered fill shall be to the nearest cubic yard placed and compacted. In-place material shall be measured between excavation and finished grade lines as determined by the field survey.

Payment shall be based on the applicable contract price per cubic yard of material in place. The unit price shall include hauling, placing, moisture control, and compacting and backfill to the specified density and elevation.

5. Rock Excavation

Payment shall be based on the applicable contract price per cubic yard of rock excavated. Rock excavation shall be defined as very dense bedrock that cannot be excavated by a D-9 with a single tooth ripper and where seismic velocities exceed 15,000 ft. per sec. The unit price shall include excavation, hauling and disposal of the excavated rock debris.

Quantity of rock excavation should be determined by surveyor's measurements and shall be calculated to the nearest cubic yards.

6. Soil Cement Admix

Payment shall be made at the applicable contract price per cubic yard of the in-place material meeting the project specifications and acceptable to the Engineer and owner.

Measurement of the cement-treated subgrade barrier should be conducted to the nearest cubic yard placed and compacted in conformance with the project speci ications. Any rework and retesting will be at the cost of the contractor. The unit price shall include all labor, materials, equipments, placement and compaction.

7. Soil/Bentonite Admix

Payment shall be made at the applicable contract price per cubic yard of soil-bentonite material satisfactorily placed and compacted in conformance with the project specifications for clay liner with minimum acceptable permeability. The unit price shall include all labor, materials, equipments, placement and compactions. Any rework and retesting will be at the cost of the contractor.

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Apanolio Canyon Boring Logs
(Purcell, Rhoades & Associates)

BORING NO.	LOCATION*		TOP ELEV.	DEPTH DRILL	BOTTOM ELEV.	HOLE SIZE	NO. SAMPLES / BOXES	DATE		REMARKS
	NORTHING	EASTING						BEGIN	END	
B-1	APPROXIMATE N.371,750±	E.1,443,960±	540	57.5		6"	5/0	5/30/85	5/30/85	
B-2	APPROXIMATE N.371,890±	E.1,443,880±	475	76.0		6"	6/0	6/4/85	6/4/85	
*B-3	N.371,970	E.1,444,076	434.1	82.5	351.6	10"	6/2	5/30/85	5/31/85	4" ID PVC Top PVC El.434.30'*
*B-4	N.372,796	E.1,444,675	489.2	42.5	446.7	6"	2/2	4/1/85	4/1/85	2" ID PVC Top PVC El.-492.20'*
*B-5	N.372,824	E.1,444,988	514.0	40.0	474.0	6"	2/2	4/17/85	4/18/85	2" ID PVC Top PVC El.-514.11'*
*B-6	N.372,986	E.1,445,378	588.2	37.0	551.2	6"	5/0	4/2/85	4/2/85	2" ID PVC Top PVC El.-591.30'*
*B-7	N.372,912	E.1,445,826	597.9	29.0	568.9	6"	5/0	4/8/85	4/8/85	2" ID PVC Top PVC El.-600.60'*
*B-8	N.373,368	E.1,446,617	751.4	13.0	738.4	6"	0/1	5/2/85	5/2/85	2" ID PVC Top PVC El.-755.10'*
*B-9	N.373,211	E.1,444,677	518.2	42.5	475.7	6"	6/1	4/25/85	4/26/85	2" ID PVC Top PVC El.-521.50'*
*B-10	N.374,498	E.1,444,633	604.2	39.5	564.7	6"	6/1	4/26/85	4/26/85	2" ID PVC Top PVC El.-607.81'*
B-11	N.374,820±	E.1,444,360±	850	50.0		6"	5/0	6/7/85	6/7/85	
*B-12	N.375,126	E.1,444,593	643.1	27.0	616.1	6"	2/1	4/27/85	4/29/85	2" ID PVC Top PVC El.-643.36'*
*B-13	N.375,344	E.1,444,153	743.3	36.5	706.8	6"	0/2	4/29/85	4/30/85	2" ID PVC Top PVC El.-745.07'*
*B-14	N.375,209	E.1,445,358	775.5	21.0	754.5	6"	1/1	4/30/85	5/1/85	2" ID PVC Top PVC El.-778.03'*
*B-15	N.375,802	E.1,444,866	698.5	22.0	676.5	6"	1/1	5/1/85	5/1/85	2" ID PVC Top PVC El.-701.30'*
B-16	N.376,670±	E.1,444,850±	825	44.5		6"	2/3	5/20/85	5/21/85	
*B-17	N.377,621	E.1,444,796	954.8	34.0	920.8	6"	2/2	5/24/85	5/24/85	2" ID PVC Top PVC El.-957.84'*
B-18	N.377,160±	E.1,445,560±	1,300	67.5		6"	5/01	5/7/85	5/8/85	
B-19	N.374,430±	E.1,446,040±	1,315	104.0		6"	8/1	5/3/85	5/6/85	
B-20	N.373,250	E.1,444,817	560.6	11.5	549.1	5½" HX	1/1	1/7/87	1/7/87	
60 N85W B-21	N.373,247	E.1,444,814	560.6	220.0	370.1	"	0/18	1/8/87	1/21/87	V.D.=190.5' H.D.=110.0'
B-22	N.373,250	E.1,444,653	527.5	13.5	514.0	5½"	1/0	1/23/87	1/23/87	
57N90E B-23	N.373,259	E.1,444,656	527.5	149.0	402.5	5½" HX	0/11	1/25/87	1/29/87	V.D.=125.0' H.D.=81.2'

* Piezometer installed; location & elevation top of PVC pipe surveyed by BKF, Redwood City, CA.

PURCELL, RHOADES & ASSOCIATES Foundation Engineering • Soil Engineering • Geology JOB NO. 3449-04 DATE 12-30-87 DRAWN BY C. J. Grantham APPROVED BY C. J. Grantham	BORING SUMMARY DATA Apanolio Canyon Expansion Site San Mateo County, California	FIGURE of

FORM 10-5/87

BORING NO.	LOCATION		TOP ELEV	DEPTH DRILL	BOTTOM ELEV.	HOLE SIZE	NO. SAMPLES / BOXES	DATE		REMARKS
	NORTHING	EASTING						BEGIN	END	
RD1-1	N.372,538	E.1,444,524	482.6	28.6	454.0	8"	6/0	9/10/86	9/10/86	Auger to 26.6' Rock @ [illegible]
RD1-2	N.372,477	E.1,444,477	478.5	38.0	440.5	8" NX	4/2	9/9/86	9/9/86	Auger [illegible] Auger to 21.0' Rock @ [illegible]
* RD1-3	N.372,456	E.1,444,4[illegible]	478.7	41.5	437.2	8" NX	5/1	9/22/86	9/22/86	Auger to [illegible] Rock @ 3. Top 1" PVC cap [illegible]
RD1-4	N.372,391	E.1,444,540	473.6	41.0	432.6	8" NX	6/1	9/12/86	9/12/86	Auger to [illegible] Rock @ [illegible]
* RD1-5	N.372,369	E.1,444,567	490.5	38.0	452.5	8" NX	3/2	9/20/86	9/22/86	Auger to 20.0' Rock @ [illegible] Top PVC cap El 492.[illegible]
* RD1-6	N.372,411	E.1,444,454	471.7	30.2	441.5	8"	6/0	9/23/86	9/23/86	Auger to 30.2' Rock @ 20.5' Top PVC cap El 473.[illegible]
RD1-7	N.372,638	E.1,444,539	495.2	26.2	469.0	8"	5/0	9/10/86	9/10/86	Auger to 26.2' Rock @ 26.2'
RD1-8	N.372,272	E.1,444,507	495.3	60.0	435.3	8" NX	6/2	9/16/86	9/16/86	Auger to [illegible] Rock @ 5.5'
RD1-9	N.372,233	E.1,444,377	479.8	47.0	432.8	8" NX	7/1	9/18/86	9/18/86	Auger to 35.1' Rock @ 30
RD2-1	N.372,206	E1,444,199	500.7	25.5	475.2	7"	2/0	9/27/86	9/27/86	Auger to 25.5' Rock @ 3.5'
RD2-2	N.372,308	E1,444,171	460.4	20.2	440.2	7"	4/0	9/26/86	9/26/86	Auger to 20.2' Rock @ 18.5'
* RD2-3	N.372,406	E.1,444,065	462.9	45.0	417.9	7" NX	6/1	9/27/86	9/27/86	Auger to 29.5' Rock @ 24 Top PVC cap El 463.[illegible]
RD2-4	N.372,120±	E.1,444,030±	450.8	69.8	381.0	7"	8/2	9/26/86	9/26/86	Auger to 60.0' Rock @ 60
* RD2-5	N.372,081	E1,444,117	445.3	65.0	380.3	7" NX	6/2	9/22/86	9/22/86	Auger to 54 Rock @ 54.0' Top PVC cap El 446.[illegible]
* RD2-6	N.372,017	E.1,444,207	464.1	40.0	424.1	7" NX	5/1	9/19/86	9/19/86	Auger to 20.5' Rock @ 20.5' Top PVC cap @ El 465.0'
RD2-7	N.372,017	E.1,444,127	443.2	71.0	372.2	7" NX	5/2	9/18/86	9/18/86	Auger to 56.[illegible] Rock @ 56
* RD2-8	N.372,014	E1,444,035	445.3	46.0	399.3	8" NX	4/2	9/26/86	9/26/86	Auger to 25.0' Rock @ 15 Top PVC cap @ El 446.20
RD2-9	N.372,018	E.1,443,993	461.1	38.0	423.1	8" NX	2/2	9/30/86	9/30/86	Auger to 10.4' Rock @ 10'
RD2-10	N.371,978	E.1,444,068	436.0	53.0	383.0	8" NX	8/1	9/28/86	9/28/86	Auger to 40.5' Rock @ 40'
RD2-11	N.372,135	E.1,444,078	448.80	65.0	383.8	7" NX	6/2	9/23/86	9/23/86	Auger to 47.0' Rock @ 42'

* Piezometer installed, 1" ID PVC pipe.

NOTES:

1. All holes vertical, drilled by Datum Exploration using CME-75 drilling
2. Surveyed elevation by BKF, Redwood City, CA.
3. All Top of hole elevations = ground elevations at hole & were surveyed by BKF.

PURCELL, RHOADES & ASSOCIATES
Foundation Engineering • Soil Engineering • Geology

JOB NO. 3449-03
DATE 1-12-88
DRAWN BY C. J. [illegible]
APPROVED BY C. J. [illegible]

BORING SUMMARY DATA

Apanolio Canyon Expansion Site
San Mateo County, California

FIGURE

[illegible] of

PRINT 12-23-8

BORING NO.	LOCATION *		TOP ELEV.	DEPTH DRILL	BOTTOM ELEV.	HOLE SIZE	NO. SAMPLES / BOXES	DATE		REMARKS
	NORTHING	EASTING						BEGIN	END	
DH-1	N.372,333	E.1,444,327	465.2	65.0	400.2	HX	10/3	2/5/87	2/10/87	Top PVC El 466.16 *
DH-2	N.372,407	E.1,444,304	477.0	55.0	422.0	HX	3/4	2/17/87	2/19/87	Top PVC El. 478.14 *
DH-3	N.372,185	E.1,444,247	511.1	65.3	445.8	HX	5/6	3/10/87	3/13/87	Top PVC El. 512.32 *
DH-4	N.372,178	E.1,444,332	503.7	50.5	453.2	HX	4/4	3/10/87	3/12/87	Top PVC El. 509.74 *
DH-5	N.372,252	E.1,444,259	474.6	60.5	414.1	HX	3/4	3/3/87	3/5/87	Top PVC El. 475.60 *
DH-6	N.372,488	E.1,444,334	536.9	80.0	456.9	HX	3/4	2/25/87	2/28/87	Top PVC El. 537.86 *
DH-7	N.372,107	E.1,444,242	504.7	60.0	444.7	HX	3/	2/26/87	3/1/87	Top PVC El. 505.72 *
DH-8	N.372,326	E.1,444,239	456.5	60.0	396.5	HX	11/3	3/16/87	3/19/87	Top PVC El. 457.51 *

NOTES * Surveyed by BKF, Redwood City, CA.
1. Piezometer installed in all borings – 2" ID schedule 40 PVC

PURCELL, RHOADES & ASSOCIATES
Foundation Engineering • Soil Engineering • Geology

JOB NO. 3449-03 | DATE 12-15-1987

DRAWN BY C J [illegible] | APPROVED BY C J [illegible]

BORING SUMMARY DATA
DH-HOLES

Apanolio Canyon Expansion Site
San Mateo County, California

FIGURE

FORM 10-3/87

BORING NO.	LOCATION* NORTHING	LOCATION* EASTING	TOP ELEV. (GROUND)	DEPTH DRILL	BOTTOM ELEV.	HOLE SIZE	NO. SAMPLES / BOXES	DATE BEGIN	DATE END	REMARKS
MW-1A	372,007.7	1,444,147.4	443.0	74.1	368.9	H	24/3	2/17/87	[illegible]/22/87	2" PVC Well Top PVC El-444.30'* Seal 48-50'
MW-1B	372,010.0	1,444,155.6	443.2	45.0	398.2	6½"	0/0	2/23/87	2/24/87	4" PVC Well Top PVC El-444.60'* Seal 5.5-4.5'
MW-2A	372,831.6	1,444,998.9	515.3	49.8	465.5	HX	12/6	2/5/87	2/10/87	2" PVC Well Top PVC El-516.65' Seal 18-20'
MW-2B	372,829.8	1,444,993.9	515.1	21.0	494.1	6½"	0/0	2/12/87	2/12/87	4" PVC Well Top PVC El-51[illegible]' Seal 4-6'
MW-3A	NOT	DRILLED		—	—	—	—	—	—	—
MW-3B	"	"		—	—	—	—	—	—	—
MW-4A	"	"		—	—	—	—	—	—	—
MW4B	"	"		—	—	—	—	—	—	—
MW-5A	374,508.7	1,444,656.3	605.4	55.0	550.4	HX	11/5	3/17/87	3/20/87	2" PVC Well Top PVC El 607.05' Seal 29-33
MW-5B	374,505.2	1,444,651.1	604.9	18.0	586.9	6½"	0/0	3/21/87	3/22/87	4" PVC Well Top PVC El-606.65'* Seal 5-7
MW-6A	375,700.6	1,443,655.0	860.6	80.8	779.8	HX	3/9	4/1/87	4/7/87	2" PVC Well Top PVC El 861.58' Seal 26-28
MW-6B	375,696.1	1,443,658.0	860.4	7.0	853.4	8"	0/0	4/8/87	4/8/87	4" PVC Well Top PVC El-861.37'* Seal 2-4
MW-7A	375,376.2	1,445,387.0	810.2	40.0	770.2	HX	3/4	3/26/87	3/30/87	2" PVC Well Top PVC El-811.34'* Seal 16.5-18.5'
MW-7B	375,37[illegible]	1,445,390.9	810.4	10.0	800.4	8"	0/0	3/31/87	3/31/87	4" PVC Well Top PVC El 811.40' Seal 0-1.5
MW-8A	376,3[illegible]7	1,445,736.6	849.1	50.3	798.8	HX	3/5	4/15/87	4/16/87	2" PVC Well Top PVC El-850.09'* Seal 17-19
MW-8B	376,34[illegible]2	1,445,740.8	849.0	6.5	842.5	8"	0/0	4/20/87	4/20/87	4" PVC Well Top PVC El-850.20* Seal 1.8-3.8
MW-9A	377,586.3	1,444,840.2	956.7	45.5	911.2	HX	5/4	3/25/87	3/27/87	2" PVC Well Top PVC El-957.73* Seal 22-24
MW-9B	377,600.6	1,444,844.2	956.8	6.0	950.8	8"	0/0	3/30/87	3/30/87	4" PVC Well Top PVC El-957.70* Seal 0.8-2.8

* Surveyed by BKF, Redwood City, CA.

PURCELL, RHOADES & ASSOCIATES
Foundation Engineering • Soil Engineering • Geology

BORING SUMMARY DATA

FIGURE

JOB NO. 3449-04

DATE 12-30-1987

DRAWN BY C. J. [illegible]

APPROVED BY C. J. [illegible]

1 of 1

FORM 19-5/87

BORING NUMBER	LOCATION		TOP ELEV.	DEPTH DRILL	BOTTOM ELEV	HOLE SIZE	NUMBER SAMPLES / BOXES	DATE		REMARKS
	NORTHING	EASTING						BEGIN	END	
B-20	N. 373,250	E. 1,444,817	560.6	11.5'	549.1	5 1/2" HX	1/1	1/7/87	1/7/87	
360° N85W B-21 ∡	N. 373,247	E. 1,444,814	560.6	220.0	370.1	"	0/18	1/8/87	1/21/87	V.D. = 190.5' H.D. = 110.0'
B-22	N. 373,250	E. 1,444,653	527.5	13.5	514.0	5 1/2"	1/0	1/23/87	1/23/87	
357° N90E B-23 ∡	N. 373,253	E. 1,444,659	527.5	149.0	402.5	5 1/2" HX	0/11	1/25/87	1/29/87	V.D. = 125.0' H.D. = 81.2'
			Correct to 1 12 21-87							

NOTES:

PURCELL, RHOADES & ASSOCIATES
Foundation Engineering • Soil Engineering • Geology

JOB NO. 3449-02 DATE 13 MAY '87

DRAWN BY CIT APPROVED BY BJM, DRS

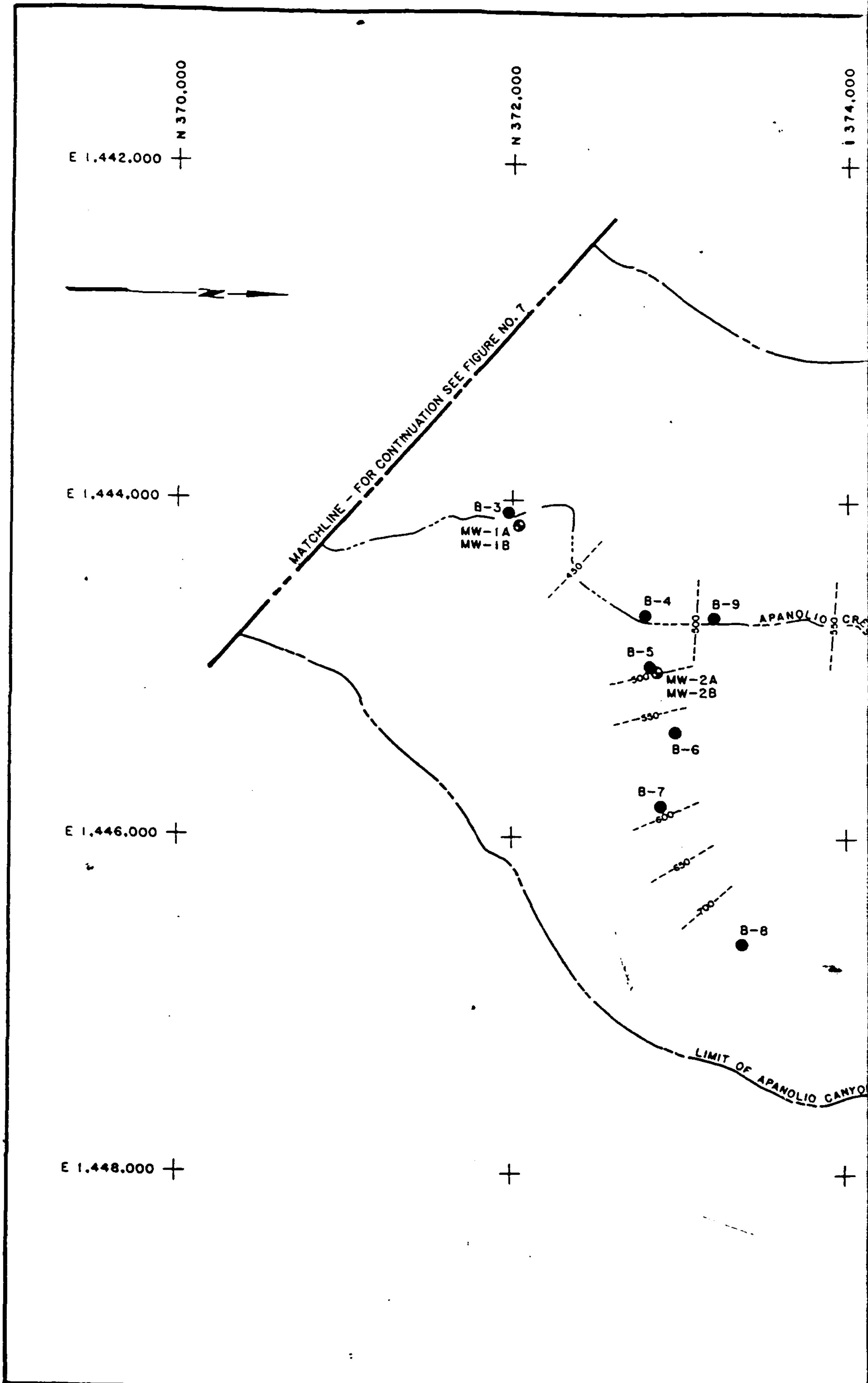
BORING SUMMARY DATA

Apanolio Canyon Expansion Site
San Mateo County, California

TABLE A-1

D-8

Potentiometric Surfa·e Maps, Apanolio Canyon
(Purcell, Rho. d:s & Associates)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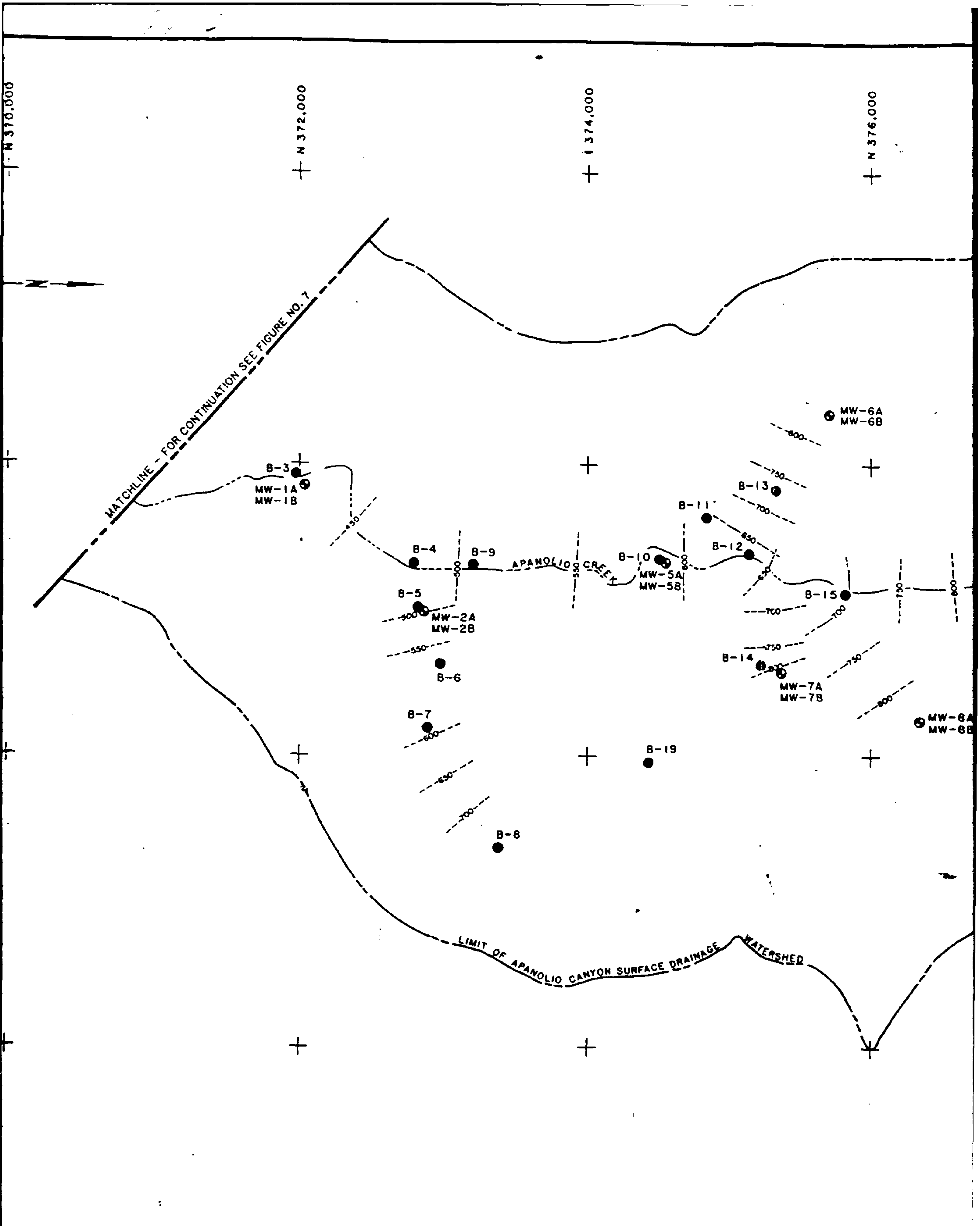
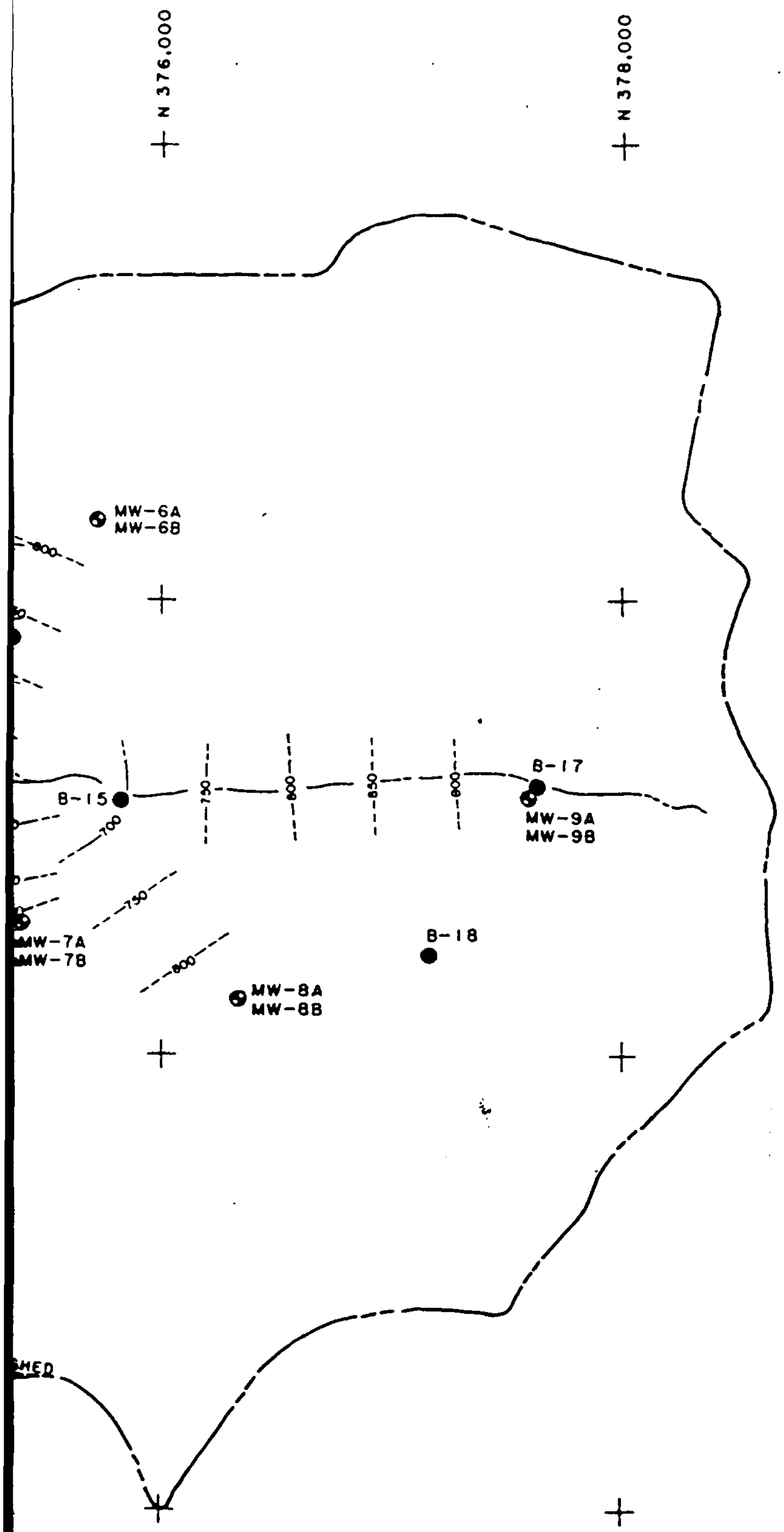
N 374,000
E 1,442,000
E 1,444,000
E 1,446,000
E 1,448,000
N
MATCHLINE – FOR CONTINUATION SEE FIGURE NO. 7
B-3
MW-1A
MW-1B
450
B-4
B-9
500
APANOLIO CR
530
B-5
MW-2A
MW-2B
500
550
B-6
B-7
600
650
700
B-8
LIMIT OF APANOLIO CANYO

1183


N 370,000
N 372,000
N 374,000
N 376,000
MATCHLINE - FOR CONTINUATION SEE FIGURE NO. 7
B-3
MW-1A
MW-1B
B-4
B-9
APANOLIO CREEK
B-10
MW-5A
MW-5B
B-11
B-12
B-13
MW-6A
MW-6B
B-5
MW-2A
MW-2B
B-6
B-7
B-8
B-19
B-14
MW-7A
MW-7B
B-15
MW-8A
MW-8B
450
500
550
600
650
700
750
800
LIMIT OF APANOLIO CANYON SURFACE DRAINAGE WATERSHED



NOTES

1. WATERSHED AREA TAKEN FROM SAN MATEO COUNTY TOPOGRAPHIC MAP REVISED 1982.

2. GROUNDWATER LEVEL MEASURED 06/23/87

EXPLANATION

● BORING LOCATION

MONITORING WELL LOCATION

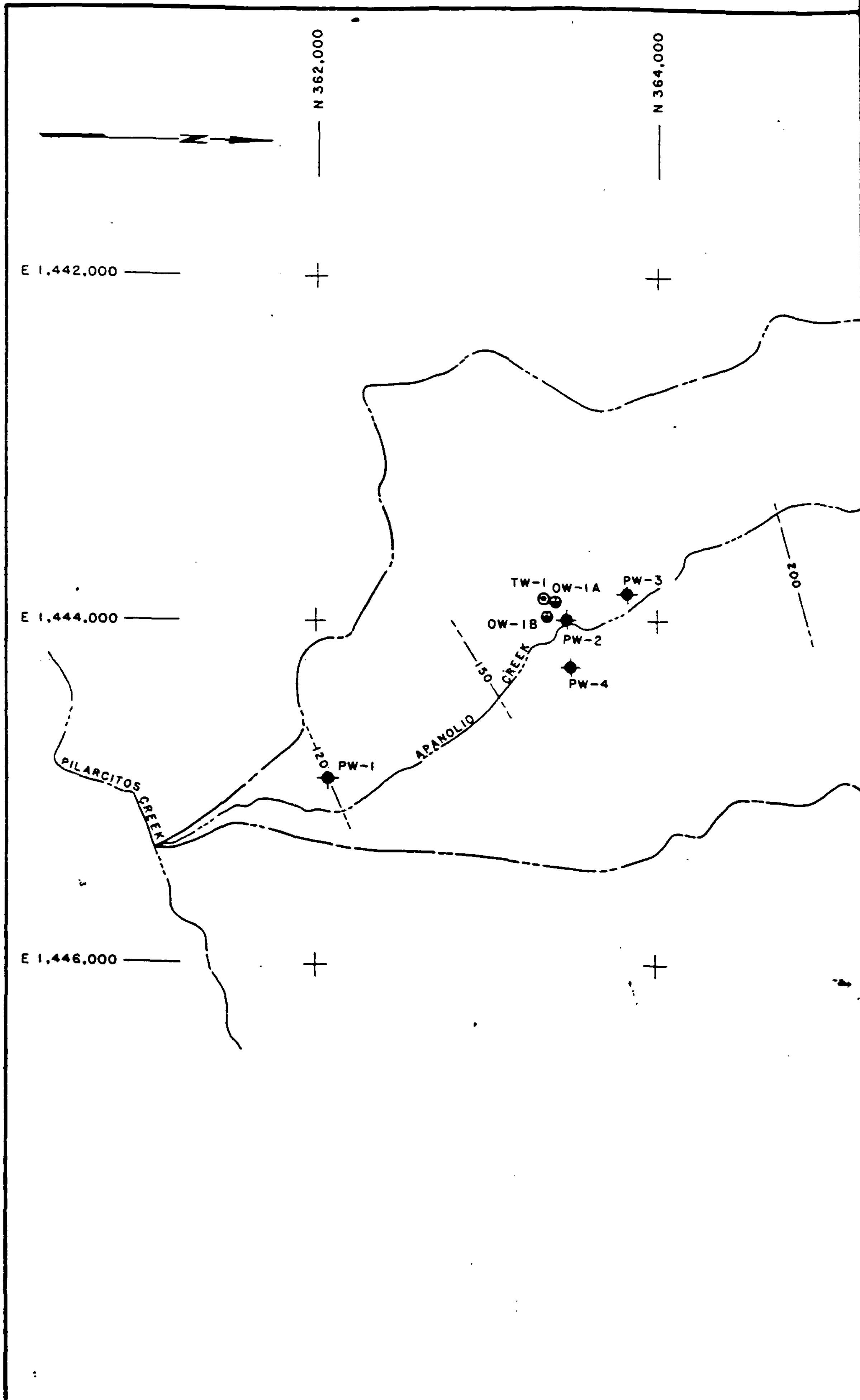
---450--- GROUNDWATER SURFACE ELEVATION

0 500 1000 FT

GRAPHIC SCALE

DATE	04/13/88	Purcell, Rhoades & Associates Consultants in the Applied Earth Sciences 2504 Technology Drive Hayward, CA 94545 (415) 732-4800 · 1041 Hook Avenue Pleasant Hill, CA 94523 (415) 932-1177	
JOB NO.	3449-16		
DESG'D	M HECKATHORN	GROUNDWATER SURFACE ISOPLETH MAP UPPER APANOLIO CANYON	FIGURE NO. 4
DRAWN	C SHEEHAN		
CHK'D	R BRACKETT	APANOLIO CANYON EXPANSION SITE, SAN MATEO COUNTY, CALIFORNIA	
APP'D	B MURPHY	BROWNING-FERRIS INDUSTRIES	REV NO.

3083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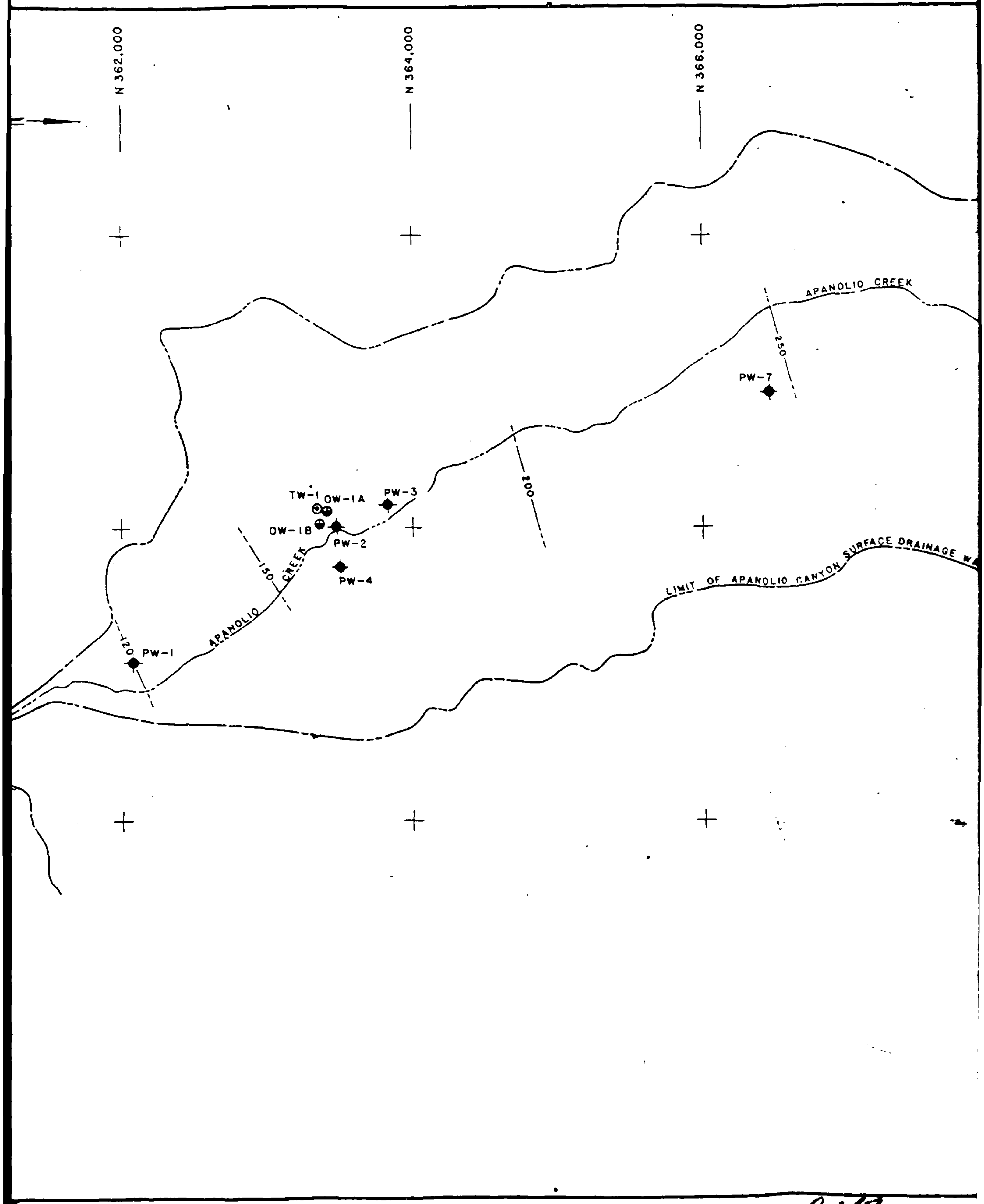
E 1,442,000
E 1,444,000
E 1,446,000
PILARCITOS CREEK
APANOLIO CREEK
120
150
200
PW-1
PW-2
PW-3
PW-4
TW-1
OW-1A
OW-1B

143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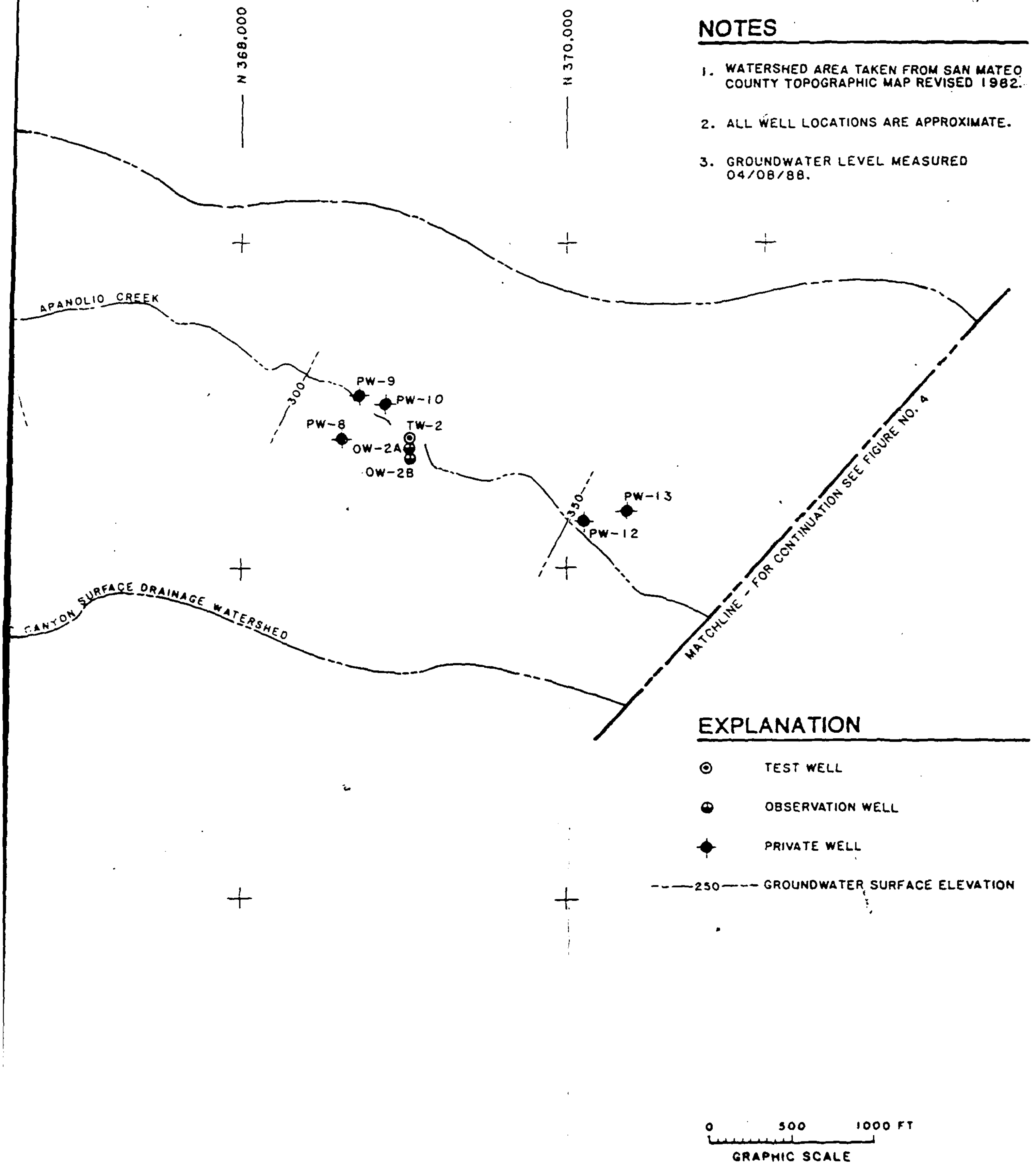
N 366,000
APANOLIO CREEK
250
PW-7
200
PW-3
TW-1
OW-1A
OW-1B
PW-2
PW-4
150
CREEK
APANOLIO
120
PW-1
LIMIT OF APANOLIO CANYON SURFACE DRAINAGE

2 of 3

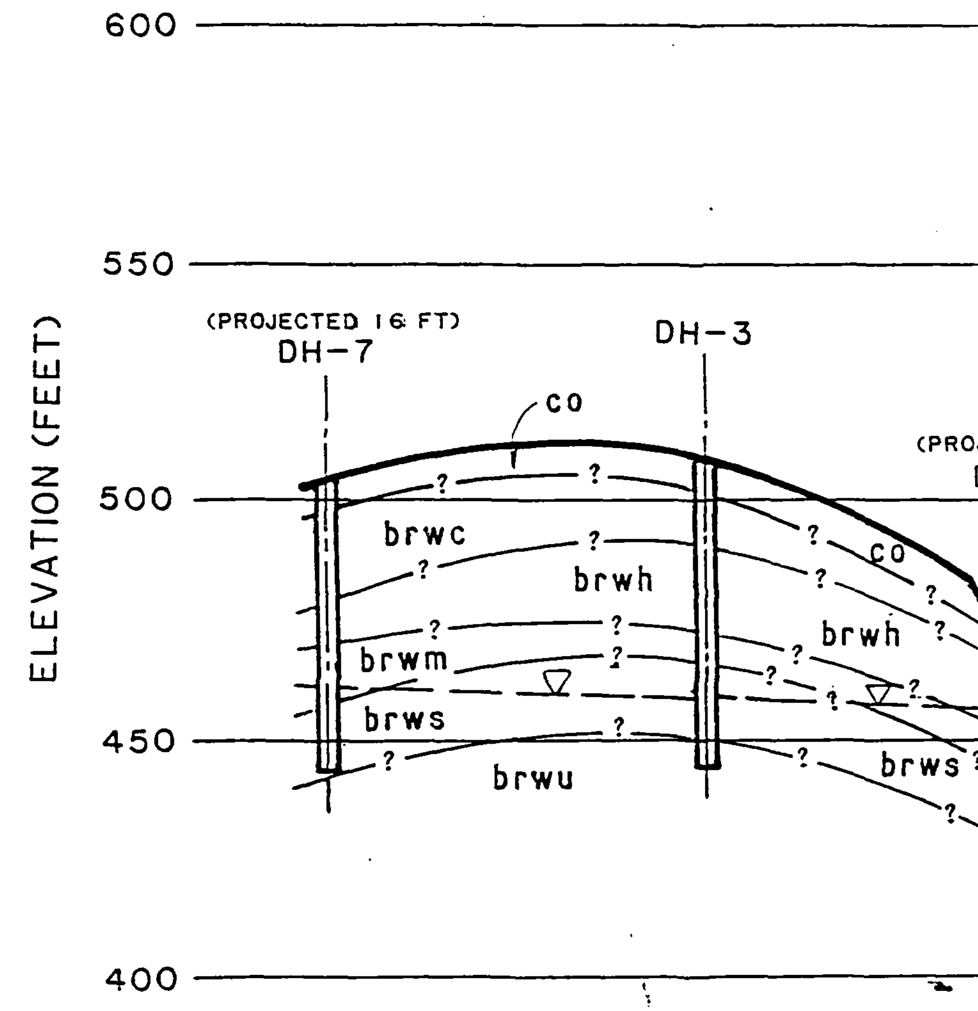


DATE	04/13/88	Purcell, Rhoades & Associates Consultants in the Applied Earth Sciences	
JOB NO.	3449-16		
DESG'D	M HECKATHORN	GROUNDWATER SURFACE ISOPLETH MAP LOWER APANOLIO CANYON	FIGURE NO. 9
DRAWN	C SHEEHAN		
CHK'D	R BRACKETT	APANOLIO CANYON EXPANSION SITE, SAN MATEO COUNTY, CALIFORNIA	
APP'D	B MURPHY	BROWNING-FERRIS INDUSTRIES	REV NO.

3 of 3

D-9

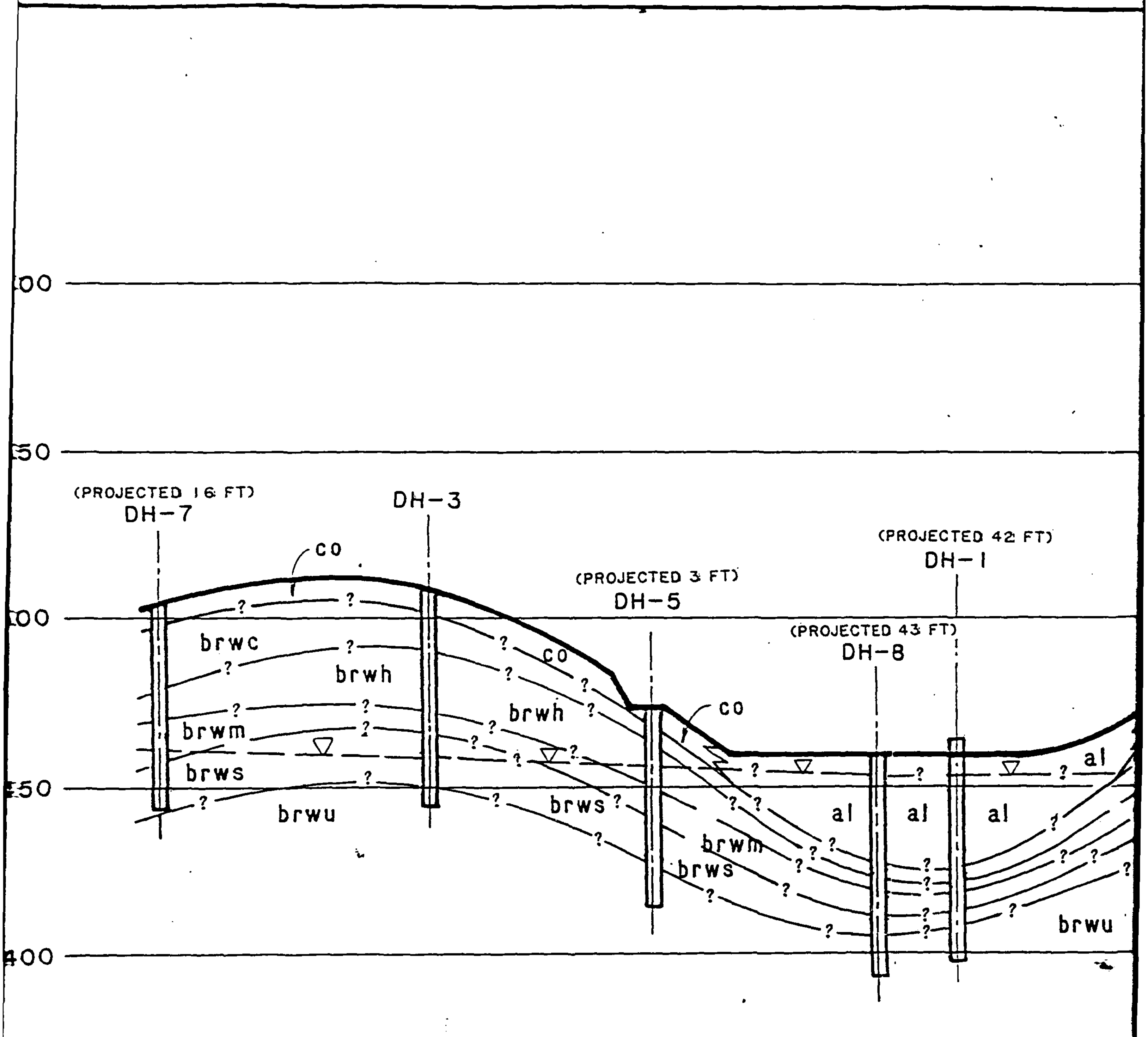
Geologic Cross Sections - Apanolio Canyon
(Purcell, Rhoades & Associates)



EXPLANATION

al ALLUVIUM
co COLLUVIUM
br BEDROCK; wc - COMPLETELY
wh - HIGHLY WEATHERED, W
WEATHERED, ws - SLIGHTLY
wu - UNWEATHERED
▽ GROUNDWATER LEVEL (10/0

1 of 3

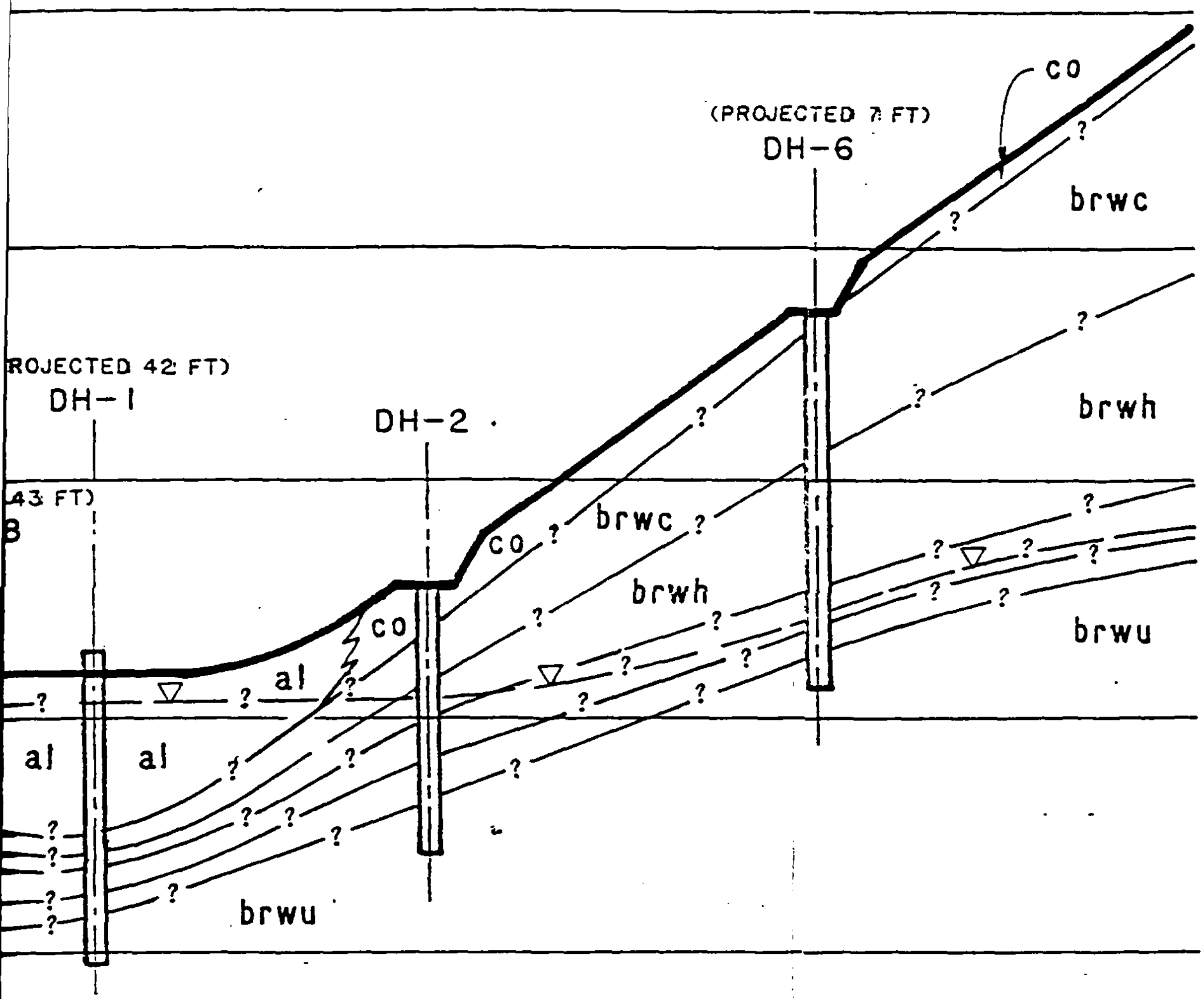


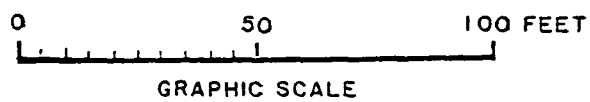
EXPLANATION

al ALLUVIUM
co COLLUVIUM
br BEDROCK; wc - COMPLETELY WEATHERED, wh - HIGHLY WEATHERED, wm - MODERATELY WEATHERED, ws - SLIGHTLY WEATHERED, wu - UNWEATHERED
▽ GROUNDWATER LEVEL (10/01/87)

NOTE

FOR LOCATION OF SECTION C-C REFER TO FIGURE NO. 3.

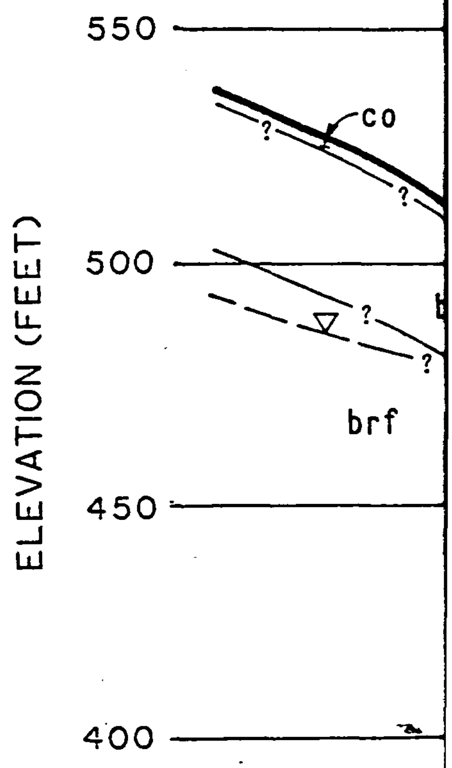




CATION OF SECTION C-C
TO FIGURE NO. 3

DATE 01/29/88	Purcell, Rhoades & Associates — Consultants in the Applied Earth Sciences	
JOB NO. 3449-03		
DESG'D C TRANTHAM	GEOLOGIC SECTION C-C	FIGURE NO. 6
DRAWN R BRACKETT		
CHK'D C SHEEHAN	APANOLIO CANYON EXPANSION SITE	
APP'D BJM/DJR	BROWING-FERRIS INDUSTRIES	REV NO.

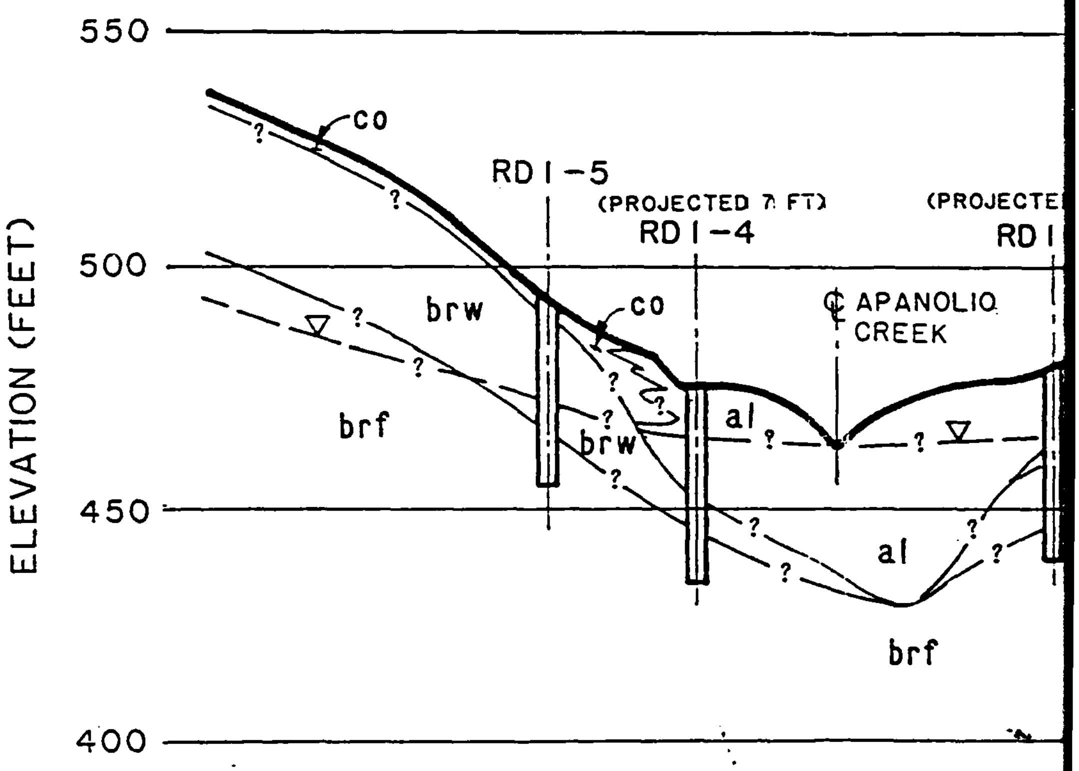
3013



EXPLANATION

co COLLUVIUM
al ALLUVIUM
brw BEDROCK, WEATHERED
brf BEDROCK, FRESH
▽ GROUNDWATER LEVEL (10/(

1of3

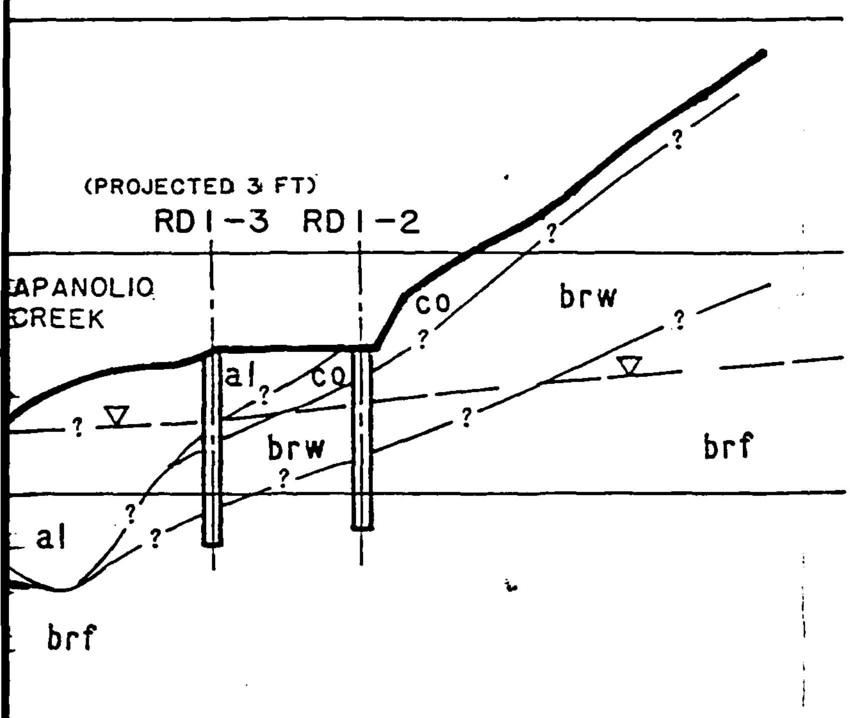


EXPLANATION

co COLLUVIUM
al ALLUVIUM
brw BEDROCK, WEATHERED
brf BEDROCK, FRESH
▽ GROUNDWATER LEVEL (10/01/87)

NOTE

FOR LOCATION OF SEC
REFER TO FIGURE NO.



0 50 100 FEET

GRAPHIC SCALE

ATION OF SECTION B-B
O FIGURE NO. 3.

DATE 01/29/88	Purcell, Rhoades & Associates Consultants in the Applied Earth Sciences
JOB NO. 3449-03	
DESG'D C TRANTHAM	GEOLOGIC SECTION B-B
DRAWN R BRACKETT	
CHK'D C SHEEHAN	APANOLIO CANYON EXPANSION SITE
APP'D BM/DJR	BROWNING-FERRIS INDUSTRIES

FIGURE NO. 5

REV NO.

3 of 3

D-10

Interim Report on Leachate Exposure Test Program, Apanolio Canyon Landfill Expansion
(Haynes & Associates)

HAYNES & ASSOCIATES

INTERIM REPORT
ON
LEACHATE EXPOSURE TEST PROGRAM
APANOLIO CANYON LANDFILL EXPANSION

TO: BROWNING-FERRIS INDUSTRIES,
SAN CARLOS, CA

BY: HAYNES & ASSOCIATES,
OAKLAND, CA

DATE: MAY 20,1988

CONSULTING ENGINEERS
3803 RANDOLPH AVE.
OAKLAND, CALIFORNIA 94602
415 / 531-8055

1. STRUCTURAL CONCRETE MATERIALS SELECTION

The structural concrete will be used to construct the under drain conduit structure; and therefore requires high durability and low permeability characteristics.

A. CONCRETE MATERIALS

Four coarse aggregate sources were considered for use:

1. Pleasanton sandstone
2. Clayton basalt
3. Watsonville granite
4. Permanente limestone

Pleasanton Sandstone

The Pleasanton sandstone is an alluvial source characterized by rounded particles. It exhibits moderate to high drying shrinkage volumetric changes. Cracking must be minimized in this particular application due to the acidic nature of the leachate and the fact that the concrete will be reinforced. Drying shrinkage cracking will allow leachate to intrude into the concrete and possibly attack the rebar. This source was not selected as a candidate due to its drying shrinkage characteristics and the fact that it is not as resistant to chemical attack as some of the other candidates.

Clayton Basalt

The Clayton basalt exhibits very low drying shrinkage values and should be fairly resistant to chemical attack. It is considered to be excellent candidate for the project. The drawback is the distance from the source to the project site and the associated hauling costs.

Watsonville Granite

This material also exhibits low drying shrinkage values; however, granitic materials are less resistant to acid attack than the basalt or the limestone.

Permanente Limestone

Limestone is known to be highly resistant to chemical attack. It exhibits low drying shrinkage values. The Permanente source is reasonably close to the proposed site making it an ideal candidate for this project.

Of the two sands available, Radum Top sand from Pleasanton and Felton "O" from Felton, the Felton material appears to be the best choice. It exhibits lower drying shrinkage values and should be more chemically resistant than the Radum material. It consists principally of silicon and aluminum oxides.

A Type II, moderate sulfate resisting Portland cement will be used.

A Class F pozzolan (fly ash) will be added in the amount of 20-33 percent of the weight of Portland cement to reduce permeability and to control any alkali aggregate reactions which might occur.

Chemical admixtures will be incorporated to enhance the mix properties. A water reducing admixture will be used enhance the workability while maintaining a low water/cement ratio. An air entraining admixture will be used to reduce permeability and improve workability. If the structural design of the collection system is complex with respect to concrete placing, a superplasticizer may be used.

2. CONCRETE MIX DESIGNS

Concrete mix designs were prepared to incorporate the project parameters and the materials which appeared to be most suitable during our theoretical evaluation of the candidates. The mixes were designed by a modified fineness modulus method, using adjustments for the candidate materials.

BATCH J — Clayton Basalt Aggregates, one inch maximum size, were used with Felton sand and 7.85 sacks of cementitious material (20% fly ash). Water reducing and air entraining admixtures were used.

BATCH K — Mt. View Limestone Aggregates, one and one-half inch maximum size, with Felton sand and 6.87 sacks of cementitious material (20% fly ash). Water reducing, superplasticizing and air entraining admixtures were used.

BATCH L — Mt. View Limestone Aggregates, one and one-half inch maximum size, with felton sand and 7.2 sacks of cementitious material (33% Fly ash). Water reducing, superplasticizing and air entraining admixtures were used. The mix designs are appended herein.

A. Materials

Aggregates:	Lonestar Felton "O" Sand Lonestar Clayton Basalt, 1" X #4 Kaiser Limestone, 1-1/2" X #4 Kaiser Limestone, 1" X #4
Cement:	Lonestar Type II (See attached mill report)
Pozzolan:	Pozzolanic Northwest Centralia Plant (See attached mill report) Type F
Admixtures:	Water Reducing Grace WRDA 79 Air Entraining Grace Darex Superplasticizer Grace WRDA 19

B. Aggregate Properties

Gradation Sieve Size	Felton Sand	Percent Passing, by Weight Limestone 1-1/2 X #4	Limestone 1" X #4	Basalt 1" X #4
2"		100		
1-1/2"		95		
1"		52	100	100
3/4"		8	83	82
1/2"		2	38	45
3/8"	100	2	18	22
#4	96	1	4	1
#8	91	-	1	-
#16	79	-	-	-
#30	48			
#50	19			
#100	7			
#200	3			
Specific Gravity	2.60	2.68	2.68	2.84
Absorption, %	1.5	0.7	0.5	1.0
Cleanness Value		79	82	84
Sodium Sulfate Soundness, %	2.5	0.5	3.6	1.8
Alkali Reactiv.		Innoc.	Innoc.	Innoc.
Fineness Modulus	2.59			
Sand Equivalent	80			
Organic Impur.	Nil			

3. LABORATORY TRIAL BATCHING

A. MIXING PROCEDURES

Mixing for each trial batch was accomplished with a six cubic foot, tilting-drum mixer. Batching was conducted in accordance with the mix designs and compensations were made for free water in the aggregates. All aggregates were placed in the mixer, followed by approximately three-fourths of the mixing water. The cement and the balance of the mixing water were then added and mixing continued for a minimum of two minutes, followed by three minutes at rest and then three minutes of additional mixing. In the mixes which incorporated superplasticizers, the admixture was added after taking the initial slump test. A squeeze bulb with a spray tip was used to inject the liquid directly into the concrete in the mixer, during mixing. A second slump test was taken subsequently, along with the unit weight, air content and temperature.

B. FABRICATION OF TEST SPECIMENS

Six-inch diameter compression test specimens were cast according to ASTM C-192. Additional four inch diameter by eight inch tall test specimens were cast for further cutting and leachate exposure tests.

C. CURING OF SPECIMENS

Specimens were removed from the molds after 24 hours and placed in a moist curing room maintained between 70 and 76 degrees F.

D. TESTING PROCEDURES

Compression tests were performed in accordance with (ASTM C-39). One-inch thick discs were cut from the four-inch diameter test samples for leachate exposure. The discs were cut in half leaving a semi-circle, one inch thick. Half of each sample was immersed in leachate and half in tap water. The vessels are being held at 130 degrees F with the aggregate/leachate exposure tests. They are being weighed monthly and visually examined.

E. TEST RESULTS

Compression Tests

AGE	COMPRESSIVE STRENGTH, PSI BATCH NO. J	K	L
7	3080	4580	4420
7	2990	4360	4360
AVG	3040	4520	4390
28	4660	6580	6320
28	4670	7070	6510
AVG	4660	6820	6410
56	5650	7350	7280
56	5510	7280	7140
AVG	5580	7320	7210
84	5720	7600	7510
84	5710	7600	7370
AVG	5720	7600	7440

Graphs of the age-strength relationships follow:

LEACHATE EXPOSURE TESTS

	WEIGHT CHANGE, %					
	EXPOSED			UNEXPOSED		
AGE	J	K	L	J	K	L
1 MONTH	+0.08	+0.04	+0.05	+0.04	-0.05	+0.05

No visual indications of attack have been observed to date.

4. POTENTIAL REACTIVITY OF CEMENT-AGGREGATE COMBINATIONS ASTM C-227

This test covers the determination of the susepcibility of cement-aggregate combinations to expansive reactions involving the alkalies by measuring the length change of mortar bars. Alkalies participating in the reactions are usually derived from the Portland cement; however, external sources of alkalies can have the same effect. The reaction is usually produced by alkalies reacting with silicas in aggregates.

Three trial batches were made up from the three aggregate sources and one cement source proposed for use on this project: Felton "O" sand, limestone and basalt. The basalt and the limestone were crushed down to the required gradation. Each of the aggregate samples were separated into the required amounts of each size fraction and recombined. The batches were mixed, tested for flow, and molded into 1" X 1" X 10" prisms. Two batches were run for each aggregate.

After demolding, the specimens were measured for length, placed in racks in a sealed container at 100 percent relative humidity, and the containers placed in a constant temperature bath held at 100 degrees Fahrenheit. Measurements are continuing on a monthly basis.

The following results have been obtained to date:

AVERAGE LENGTH CHANGE, PERCENT

AGE	BASALT (1")	LIMESTONE (1")	FELTON SAND
14 Days	+ 0.004	+ 0.002	+ 0.009
1 Month	+ 0.014	+ 0.007	+ 0.017
2 Months	+ 0.015	+ 0.008	+ 0.016
3 Months	+ 0.016	+ 0.005	+ 0.018

Plots of the values with time indicate that the curves are becoming asymptotic. It is unlikely that the trend will change in future readings. The graphs follow:

5. SODIUM/MAGNESIUM SULPHATE SOUNDNESS TEST - ASTM C-88

Coarse aggregates from both sources, Kaiser limestone and Lonestar basalt, were subjected to five cycles of the magnesium sulphate soundness test. The magnesium sulphate is the more severe of the two options given in the test method. The test method describes the test procedures only and not the acceptance criteria. ASTM C-33 gives the acceptance criterion, which is different for the two methods.

The mechanism of this test involves soaking a sample of the aggregate in a saturated solution of sodium or magnesium sulphate and subsequently drying the sample. As the test is repeated, salts accumulate in the pore spaces and cracks in the rock, setting up expansive forces. The test cycle is repeated five times and the weight loss and change in gradation are noted. Petrographic examination is also used to evaluate the aggregate's performance.

Some controversy exists in the interpretation of how to apply the results of these tests. Most researchers agree that the test will give a good indication of the susceptability of an aggregate to damage by freeze-thaw and other destructive mechanisms which tend to invade the rock and set up expansive conditions.

The following results were obtained:

KAISER LIMESTONE
Loss after 5 cycles = 0.6%

LONESTAR BASALT
Loss after 5 cycles = 4.5%

ASTM C-33 REQUIREMENT
Loss after 5 cycles, maximum = 18%

The two materials exhibit acceptable values under the ASTM criteria.

6. AGGREGATE - LEACHATE EXPOSURE TESTS

No standard ASTM test is available to simulate the effect of landfill leachate on Portland cement concrete. A test was developed to attempt to demonstrate these effects, if any. Twenty representative particles of aggregate were selected from the limestone and from the basalt. Each particle was cut in half on a water-cooled, diamond bladed saw and given identification markings. The particles were saturated by five hour boiling and weighed in the saturated surface dry condition to 0.0001 gram. Ten particles of each source were placed in containers of leachate sampled from the existing BFI landfill site. The other ten particles were placed in containers of tap water. Containers of tap water and leachate were also prepared for pH testing. All of the containers were placed in a covered constant temperature water bath. Weighings, pH tests and visual examinations were made weekly for the first month and are being continued on a monthly basis for one year.

A tenacious surface sludge is building up on the samples exposed to leachate. We are attempting to remove this sludge with a stiff bristled brush at each weighing; however, it may not be entirely successful.

The results are summarized below and in the following graphs:

Examination of the aggregate particles under a stereo-microscope reveals no detrimental effects to date.

7. SOIL BENTONITE PERMEABILITY TESTS

Several bentonite soil mixtures, exposed to fresh water for time periods of about 14 days, have already been tested by Purcell-Rhodes & Associates. Permeability tests are presently planned to expose bentonite soil mixture to leachate for time periods of up to one year.

Constant head permeability tests will be conducted by using the rigid compaction mold method on samples prepared with optimum bentonite contents. Sodium bentonite, processed by the American Colloid Company, from two different sources, will be tested. Lovell, Wyoming and Barstow, California sources will be used. The following matrix of seven tests is planned. The samples would be compacted at optimum moisture content in accordance with ASTM D-1557 and then loaded into the permeameter apparatus for testing.

MATERIAL	% SOIL REPLACEMENT, BY WEIGHT
Wyoming Bentonite	3.0
	4.5
	6.0
Barstow Bentonite	4.5
	6.0
	8.0
Native Soil Only	0.0

SCE

SCHWEIN/CH..ISTENSEN ENGINEERING, LTD.
materials consulting
electron microscopy
failure analysis

.TE: May 5, 1988 **DESIGN OF CONCRETE MIX** PROJECT NO. 87249

CONCRETE SUPPLIER: LONESTAR

MATERIAL AND LABORATORY DATA

REGATE SOURCE: F. A. FELTON C.A. LONESTAR

A. S. T. M.	C-29	C-127	C-117	C-127
AGGREGATE	WEIGHT PER. CU. FT.	SPECIFIC GRAVITY	DECANTATION	ABSORPTION
:LTON "O"		2.60		1.5%
x #4 Clayton Basalt		2.84		1.0%

TYPICAL MECHANICAL ANALYSES PERCENT PASSING U.S. STANDARD SIEVES AS REPORTED BY SUPPLIER.

SIEVE	2"	1.5"	1"	3/4"	3/8"	4	8	16	30	50	100	F.M.
ind					100	96	91	79	48	19	07	2.59
' x #4			100	82	22	01	----					6.5
COMBINED			100	88	46	31	28	24	15	06	02	5.6

MIX DESIGN

ENT FACTOR, SACKS / CUBIC YARD: 7.59

WATER CEMENT RATIO: 0.40

D 28 DAY STRENGTH: 4000 PSI

SLUMP: 4.0 INCHES, MAX.

RAINED AIR REQUIRED: 4.0%

TYPE CEMENT: LONESTAR II

NO. 87249-J

MATERIAL	ABS. VOL.	% BY WGT.	QUAN. - 1 CU. YD.
Sand	5.81	31	943 LBS.
1" x #4	11.63	69	2061
Air	1.08		----
Fly Ash	1.01		144
CEMENT	2.90		570
TOTAL WATER	4.57		285
ADMIXTURE			
TOTALS	27.0	100	4003 LBS.

BASED UPON AGGREGATES IN SATURATED SURFACE - DRY CONDITION, CORRECTION NECESSARY FOR FREE MOISTURE ON AGGREGATES, OR ABSORPTION BY DRY AGGREGATE.

ORTED TO: ADMIXTURES:
Grace WRDA 79: 6.5 fl.oz./100# cem.
Grade DAREX: 1.5 fl.oz./100# cem.

BY R L Schwein

Fresh Unit Weight = 148.2 pcf

sce

SCHWEIN/CHRISTENSEN
ENGINEERING, LTD.
materials consulting
electron microscopy
failure analysis

TE: May 5, 1988 | DESIGN OF CONCRETE MIX | PROJECT NO. 87249

CONCRETE SUPPLIER: LONESTAR

MATERIAL AND LABORATORY DATA

EGATE SOURCE: F.A. FELTON C.A. KAISER - MT. VIEW

A.S.T.M.	C-29	C-127	C-117	C-127
AGGREGATE	WEIGHT PER. CU. FT.	SPECIFIC GRAVITY	DECANTATION	ABSORPTION
LTON "O"		2.60		1.5%
x #4		2.68		0.5%
5" x #4		2.68		0.7%

TYPICAL MECHANICAL ANALYSES PERCENT PASSING U.S. STANDARD SIEVES AS REPORTED BY SUPPLIER.

SIEVE	2"	1.5"	1"	3/4"	3/8"	4	8	16	30	50	100	F.M.
ND					100	96	91	79	48	19	07	2.59
x #4	100	100	100	83	18	04	01					6.56
5" x #4	100	95	52	08	02	01						7.94
COMBINED	100	98	81	58	37	31	28	24	15	06	02	6.01

MIX DESIGN

T FACTOR, SACKS / CUBIC YARD: 7.0 WATER CEMENT RATIO: 0.40

28 DAY STRENGTH: 4000 PSI SLUMP: 1.5 INCHES

INED AIR REQUIRED: 4.0% TYPE CEMENT: LONESTAR II

). 87249-L

MATERIAL	ABS. VOL.	% BY WGT.	QUAN. - 1 CU. YD.
Sand	7.19	31	1167 LBS.
1" x #4	5.21	29	871
1.5" x #4	5.57	40	932
Air	1.08		----
Fly Ash (33%)	4.20		216
CEMENT	2.23		438
TOTAL WATER	4.20		262
ADMIXTURE			
TOTALS	27.00	100	3886 LBS.

BASED UPON AGGREGATES IN SATURATED SURFACE-DRY CONDITION, CORRECTION NECESSARY FOR FREE MOISTURE ON AGGREGATES, OR ABSORPTION BY DRY AGGREGATE.

TED TO: ADMIXTURES:
Grace WRDA 79: 6.5 fl.oz./100# cem.
Grace WRDA 19: 13.0 fl.oz./100# cem.
Grace DAREX: 1.0 fl.oz./100# cem.

BY R.L. Schwein

Fresh Unit Weight = 145.6pcf

sce

SCHWEIN/CHRISTENSEN
ENGINEERING, LTD
materials consulting
electron microscopy
failure analysis

ATE: May 5, 1988 **DESIGN OF CONCRETE MIX** PROJECT NO. 87249

CONCRETE SUPPLIER: LONESTAR

MATERIAL AND LABORATORY DATA

GREGATE SOURCE: F. A. FELTON C.A. KAISER - MT. VIEW

A. S. T. M.	C-29	C-127	C-117	C-127
AGGREGATE	WEIGHT PER. CU. FT.	SPECIFIC GRAVITY	DECANTATION	ABSORPTION
FELTON "O"		2.60		1.5%
KAISER LIMESTONE 1"x#4		2.68		0.5%
KAISER LIMESTONE 1.5"x#4		2.68		0.7%

TYPICAL MECHANICAL ANALYSES PERCENT PASSING U.S. STANDARD SIEVES AS REPORTED BY SUPPLIER.

SIEVE	2"	1.5"	1"	3/4"	3/8"	4	8	16	30	50	100	F.M.
SAND					100	96	91	79	48	19	07	2.[illegible]
1" X #4	100	100	100	83	18	04	01					6.[illegible]
1.5" X #4	100	95	52	08	02	01						7.94
COMBINED	100	100	98	80	47	39	35	31	19	07	03	5.[illegible]

MIX DESIGN

ENT FACTOR, SACKS / CUBIC YARD: 6.87 WATER CEMENT RATIO: 0.37

D 28 DAY STRENGTH: 4000 PSI SLUMP: 2.0 INCHES.

RAINED AIR REQUIRED: 4.0% TYPE CEMENT: LONESTAR II

NO. 87249-K	MATERIAL	ABS. VOL.	% BY WGT.	QUAN. - 1 CU. YD.	
	Sand	7.38	39	1197 LBS.	
	1"x #4	5.34	29	893	
	1.5"x #4	5.71	32	955	
:	Air	1.08		----	BASED UPON AGGREGATES IN SATURATED SURFACE - DRY CONDITION, CORRECTION NECESSARY FOR FREE MOISTURE ON AGGREGATE OR ABSORPTION BY DRY AGGREGATE.
	Fly Ash	0.88		125	
	CEMENT	2.54		499	
	TOTAL WATER	4.07		254	
	ADMIXTURE				
	TOTALS	27.00	100	2924 LBS.	

ORTED TO: ADMIXTURES:
Grace WRDA 79: 6.5 fl.oz./100#cem.
Grace WRDA 19: 13.0 fl.oz./100#cem.
Grace DAREX: 1.0 fl.oz./100#cem.

BY R.L. Schwein

Fresh Unit Weight = 145.3 pcf

TO : WILBUR MOULTON
SAN FRANCISCO LAB

LONE STAR IND., INC.
SANTA CRUZ MILL

TYPICAL ANALYSES
FOR : Dec-87

LABORATORY REPORT

RECEIVED FEB 2 0 1988

		II
CHEMICAL ANALYSIS		
SIO2		22.34
AL2O3		4.00
FE2O3		3.30
CAO		63.71
MGO		2.16
SO3		2.47
LOI		0.81
NA2O		0.25
K2O		0.48
TOTAL		99.51
F.CAO		0.40
T.ALK		0.56
INSOL.		0.12
COMPOUND COMPOSITION		
C3S		50.97
C2S		25.59
C3A		5.02
C4AF		10.04
CASO4		4.20
PHYSICAL ANALYSIS		
325		88.9
WAGNER		1973
BLAINE		3469
N.C.		24.0
EXP.		0.031
GILLMORE	INITIAL	02:30
	FINAL	04:25
VICAT	INITIAL	106
	FINAL	235
PFS		83
AIR		10.7
1 DAY		1470
3 DAY		2865
7 DAY		4108
28 DAY (PREV.MONTH)		5002

COMMERCIAL TESTING LABORATORIES

A DIVISION OF CTL/THOMPSON, INC
22 LIPAN STREET DENVER, COLORADO 80223 (303) 825-3207

CHEMICAL AND PHYSICAL ANALYSES OF FLY ASH

TICKET NUMBER: 2154- 18287 REPORT DATE: 10/24/87

REPORT TO: Pozzolanic Northwest
2448 76th Avenue SE
Suite 222
Mercer Island , WA 98040

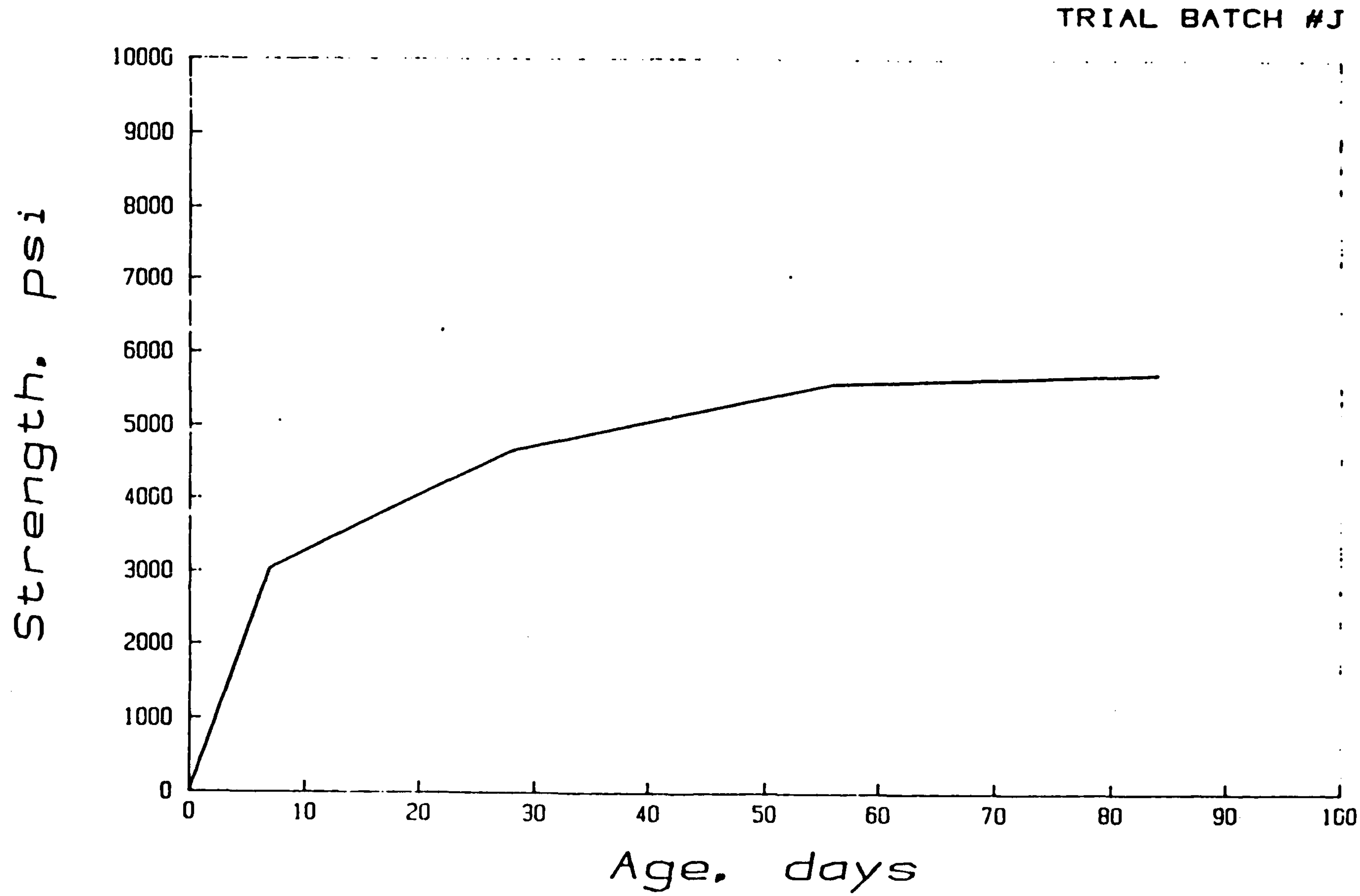
PLANT OF ORIGIN : Centralia
SAMPLE ID : #306 Dkts 28127-28168
DATE SAMPLED : -- --
DATE RECEIVED : 09/22/87

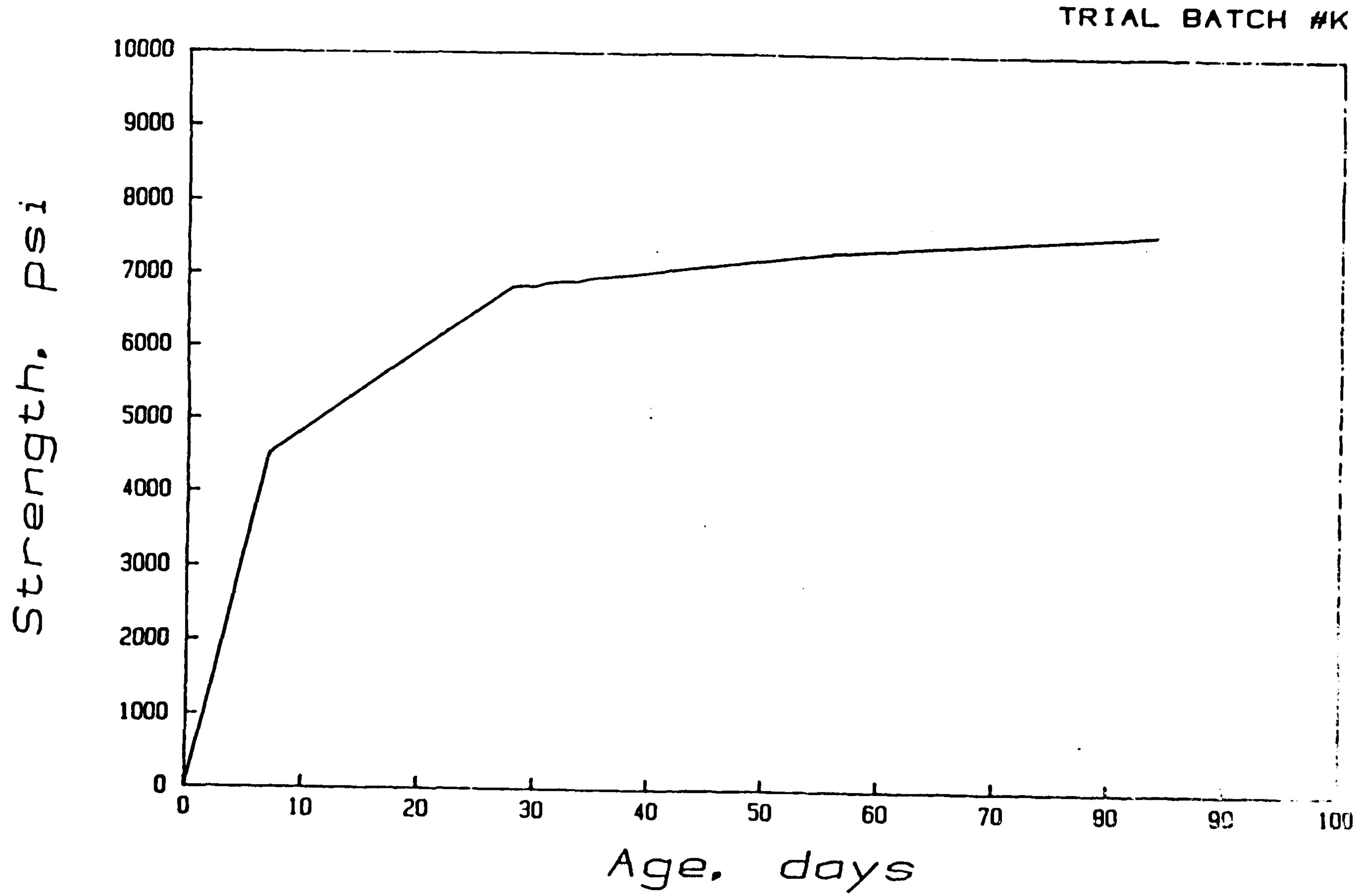
			ASTM: C 618-85 SPECIFICATIONS	
CHEMICAL COMPOSITION(%):			CLASS F	CLASS C
Silicon Dioxide	49.48			
Aluminum Oxide	25.51			
Iron Oxide	6.72			
* * * Total		81.71	70.0 Min	50.0 Min
Sulfur Trioxide		0.45	5.0 Max	5.0 Max
Calcium Oxide		7.07		
Moisture Content		0.00	3.0 Max	3.0 Max
Loss on Ignition		0.10	6.0 Max	6.0 Max
PHYSICAL TEST RESULTS:				
Fineness				
Retained on #325 sieve, (%)		28.15	34 Max	34 Max
Pozzolanic Activity Index				
With Portland Cement (%)				
Ratio to Control @ 28 days		82.0	75 Min	75 Min
With Lime @ 7 days (psi)		940.0	800 Min	No Limit
Water Requirement, % of Control		89.5	105 Max	105 Max
Soundness				
Autoclave Expansion (%)		-0.038	0.8 Max	0.8 Max
Specific Gravity		2.14		

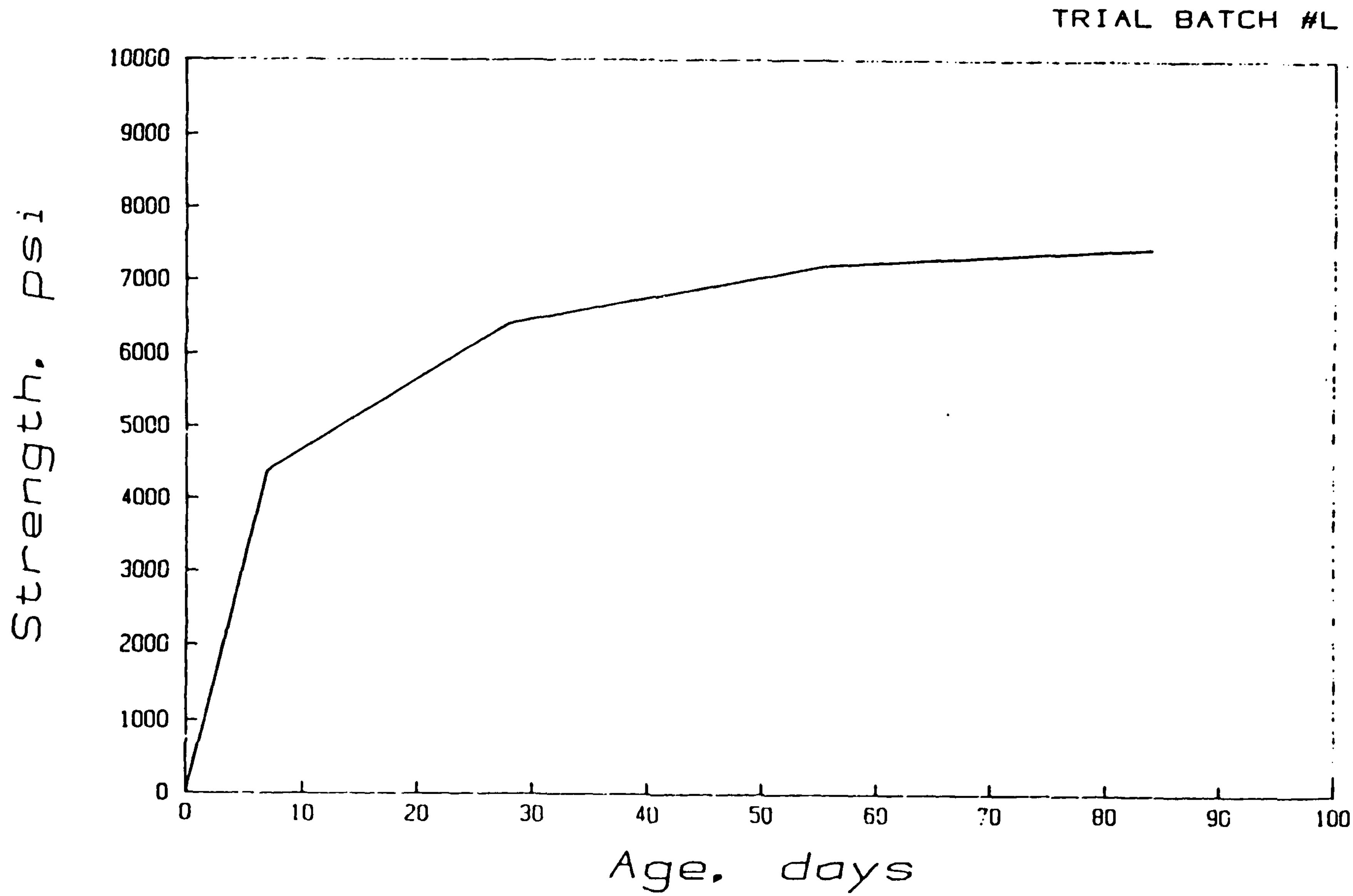
Comments: --

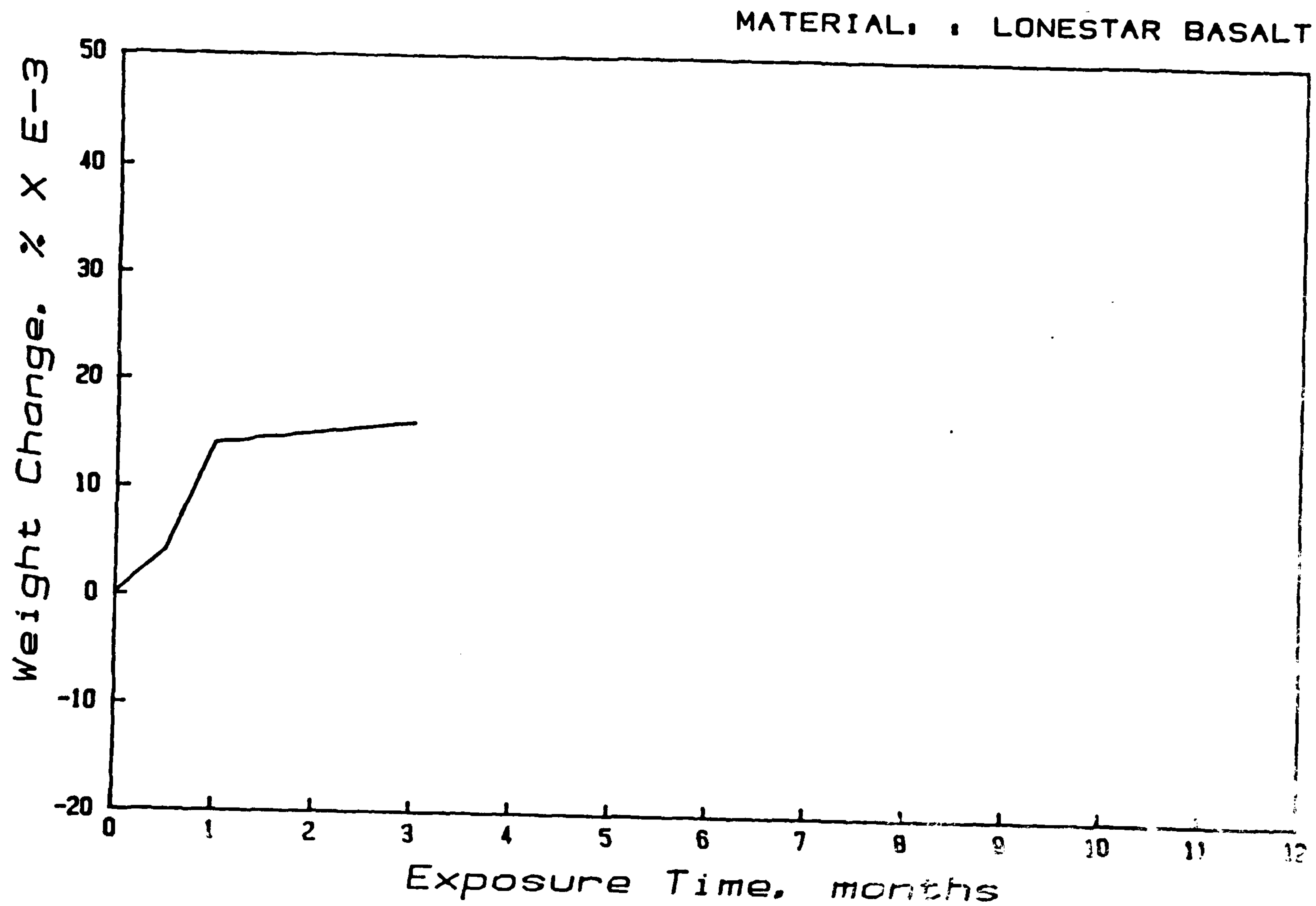
COMMERCIAL TESTING LABORATORIES

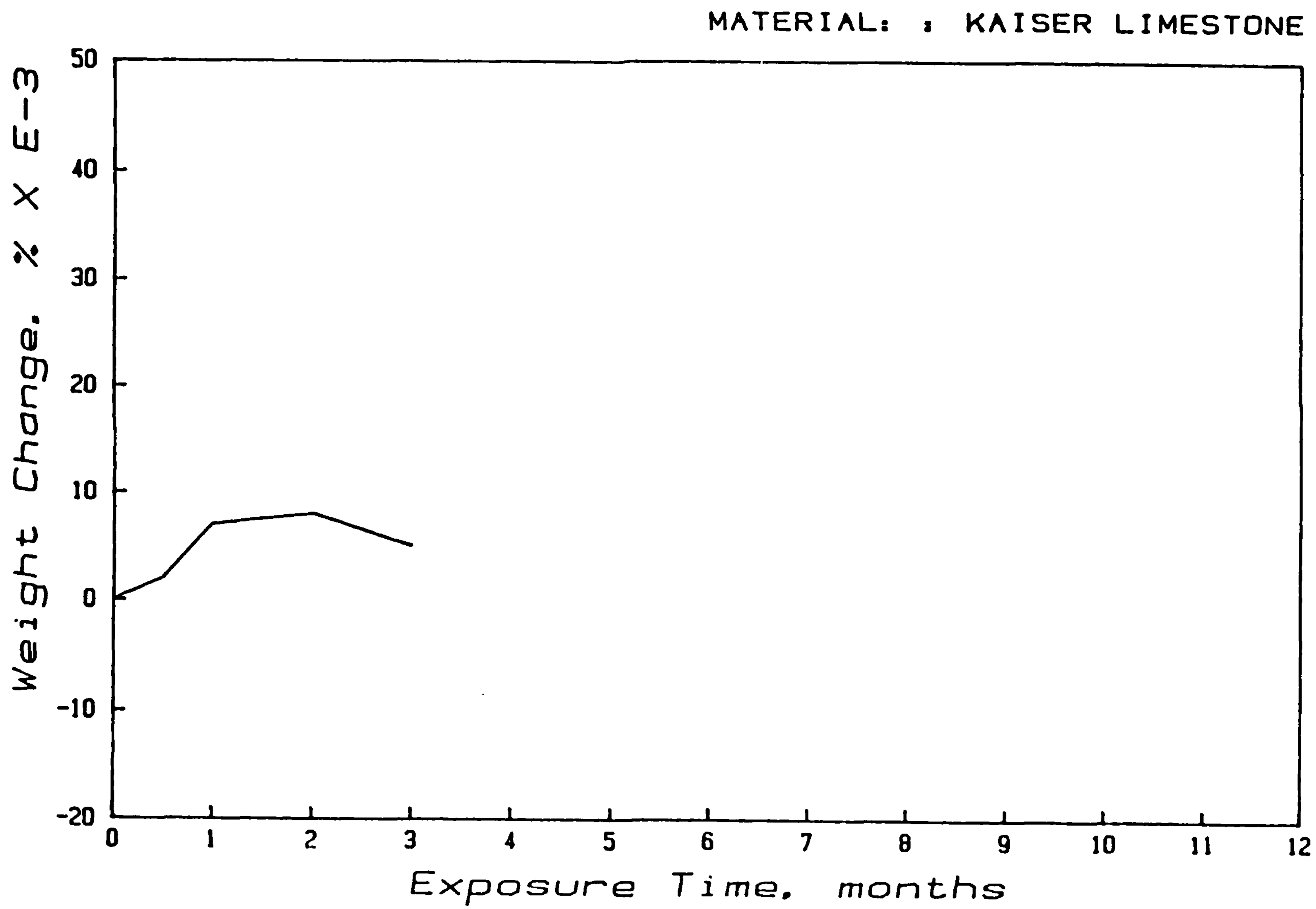
By [signature]
Orville R. Werner II, P.E.

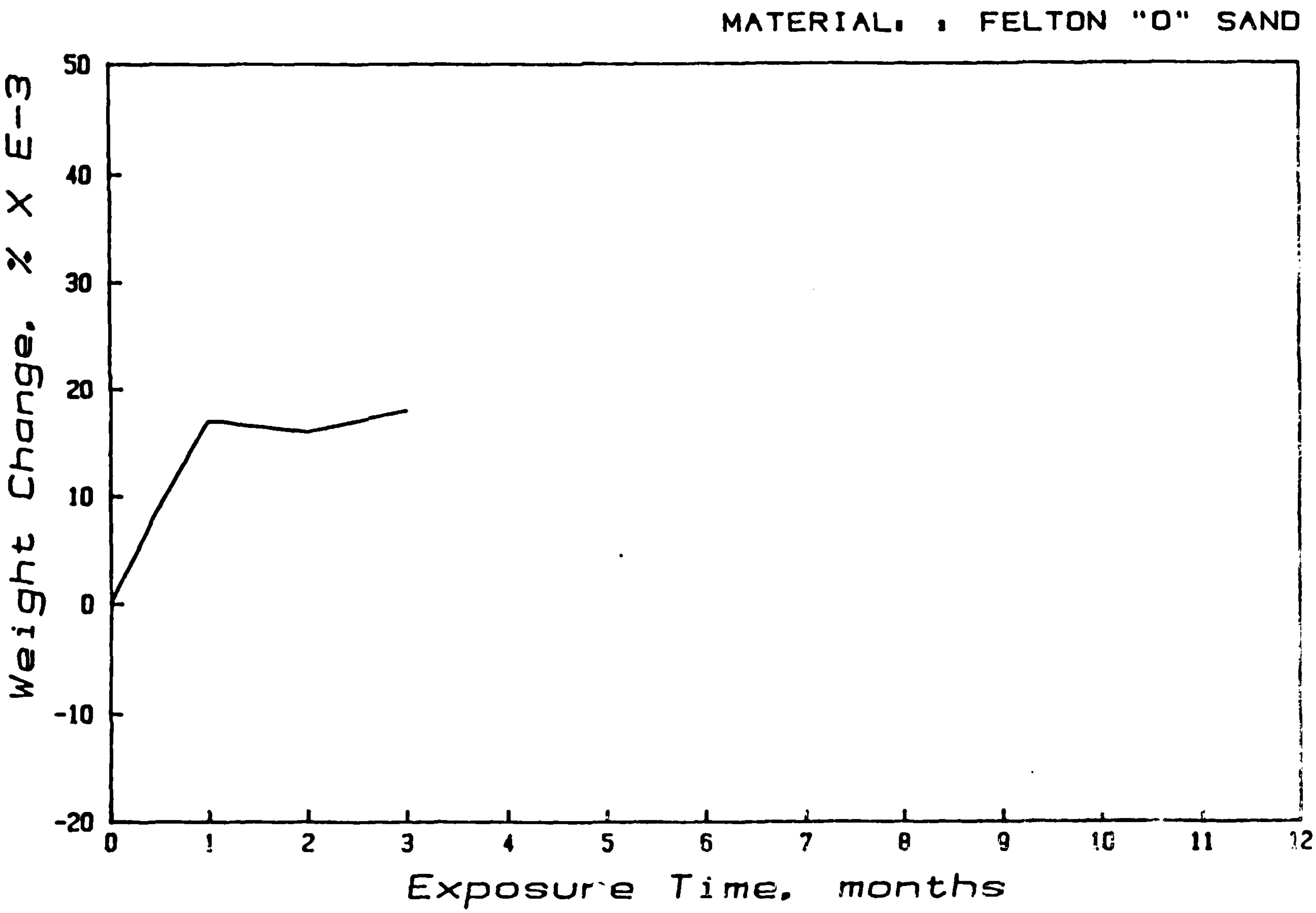

TRIAL BATCH #J
Strength, psi
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
80
90
100
Age, days


TRIAL BATCH #K
Strength, psi
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
80
90
100
Age, days

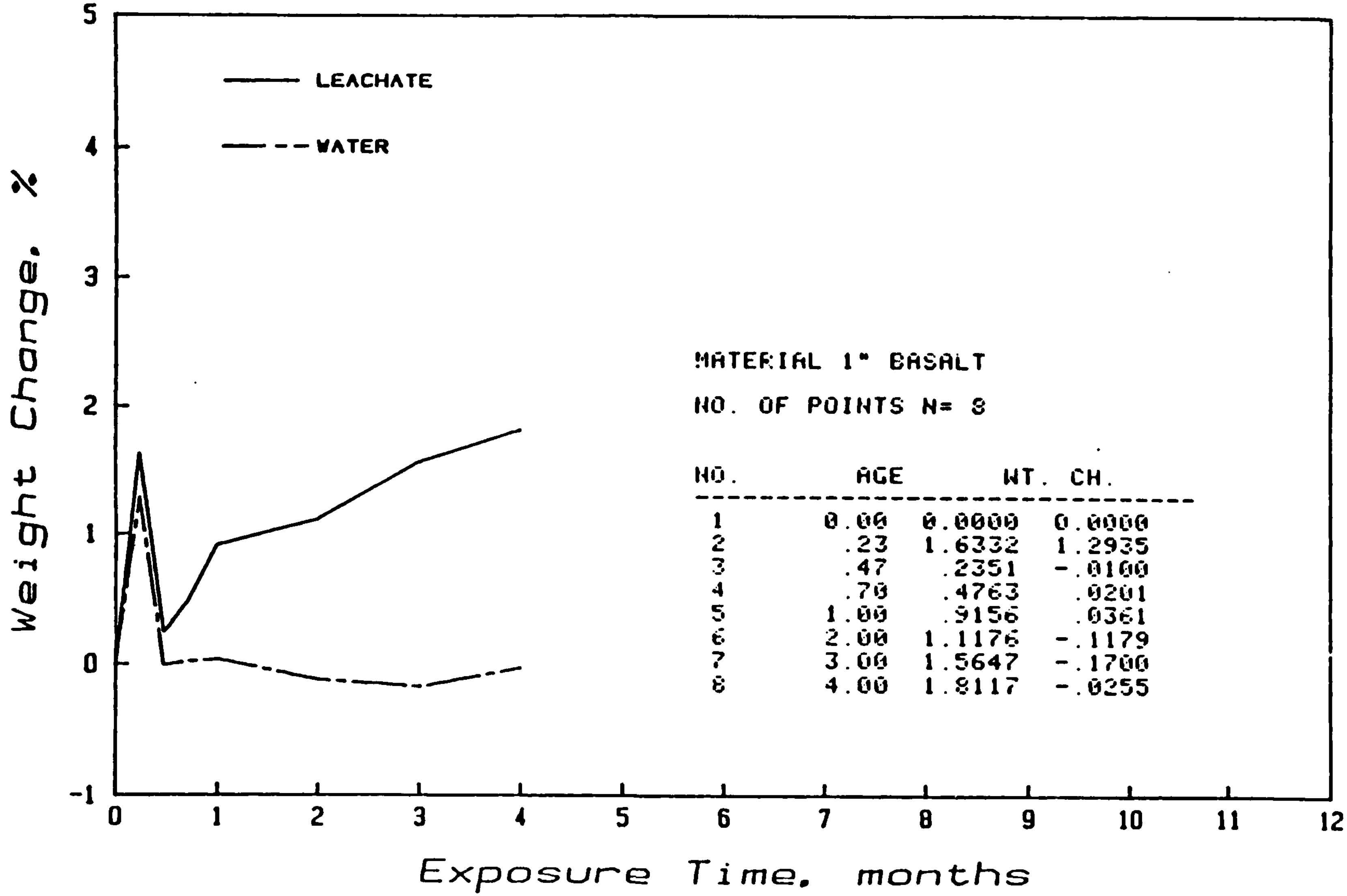

TRIAL BATCH #L
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
80
90
100
Strength, psi
Age, days


MATERIAL: : LONESTAR BASALT
50
40
30
20
10
0
-10
-20
Weight Change, % X E-3
0
1
2
3
4
5
6
7
8
9
10
11
12
Exposure Time, months


MATERIAL: : KAISER LIMESTONE
Weight Change, % X E-3
50
40
30
20
10
0
-10
-20
0
1
2
3
4
5
6
7
8
9
10
11
12
Exposure Time, months


MATERIAL: FELTON "O" SAND
Weight Change, % X E-3
50
40
30
20
10
0
-10
-20
0
1
2
3
4
5
6
7
8
9
10
11
12
Exposure Time, months

MATERIAL: 1" BASALT

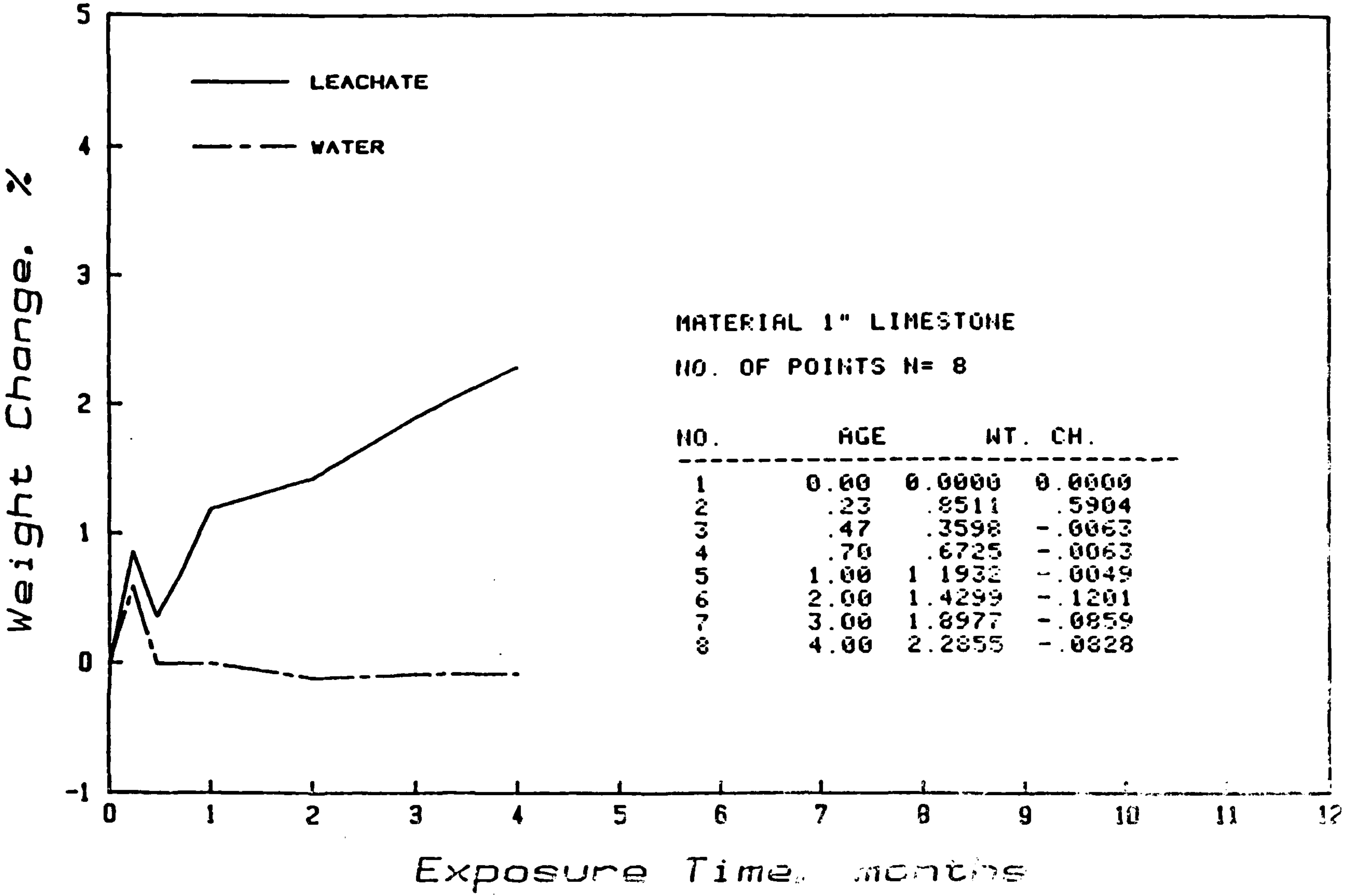


MATERIAL 1" BASALT

NO. OF POINTS N= 8

NO.	AGE	WT. CH.	
1	0.00	0.0000	0.0000
2	.23	1.6332	1.2935
3	.47	.2351	-.0100
4	.70	.4763	.0201
5	1.00	.9156	.0361
6	2.00	1.1176	-.1179
7	3.00	1.5647	-.1700
8	4.00	1.8117	-.0255

MATERIAL: 1" LIMESTONE

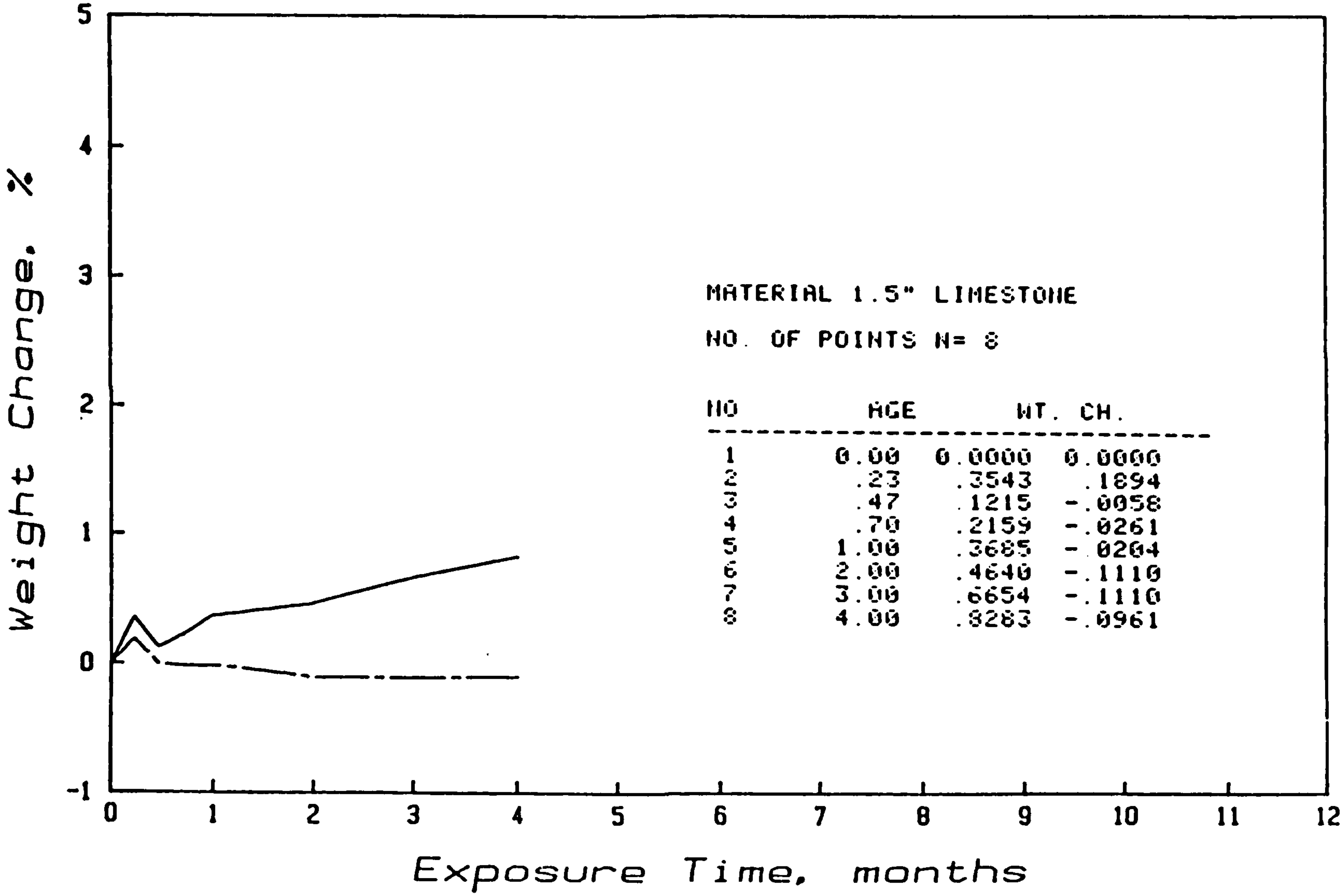


MATERIAL 1" LIMESTONE

NO. OF POINTS N= 8

NO.	AGE	WT. CH.	
1	0.00	0.0000	0.0000
2	.23	.8511	.5904
3	.47	.3598	-.0063
4	.70	.6725	-.0063
5	1.00	1 1932	-.0049
6	2.00	1.4299	-.1201
7	3.00	1.8977	-.0859
8	4.00	2.2855	-.0828

MATERIAL: 1.5" LIMESTONE



NO	AGE	WT. CH.	
1	0.00	0.0000	0.0000
2	.23	.3543	.1894
3	.47	.1215	-.0058
4	.70	.2159	-.0261
5	1.00	.3685	-.0204
6	2.00	.4640	-.1110
7	3.00	.6654	-.1110
8	4.00	.8283	-.0961

ANATEC LABORATORIES INC.

APPENDIX A

LEACHATE ANALYSIS

435 Tesconi Circle
Santa Rosa, CA 95401
707-526-7200
Fax 707-526-9623

Harvey Haynes & Associates
3803 Randolph Avenue
Oakland, CA 94602

February 21, 1988
ANATEC Log No: 2109 (-1)
Series No: 036/Haynes
Client Ref: (V) Schwein

Subject: Transmittal of Results for One Water Sample Identified as "P.U. Sample 1/21/88" Received January 21, 1988.

Gentlemen:

Attached as Table 1 are summarized analytical results for the above referenced sample.

Please feel welcome to contact us should you have questions regarding procedures or results.

Submitted by:

Jules Skamarack
Project Chemist

Approved by:

Greg Long
Project Manager

/ml