

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843



August 9, 2006

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CLIFFORD P. LUM
Manager and Chief Engineer

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Ms. Salmonson:

Subject: Finding of No Significant Impact, Kaipapau Well and Associated Facilities, TMK: 5-4-04:04 (Portion), Koolauloa, Oahu, Hawaii

The Board of Water Supply has reviewed the comments received during the 30-day public comment period. The agency has determined that this project will not have significant environmental effects and has issued a Finding of No Significant Impact (FONSI). Please publish this in the next available Office of Environmental Quality Control (OEQC) notice. We have enclosed the following:

- Completed OEQC Publication Form for the FONSI
- Four copies of the Final Environmental Assessment
- Project summary on disk

If you have any questions, please contact Scot Muraoka at 748-5942.

Very truly yours,

CLIFFORD P. LUM
Manager and Chief Engineer

Enclosures

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Final Environmental Assessment

Kaipapa`u Well and Associated Facilities

Ko`olau Loa District, City and County of Honolulu, State of Hawai`i
TMK 5-4-4:4

Prepared for:
Honolulu Board of Water Supply
630 South Beretania Street
Honolulu Hawai`i 96843

Prepared by:

Geometrician Associates and
HC 2 Box 9575
Kea`au HI 96749

Okahara & Associates
677 Ala Moana Blvd, Suite 703
Honolulu HI 96813

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Kaipapa`u Water Well Environmental Assessment

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Summary

The project would convert an existing exploratory well near Hau`ula, O`ahu, to a production well. The site is a previously graded pad upslope of Kaipapa`u Stream, at 205 feet elevation, about 4,000 feet from the shoreline. The project is consistent with the Ko`olau Loa Water Management Plan, which focuses on sustainability in water use and development, including watershed protection, management, conservation, and restoration. The project would assist in fulfilling the plan's goal of optimizing pumping, in part, by redistributing existing permitted uses among several wells. This will help minimize aquifer impacts by allowing pumping reductions at Punalu`u wells, which are experiencing rising chloride levels.

The well extends 165 feet below sea level and taps the basal aquifer. It would be fitted with a pump with a capacity of 1.0 million gallons per day. The pad will also house a control building, pump building and a 10,000-gallon concrete breaker reservoir. The buildings and reservoir will be painted in an earth-colored tone and the area surrounding the building will be ringed with security fencing. The remaining area in the well pad, except for the access road and turn-around, will be landscaped to restore a vegetated cover. A 2,400-foot long unpaved road from the Hau`ula 180 reservoir that was graded for the test well will be improved and paved to provide access. Utilities and water interconnections will also be built. An integral part of the project will be Best Management Practices (BMPs) to minimize potential pollution of receiving waters that could arise from erosion and sedimentation and hydrotesting of the pipeline. These BMPs will be developed as part of a National Pollutant Discharge Elimination System permit. No sensitive flora or fauna is present, and the project will not dewater or otherwise affect Kaipapa`u Stream, given proper implementation of BMPs. Visual impacts will be minimal and mitigated by landscaping and project design, and there will be no effect to trails. No significant archaeological or cultural sites are present or will be affected, and in the unlikely event that archaeological resources are encountered, work in the immediate area of the discovery will be halted and DLNR-SHPD contacted.

Kaipapa`u Water Well Environmental Assessment

SECTION 1: PROJECT LOCATION, DESCRIPTION AND BACKGROUND

1.1 Project Location and Land Ownership

The proposed production water well is located on a graded pad upslope of Kaipapa`u Stream, about 4,000 feet from the shoreline, near the town of Hau`ula, O`ahu, in the Ko`olau Loa District, City and County of Honolulu (Fig. 1 & 4). The property is a portion of TMK 5-4-4:4 and is owned in fee by Plumbers and Fitters Local 675.

The Ko`olau Loa District consists of a 58 square-mile area on the windward side of the Ko`olau Mountains stretching from Ka`a`awa to Kawela. It includes the communities of Ka`a`awa, Kahana, Punalu`u, Hau`ula, Lai`e, Kahuku, and has a population of approximately 15,000.

1.2 Project Description

The project would convert an existing exploratory well to a production well and would consist of the following features (Figs. 2a-e, 3a-b)

Well/Reservoir Pad

The well/reservoir pad is a 30,000-square foot graded area on the northwest slope of Kaipapa`u Gulch at an elevation of 205 feet above sea level (Figs. 2e, 3a).

Well, Pump, Control Building and Reservoir

The exploratory well will be converted to a production well extending to a depth of 370 feet, or 165 feet below mean sea level (MSL). The well has a solid steel casing with a cement annulus to a depth of 268 feet (-63 feet MSL); below this the well will be fitted with a perforated casing to 370 feet (-165 MSL). The pump will have a capacity of 1.0 million gallons per day (mgd), and will be equipped with a mute to baffle sound.

The visible, aboveground component at the well site will include two hollow tile buildings: a control building (2,100 square feet and 16 feet maximum height); and a pump building (800 square feet and 14 feet maximum height). A 10,000-gallon concrete breaker reservoir will also be constructed on the pad.

The buildings and reservoir will be painted in an earth-colored tone to blend in with the surrounding landscape. The area surrounding the building will be ringed with security perimeter fencing. The remaining area in the well pad, except for the access road and turn-around, will be landscaped to restore a vegetated cover to the terrain. Access for fire

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apparatus, water supply and building construction shall be in conformance with existing codes and standards.

Access Road

Access to the site will be provided by improvements to the unpaved access road that was graded for the test well but has since grown over. The portion of the access road covered by this EA extends from the well site downhill to the Hau`ula 180 reservoir site, a distance of approximately 2,400 feet (Refer to Figs. 2a-e and 3a-b for precise route, plan, profile and typical cross-sections).

The access road will be 12 feet wide and paved with asphalt concrete on sections where profile grades are 12 percent or less and reinforced concrete on grades in excess of 12 percent. The maximum grade is 20 percent and occurs at two places along the route. The access road will have 2-foot wide gravel shoulders on each side. Drainage will be directed to culvert inlets by roadside ditches and swales.

Utilities

Hawai`i Electric Company (HECo) will supply 480Y/227 Volts, 3-phase, 4-wire service for the project site via a pad-mounted transformer located at the well site. HECo will extend underground power (12.47 kV, 3-phase) from the Hau`ula 180 Reservoir site access road to the Kaipapa`u Well site. Hawaiian Telcom will provide telemetering circuits between the well and reservoir sites, and between the well site and the BWS Beretania station.

The underground electric and telephone ductline will be concrete-encased and installed within the proposed access road to the Kaipapa`u well. Minimum cover from the top of the roadway to the top of the concrete encasement will be 18 inches. HECO manholes (4 x 6 feet) and Hawaiian Telcom pullboxes (2 x 4 feet) will be installed along the ductline, approximately 250 apart. The ductline length is approximately 2,470 feet.

Interconnection with Hau`ula Booster System and Pipeline Testing

Water from the well will be pumped to a 10,000-gallon breaker reservoir located at the well site and will flow by gravity in a 12-inch pipe approximately 2,400 feet to the Hau`ula 180 Reservoir. The effluent line of this reservoir connects directly to the Kahana 315 System, which collects water from various sources and serves the Ko`olau Loa area of O`ahu.

The 12-inch transmission main from the on-site breaker reservoir to the Hau`ula 180 reservoir will generally follow the profile of the service road with deviations to accommodate drainage pipe crossings (see Fig. 3). The pipe material will either be ductile iron or PVC, depending on the outcome of the contractor bid process.

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Best Management Practices (BMPs) developed as part of a National Pollutant Discharge Elimination System (NPDES) permit, such as screening and dechlorination procedures, will be implemented during hydrotesting of the pipeline to minimize potential pollution of receiving waters.

Best Management Practices During Construction

An integral part of construction will be the implementation of Best Management Practices, as described in Section 3.1.1, below, to minimize adverse impacts of erosion and sedimentation.

Project Cost

Cost for this component of Kaipapa`u Well Project is estimated to be \$5,175,000. The project will be fully funded by the Honolulu Board of Water Supply. Construction of the project is currently programmed in a time frame beyond the Board of Water Supply's present 6-year capital plan (2006-2011).

1.3 Background

A Chapter 343 Draft Environmental Assessment and Negative Declaration for the exploratory well and access road at Kaipapa`u were prepared by Belt Collins and Associates and published in the *OEQC Bulletin* in 1989. The access road and well pad were graded and the well was drilled during 1993.

The exploratory well was drilled to a depth of 165 feet below sea level, with a head at 17 feet above sea level. Pumping tests indicated that the basal aquifer at the well site was capable of a sustainable yield of more than one million gallons per day.

The next step was to prepare an Environmental Assessment for the production well. The Draft Environmental Assessment for the *Kaipapa`u Well, Breaker Reservoir, Control Station, Pipeline and Access Road Development at Kaipapa`u, O`ahu* (title shortened for Final EA) was published in the Office of Environmental Quality Control's (OEQC) *Environmental Notice* on July 8, 1995. Several comment letters (see App. 1b) requested additional information concerning the stream resources of Kaipapa`u Stream. The Honolulu Board of Water Supply (BWS) agreed that such information would be useful. To allow for eventual completion of the EA, the BWS contracted for a stream survey, which was completed in 2001 (App. 3).

In the meantime, the project was placed on hold while BWS updated the O`ahu Water Management Plan. The BWS is responsible for providing a safe and reliable water distribution system for O`ahu residents at the most affordable cost possible. The BWS

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presently serves approximately 900,000 people. It is one of the 10 largest water utilities in the country. The current average daily water demand for the system is 150-160 million gallons per day (mgd).

Starting in the late 1990s, BWS revised their planning approach to create watershed management plans for each of the eight sustainable community and development plan areas established in the *O`ahu General Plan* (<http://www.honolulu.gov/Planning/OahuGenPlan.asp>). This holistic approach focuses on sustainability in water use and development, including watershed protection, management, conservation, and restoration. The State Commission on Water Resource Management (CWRM) approved the watershed management plan approach and scope on March 17, 2004.

The Kaipapa`u Well project, originally conceived as increasing the supply for the Ko`olau Loa system and allowing greater transfer of water outside the system to areas of greater water need, was re-evaluated in light of the goals of the watershed management plan. The BWS currently has permitted uses of 8.915 million gallons per day (mgd) distributed among 16 wells in the Ko`olau Loa Water Management Area Aquifer System, which has a sustainable yield of 35 mgd and a total of 21.508 mgd permitted uses from all sources (Source: CWRM database, Oct. 2005).

Future use levels are expected to be similar. BWS well sources in Punalu`u have experienced increasing chlorides, notably Punalu`u Wells II and III. The Kaipapa`u project has been reoriented in its purpose to assist in fulfilling the water management plan's goal of optimizing pumping, in part, by redistributing existing permitted uses among several wells. This will help minimize aquifer impacts by allowing pumping reductions at Punalu`u Wells II and III. This multifaceted approach also includes advanced conservation and leak detection and repair.

Aside from procedural changes related to the advancement from Draft to Final, the Final EA has been reorganized and modified in a number of ways. Because of the extensive nature of the additions and modifications, it has not been practical to denote the changes from Draft to Final EA. Of primary importance are the following:

- A stream survey has been added (Section 3.1.3.3 and App. 3).
- Environmental, water use and demographic data have been updated.
- A supplemental archaeological inventory survey and cultural impact assessment have been prepared (Section 3.4 and App. 4b).
- Various sections have been modified to address aspects of the OEQC's *Guidelines for Assessing Well Water Impacts*.
- Additional significance criteria have been added to HAR 11-200; these are addressed in the Final EA.

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1.4 Consultation with Government Agencies

As part of pre-consultation during 1994, comments were solicited from the following agencies. Written comments from these agencies are duplicated in Appendix 1a.

City/County Agencies

City and County of Honolulu
Planning Department
Department of Land Utilization

State Agencies

Department of Agriculture
Department of Business, Economic Development and Tourism
Department of Land and Natural Resources
 Water Resources Management Division
 State Historic Preservation Division
 Na Ala Hele
Department of Health
 Environmental Management Division
University of Hawaii
 Water Resources Center
 Environmental Center

Federal Agencies

U.S. Department of Agriculture Soil Conservation Service
U.S. Army Corps of Engineers, Pacific Ocean Division
U.S. Fish and wildlife Service

As stated above, the Draft Environmental Assessment was published in the Office of Environmental Quality Control's (OEQC) *Environmental Notice* on July 8, 1995. This initiated a 30-day comment period during which 20 letters were received. These comments and the BWS responses to them are reproduced in Appendix 1b. As discussed in Section 1.3 above, the Final EA has been substantially modified, among other reasons, in order to address concerns raised by commenters.

SECTION 2: ALTERNATIVES

2.1 Alternative Strategies

As discussed in Section 1.3, there are a number of possible alternative strategies besides the current approach, which would redistribute existing permitted uses among several wells, for minimizing aquifer impacts. These include:

- Demineralization of brackish ground water;
- Use of sewage effluent or storm water;
- Exchanging or appropriating agricultural water sources;
- Implementing stricter water conservation program such as xeriscape, leak detection, low-flush and dual-flush toilets, and other low-flow fixtures, meter repair/replacement programs, modification of plumbing code regulations, voluntary water restriction notices; and
- Public education outreach/education programs to allow the BWS to share information about the potable water system and water conservation.

Rather than viewing such alternatives as mutually exclusive, BWS seeks to optimize their mix and create a framework for adapting the mix and integrating new strategies in response to evolving needs. Though the mix will undoubtedly rely on a number of alternative strategies, development of new wells consistent with the sustainability of the aquifer plays a role in some areas at some times.

2.2 Alternative Well Site Locations

It is probable that several specific sites within Kaipapa`u Valley could provide a feasible well pad for tapping into the basal aquifer. Several factors, however, favor the existing site:

- The site was chosen over others in Kaipapa`u because of its advantages in terms of accessibility, relative lack of sensitive environmental conditions, and land ownership/regulations. Other sites were determined to be less than optimum.
- The site has already proven capable of producing a satisfactory quantity and quality of water.
- An exploratory well pad and access road have already been constructed. An alternative site would entail the expense and impacts of additional drilling and grading.

In terms of the general sensitivity of much of the Ko`olau Loa environment, the existing distribution of wells, and information about aquifer resources, Kaipapa`u Valley offers an ideal location, and other locations in Ko`olau Loa were not considered suitable.

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2.3 No Action

If the proposed action does not proceed, the sum of other strategies – i.e., advanced conservation, leak detection and similar programs – will not likely be sufficient to allow substantial reduction of pumpage at Punalu`u Wells II and III. Ultimately, in order to maintain the same level of production from the Ko`olau Loa Aquifer System despite the lack of a well at Kaipapa`u, the deficit in production would have to be taken up by existing or new wells elsewhere in the system.

2.4 Alternatives Advanced for Consideration in the Environmental Assessment

As use of the Kaipapa`u site appears to be efficient and without significant environmental impacts, as discussed in Section 3 below, it is prudent to use it at this point rather than exploring new well sites that might be less productive or entail more environmental impacts. Therefore, although it is acknowledged that a variety of methods to conserve and reuse water will continue to be integral to the overall strategy of supplying potable water to BWS customers, only two alternatives are addressed in this EA: No Action and the proposed Kaipapa`u Well site. No Action is considered here primarily because it provides a useful baseline for discussing the environmental impacts of the project.

SECTION 3 ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION

3.1 Physical Environment

3.1.1 Geology, Soils and Drainage

Geomorphology

The project site is located in a steep-sided stream valley near the northern edge of the Ko`olau Mountains. The geomorphology of the project area is derived from stream erosion through layers of basalt, along with chemical weathering and mass wasting of the side walls of the canyon (MacDonald et al 1983:429-432).

Kaipapa`u Stream twists for approximately 5.2 miles, from just less than 2,600 feet elevation to sea level. It is classified by the U.S.G.S. on the Hau`ula 1:24,000 scale topographic map (1983) as intermittent for its entire length. It has one tributary in addition to the main trunk.

The elevation at the well site is 205 feet above sea level. The portion of the access road discussed in this EA extends from the well site downhill to approximately 145 feet elevation. The well pad has been graded flat. The slope of the valley wall at the well site and along the access road varies from 30 to 75 percent or higher. The slope along the access road parallel to the stream averages about 5 percent but has several steep sections with slopes over 10 percent.

Climate

The average annual rainfall at the site is between 50 and 75 inches per year, with a pronounced winter maximum. Fog drip also contributes surface water to the drainage basin. Rainfall in the upper reaches of Kaipapa`u drainage basin may approach twice this amount (Giambelluca et al 1984). Average annual temperature is approximately 75 degrees Fahrenheit, with small diurnal and seasonal variation (UH-Hilo Dept. of Geography 1998). Winds are generally light to moderate northeasterly trades.

Average weather is not expected to have any significance in terms of the design or use of the proposed facility. However, the windward slopes of O`ahu are known for intense rainfall episodes. Analysis of long-term data from a relatively dense network of rain gages estimates that storms producing as much as 2 inches of rain per hour in some parts of the drainage basin are likely every 2 years, and that up to 3 inches per hour may be expected on the average every 10 years. Twenty-four hour rainfall totals may exceed 8 inches every two years and 12 inches every 10 years on the average (Giambelluca et al 1984: 16-25).

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Soils

The soil types found on and surrounding the access road and well pad are classified by the U.S. Soil Conservation Service as Kawaihapai Stony Clay Loam (KlaB) on the low-sloping areas and Paumalu silty clay (PeF) on the steeper slopes.

Kawaihapai Stony Clay Loam is a well-drained soil found on drainageways and alluvial fans derived from igneous rock in humid areas. Runoff is slow and erosion hazard slight.

Paumalu silty clay is a well-drained soil found on old alluvium and colluvium. The PeF variety is found on slopes of 40-70 percent. Because of the high slope, runoff is rapid and erosion hazard is severe, especially in unvegetated areas (U.S. Soil Conservation Service 1972).

The U.S. Natural Resources Conservation Service (formerly Soil Conservation Service; see Appendix 1a for letter) has stated that precautions should be taken to ensure that construction of the access road avoids causing sedimentation into Kaipapa`u Stream.

FIRM Flood Zone Status and Seismic Zone

The project site, including well pad and access road, is designated on Flood Insurance Rate Maps (FIRM) as Zone X, areas determined to be outside the 500-year flood plain (FEMA FIRM Map Panel 150001 0015c). In terms of seismic risk, the entire Island of Hawai'i is rated Zone 2a Seismic Probability Rating (*Uniform Building Code*).

Erosion and Sedimentation Impacts and Mitigation

Additional grading and trenching will occur on the current temporary access road and well pad. The soil character requires special considerations for engineering roads, pads and structures. The access road and well-pad are situated above Kaipapa`u Stream at lateral distances between 30 and 200 feet. Heavy rainfall before slopes become stabilized could produce runoff that might erode and carry sediment to lower elevation areas. The soil-laden runoff could possibly discharge into the stream and cause temporary turbidity if appropriate preventative measures are not implemented. Contaminants associated with heavy equipment and other sources during construction may also impact receiving stream, ocean and ground water. In addition the access road will require cut and fill in steep slopes. This context requires careful engineering of erosion control structures in order to prevent erosion of cut and fill slopes, potential sedimentation of the stream and prevention of spills of potential contaminants.

Final engineering will involve additional evaluation of the site-specific slope hazard and subsurface conditions and the development of appropriate structural criteria. All grading and

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building foundations will be engineered to conform with such recommendations, and no impact on the stability of the site nor damage to structures is to be expected as a result of the project. The reservoir will be designed in accordance with applicable American Water Works Association and American Concrete Institute standards for this Seismic Zone 2a, as well as all applicable City/County Building Department requirements.

Because the project will disturb more than one acre of soil, a National Pollutant Discharge Elimination System (NPDES) permit must be obtained by the contractor before the project commences. This permit requires the completion of a Storm Water Pollution Prevention Plan (SWPPP). In order to properly manage storm water runoff, the SWPPP will describe the emplacement of a number of best management practices (BMPs) for the project. These BMPs may include, but will not be limited to, the following:

- During construction, erosion will be minimized by applying temporary measures that will reduce the velocity of the runoff and retain sediment on-site. Examples of these measures may include but are not limited to: silt fences, check dams, mulching, culvert outlet protection, and sedimentation basins. Construction materials will be stored in a protected area with measures in place to contain and clean-up spills
- Clearing and grubbing of construction work areas will be phased to minimize the amount of exposed soil at any one time.
- A gravel vehicle ingress/egress at entrance to the access road will be constructed in order to minimize tracking debris offsite. Reduction in the tracking of sediments onto paved roads helps prevent the deposition of sediments into local storm drainage systems and reduces airborne dust.
- A slope hazard study will be conducted, and cut and fill slopes will be stabilized by vegetative as well as non-vegetative means. Exposed embankment slopes will be planted and mulched, and a biodegradable close weave heavy fiber netting will be emplaced in order to control erosion and protect seedlings.
- On slopes too steep to support vegetation, stone riprap lining will be utilized.
- The grading plan will minimize disturbance to the semi-native shrubby community on the slopes to the extent feasible, as it is recognized that this community occurs on nutrient- limited sites where vegetation recovery is slow, and where significant erosion may occur if the present vegetation is removed. Thus, the native shrub community provides a natural protection against soil erosion.
- In addition, the plan will include landscaping incorporating native shrubs for erosion control where feasible and appropriate.
- Best Management Practices that trap pollutants before they can be discharged such as silt fences and sedimentation basins will be employed.

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- Best Management Practices that prevent the mixing of pollutants from construction materials and storm water, such as providing protected storage for chemicals, paints solvents, and other toxic materials will be employed.
- Permanent pollution control measures will be applied to minimize degradation of storm water quality after construction of the road has been completed. These measures may include providing velocity reducers and/or settlement basins at culvert outlets, and slope stabilization.
- As discussed in Section 1.4, BMPs such as screening and dechlorination procedures will be implemented during hydrotesting of the pipeline to minimize potential pollution of receiving waters.

3.1.2 Groundwater Hydrology

Groundwater Hydrology -Regional Background

The groundwater and stream hydrology of Windward O`ahu have been the subject of several investigations. Research has focused on locating additional sources for domestic water supply, determining sustainable yields in aquifers, and examining the relationship between ground water and stream flow, particularly as it pertains to stream ecology. Background for this section is largely derived from the *Final Environmental Impact Statement for Windward O`ahu Regional Water System Improvements* (VTN Pacific 1988) and the *1992 O`ahu Water Management Plan* (Wilson Okamoto & Associates 1992), which supplement original research with reviews of published material.

Dike intrusions into lava flows associated with the rift zone of the former Ko`olau volcano provide relatively impermeable traps for percolating ground water. Large volumes of groundwater may be stored in the basalt layers confined among such dikes. In addition, freshwater lenses exist at the base of the island. These freshwater lenses of variable thickness floating atop salt water are found underneath dike-free locations on the island, and form basal aquifers that are particularly useable at low elevations. In most of Windward O`ahu, sedimentary caprock overlies more permeable lavas, encouraging thick basal lenses and restricting the overflow of basal groundwater to the surface.

An important distinction must be made between high-level aquifers and basal aquifers, such as the one from which the proposed well would draw. Significant quantities of ground water may "leak" from some high-level aquifers into streams, providing a direct relationship between surface and ground water conditions. In other high-level aquifers, this relationship may be negligible or non-existent. Basal aquifers do not supply water to streams except at the mouth of certain streams, where in some cases water leaks through the caprock, creating a brackish estuary.

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This relationship is important because ground water withdrawals – i.e., wells – may under certain conditions impact stream flow. A decrease in stream flow may be detrimental to a stream's ecology. It must be remembered, however, that the relationship is site specific and is based on a stream's elevation and bed stratigraphy.

Groundwater and Hydrology of Kaipapa`u

The Kaipapa`u Aquifer is classified as part of the Ko`olau Loa basal aquifer system (State No. 30601) of the Windward Sector (Fig. 5). As discussed in Section 1.3, above, the BWS has permitted uses of 8.915 million gallons per day (mgd) distributed among 16 wells in the Ko`olau Loa Water Management Area Aquifer System, which has a sustainable yield of 35 mgd and a total of 21.508 mgd of permitted uses (Source: CWRM database, Oct. 2005).

Hydrologists have not yet determined to what extent the discrete aquifers identified with individual stream valleys within the larger Ko`olau Loa system are hydrologically connected. For most of its length, flows on Kaipapa`u stream are clearly unrelated to the basal aquifer that lies beneath it and which would be tapped by the proposed project. In the upper reaches of the stream, rainfall and high-level groundwater leakage contribute to the flows. Although the stream is not gaged, it is estimated that the Q90 flows (flows exceeded 90 percent of the time) at the elevation of maximum dry-weather discharge (above 3,500 feet in elevation for Kaipapa`u Stream) are on the order of 0.1 to 0.2 mgd (VTN Pacific 1988:104).

In its lower sections, Kaipapa`u Stream is perched upon the coastal plain sediments and thickened alluvium, which is over 100 feet thick above the basal aquifer at the estuary. In the vicinity of the well, temporary or permanent water tables may occur in this alluvium, but they would be perched over 100 feet above the underlying basal aquifer which the well taps. Based on the geological setting, the contribution of basal water to the estuary of Kaipapa`u Stream appears to be negligible, if any.

The biological implications of the hydrologic setting of Kaipapa`u Stream is discussed in section 3.1.3 below.

Aquifer Impacts

As discussed in Section 1.3, above, the purpose of the Kaipapa`u project is to assist in fulfilling the water management plan's goal of optimizing pumping, in part, by redistributing existing permitted uses among several wells. The Kaipapa`u project will not have adverse impacts to the aquifer, and will in fact help minimize overall aquifer impacts, especially related to the large well sources at Punalu`u which have experienced increasing chlorides.

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Stream Flow Impacts

As discussed above, the aquifer tapped by the well appear to be unrelated to the stream that runs above it within Kaipapa`u Stream Valley. Withdrawals from Kaipapa`u Well would not be expected to affect flow in any measurable way in the stream or estuary.

Several commenters on the Draft EA questioned whether there was stream flow monitoring during the pump test of the well, and if not, suggested that such tests might help determine the relationship between the flow at the mouth of Kaipapa`u Stream and the pumping of the aquifer. Such monitoring was not conducted during the pump test, and BWS hydrologists have concluded that measuring stream flow during a pump test would in fact fail to yield any credible data. Leakage upward into the alluvium may occur, but it is small because the alluvium is very poorly permeable. Thus, pumping the well would have to decrease head in the basal aquifer by many feet before even the slightest effect took place in the stream flow.

At the proposed rate of 1.0 mgd, there would only be a fraction of a foot of drawdown in the aquifer. Over 90 percent of any leakage that exists would continue, and the loss would be immeasurably small. In the long term, natural variability in the aquifer levels and leakage rates would completely obscure any effects of well pumping.

Instream standards, which are set and administered by the Commission on Water Resources Management (CWRM), were developed to protect fishery, wildlife, recreational, aesthetic, scenic, water quality, irrigation and traditional Hawaiian rights. Any ground water withdrawals from streams determined by the CWRM to have a direct relationship to stream flow are subject to the provisions of the instream use protection program. The present interim instream flow standard for all streams in the State is the "status quo". Such standards prohibit water removal whenever dry-weather stream flow is at or less than the existing median flow. The proposed project at Kaipapa`u will have no effect on instream flow.

Drinking Water Quality Impacts and Mitigation Measures

The Kaipapa`u Well taps water that is derived from a virtually pristine watershed. As shown in Figure 4, all land mauka of an area about 2,000 feet makai of the well site is located within the Conservation District. Groundwater flowing from mauka recharge areas to wells in Ko`olau Loa is shielded from contamination by a thick blanket of rock. Contamination can potentially occur, however, through deep percolation of cesspools, injection wells, and similar sources. In the case of Kaipapa`u, such contamination would appear unlikely, since the well is more than 2,000 feet upgradient from the nearest home, cesspools, injection wells, and other sources of contamination. No active land uses are present here, and there are thus no potable or agricultural water wells, no injection wells, and no cesspools. No residential, commercial, industrial, military or agricultural sources of contaminants are present, and none are anticipated in the future.

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The design of the well helps prevent contamination from sources at and around the well pad. The well casing extends to a depth of 370 feet from the ground surface and is grouted to the surface, protecting the aquifer from contaminants from any surface source. The bottom of the casing is submerged about 165 feet below the water level, and therefore cuts off the top water from entering the well. Prior the final pump installation, the well will be disinfected. A chlorinator will be installed in the control building and used should microbial contamination occur.

As indicated in the Well Completion Report filed with the Hawai'i State Commission on Water Resources Management on August 22, 1993, the pump test for the test well included sampling and laboratory testing for chlorides, hydrogen, alkalinity, nitrates and pH. Results indicated that the water was within acceptable standards for these components.

Drinking water regulations require that all public water supply systems test for a variety of contaminants in drinking water. For many of the contaminants, the U.S. Environmental Protection Agency (EPA) has set enforceable standards for the maximum amount allowed in drinking water. These standards are based on possible health effects of consuming the water. The standards are known as maximum contaminant levels (MCLs), and are published as national primary drinking water regulations (NPDWR). The MCLs are set at levels of which no significant health effects would occur if water was consumed for an entire lifetime. The MCLs are set by EPA, and then adopted by the State. The State must adopt MCL standards at least as stringent as EPA, but may adopt more stringent standards.

Although standards have been set for many contaminants, some contaminants, which may occur in drinking water, have not yet had NPDWR MCL standards established. The EPA still requires systems to test for some of these "unregulated" contaminants and to report on their testing. Even though MCLs have not been set for the unregulated compounds, many of them have been studied by EPA for both their acute health effects and in some cases for their long-term effects, which may involve carcinogenic or noncarcinogenic effects.

All water served by the Board of Water Supply (BWS) is tested by the DOH in accordance with NPDWR. In addition, BWS also conducts routine examinations of waters for salt-water intrusion, which helps protect natural drinking water resources by protecting them from overpumpage. The DOH's enforcement of the NPDWR testing enables both the DOH and BWS to cover a wide range of drinking water issues. DOH focuses on NPDWR testing, while the BWS performs all salt water intrusion monitoring, treatment plant operations, and distribution system testing.

The BWS will monitor the quality of withdrawn water to ensure that it meets applicable State and federal drinking water regulations. The agency will also measure salinity in the

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well for seawater intrusion into the basal aquifer. If there is a risk of intrusion, the BWS will decrease the well pumpage.

3.1.3 Flora, Fauna and Habitat

The site was originally surveyed for vascular plants and wildlife on November 18, 1993, by botanist Lani Stemmermann, Ph.D., assisted by Ron Terry, Ph.D. At that time the well site and access road had been bulldozed. A subsequent botanical survey was conducted by Orlo Steele, M.A., on April 24, 2002, directed by Ron Terry. The original report is attached as Appendix 2A, and the subsequent report is attached as Appendix 2B. The results are summarized below.

3.1.3.1 Terrestrial Flora

Existing Flora

The original vegetation of the project area was Lowland Wet Forest (Gagne and Cuddihy 1990), but the region has been extensively modified by Hawaiian cultivation, cattle grazing, wild pig rooting, and the introduction of non- native flora and fauna.

Several plant communities that vary according to substrate, slope, aspect and local drainage factors are present. Most of the vegetation is dominated by alien trees, shrubs and forbs, such as Christmas berry (*Schinus terebinthifolius*), lantana (*Lantana camara*), vervain (*Stachytarpheta* sp.), and waiawi (*Psidium cattleianum*).

However, several native and Polynesian species are present in the area, some commonly. Native species included the pala`a fern (*Spenomeris chusana*), hala (*Pandanus tectorius*), `ilima (*Sida fallax*), wood sorrel (*Oxalis corniculata*), `u`ulei (*Osteomeles anthyllidifolia*), sandalwood (*Santalum freycinetianum*), alahe`e (*Psydrax odoratum*) and hi`aloha (*Waltheria indica*). Polynesian introduced species include ti (*Cordyline fruticosa*), coconut (*Cocos nucifera*), `awapuhi (*Zingiber zerumbet*), kukui (*Aleurites moluccana*), and noni (*Morinda citrifolia*). A semi-native shrubby community including sandalwood, hi`aloha, and `u`ulei is distributed intermittently on the slopes of Kaipapa`u Valley

Also observed in the streambed below the project – out of the area of impact – was a lo`ulu palm (*Pritchardia* sp.). These native fan palms are not uncommon throughout the Ko`olau range, and seeds could have been washed downstream, though their occurrence at this low elevation is an anomaly.

None of the plants is a listed or candidate threatened or endangered species. None of the plants or vegetation types is legally protected or requires special planning considerations.

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Flora Impacts

No substantial adverse impact to terrestrial flora is expected. The vegetation in the vicinity of the access road and well pad is basically weedy, with a few common natives, and the Stormwater Pollution Prevention Plan (as discussed in Section 3.1.1, above) will minimize disturbance to the semi-native shrubby vegetation on the slopes. In addition, the plan will include landscaping incorporating native shrubs for erosion control where feasible and appropriate. The lo`ulu palm found near the streambed will not be affected. Stream flow levels will be unaffected by the proposed action (see 3.1.2 above) and mitigative structures and landscaping on cut and fill areas should eliminate or reduce to insignificant levels erosion and sedimentation. However, construction and maintenance of the facility pose at least some risk of wildfire, especially during a prolonged dry period.

Mitigation

The Division of Forestry and Wildlife shall be consulted to determine an appropriate fire contingency plan prior to construction.

3.1.3.2 Terrestrial Fauna

Existing Fauna

Native fauna in disturbed lowland habitats of O`ahu is not abundant. No native forest bird species are likely to frequent the site, although `amakihi (*Hemignathus virens chloris*) may venture into the native scrub during times of heavy lehua bloom. Auku`u (*Nycticorax nycticorax hoactli*) are also observed flying up the valley, although they are more common in nearby wetlands than in streams.

No mammals were seen during either survey, though mongooses, rats, mice, cats, dogs, and perhaps goats and pigs could be present at the site. None of these are native or require protection. The native shrubby component of the vegetation would once have been habitat for a now-endangered O`ahu genus of land snail, *Achatinella*. However, the presence at the site of *Euglandina*, the introduced predatory snail, is a good indicator that the native snail is now absent. No *Achatinella* were observed.

Impacts and Mitigation Measures

As existing fauna is largely alien, and no rare, threatened or endangered animal species would be expected in the area of impact, no substantial adverse impact to terrestrial fauna is expected.

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3.1.3.3 Stream Fauna and Habitat

Introduction

Windward O`ahu streams serve as habitat for a number of aquatic species, which in turn constitute part of a larger food chain that provides sustenance for native birds, fish and invertebrates. Estuaries, which are coastal bodies of brackish water formed by mixing of fresh water and seawater (often found at the mouth of streams), also provide habitat for a wide variety of aquatic biota.

Some native fish species such as gobies (o`opu) require completely fresh water habitat during part of their life cycles. Wetlands, particularly large examples such as those at Kahuku and Waimanalo, provide habitat for several species of Hawaiian endangered waterbirds. A variety of aquatic insects, including crustaceans and two species of damselflies that are being considered for listing as endangered, also inhabit windward streams. The reduction of stream flow, especially by significant amounts, could adversely affect these species.

Native diadromous species live and spawn in streams and estuaries, but their hatchlings must develop in the ocean before returning to fresh or brackish water. Sufficient stream flow is necessary for diadromous stream fauna to have feeding and breeding areas and to permit passage to and from the ocean.

The draft *Hawai`i Stream Assessment* (Hawai`i State DLNR 1990) is an inventory of streams that have special value in terms of physical beauty, cultural importance, or biological habitat. Kaipapa`u Stream is listed in the inventory of streams but is not included as a candidate special stream; i.e., areas identified as having natural or cultural resources of particular value (Ibid:xiv). However, the few investigations that had been accomplished for the stream indicated that it drained an area of mostly undisturbed native forest and supported a variety of native stream organisms, which indicated that it might be of very high quality. Although the proposed project did not appear to affect stream in any way – e.g., alteration of flow, degradation of water quality, or alien species introduction – the BWS responded to concerns expressed in comments on the Draft EA (see App. 1b). BWS commissioned the consulting firm Oceanit to survey Kaipapa`u Stream in order to determine the pattern of distribution and abundance of stream flow, habitat, native and alien fish, stream invertebrates, and insects in the stream. This report is summarized here; for detailed descriptions of methodology, survey sites and findings, the reader is referred to Appendix 3.

Setting

Kaipapa`u Stream originates in the northern section of the windward Ko`olau Mountains and flows for approximately 6.8 miles. Its headwaters are a series of sinuate and gradually

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descending streams originating at an elevation of 2,600 feet in a bowl-like catchment southeast of Pu`uka`inapua`a, an area containing dense mountain native forest. At approximately 1,400 feet in elevation the stream becomes more incised and begins to plunge over a series of 30-50-foot waterfalls. The last 60-foot waterfall drops from an elevation of about 860 feet and marks the upper limit of the stream survey accessible by foot. Stream flow below this point steadily and naturally seeps into the alluvium and becomes intermittent at an elevation of approximately 300 feet (the well pad is located adjacent to a site on the stream at approximately 160 feet in elevation). Starting from an area about one mile mauka of the well pad and going mauka, the stream drains an undeveloped native forest, and the very clear stream flow reflects the undisturbed nature of this catchment.

Methods

On September 17 and October 1, 2000, researchers sampled along five reaches from the headwater falls at elevations of about 800 feet (Site 1), 600 feet (Site 2), 450 feet (Site 3), 300 feet (Site 4) and 200 feet (Site 5). Below Site 5, stream flow became minimal. As the stream area adjacent to the well site flows only during high water events, this area was not sampled. In addition, a cursory survey was performed at the stream mouth.

Insects and aquatic organisms, including native and alien fish, crustaceans, and gastropods were assessed at the five sites. These primary sample sites were spaced evenly along the stream from the highest accessible point at Kaipapa`u Falls to the lowest elevation exhibiting water flow. Insects were sampled through aerial netting of adult aquatic insects, visual observations, and benthic sampling of immature stages of aquatic insects. *Megalagrion* damselflies were the focus species of this survey as they are generally accepted as an indicator species to assess the health of the arthropod fauna. Other aquatic insects encountered, including both endemic and alien species, were collected. The density of key species of native and alien fish, crustaceans, and gastropods were assessed at five sample quadrants were measured at each of the five stream sites. The sampling method involved counting fish and invertebrates within a number of small quadrants, or points. Density estimates were then derived from point counts for comparisons among habitats, reaches, streams and flow velocity.

Results

Stream Environments and Flow. The quality of a stream is directly linked to the quality of the surrounding watershed, and the upper Kaipapa`u watershed shows little human impact, as the presence of certain rare native plants (e.g., lo`ulu) indicates. The sample sites included reaches consisting of narrow waterfall canyons, open boulder streambeds with riffles and pools, and stretches of slow flow percolating into the streambed. Flow quantities varied from about 1.6 cubic feet per second (cfs) at the uppermost sample site to less than 0.5 cfs at the lowest elevation. No water quality measurements were taken. However, the

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general condition of the streambed, the abundance of undisturbed stream bank vegetation, and the general clarity of the water suggests that water quality at present appears to be suitable for all aquatic taxa.

Insects. A total of 17 aquatic insect species were collected or observed in Kaipapa`u Stream during approximately eight hours of sampling on September 17, 2000 (see Table 3 of App. 3 for species). Of the 17 aquatic insect taxa collected during the current study, 82 percent were native species. The introduced aquatic insect species currently found in Kaipapa`u Stream are considered relatively innocuous.

An important finding of this survey was the discovery of one of the rarest native aquatic insect species, the giant midge *Telmatogeton williamsi* at the 600 ft. and 800 ft. sample sites. This species was not found in Kaipapa`u Stream during previous Bishop Museum surveys but was relatively common in upper elevations of this survey. *Telmatogeton williamsi* is an O`ahu endemic and, although formerly common, is currently only known from one other stream.

As mentioned above, *Megalagrion* damselflies were the focus species of this survey. Native damselflies are considered sensitive to disturbance and are good indicators of native aquatic ecosystem health. Previous Bishop Museum surveys in the 1990s of Kaipapa`u Stream found three rare species of stream-dwelling native damselflies (Polhemus and Asquith 1996). Weather conditions in the mountains during this survey included rain and overcast, and this undoubtedly led to the absence of any native damselflies being collected. Native damselflies and dragonflies are generally observed during periods of sunny, clear weather and poor weather conditions usually preclude their capture (Ibid). Two of the damselfly species are currently listed as candidates for protection under the Endangered Species Act. It is highly likely these damselfly species are still found in Kaipapa`u Stream because this stream lacks introduced fish species and the watershed is lacking in feral ungulate damage.

Fishes. Of the five sites surveyed, fishes were observed only at the two highest elevations (Sites 1 and 2) and the stream mouth. The same two native gobies, *Awaous guamensis* (‘o`opu nakea) and *Sicyopterus stimpsoni* (‘o`opu nopili), were found at the both Sites 1 and 2. This agrees with the results of a 1992 reconnaissance. Just as then, Kaipapa`u Stream continues to be free of introduced species above 200-foot elevation (i.e., in the area of semi-permanent flow, starting about a half-mile mauka of the well pad).

The stream reach adjacent to the ocean was observed to have many non-native as well as native stream organisms, although it was not formally surveyed. Fishes of the introduced genera *Tilapia*, *Gambusia*, and *Poecilia* were observed to be common in this reach, as were the native genera *Kuhlia*, *Stenogobius*, and *Eleotris*. It is unknown how far inland the ranges of these fishes extend, but they have not colonized the area of Site 5 at an elevation of 200 feet, probably because the flow becomes intermittent somewhere below that

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elevation. The stream reach adjacent to the ocean appears to have perennial flow, even though it may be quite minimal during dry periods.

An important find was the scarcity of juvenile fish in Kaipapa`u. The population of gobies in Kaipapa`u are likely recruitment limited and are therefore comprised of large, older individuals. The low level of recruitment can be attributed to the known flow regime of the stream. Intermittent flow in the lower reaches prevents upstream migration of post-larvae and juveniles, which have been shown to be amphidromous, i.e., to have obligatory marine larval phases (Radtke et al 1988). Recruitment of Hawaiian stream gobies tends to be episodic in nature and occurs mostly in the spring and early summer (Nishimoto and Kuamo`o 1997), so it is not surprising that post-larval fishes were absent during this survey.

The species composition and distribution of adult fish populations also relate to general stream conditions. The lack of fishes at Site 3 (450-foot elevation) shows that even though there appeared to be perennial flow at the site, it is unsuitable habitat either because colonizers die during low flow or because the fish choose not to remain there. It may be unfavorable to fishes for a number of reasons including food availability and temperature, both of which can be related to unstable flow conditions.

Crustaceans and Mollusks One species of crustacean, the introduced Tahitian prawn (*Macrobrachium lar*), was found in the three highest elevation sites surveyed. No other crustaceans were seen in the upper watershed, including the native `opae, *Atyoida bisulcata*. Immediately upstream of Site 3, *M. lar* became more common and the presence of gobies was also observed. Grapsid crabs and the shrimp *Palaemon debilis* were observed near the mouth of the stream. No *M. lar* were seen in this area, but they may have gone undetected. Like the fishes, the population of *M. lar* in Kaipapa`u stream appears to be recruitment limited.

Near the mouth of the stream, large individuals of *Neritina granosa* (hihiwai) were observed along with numerous egg capsules on the rocks. Where tidal influence was present, *Neritina vespertina* (hapawai) was abundant and also producing many egg capsules

Sites 4 and 5 had no macrofaunal organisms except frogs, which were observed to be present outside the sample areas, and two species of mollusks. The introduced Thiarid snail *Tarebia* was found. Native Neritid snails were common near the mouth of the stream. The fact that snails are present at the lower elevation Sites 4 and 5 suggests that there is permanent standing water at those sites, even if flow is intermittent.

Conclusions

The intermittent flow below approximately 400 ft. in elevation prevents native species from inhabiting these reaches, but also protects the upper stream from invasion by alien species

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present at the stream mouth. The greatest species diversity was observed near the mouth of the stream, downstream of populated areas, where water quality is likely to be poorest in Kaipapa`u Stream.

Because of its relatively undisturbed riparian surroundings, presence of adult populations of native goby fish, abundance of relatively rare insect species a lack of introduced fish in upper elevations, and only a relatively few innocuous introduced aquatic insect species, Kaipapa`u Stream is of very high quality. It can thus be considered one of the most important watersheds for the preservation of native biodiversity on O`ahu and also for the State of Hawai`i.

Impacts and Mitigation Measures

The aquifer tapped by the proposed well does not appear to be related to the stream flow within Kaipapa`u Valley, as the two are separated by a more than 100-foot thick layer of alluvium that prevents any significant interchange. Withdrawals from Kaipapa`u Well would not be expected to affect flow in any measurable way in the stream or estuary, and no effect upon stream biology would be expected.

Any input of sediment from the well pad and access road into Kaipapa`u could have detrimental effects to stream water quality and ecology. Potential impacts will be avoided by implementing the erosion control measures listed in section 3.1.1 above

3.1.3.4 Wetlands and Estuaries

Wetlands are areas that are at least occasionally inundated or saturated, have hydric soils, and have a predominance of plants adapted to life in wet soils. Wetlands provide valuable habitat and also act as natural flood control basins and sediment traps.

Significant natural wetlands in the Ko`olau Loa area of windward O`ahu occur mostly at Kahuku and Kahana, i.e., four miles down the coast from Kaipapa`u in both directions (VTN Pacific 1988:145). Smaller, isolated wetlands with some habitat value do occur scattered along the entire Windward Coast. Hawaiian estuaries are generally few and small, but some substantial estuaries are present at certain stream mouths and embayments. Kahana Bay is one location in Ko`olau Loa with estuarine qualities. The estuary at Kaipapa`u is very limited in extent, but has value for native stream species.

According to the U.S. Fish and Wildlife Service's National Wetlands Inventory maps and field observations, no wetlands are in or adjacent to the well site or access road. A wetland of approximately 10 acres in size is present approximately 200 feet north of Kaipapa`u Stream at an elevation of approximately 30-40 feet above mean sea level (see Appendix 1a for map).

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A portion of the access road for the Hau`ula 180 Reservoir (which will be used but not modified for this project) passes within several hundred feet of this wetland.

Because the relationship of the static water level in the well (17 feet above sea level) and the wetland (which is located approximately 30 - 40 feet above sea level), it is unlikely that there is any direct hydrological connection between the two; i.e., the wetlands probably derives its flow from upslope sources unrelated to the aquifer.

Wetlands Impacts

No impacts to wetlands is expected. According to reviews of scientific literature conducted in the Windward Water System EIS, no wetland or estuarine environment is thought to interact significantly with stream or ground water from the Kaipapa`u aquifer (VTN Pacific 1988:171, 210). Due to the possible hydraulic connectivity between the windward aquifers, some potential exists for reduced flux of ground water along the coast, which might theoretically result in slight increases in salinity at caprock springs, which feed wetlands in Kahuku. The degree of this reduction, however, would be so minimal as to not be measurable.

A portion of the paved access road for the Hau`ula 180 Reservoir (which will be used but not modified for this project) passes within several hundred feet of a small wetlands situated about 30 feet above sea level. Erosion control measures discussed in Section 3.1.1 will also prevent sedimentation or runoff from adversely affecting this wetland. Because the small area of wetlands present in the area derives its moisture from upslope sources unrelated to the aquifer, no adverse impact to the water levels wetland is anticipated as a result of the groundwater withdrawal.

3.1.4 Air Quality and Noise

Existing Environment

Air quality in Windward O`ahu is generally excellent and pollution is minimal due to the lack of pollution sources and the dispersive effect of the tradewinds. In the Hau`ula area there are no stationary sources of pollution and traffic volume is low, leading to excellent quality. Ambient noise in the area is low, and comes mainly from households and farms in the area.

Impacts and Mitigation Measures

Construction will entail excavation, grading, compressors, vehicle and equipment engine operation, and movement of vehicles on and off-site. This will produce some heavy

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equipment emissions, noise and dust, as well as minor disruption to traffic. Noise may exceed 95 decibels at times in the immediate vicinity of the construction. In general, the long distance from the site to residences or other sensitive land uses will reduce air quality impacts and noise impacts to insubstantial levels. Nevertheless, several mitigation measures will be instituted as appropriate as part of the contractors' conformance with State rules governing construction activities.

- The contractor will conform with the air pollution control standards contained in Hawai'i Administrative rules Chapter 11-60, "Air Pollution Control." The Contractor shall keep the project site and surrounding area free from dust nuisance. Various forms of dust control may be employed to reduce dust emission, such as vegetative cover, mulch, spray-on adhesives, water sprinkling, topsoiling, and barriers.
- The contractor will consult with the Hawai'i State Department of Health's (DOH) to determine if construction noise is expected to exceed the "maximum permissible" property-line noise levels. If so, contractors would then be required to obtain a permit per Title 11, Chapter 46, HAR (Community Noise Control) prior to construction. DOH would review the proposed activity, location, equipment, project purpose, and timetable in order to decide upon conditions and mitigation measures, such as restriction of equipment type, maintenance requirements, restricted hours, and portable noise barriers.

No permanent air quality effects of any type are expected. Noise levels near the well pad will be slightly elevated by the sound of the pump. The minimum 2,000 feet distance to sensitive receptors, such as homes, schools or churches, will greatly attenuate the sound and limit any effects. The light noise from the deepwell pump will be baffled by a pump building made of CMU and built to enclose the well pump and motor. The control building also has two small booster pumps to pressurize the chlorination system, one of which will be operating at any given time. Sound attenuating louvers will be installed in the exterior walls of the booster pump room to minimize the noise while providing ventilation. After mitigation, the well will not be audible from any sensitive receptors.

3.1.5 Scenic Resources

The ridges and upper reaches of Kaipapa`u Valley as seen from the coastal settled area offer striking vistas of lush vegetation and bold rock outcrops, similar to views elsewhere in the Ko`olau range. Because no roads exist adjacent to Kaipapa`u Stream, the public has little opportunity to view the site from above. Hikers on Kaipapa`u Ridge Trail (see section 3.2.3) are able to view the well pad and access road.

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Impacts and Mitigation Measures

The project will subtly alter the visual characteristics of the lower northwest slope of Kaipapa`u Valley permanently by inserting a man-made element into the landscape. The well pad and access road have already been graded as part of the exploratory well project. Because of the topography and vegetation in the valley bottom, they are visible from very few locations on the coastal plain. Additional activity including some grading, construction of the control and pump buildings, and drainage control measures will further alter the visual characteristics of the area slightly. Because of distance, lack of vantages, and intervening topography, structures and vegetation, none of this represents a substantial impact.

The construction contractor will be required to develop a landscaping plan for the access road and well site that reduces visual impact. The plan will incorporate native shrubs where feasible and appropriate. The control building will be painted with tones designed to blend in with existing terrain.

3.2 Socioeconomic Environment

3.2.1 Land Use, Land Use Designations and Community Plans

Land Use and Land Use Designations

All land within a 1,000-foot radius of the well pad and access road is presently vacant and unused for any purpose. The makai section of the access road passes next to a tomato farm.

The subject property is located within the Conservation District, General (G) subzone. Well facilities are an identified use within this subzone. A short segment of the access road adjacent to Kawaipuna street is in the Urban Land Use District; the remainder is also zoned Conservation (Figs. 4a-b).

The subject property is zoned Preservation (P-1) by the city and County of Honolulu and is within an area designated "Preservation" on the City and County Development Plan Land Use Map.

The Kaipapa`u Well was designated as "site determined, within six years" on the Ko`olau Loa Development Plan Public Facilities Map (DPPFM), by Ordinance No. 9465, which went into effect on September 19, 1994.

The project will require a Conservation District Use Permit (CDUP).

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Community Plans

The *Ko`olau Loa Sustainable Communities Plan* was incorporated by reference through Ordinance 99-72 into Chapter 24, "Development Plans", of the Ordinances of Honolulu. The vision for Ko`olau Loa seeks to preserve the region's rural character and its natural, cultural, scenic and agricultural resources. The region will remain country, characterized by small towns and villages with distinct identities that exist in harmony with the natural settings of mountain ridges and winding coastline. Key elements of the vision for Ko`olau Loa include:

- Establish Rural Community, Agricultural and Preservation Boundaries.
- Preserve and enhance the natural, recreational and cultural resources which contribute to Ko`olau Loa's sense of "Old Hawai'i."
- Preserve agricultural lands and encourage diversification of agricultural-related enterprises to maintain its viability.
- Enhance the existing recreational areas and resources, which offer a variety of outdoor recreational activities and cultural experiences.
- Establish rural area development standards to maintain the rural character of residential areas in Ko`olau Loa.
- Enhance the character of the region's commercial areas and recognize the contribution of country stores to Ko`olau Loa's rural fabric.

According to this plan:

"In keeping with the rural character of Ko`olau Loa, allocation of water is an important issue. Water management strategies include water conservation, groundwater development, surface water development, desalination, and effluent water reuse, without adversely impacting stream flow or nearshore water quality. In the development of water resources, it is important that the needs of Ko`olau Loa be met first, and that the transmission of water out of Ko`olau Loa will not be detrimental to Ko`olau Loa. Hence, the availability of Ko`olau Loa water for the islandwide water supply needs will first account for all in-district agricultural and urban needs, while balancing the environmental and cultural value of the area's stream systems."

The following general policies seek to maintain an adequate supply of good quality water, retain sufficient acreage in watersheds to insure infiltration into groundwater aquifers, and strengthen the protection of watersheds:

- Protect and preserve streams, wetlands' natural drainage systems, watershed areas and the shoreline and coastal areas. The high quality of the region's nearshore and coastal water should be maintained to benefit recreation, the economy, and the

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region's natural biological systems. Buffer zones around streams and wetlands should be provided to protect the ecological integrity of these features.

- Retain existing acreage in the State Conservation or the City Preservation Districts to protect watersheds. In addition, important watershed areas, which are in designated but unused Agricultural or Urban Districts, should be reclassified to the State Conservation or City Preservation Districts, in consultation with affected landowners, community and pertinent resource agencies.
- Integrate management of all potable and nonpotable water sources, including groundwater, stream water, storm water and effluent, following State and City legislative mandates.
- Adopt and implement water conservation practices in the design of new development and the modification of existing uses, including landscaped areas.
- Where feasible and appropriate, encourage use of nonpotable water for irrigation of landscaping and agricultural lands to conserve the supply of potable water. Consider the use of dual water lines to allow conservation of potable water and the use of nonpotable water for irrigation and other appropriate uses, where practical.

The plan includes among its planning principles and guidelines the following measures related to water conservation:

- Low flush toilets, flow restrictors and other water conserving devices in commercial and residential developments.
- Indigenous, drought-tolerant plant material and drip irrigation systems in landscaped areas, and use drip irrigation systems.
- The reuse of treated wastewater effluent for the irrigation of golf courses and other landscaped areas where this would not adversely affect potable groundwater supply.
- Future water development should not adversely impact stream flow or nearshore water quality.

DISCUSSION: The proposed project fulfills or is not inconsistent with all aspects of the plan, in that it seeks to redistribute existing permitted uses among several wells, for minimizing aquifer impacts, promoting sustainable use of water resources.

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3.2.2 Socioeconomic Characteristics

The neighborhood closest to the project site is part of the village of Hau`ula, a residential beach town composed largely of single-family homes. In 2000, Hau`ula had a population of 3,651 (U.S. Census Bureau 2001). Land uses include low-density residential, small-scale agriculture and light commercial. A shopping center, county beach park, fire station, and elementary school are present.

Hau`ula's ethnic composition in 2000 was approximately 37 percent Hawaiian/or Pacific Islander, 16 percent Caucasian, 5 percent Asian, and 38 percent two or more races (Ibid.). Historically, Hau`ula has had a per capita income somewhat lower than the O`ahu average and a somewhat higher poverty rate. However, it compares favorably in this regard with neighboring communities such as Punalu`u and Lai`e (U.S. Census Bureau 1991: Table 6).

No socioeconomic impacts are expected as the result of the project. The issues of growth induction is dealt with in Section 3.5.

3.2.3 Recreational Use

Two trails inventoried by the State Na Ala Hele program are present in the vicinity of Kaipapa`u (see Appendix 1a). The streambed, referred to as the Kaipapa`u Gulch Trail, is occasionally used by hikers and hunters. The west ridge of the valley, called the Kaipapa`u Ridge Trail, also sees occasional use. Although these trails are inventoried as State-owned, access is currently private (see Appendix 1a).

Since the grading of the access road, hikers and hunters have also made use of the new "trail" as spent shotgun shells reveal.

Recreational Use Impacts

No restriction of access to the valley for hiking and hunting purposes has been requested as part of the action. The construction of the final facility will require security fencing of a small area of the well pad to prevent vandalism and lessen liability in case of damage. The access road will also be gated. This will not impact use of Kaipapa`u Stream or Kaipapa`u Ridge Trail.

Kaipapa`u Water Well Environmental Assessment

3.3 Transportation and Utilities

3.3.1 Roads and Traffic

Existing Access, Traffic and Road Facilities

Kamehameha Highway, a two-lane State highway with a 35 mph speed limit, is the only highway conducting traffic to and from Hau`ula. Traffic is a mix of autos, trucks and buses.

Direct access to the site is provided by Kawaipuna Street (Fig.1b), a City/County road, which leads to the reservoir access road. Traffic is light on this local road. This access road travels approximately 1,000 feet to the Hau`ula reservoir site. The well pad is about 2,000 feet beyond to the well pad.

Impacts and Mitigation Measures

Although construction will cause a slight and temporary rise in heavy truck traffic, no permanent or significant impact on roads or traffic should be expected as a result of the proposed project. A Traffic Control Plan will be prepared during the design phase. This plan will be implemented by the contractor during construction, and will specify measures to minimize impact related to movement of heavy equipment or materials in large trucks on and off the site. The plan will be enforced by the BWS as part of the construction contract.

3.3.2 Public Facilities, Services and Utilities

Utilities

Electrical service required for the site is available via Hawai`i Electrical Company (HECO), which currently extends to the end of Kawaipuna Street. Telephone service for telemetering circuits is provided Hawaiian Telcom and is available from the same area. The power demands of the well pump will be relatively small, and no adverse affect to the utility will occur. Details of the proposed electrical and telephone connections and facilities are described in Section 1.4.

Police, Fire, Emergency Medical, Schools, and other Public Facilities and Services

No such facilities are present, and no facilities or services would be affected in any adverse way.

Kaipapa`u Water Well Environmental Assessment

3.4 Cultural and Archaeological Resources

Archaeological surveys of the site were conducted by Social Research Systems (SRS) of Honolulu between 1992 and 1995, including resurvey of previous finds, monitoring of grubbing and clearing of the access road and, later, an intensive survey of the entire project area. Scientific Consultant Services (SCS) of Honolulu conducted a supplemental archaeological inventory survey in 2003 to resolve several issues and also performed a Cultural Impact Assessment. The reports by SRS and SCS are attached to this document as Appendices 4a and 4b respectively, and are summarized below. Also included as Appendix 4c is correspondence related to the reviews of the archaeological work.

An extensive search of published and unpublished literature concerning traditional culture, mythology, land use and history uncovered no citations that related directly to the specific project area, although some sources suggested a religious connotation for Kaipapa`u Valley as a priestly residence. A geographic review of traditional cultivation areas in Hawai`i described the upper stream valley (including the project site) as "...steep and narrow, yet natives of the district say that, making the most of a small opportunity, a few lo`i used to be worked there" (Handy and Pukui 1972:460).

The earliest land records for the area date to the time of the Great Mahele. Only two claimants received Land Commission Awards during 1848-1854 in Kaipapa`u, which contained relatively little irrigable land and was far from the centers of population on O`ahu at that time. Both claims are located well south and makai of the subject property area. However, both claimants also made use of unspecified inland areas for cultivation and gathering. Two land grants from 1855 and 1856 included the part of the current project area.

A total of 9 archaeological sites composed of 22 features were identified in or near the construction corridor for the planned well, reservoir, road and transmission. These included segments of a mauka-makai trail that date from prehistoric, historic and recent eras; segments of stacked walls; bulldozer traces; terraces; a possible shelter cave; and other features. Most of the sites are associated either with intermittent agricultural activities of the prehistoric and historic eras, or with land clearing activities in the modern era. The reader is referred to Appendix 4a for detailed descriptions and site map locations.

About half of the sites were initially evaluated by SRI as either non-significant under State criteria or significant for information or research only. Once these sites were recorded and studied, they are considered no longer significant. Several other sites were recommended for data recovery or preservation by the archaeologist.

The State Historic Preservation Division (SHPD) reviewed the archaeological report and required various clarifications and revisions before the report could be accepted. In particular, SHPD noted in a letter of October 9, 1995, that none of the sites except possibly

Kaipapa`u Water Well Environmental Assessment

Site 4874 were any longer significant. Site 4874 was described in the SRI report as a "tightly packed cluster of large boulders in the spur ridge at the stream side of the new well site... pointed out by informants as having some *mana*". SHPD noted that site would require further investigations, and in particular, consultation with native Hawaiians.

SCS undertook these investigations as part of the inventory recheck and cultural impact assessment (CIA). No new archaeological sites were identified along the access road or at the reservoir site. Individuals and groups having knowledge of traditional practices and beliefs associated with this area were sought for consultation. Initial contact was made with the Ko`olau Loa Hawaiian Civic Club, cultural historian Dawn Wasson, and several individuals who had previously been interviewed. Dawn Wasson contacted ahupua`a residents and researched archival records, finding no indications of culturally significant remains in the affected area or of cultural associations with Site 4874. John Santiago, a long time Hau`ula resident, had been told that there were supposed to be sacred places in the valley, but he did not know where they were located. Terry Shintaku, a farmer whose family has lived for fifty years at the end of Kawaipuna Street, the main access to the valley, reported no knowledge of traditional gathering or ceremonial activities. Neither Site 4874 or any other natural or manmade feature in the affected area appear to have significant cultural value.

Although not directly affected, it is important to note that Kaipapa`u Stream has cultural value because of the intrinsically cultural value of water, a life-giving substance sacred in Hawaiian culture.

Impacts and Mitigation Measures

Appropriate mapping, recording and data collection have been accomplished related to existing archaeological sites, and no adverse impact will occur. In their letter of December 31, 2003, and follow-up letter on January 21, 2004, the State Historic Preservation Division concurred with these findings. No cultural sites appear to be present in the well pad or access road area, and none will be impacted by the proposed project, given proper construction mitigation to avoid sedimentation impacts to the stream that will be specified in the NPDES permit. The project would not impact water levels or water quality in Kaipapa`u Stream, nor any other values that give streams such as this cultural value, given proper design, construction and maintenance of the project, including measures to minimize erosion and sedimentation. The area does not support gathering or ceremonial activities and none will be affected. No cultural impacts are expected.

In the unlikely event that archaeological resources are encountered during future development activities within the current study area, work in the immediate area of the discovery will be halted and DLNR-SHPD contacted as outlined in Hawai`i Administrative Rules 13§13-275-12.

3.5 Growth-Inducing, Cumulative and Secondary Impacts

Growth-Inducing Impacts

Analysis of growth-inducing impacts examines the potential for a project to induce unplanned development, substantially accelerate planned development, encourage shifts in growth from other areas in the region, or intensify growth beyond the levels anticipated and planned for without the project. Provision of needed infrastructure such as roads, water supply, sewer facilities, etc., if insufficiently connected to coordinated integration of the other factors required for planned growth, is often seen as growth-inducing. Of key importance is whether infrastructure fulfills the needs of planned growth, the impacts of which have been considered in approved regional plans, or whether it instead enables unplanned growth or diverts growth away from planned areas.

On O`ahu, the availability of domestic water has become an increasingly important factor in determining when, where and how growth should occur. Any increase in domestic water supply brings with it at least some implications in terms of possible growth. Population growth may be perceived as having negative, positive or mixed impacts, depending on the location, quantity, and context of the added population as well as the attitude of the observer towards growth. As discussed in Section 3.2.2 above, the Ko`olau Loa Sustainable Communities Plan envisions basically very low growth for the area.

It has generally been the policy in planning for public facilities in the State of Hawai`i that agencies and commissions charged with determining the broader patterns of land use – such as the Office of State Planning, the State Land Use commission, and the County Planning Departments and Commissions – are the bodies best suited for regulating and influencing whether, how, when and where population growth shall occur.

The Board of Water Supply is entrusted with ensuring that the entire public is served with a safe and reliable system delivering adequate amounts of water, and not with determining growth policy. As discussed in Section 1.3, BWS is creating watershed management plans that focus on sustainability for each of the eight sustainable community and development plan areas established in the *O`ahu General Plan*. The Kaipapa`u Well project is meant to assist in fulfilling the water management plan's goal of optimizing pumping, in part, by redistributing existing permitted uses among several wells, notably Punalu`u Wells II and III. This will help minimize aquifer impacts, especially related to the large well sources at Punalu`u, which have experienced increasing chlorides. As essentially a replacement project, no substantial changes in either the amount or location of the water supply will occur, and there is minimal potential for inducing unplanned growth or accelerating planned growth.

Kaipapa`u Water Well Environmental Assessment

Cumulative Impacts

Cumulative impacts result when implementation of several projects that individually have minor impacts combine to produce more severe impacts.

Essentially all adverse impacts of the Kaipapa`u Well project, including traffic, noise, native species/habitat, wetlands, groundwater and stream flow, water quality, sedimentation and erosion, historic sites, and other areas of concern, are either non-existent or extremely restricted in geographic scale, negligible, and capable of mitigation through proper enforcement of permit conditions. There is therefore little or no potential for impacts to accumulate with those of other projects and produce more severe impacts.

As stream biology was of major concern for several commenters, it is important to discuss the issue of cumulative impacts to this resource. As pointed out in the EIS for the Windward O`ahu Regional Water System Improvements, there are over two dozen proposed BWS projects that have the potential to take ground water which would otherwise end up in perennial windward Oahu streams (VTN Pacific 1988:171). It is important to review cumulative effects, because, in the words of the *Hawai`i Stream Assessment*:

“Hawai`i’s streams are small and fragile. They can affect and be affected by action far beyond their boundaries. There is evidence that clusters of streams are biologically important.”

The cumulative impacts of these projects on Windward Stream environments were assessed as part of the EIS. Three potential areas of impacts were distinguished: the streams themselves, wetlands that might be nourished by the stream, and the near shore environment into which stream and/or groundwater discharges.

As discussed in section 3.1.2, the proposed project would not dewater Kaipapa`u Stream. Furthermore, it does not appear that groundwater from the project area contributes to the sustenance of any wetlands. Therefore the project will not contribute to the cumulative impact of BWS projects on Windward stream biology or wetlands ecology.

The project will not contribute to the cumulative reduction in the flux of stream/ground water into the oceans, because it will essentially replace existing withdrawals.

Secondary Impacts

Construction projects sometimes have the potential to induce secondary physical and social impacts that are only indirectly related to project. For example, construction of a new recreation facility can lead to changes in traffic patterns that produce impacts to noise and air quality for a previously unimpacted neighborhood. In this case, the proposed project’s

Kaipapa`u Water Well Environmental Assessment

impacts are limited to direct impacts at the site itself, and there does not appear to be any potential for secondary impacts.

3.6 Required Permits and Approvals

Hawai`i Administrative Rules under Title 11, Chapter 20, require that all new sources of potable water serving a public water system be approved by the Director of Health, contingent upon a satisfactory report that addresses section 11-20-29 requirements.

Water Use, Well Construction, and Pump Installation Permits are required from the Commission on Water Resources Management.

The project also requires a Conservation District Use Permit from the Hawai`i Board of Land and Natural Resources

Because the project involves disturbance of more than one acre and hydrotesting of the transmission main, a National Pollutant Discharge Elimination System (NPDES) permit from the Hawai`i State Department of Health will be necessary.

SECTION 4 DETERMINATION

In accordance with provisions set forth in Chapter 343, Hawai`i Revised Statutes, and the significance criteria in Section 11-200-12 of Title 11, Chapter 200, the Honolulu City and County Board of Water Supply has determined that the impacts associated with the proposed Kaipapa`u Well project will not significantly alter the environment and will be minimal, that the preparation of an Environmental Impact Statement is not warranted, and has therefore issued a Finding of No Significant Impact (FONSI).

SECTION 5 FINDINGS

Section 11-200-12 of the State Administrative Rules sets forth the criteria by which the significance of environmental impacts shall be evaluated. The following discussion paraphrases these criteria individually and evaluates the project's relation to each.

1. *The project will not involve an irrevocable commitment or loss or destruction of any natural or cultural resources.* No natural resources will be irrevocably committed or lost. No measurable effect on the quality or quantity of stream water is expected, and there are no anticipated impacts to native terrestrial or aquatic flora and fauna. The State Historic Preservation Division has determined that no historic sites important for preservation in place will be impacted and that all adverse effects to significant historic sites have been mitigated. Cultural resources and impacts have been considered.

Kaipapa`u Water Well Environmental Assessment

- 2. The project will not curtail the range of beneficial uses of the environment.* No future beneficial use of the environment will be affected in any way by the proposed project. Sufficient water will remain, well within the sustainable yield of the aquifer, to promote other beneficial uses of groundwater in the region.
- 3. The project will not conflict with the State's long-term environmental policies.* The State's long term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. A number of specific guidelines support these goals. No aspect of the proposed project conflicts with these guidelines. The project's goals of providing potable water while conserving natural resources satisfies the State's environmental policies.
- 4. The project will not substantially affect the economic or social welfare of the community or State.* The improvements will benefit the social and economic welfare of O`ahu by improving the potable water supply system.
- 5. The project does not substantially affect public health in any detrimental way.* No effects to public health are anticipated.
- 6. The project will not involve substantial secondary impacts, such as population changes or effects on public facilities.* No adverse secondary effects are expected. The project will not enable development, but will instead assist in optimizing sources consistent with the sustainability goals of the O`ahu Water Management Plan.
- 7. The project will not involve a substantial degradation of environmental quality.* The implementation of Best Management Practices for all construction will ensure that the project will not degrade environmental quality in any substantial way.
- 8. The project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat.* No endangered species of flora or fauna are known to exist on the project site or would be affected in any way by the project, including through effects to habitat. No measurable impact on stream flow or water quality is expected, and there would be no effects on endangered native stream fauna.
- 9. The project is not one which is individually limited but cumulatively may have considerable effect upon the environment or involves a commitment for larger actions.* Cumulative impacts result when implementation of several projects that individually have minor impacts combine to produce more severe impacts or conflicts among mitigation measures. All adverse impacts will either not occur or will be reduced to negligible levels through mitigation measures, and will therefore not tend to accumulate in relation to this or other projects.

Kaipapa`u Water Well Environmental Assessment

10. *The project will not detrimentally affect air or water quality or ambient noise levels.* The project will have negligible effects in terms of water quality, air quality and noise.

11. *The project will not affect or will likely be damaged as a result of being located within an environmentally sensitive area such as flood plains, tsunami zones, erosion-prone areas, geologically hazardous lands, estuaries, fresh waters or coastal waters.* No floodplains, tsunami zones, or other such sensitive land is involved. The area is on the slope of a valley, which thus involves a potential for mass wasting. Final engineering will include additional evaluation of the site-specific slope hazard and subsurface conditions and development of appropriate designs. No damages to the facilities or effects on the slopes are expected as a result of the project.

12. *The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.* No protected viewplanes will be impacted by the project, which will have no adverse scenic effects.

13. *The project will not require substantial energy consumption.* Some, but not substantial, input of energy is required for the construction of the facilities and the operation of the pump.

For the reasons above, the O`ahu Board of Water Supply concludes that the proposed project will not have any significant effect in the context of Chapter 343, Hawai`i Revised Statutes and section 11-200-12 of the State Administrative Rules, and has issued a Finding of No Significant Impact.

Kaipapa`u Water Well Environmental Assessment

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Final Environmental Assessment

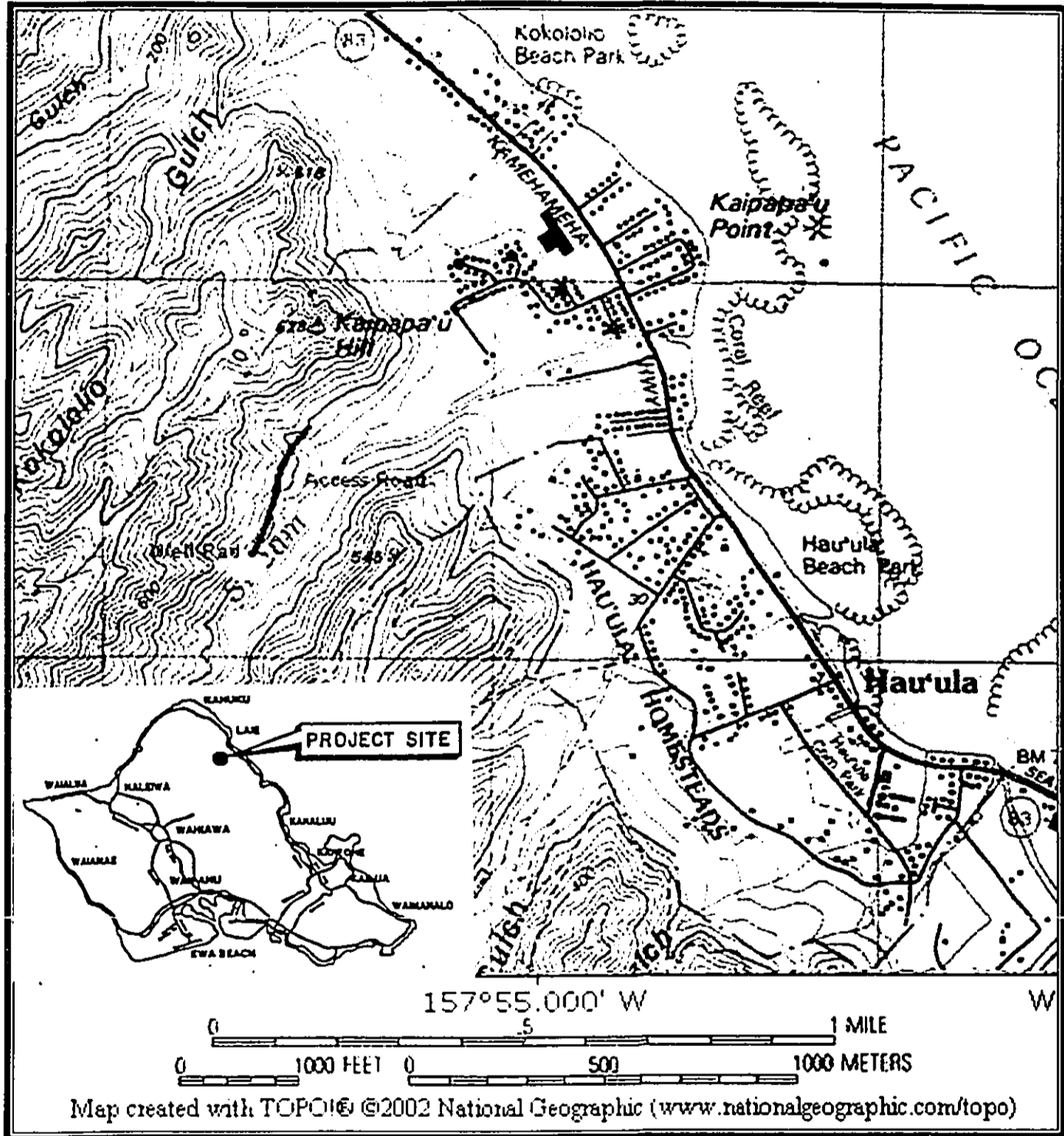
Kaipapa`u Well and Associated Facilities

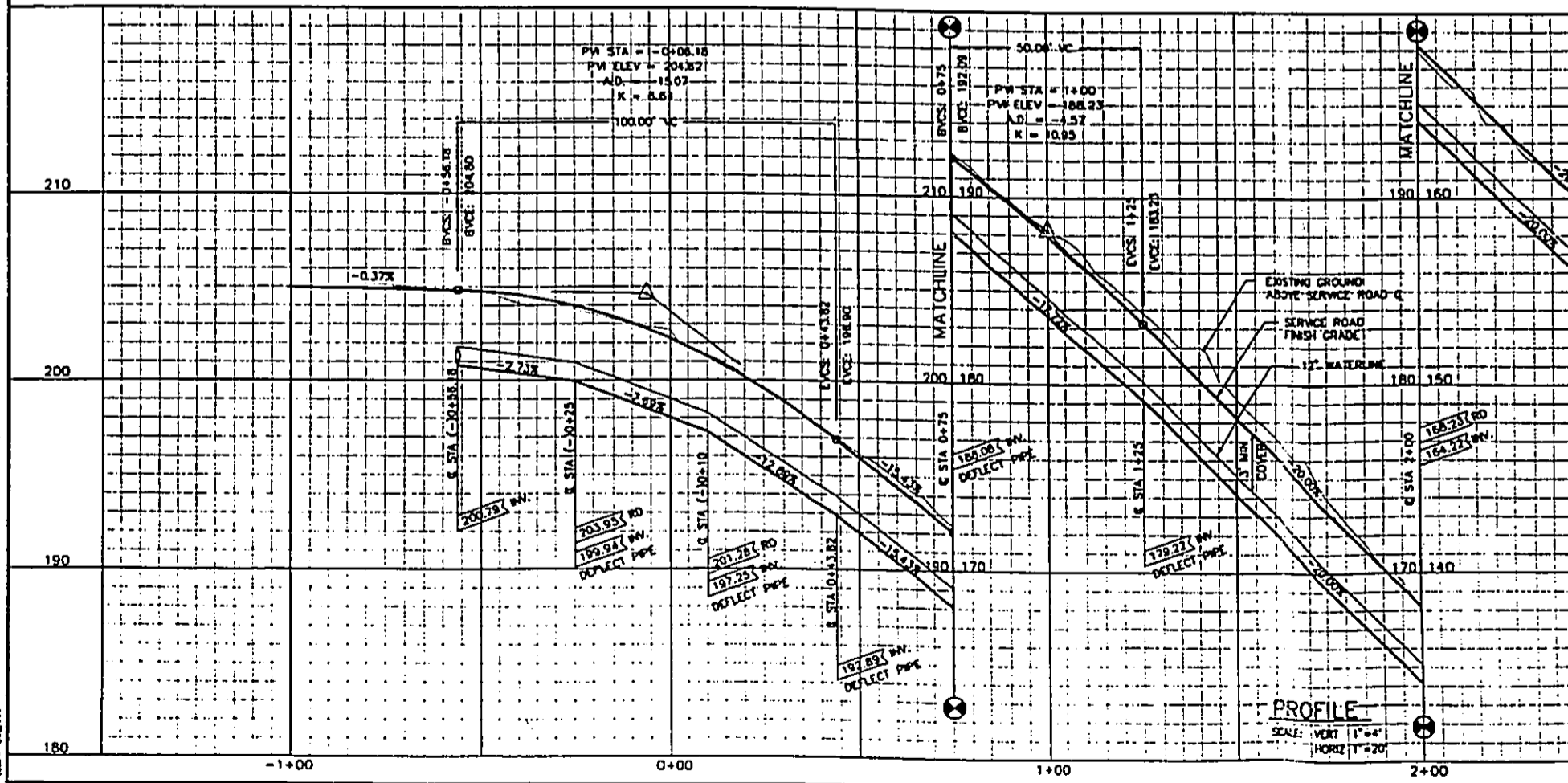
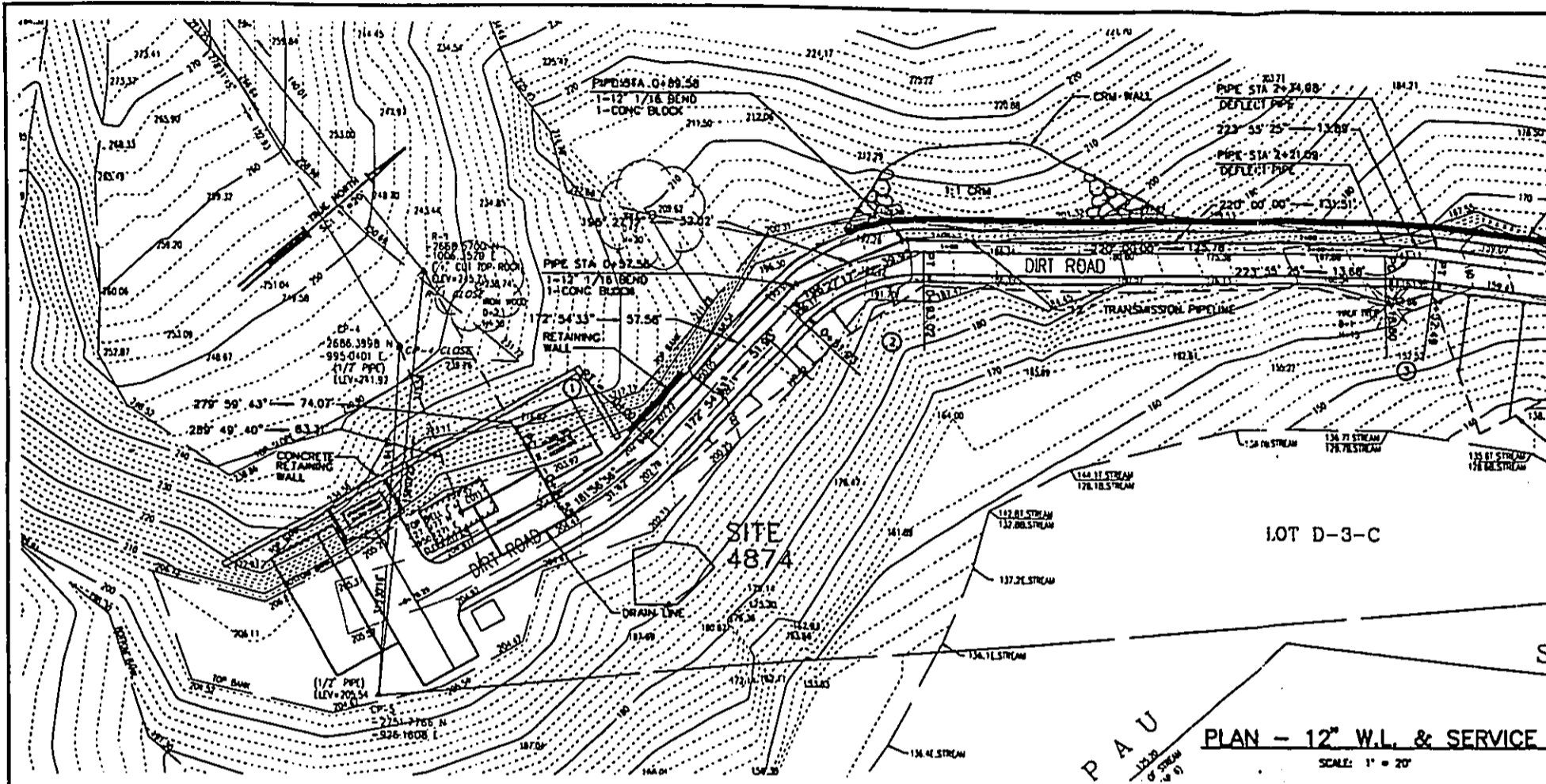
APPENDIX A

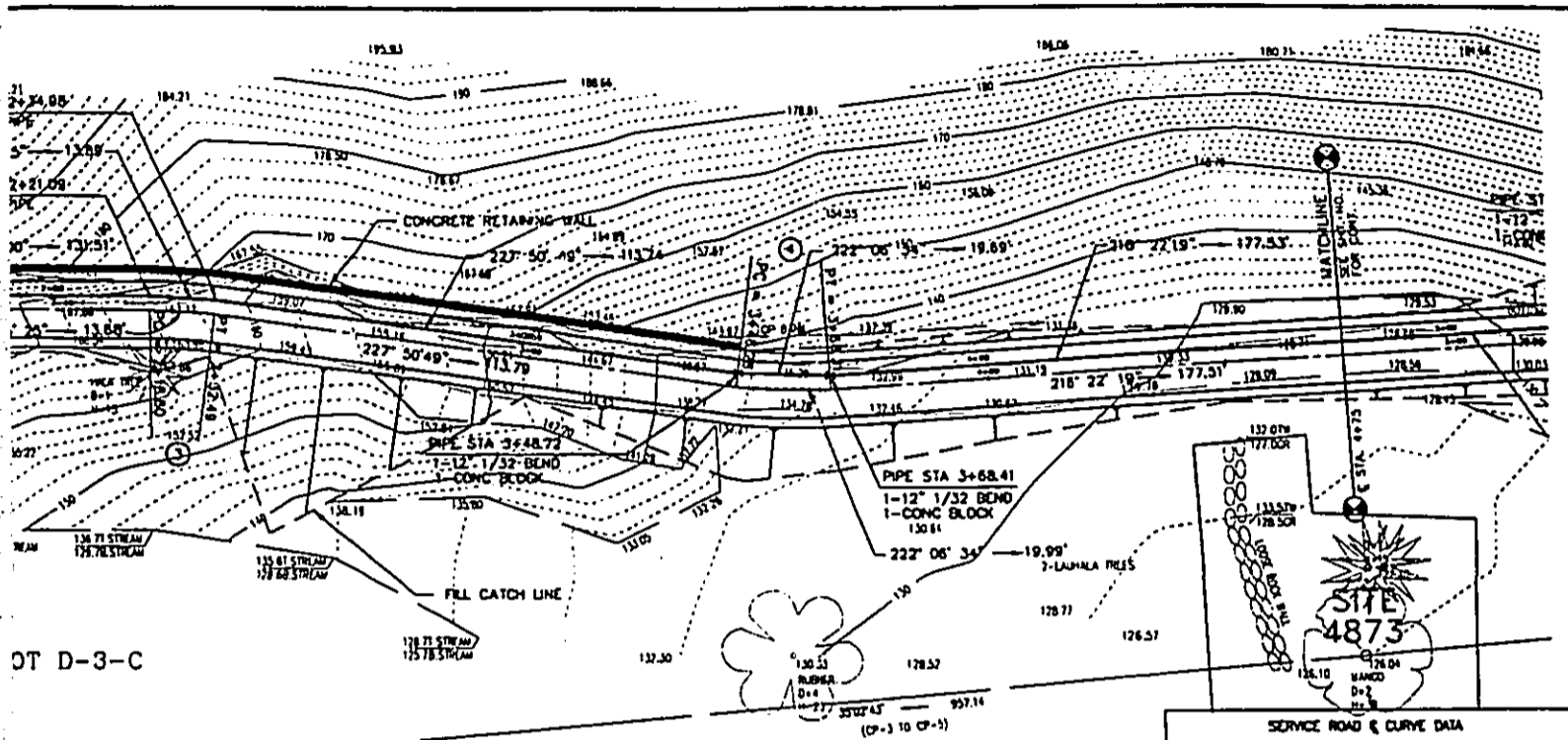
FIGURES

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|--------------------|--|
| Figure 1 | Site Map |
| Figure 2a-e | Waterline and Access Road Plan and Profile |
| Figure 3a-b | Well Pad Site Map and Access Road X-Section |
| Figure 4 | State Land Use Districts |
| Figure 5 | Hydrologic Units, Island of O`ahu |

Figure 1
Site Location Map







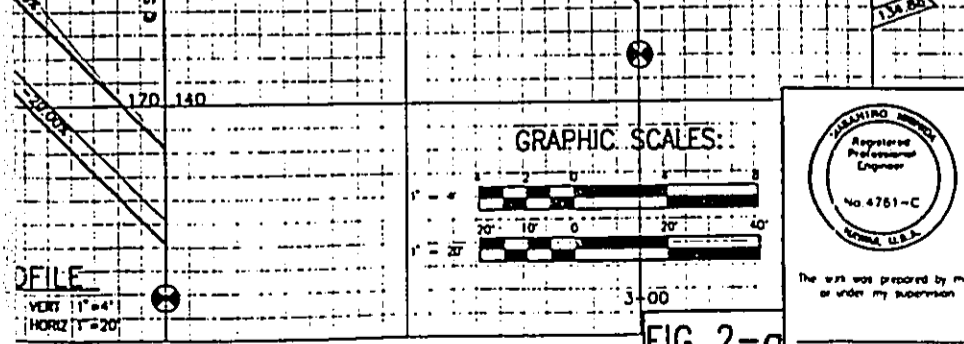
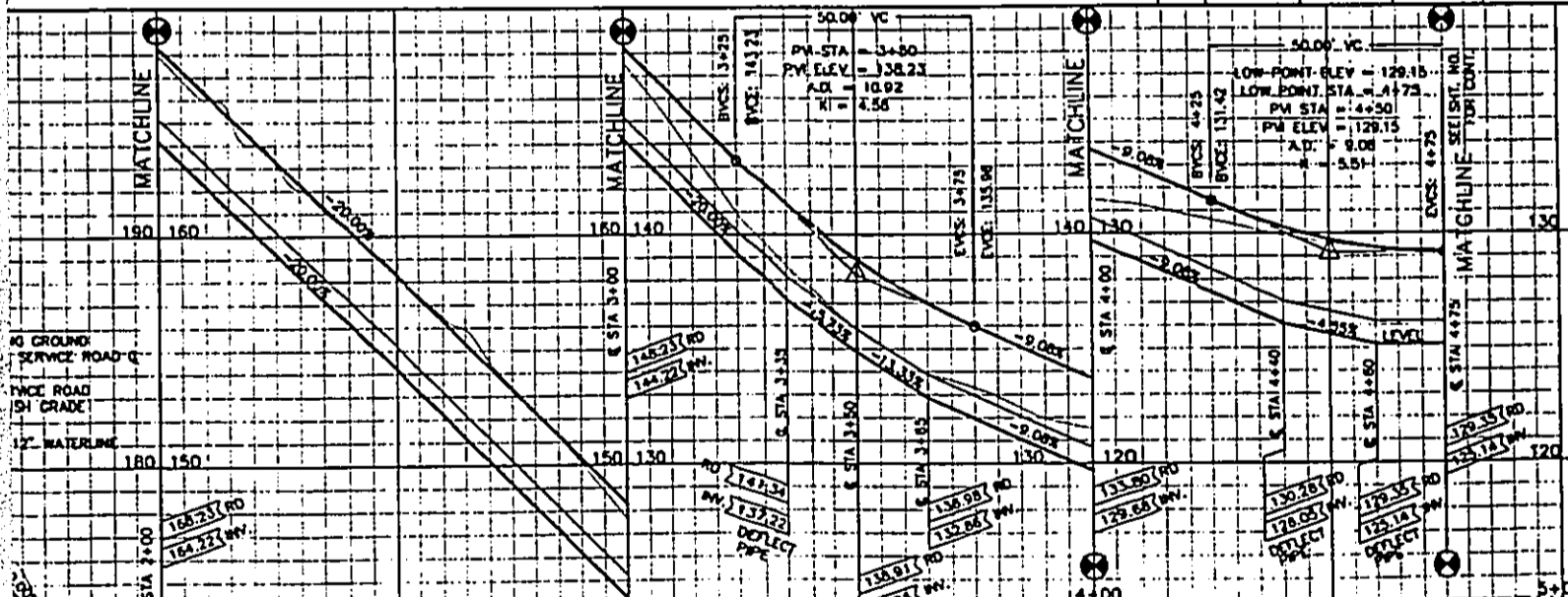
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STREAM

- 12" W.L. & SERVICE ROAD

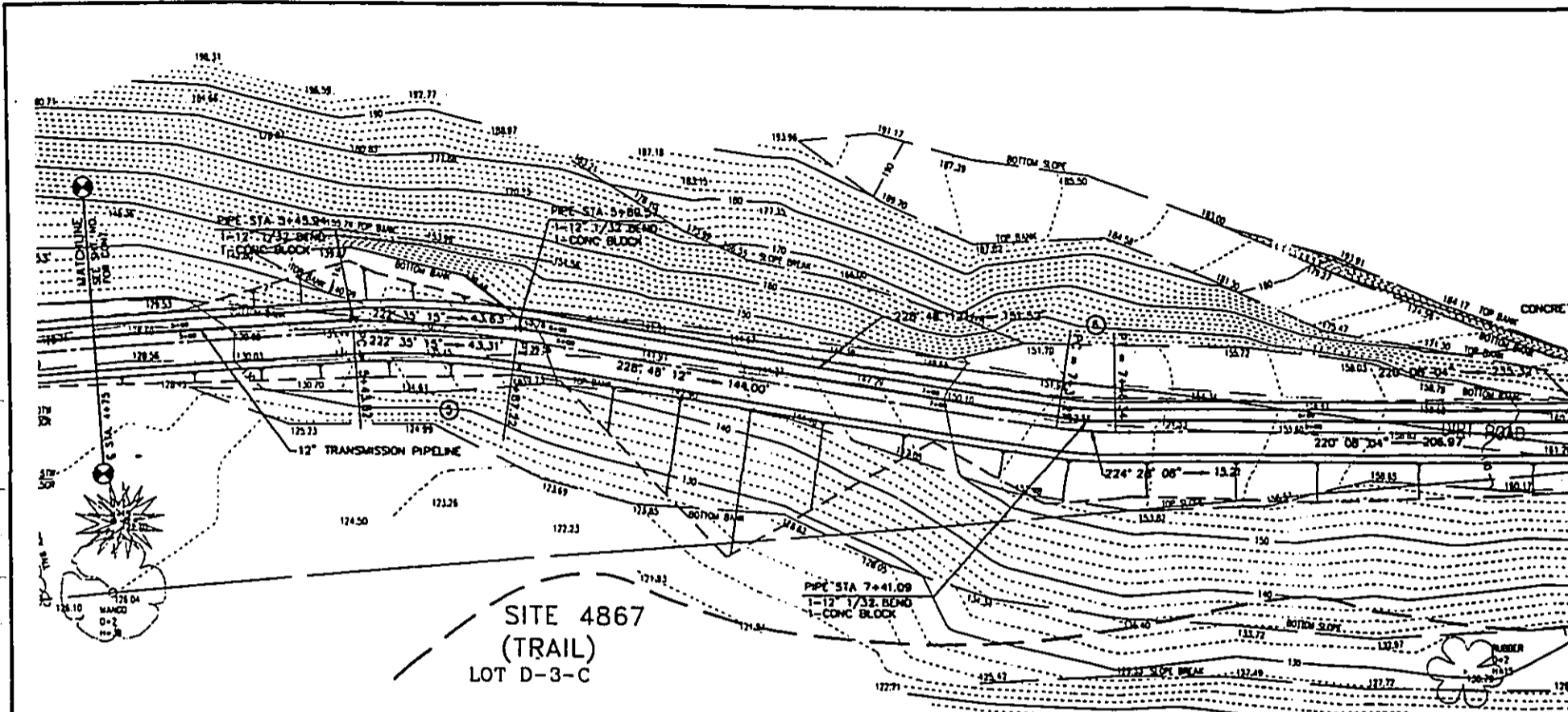
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SERVICE ROAD & CURVE DATA				
CURVE	①	②	③	④
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∇	8° 02' 25"	23° 32' 44"	3° 55' 25"	5° 44' 15"
R	100'	50'	100'	100'
T	15.81'	21.78'	6.86'	10.05'
L	31.42'	36.85'	13.68'	19.99'
L	31.55'	41.09'	13.70'	20.03'



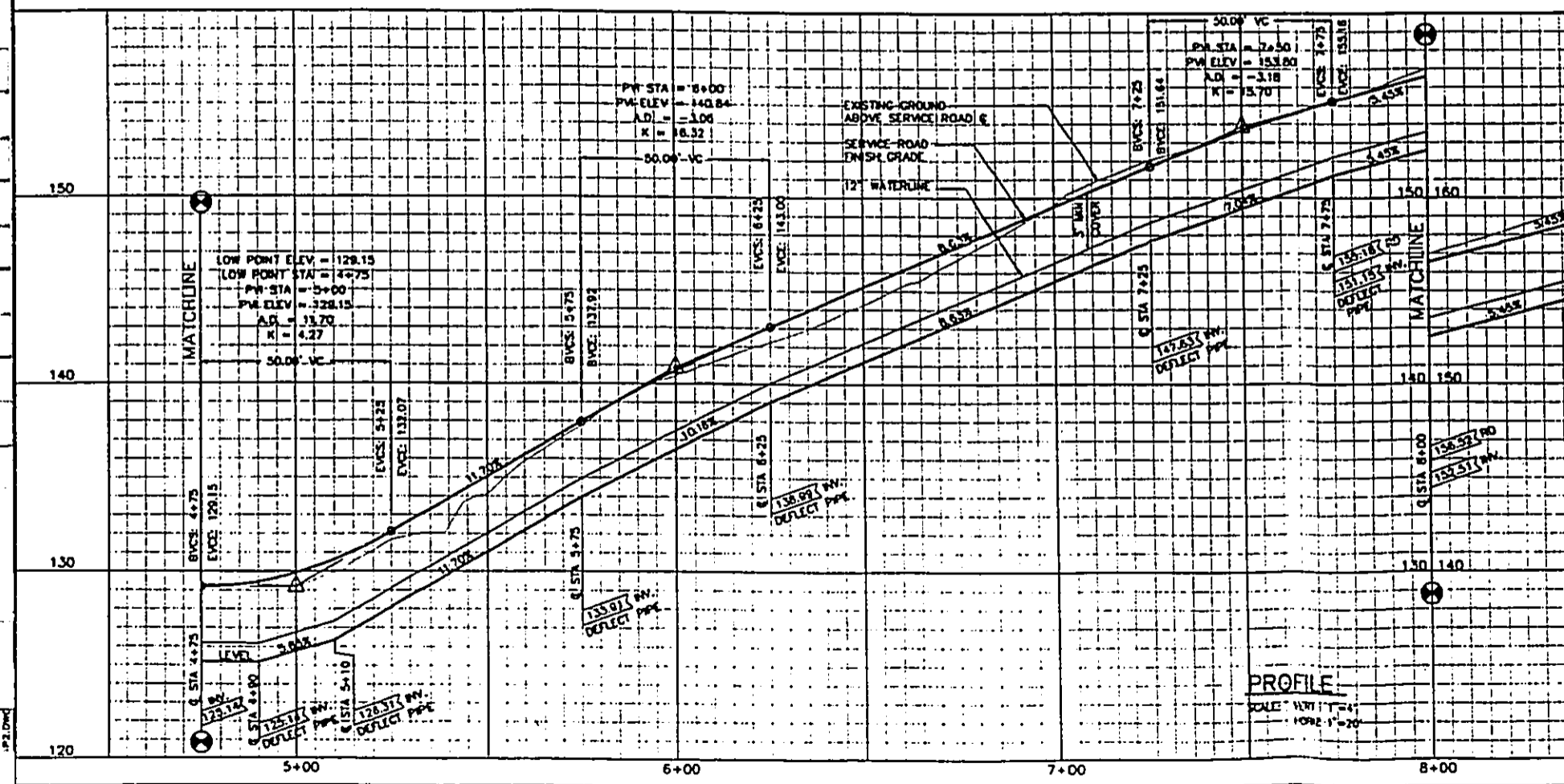
REVISION	BY	DESCRIPTION	DATE	APPROVED
<p>BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU</p> <p>JOB 95-92 KAIPAPAI WELL: INSTALLATION OF PUMP, BREAKER RESERVOIR, CONTROL BUILDING, TRANSMISSION MAIN, AND APPURTENANCES HAUULA, OAHU, HAWAII</p> <p>PLAN & PROFILE - 12" W.L. & SERVICE ROAD</p>				
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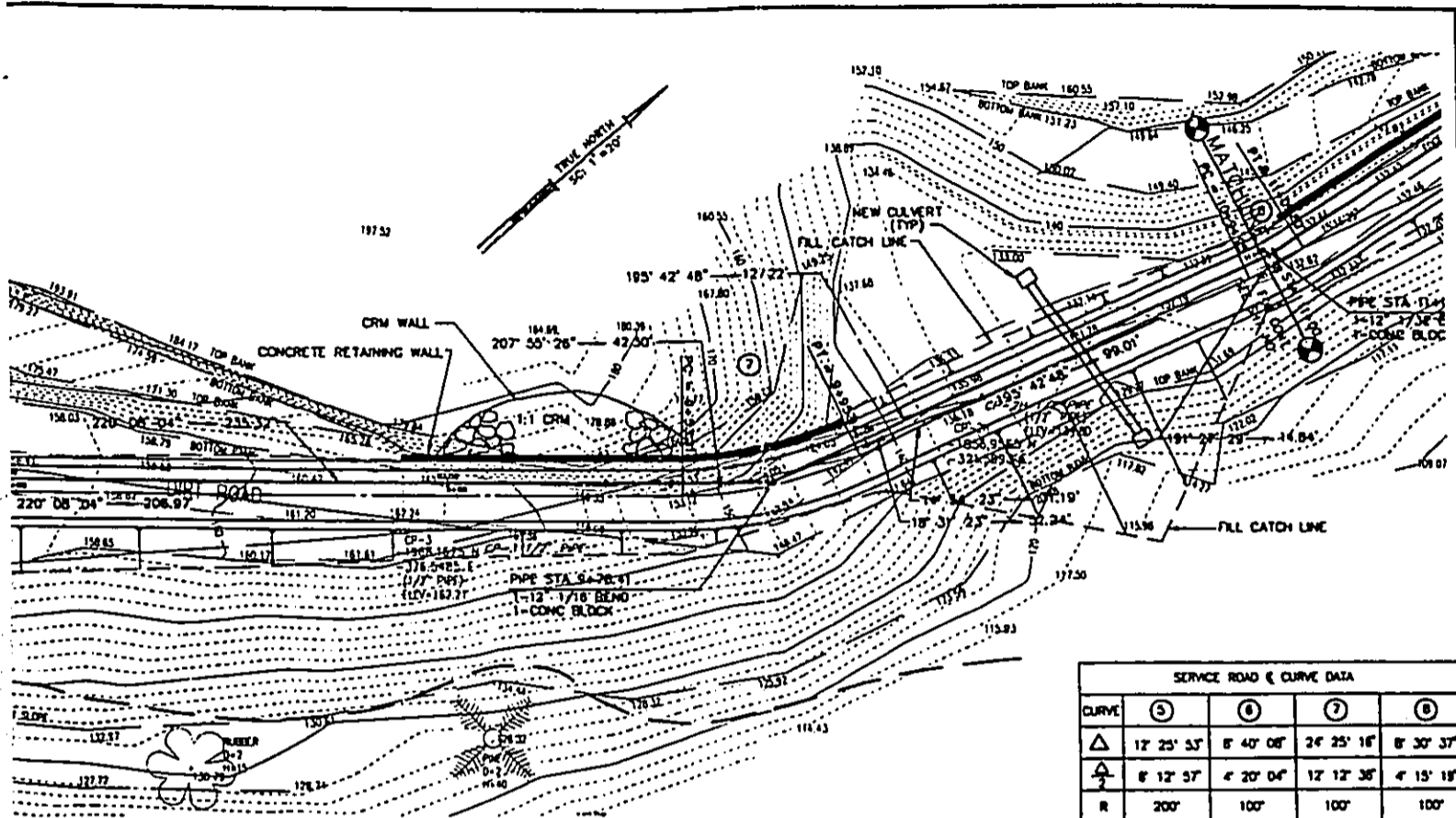
FIG 2-a



PLAN - 12" W.L. & SERVICE ROAD

SCALE: 1" = 20'

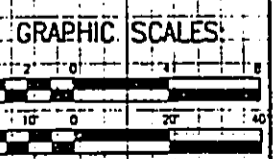
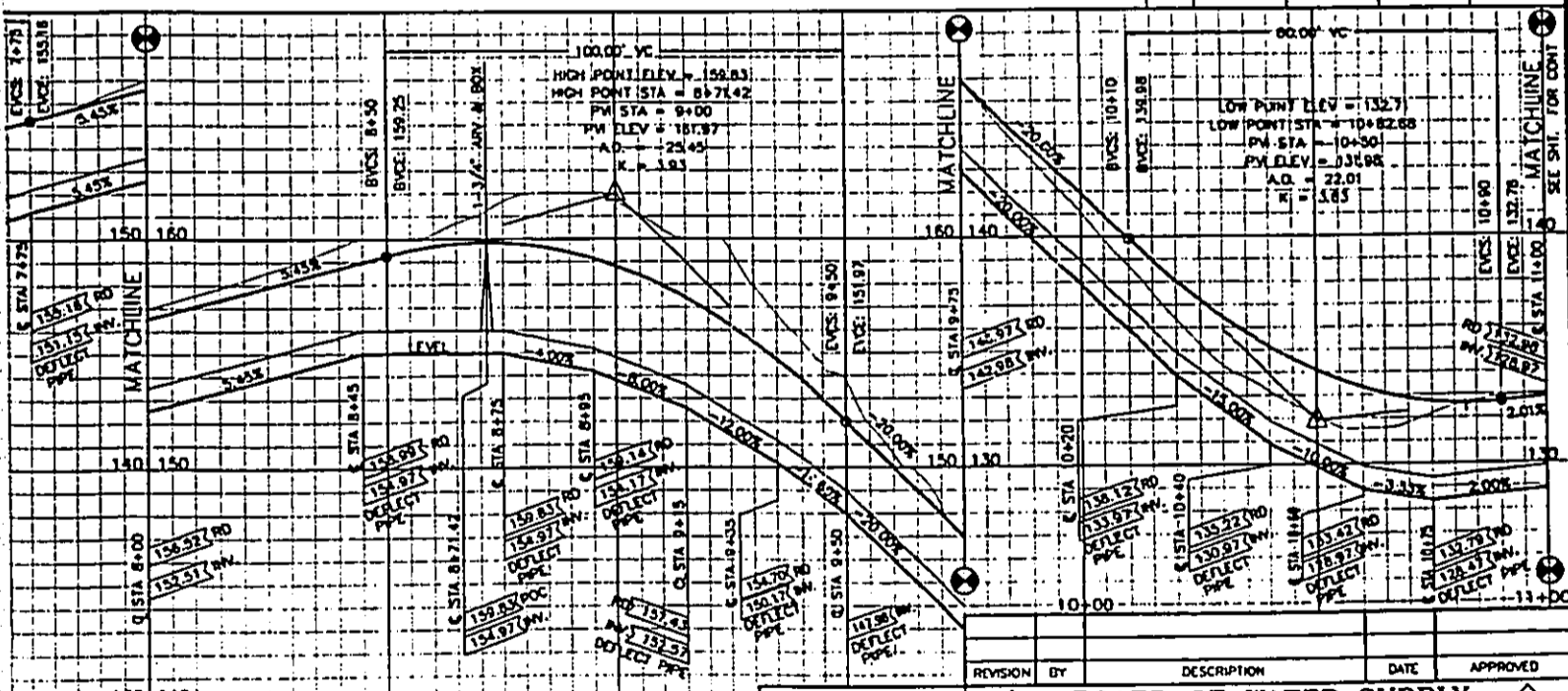




SERVICE ROAD & CURVE DATA

CURVE	⑤	⑥	⑦	⑧
△	12' 25" 53'	8' 40" 08"	24' 25" 18"	8' 30" 37'
△	8' 12" 57"	4' 20" 04"	12' 12" 38"	4' 15" 18"
R	200'	100'	100'	100'
T	21.78'	7.58'	21.84'	7.44'
C	43.31'	15.12'	42.30'	14.84'
L	43.30'	15.13'	42.82'	14.85'

RVICE ROAD



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REVISION	BY	DESCRIPTION	DATE	APPROVED

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

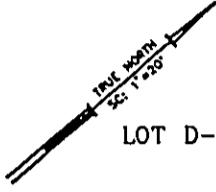
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KAIPAPU WELL: INSTALLATION OF PUMP, BREAKER RESERVOIR, CONTROL BUILDING, TRANSMISSION MAIN, AND APPURTENANCES
HAJULA, OAHU, HAWAII

PLAN & PROFILE - 12" W.L. & SERVICE ROAD

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FIG 2-b



LOT D-3-C

12' TRANSMISSION PIPELINE

PIPE STA 12+04.57
1-12" 1/32 BEND
1-CONC BLOCK

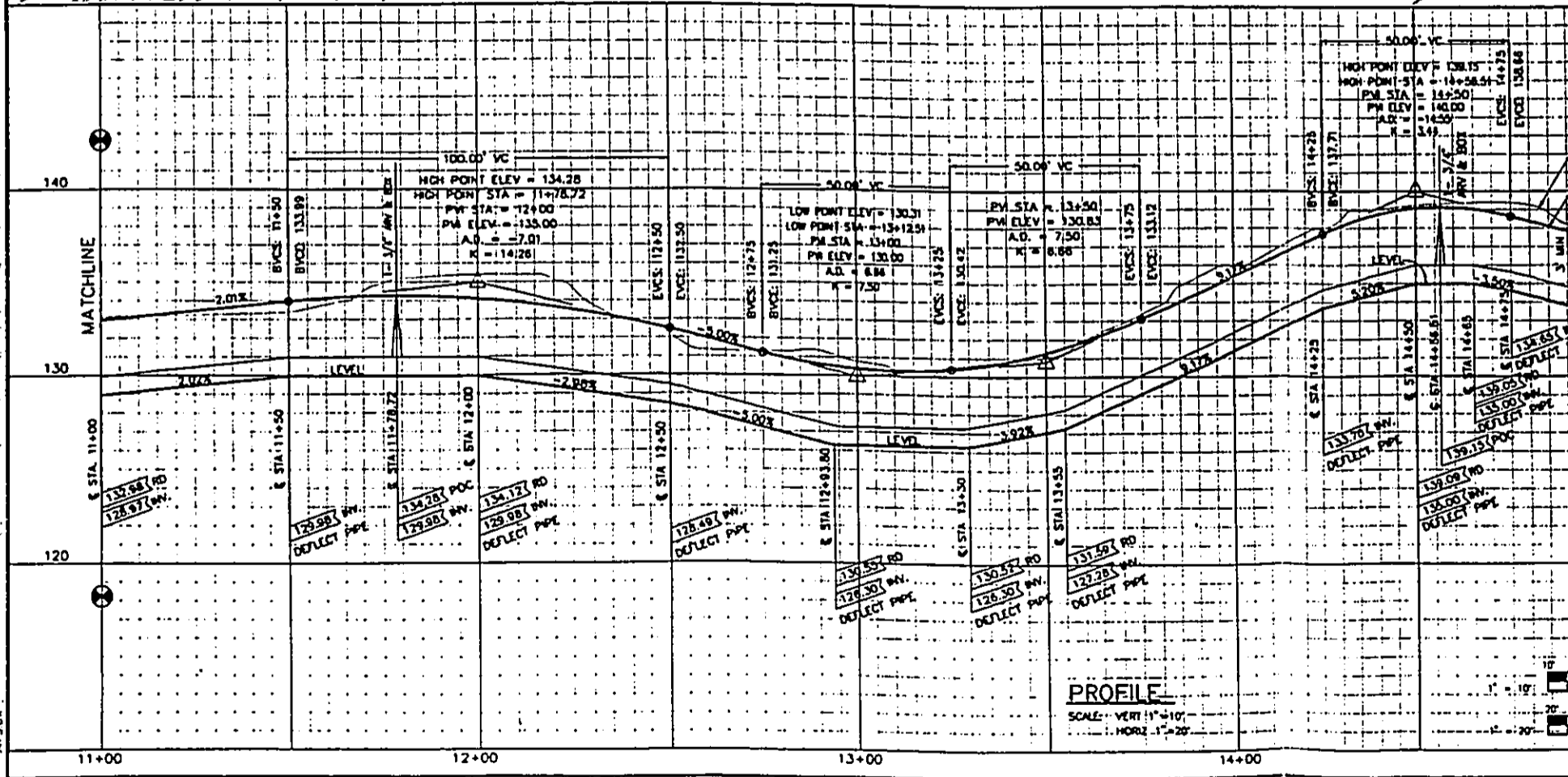
187' 12" 11" 100.94

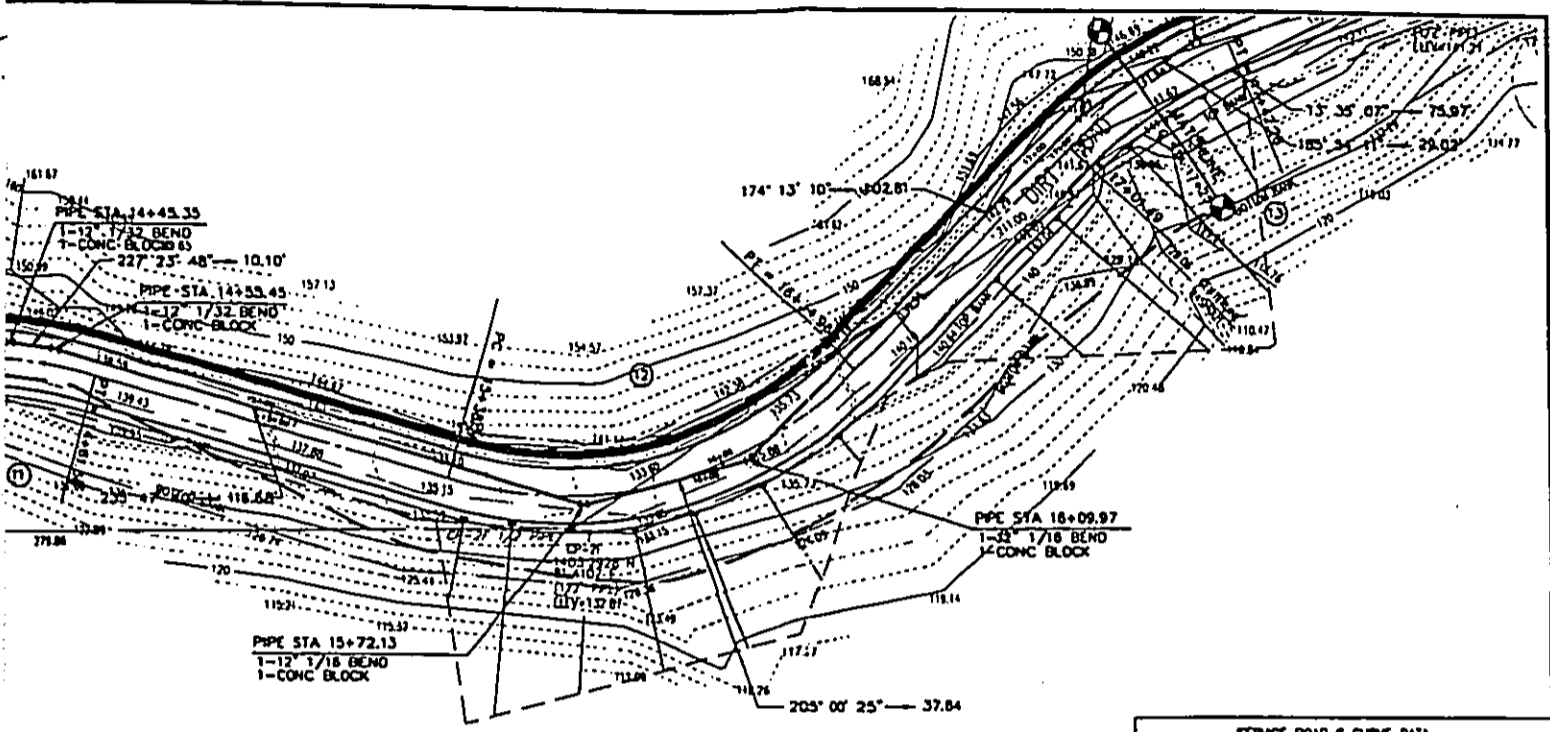
PIPE STA 11+03.63
1-12" 1/32 BEND
1-CONC BLOCK

SITE 4867 (TRAIL)

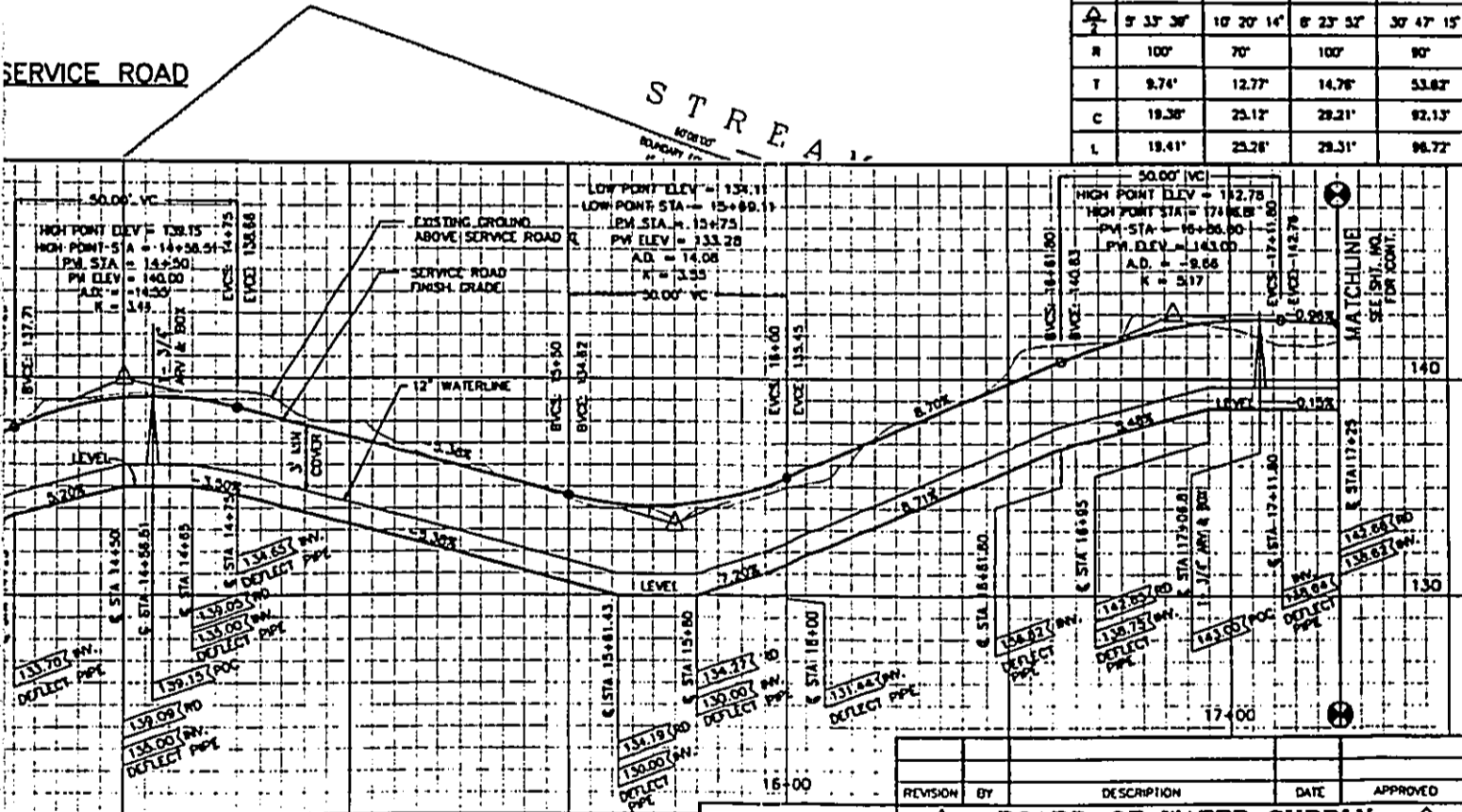
PLAN - 12" W.L. & SERVICE ROAD

SCALE: 1" = 20'

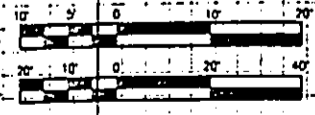




SERVICE ROAD & CURVE DATA				
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Δ	8° 33' 36"	10° 20' 14"	8° 23' 52"	30° 47' 15"
R	100'	70'	100'	80'
T	9.74'	12.77'	14.78'	53.82'
C	19.28'	25.12'	28.21'	92.13'
L	19.41'	23.28'	28.31'	98.72'



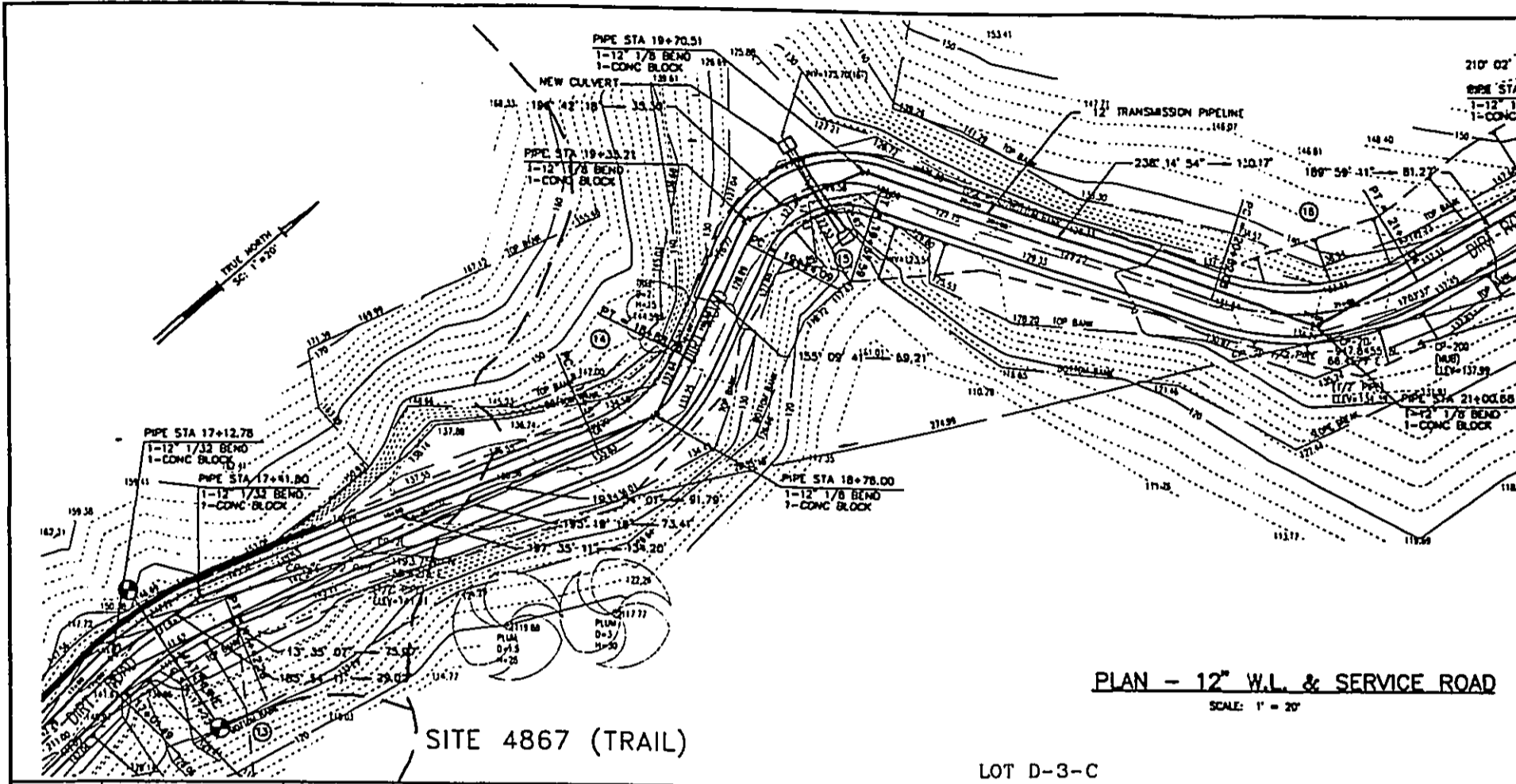
GRAPHIC SCALES:



The work was prepared by me or under my supervision

FIG 2-C

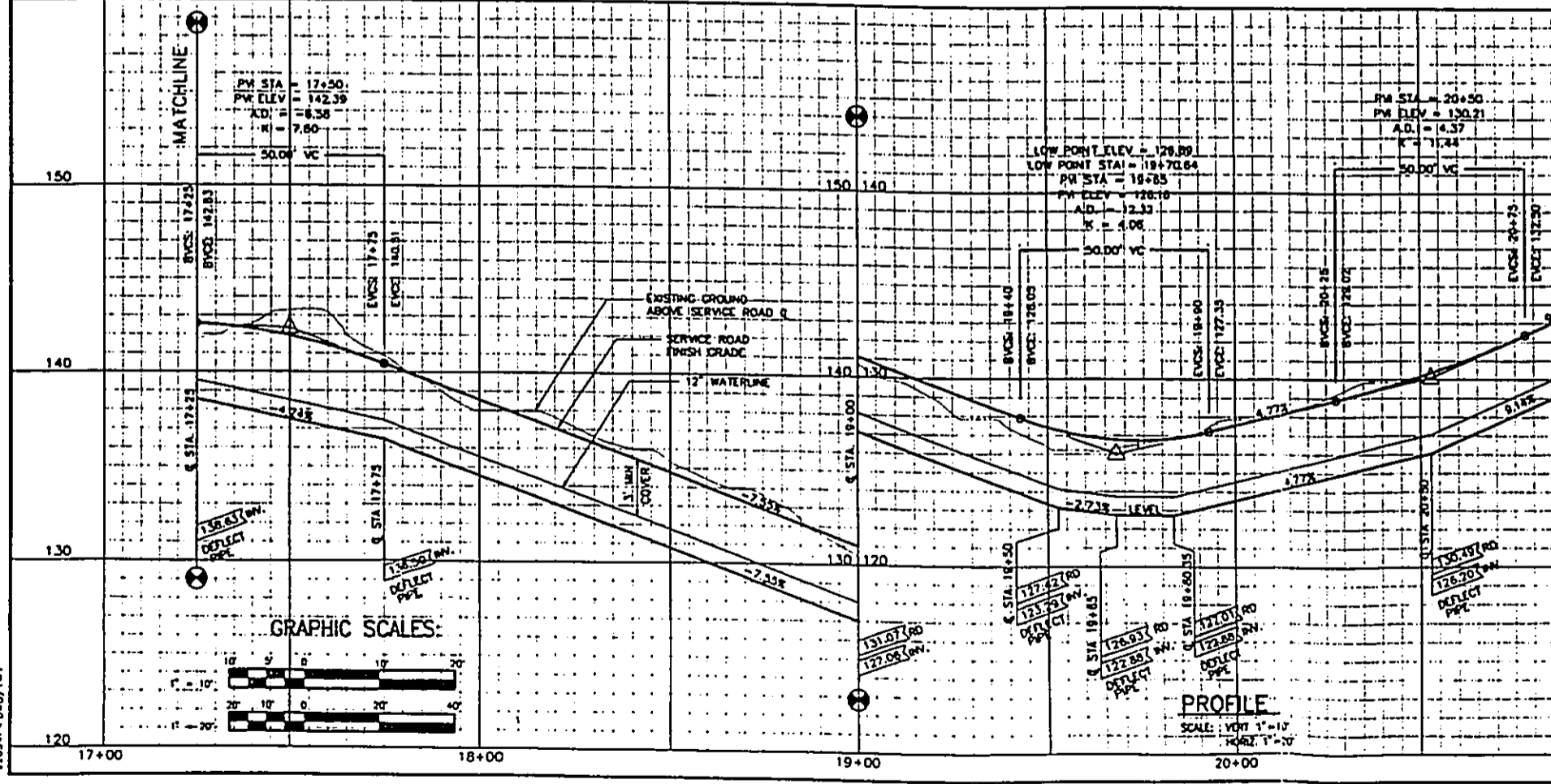
REVISION	BY	DESCRIPTION	DATE	APPROVED
BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU JOB 85-92 KAIAPAU WELL: INSTALLATION OF PUMP, BREAKER RESERVOIR, CONTROL BUILDING, TRANSMISSION MAIN, AND APPURTENANCES HAIJULA, OAHU, HAWAII				
PLAN & PROFILE - 12" W.L. & SERVICE ROAD				APPROVED: _____ DATE: _____
APPROVED: _____ CHIEF, PLANNING AND ENGINEERING DIVISION				
DRAWN BY: LY	ENGINEER: BKM	CHECKED BY: MN	FILE NO:	SHEET: 5 OF 3 SHEETS
FIELD BOOK NO:	SCALE: AS NOTED	SHEET: 5 OF 3 SHEETS		



PLAN - 12" W.L. & SERVICE ROAD
SCALE: 1" = 20'

SITE 4867 (TRAIL)

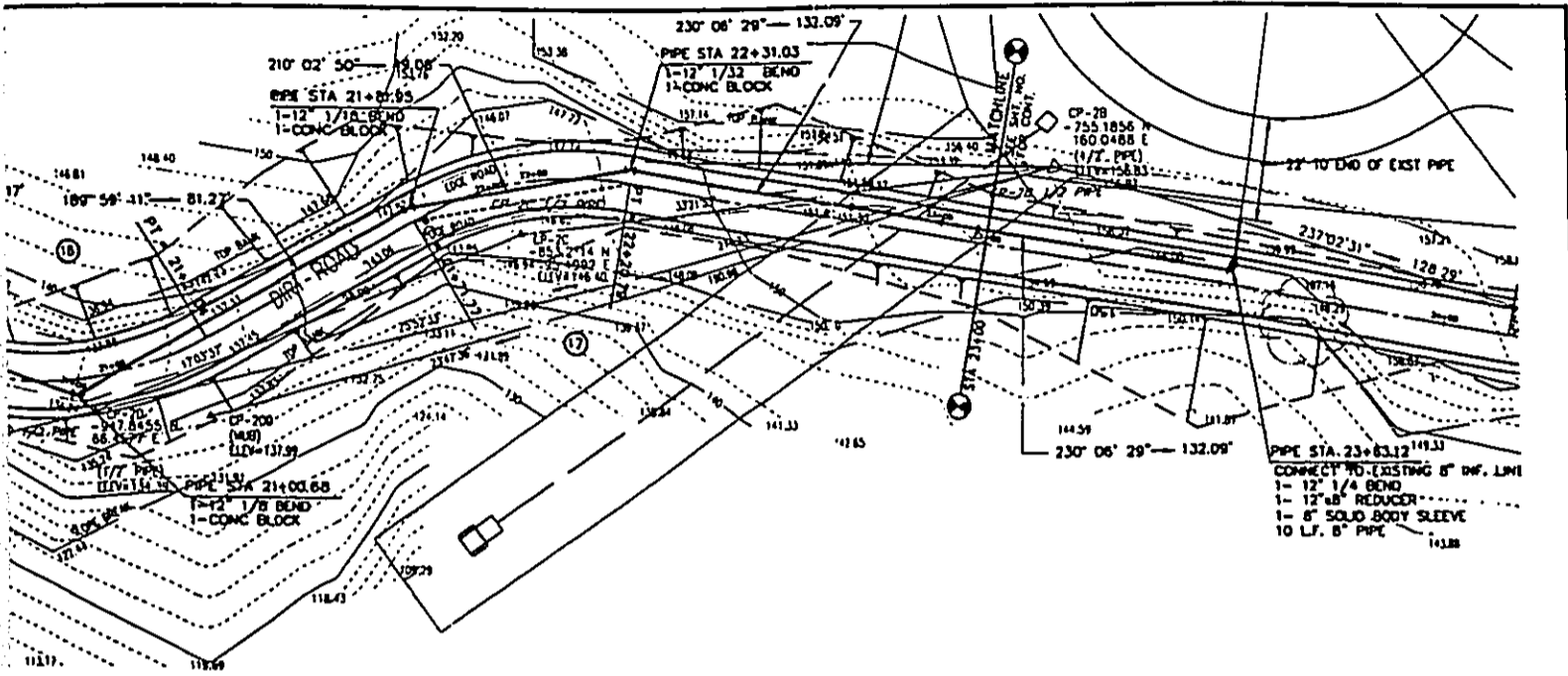
LOT D-3-C



GRAPHIC SCALES:

PROFILE
SCALE: VERT 1" = 10'
HORIZ. 1" = 20'

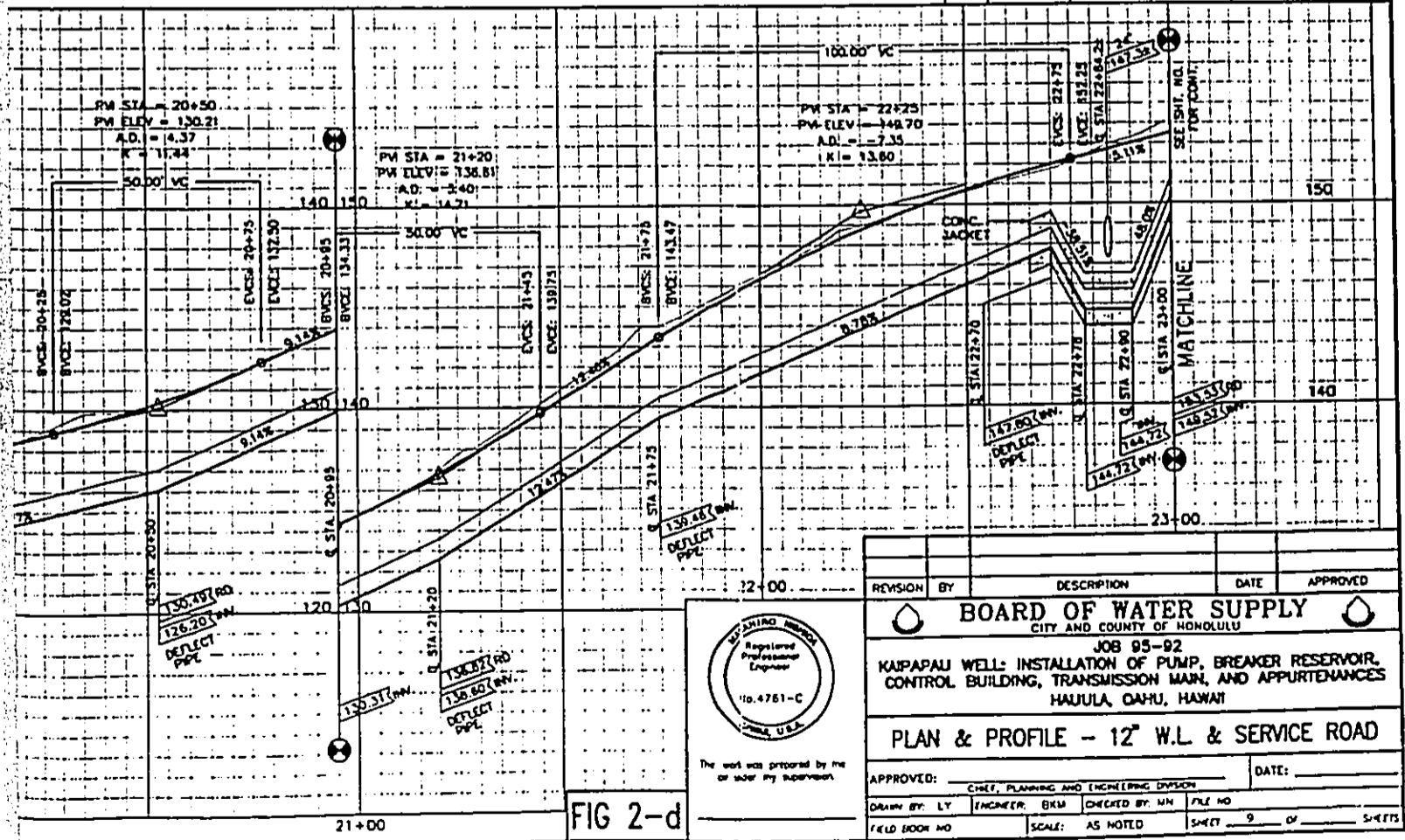
92034P4 DWG/1-1



W.L. & SERVICE ROAD

- 20 -

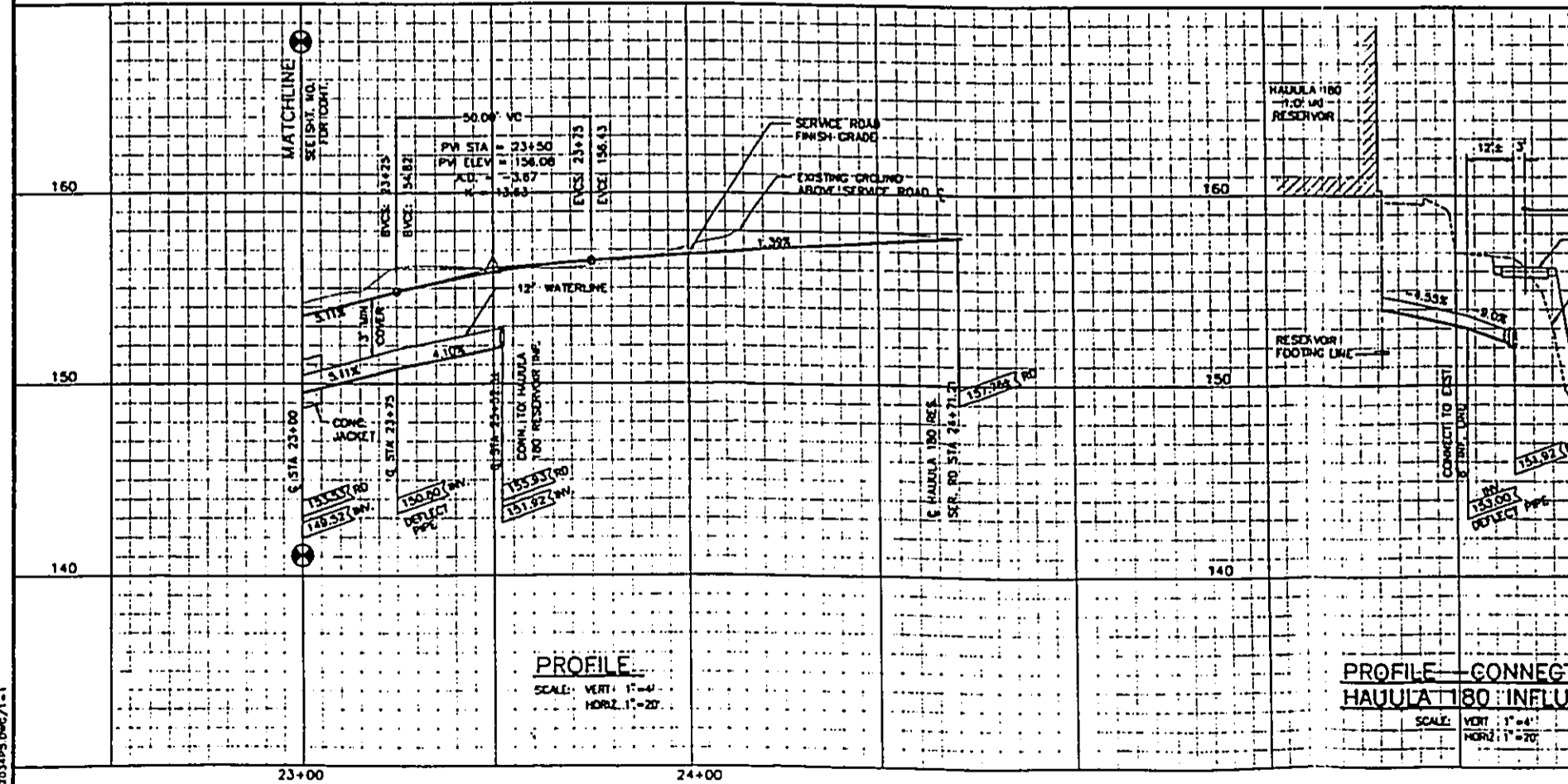
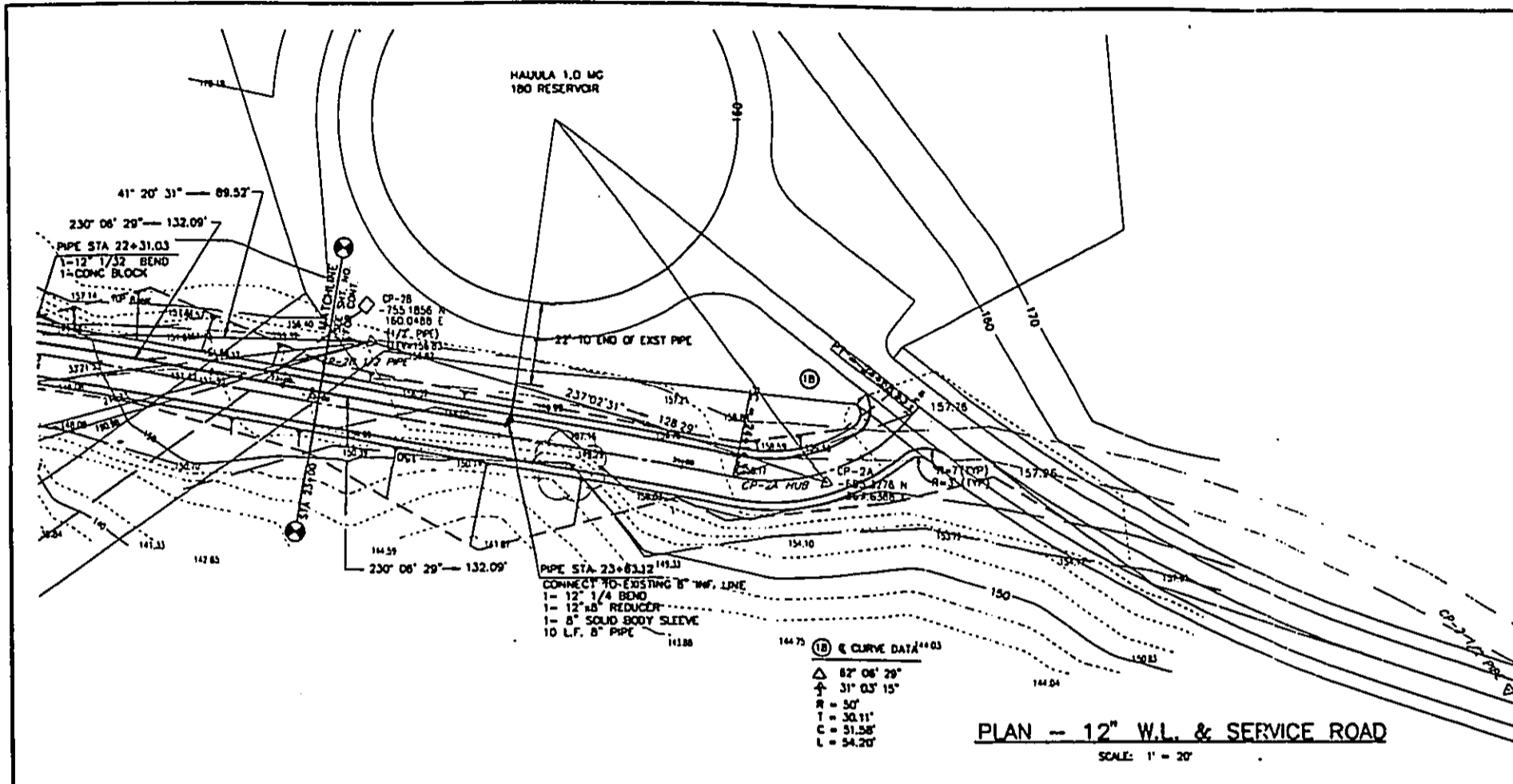
CURVE	(13)	(14)	(15)	(16)	(17)
Δ	23 22' 00"	42 25' 28"	87 05' 17"	48 15' 43"	40 17' 18"
Δ_2	11 41' 00"	21 17' 15"	41 32' 35"	24 07' 57"	20 08' 38"
R	100'	50'	30'	70'	70'
T	20.80'	18.41'	28.58'	31.36'	25.58'
C	40.50'	36.18'	39.78'	57.24'	48.02'
L	40.78'	37.02'	43.50'	58.98'	49.02'



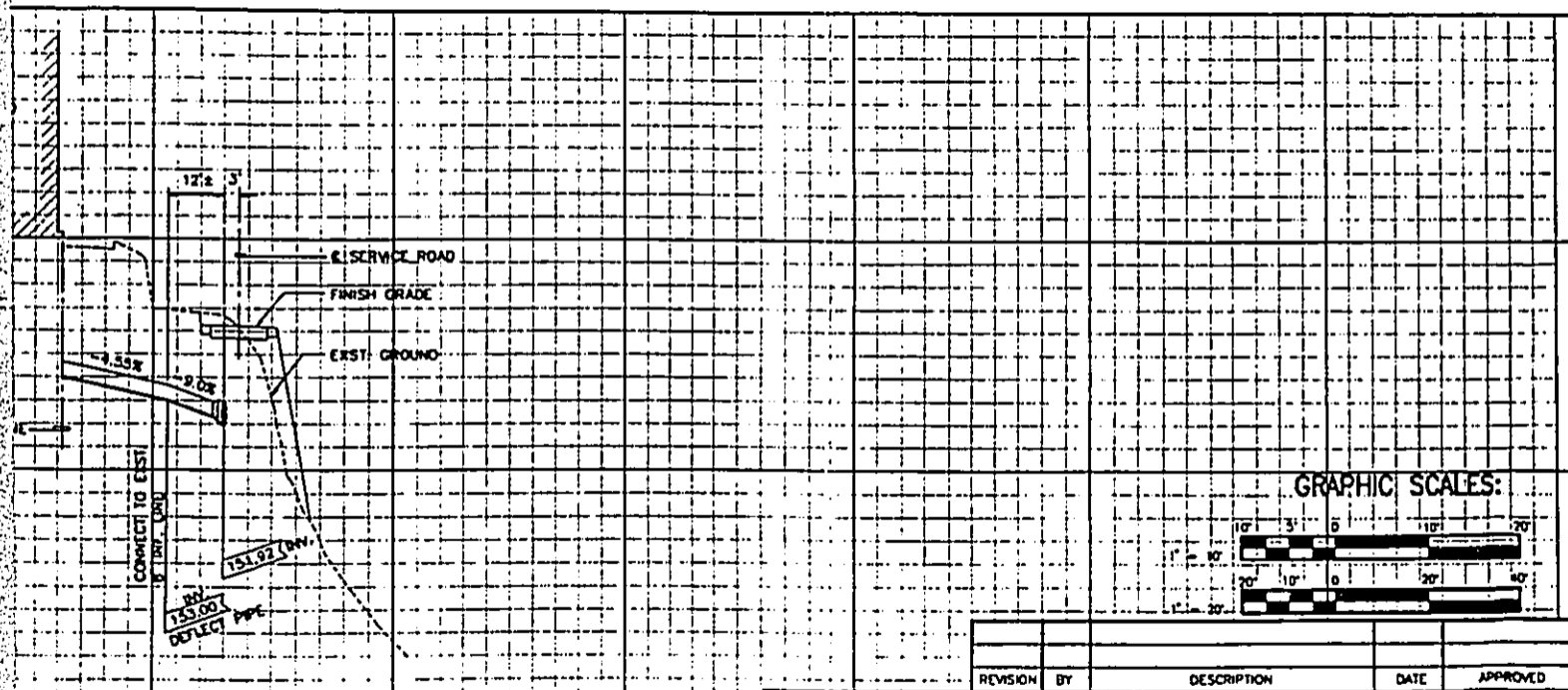
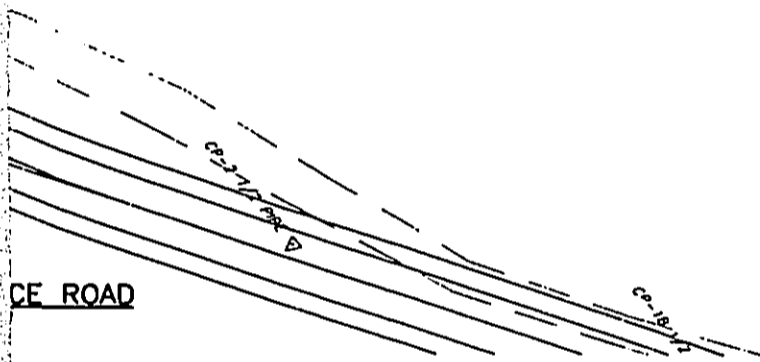
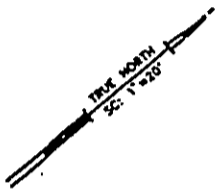
The work was prepared by me or under my supervision.

REVISION	BY	DESCRIPTION	DATE	APPROVED
<p>BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU</p> <p>JOB 95-92 KAIPAPAU WELL: INSTALLATION OF PUMP, BREAKER RESERVOIR, CONTROL BUILDING, TRANSMISSION MAIN, AND APPURTENANCES HAUULA, OAHU, HAWAII</p> <p>PLAN & PROFILE - 12" W.L. & SERVICE ROAD</p>				
APPROVED: _____				DATE: _____
CHIEF, PLANNING AND ENGINEERING DIVISION				
DRAWN BY: LY	ENGINEER: BKM	CHECKED BY: MN	FILE NO	
FIELD BOOK NO	SCALE: AS NOTED	SHEET 9	OF	SHEETS

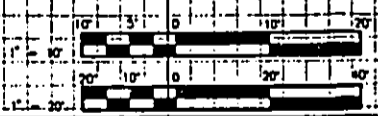
FIG 2-d



82034PS.Dwg/11-1



GRAPHIC SCALES:



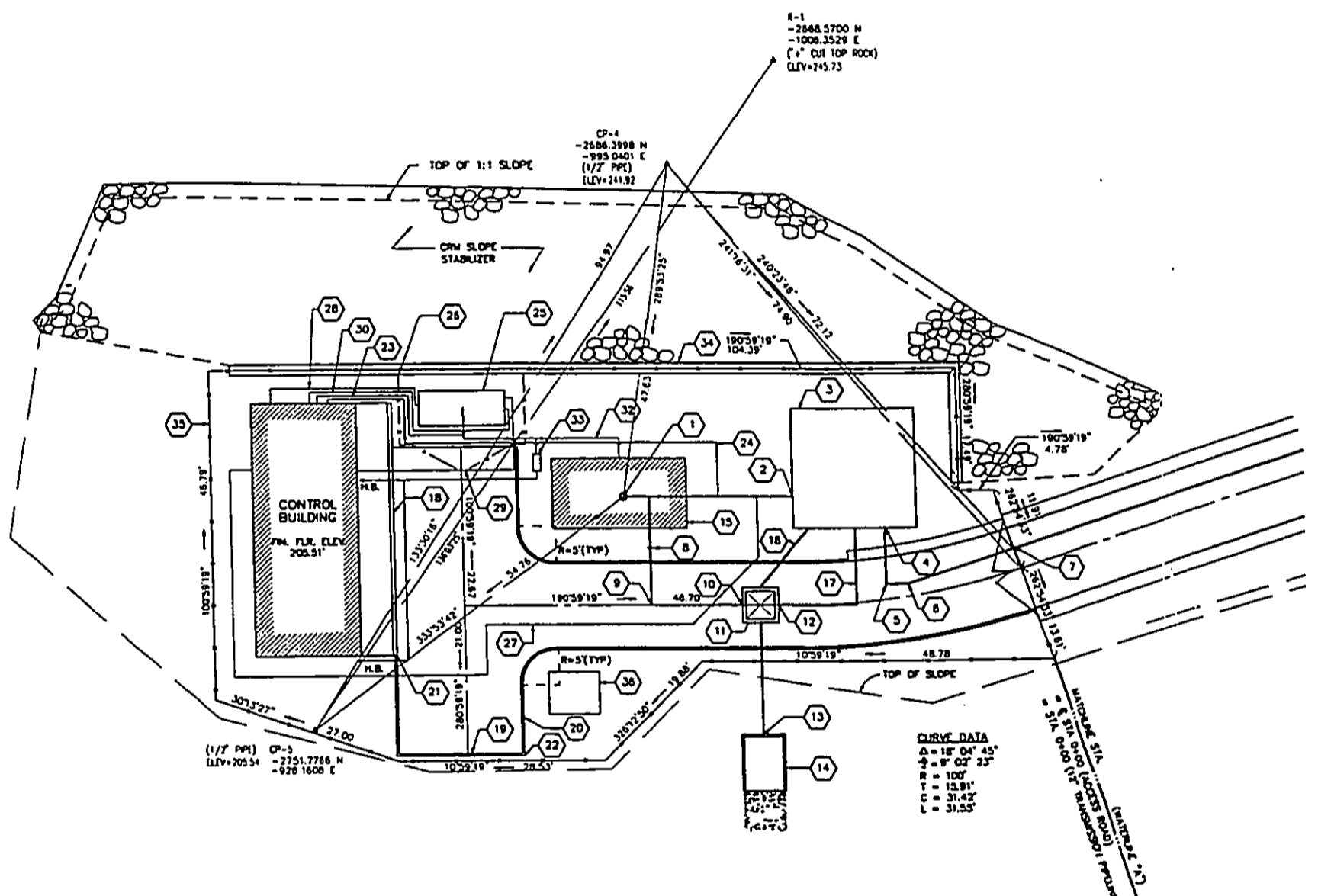
PROFILE - CONNECTION TO
HAUULA 180 INFLUENT LINE
SCALE: VERT. 1" = 4'
HORIZ. 1" = 20'

FIG 2-e



The work was prepared by me or under my supervision.

REVISION	BY	DESCRIPTION	DATE	APPROVED
BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU JOB 95-92 KAIPAPAU WELL: INSTALLATION OF PUMP, BREAKER RESERVOIR, CONTROL BUILDING, TRANSMISSION MAIN, AND APPURTENANCES HAUULA, OAHU, HAWAII				
PLAN & PROFILE - 12" W.L. & SERVICE ROAD				
APPROVED: _____				DATE: _____
DRAWN BY: LY	ENGINEER: BKM	CHECKED BY: MH	FILE NO.:	
FIELD BOOK NO.	SCALE: AS NOTED	SHEET: 10	SHEETS	



WELL SITE PLAN
SCALE: 1" = 10'

SCALE

- 1 WELL PUMP = STA. 0+00 PUMP PIPING
2702.72 S REFERED TO KAIAPAU
950.13 W
- 2 STA. 0+24 PUMP PIPING
END PUMP PIPING
- 3 10,000 GAL. CONCRETE RESERVOIR
CENTER ELEV. = 205.00
SEE DETAILS ON SHEET S-6 & S-7
- 4 STA. 0+00 WATERLINE "A"
BEGIN 12" TRANSMISSION IN WELL SITE
SEE PROFILE SHEET
- 5 STA. 0+08 WATERLINE "A"
1-12" 1/4 BEND
1-CONC. BLOCK
- 6 STA. 0+10.98 WATERLINE "A"
1-12" 1/16 BEND
1-CONC. BLOCK
- 7 STA. 0+28.41 WATERLINE "A"
STA. 0+00 12" TRANSMISSION PIPELINE
END OF WATERLINE "A"
SEE PLAN AND PROFILE SHEETS C-3 TO C-7
- 8 STA. 0+07.33 PUMP PURGE LINE
STA. 0+00 WATERLINE "B"
END LIMIT OF PUMP PIPING
BEGIN WATERLINE "B"
SEE PROFILE SHEET
- 9 STA. 0+06.17 WATERLINE "B"
1-12" 1/4 BEND
1-CONC. BLOCK
- 10 STA. 0+21.17 WATERLINE "B"
END OF WATERLINE "B"
PENETRATE DRAIN MANHOLE WALL
- 11 DRAIN MANHOLE
SEE DETAIL SHEET
- 12 STA. 0+21.78 18" DRAINLINE
BEGIN 18" RCP DRAIN
PENETRATE DRAIN MANHOLE WALL
SEE PROFILE SHEET
- 13 STA. 0+15.91 18" DRAINLINE
END OF 18" DRAINLINE
PENETRATE DRAIN OUTLET WALL
- 14 DRAIN OUTLET STRUCTURE
SEE DETAIL SHEET

- 15 PUMP BUILDING
T.O.C. ELEV. = 205.35
SEE DETAILS SHEETS S-3 TO S-5
- 16 RESERVOIR DRAINLINE
11 LIN. FT. 12" WATERLINE
PENETRATE DRAIN MANHOLE WALL
SEE PROFILE SHEET
- 17 RESERVOIR OVERFLOW LINE
3 LIN. FT. 12" WATERLINE
1-12" 1/4 BEND
1-CONC. BLOCK
PENETRATE DRAIN MANHOLE WALL
SEE PROFILE SHEET
- 18 CONCRETE SIDEWALK
SEE ARCHITECTURAL PLANS
- 19 PRECAST CONCRETE CURB
SEE CITY & COUNTY STD. DETAIL E-1
- 20 CONCRETE HEADER
SEE DETAIL SHEET C-10
- 21 STA. 00+87.75 0/S 7' LT.
2ND CONC. HEADER & CONC. SIDEWALK
- 22 STA. -0+70.75 0/S 21' LT.
2ND CONC. HEADER & PRECAST CONC. CURB
- 23 1- 1/4" COPPER WATERLINE
TO CHLORINATOR
- 24 1" RUBBER HOSE IN 3" PVC CONDUIT
TO WELL DISCHARGE PIPING
INJECTION POINT
- 25 HYDRO-PNEUMATIC TANK
SEE DETAILS ON SHEET
- 26 HYDRO-PNEUMATIC TANK FENCED ENCLOSURE
SEE DETAILS ON SHEET
- 27 1 1/2" COPPER WATERLINE
TO BOOSTER PUMPS

- 28 1- 1/2" COPPER WATERLINE
FROM BOOSTER PUMPS TO
HYDRO-PNEUMATIC TANK
- 29 1/2" COPPER AIRLINE
TO CONTROLLER
- 30 1/2" COPPER AIRLINE
FROM COMPRESSOR
TO HYDRO-PNEUMATIC TANK
- 31 1/4" COPPER AIRLINE IN 1" PVC CONDUIT
TO WELL PUMP
- 32 2" COPPER WATERLINE
TO WELL PUMP
- 33 TYPE B/X LATERAL
WITH METER, GATE VALVE AND BOXES
- 34 CONCRETE RETAINING WALL
SEE DETAILS SHEET TO
- 35 6" HIGH CHAINLINK FENCE
WITH 3 STRAND BARBED WIRE
AND DRIVE GATE. REFER TO
BWS STANDARD DETAILS 131 TO 134
- 36 TRANSFORMER PAD
T.O.C. ELEV. =
SEE ELECTRICAL DWGS

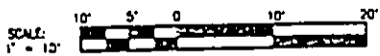
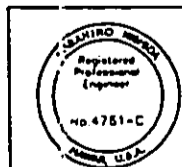
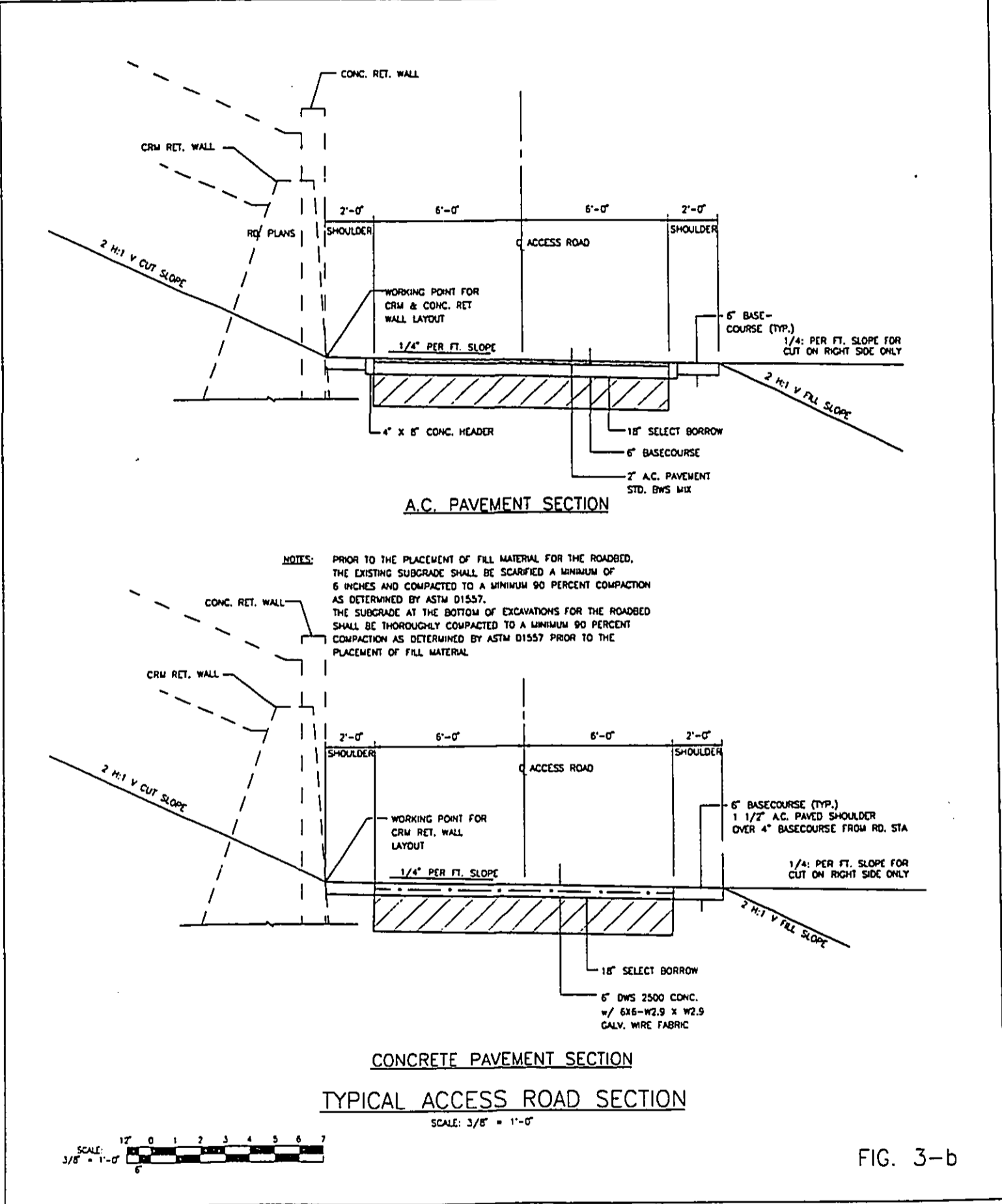


FIG 3-a



The work was prepared by me or under my supervision.

REVISION	BY	DESCRIPTION	DATE	APPROVED
BOARD OF WATER SUPPLY CITY AND COUNTY OF HONOLULU				
JOB 95-92 KAIAPAU WELL: INSTALLATION OF PUMP, BREAKER RESERVOIR, CONTROL BUILDING, TRANSMISSION MAIN, AND APPURTENANCES HAUULA, OAHU, HAWAII				
WELL SITE PLAN				
APPROVED: _____				DATE: _____
<small>CHEF, PLANNING AND ENGINEERING DIVISION</small>				
DRAWN BY: LY	ENGINEER: BKM	CHECKED BY: MM	FILE NO:	
FIELD BOOK NO:	SCALE: AS NOTED	SHEET 2 OF 3 SHEETS		



A.C. PAVEMENT SECTION

NOTES: PRIOR TO THE PLACEMENT OF FILL MATERIAL FOR THE ROADBED, THE EXISTING SUBGRADE SHALL BE SCARIFIED A MINIMUM OF 6 INCHES AND COMPACTED TO A MINIMUM 90 PERCENT COMPACTION AS DETERMINED BY ASTM D1557. THE SUBGRADE AT THE BOTTOM OF EXCAVATIONS FOR THE ROADBED SHALL BE THOROUGHLY COMPACTED TO A MINIMUM 90 PERCENT COMPACTION AS DETERMINED BY ASTM D1557 PRIOR TO THE PLACEMENT OF FILL MATERIAL.

CONCRETE PAVEMENT SECTION

TYPICAL ACCESS ROAD SECTION

SCALE: 3/8" = 1'-0"

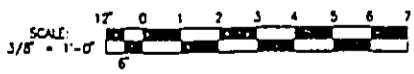


FIG. 3-b

7.5 MINUTE SERIES (TOPOGRAPHIC)
157° 54' 21" W
530 000 FT E

Figure 4 State Land Use Districts

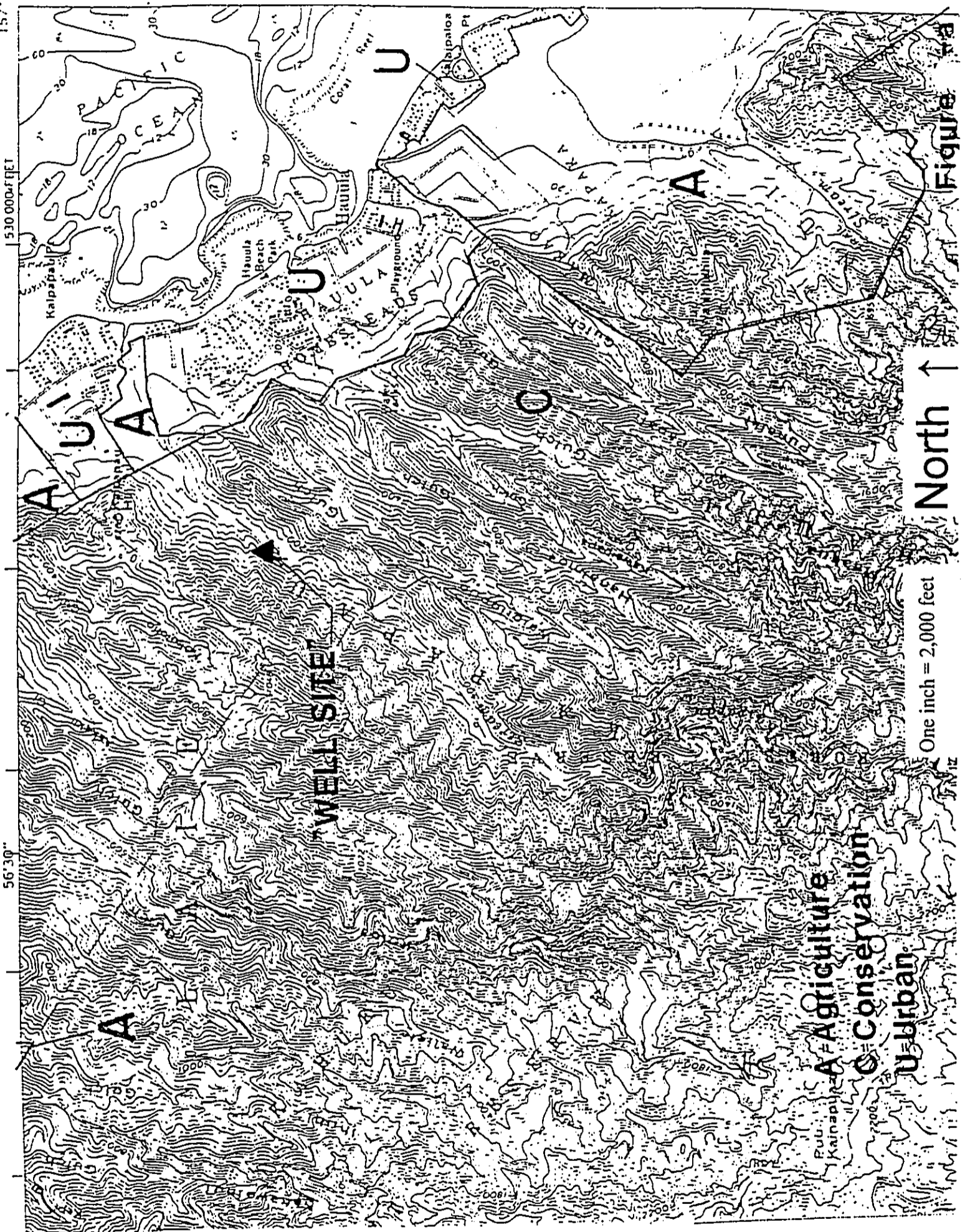
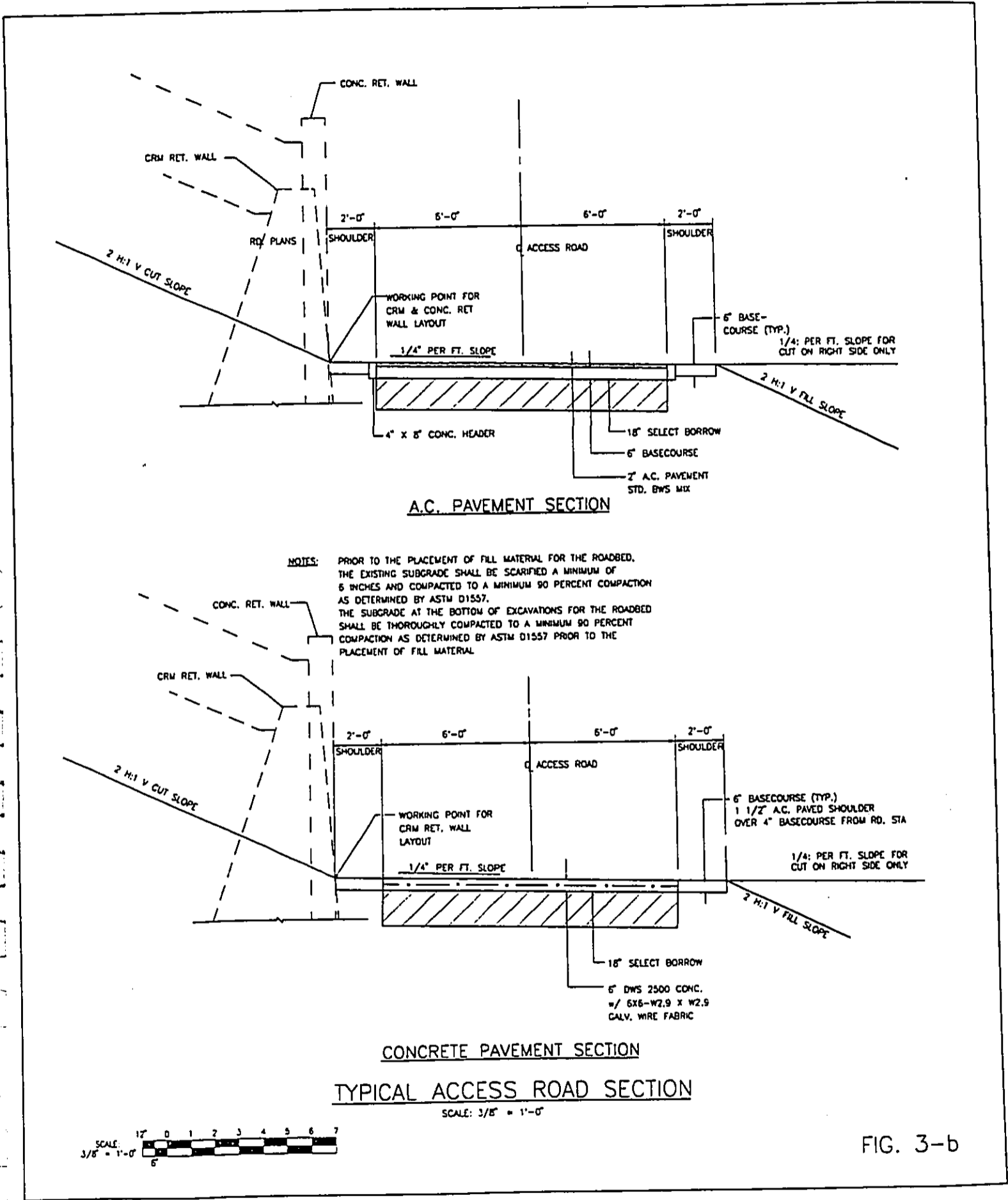


Figure 4



NOTES: PRIOR TO THE PLACEMENT OF FILL MATERIAL FOR THE ROADBED, THE EXISTING SUBGRADE SHALL BE SCARIFIED A MINIMUM OF 6 INCHES AND COMPACTED TO A MINIMUM 90 PERCENT COMPACTION AS DETERMINED BY ASTM D1557. THE SUBGRADE AT THE BOTTOM OF EXCAVATIONS FOR THE ROADBED SHALL BE THOROUGHLY COMPACTED TO A MINIMUM 90 PERCENT COMPACTION AS DETERMINED BY ASTM D1557 PRIOR TO THE PLACEMENT OF FILL MATERIAL.

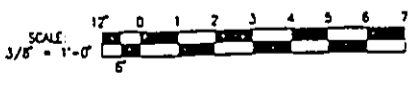
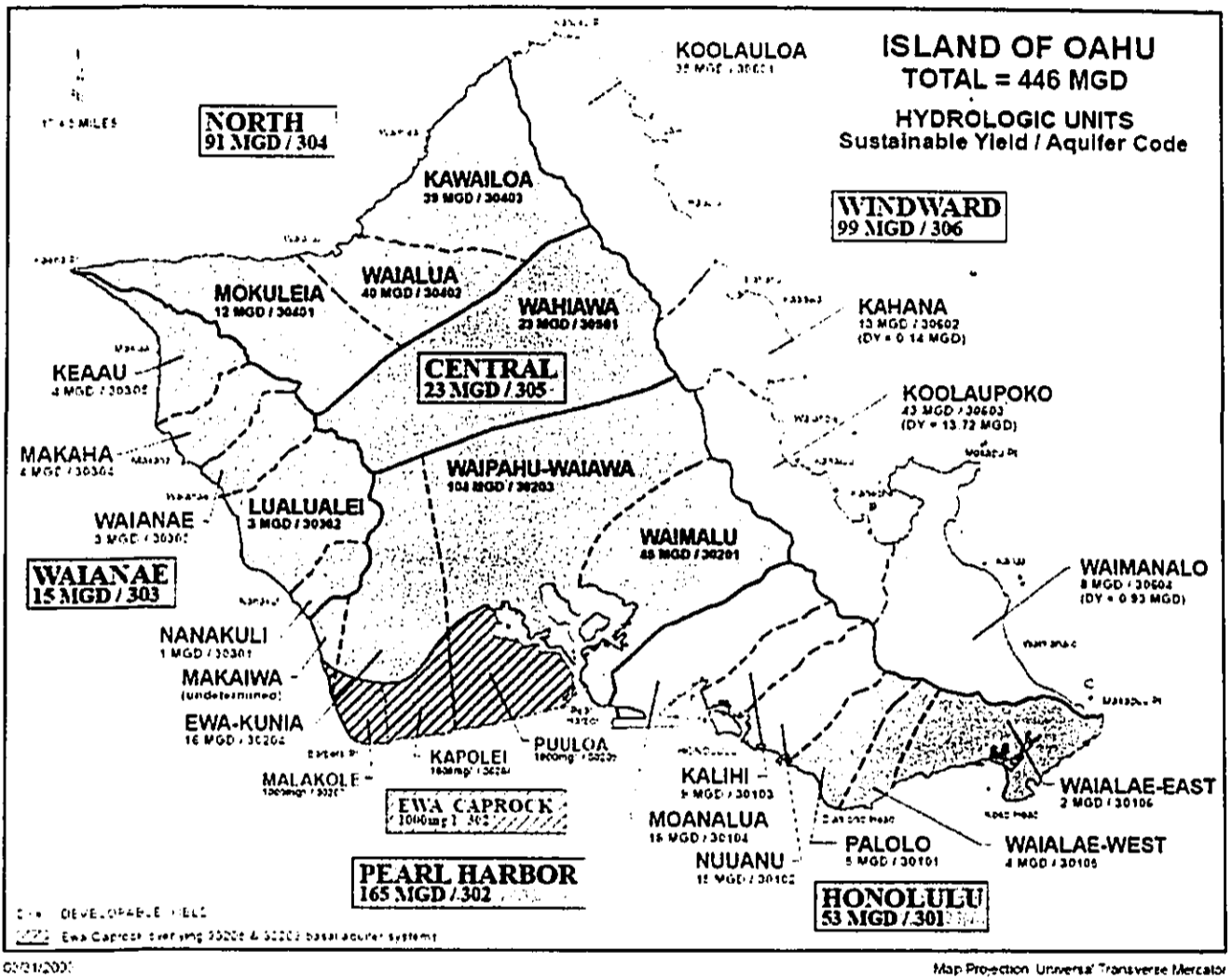


Figure 5



Final Environmental Assessment

Kaipapa`u Well and Associated Facilities

APPENDIX 1A

**COMMENT LETTERS FROM AGENCIES AND
ORGANIZATIONS IN RESPONSE TO PRE-CONSULTATION**

JOHN WAIHEE
GOVERNOR OF HAWAII



JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

In reply, please refer to:

February 28, 1994

94-013/epo

Mr. Youngki Hahn, Ph.D.
Principal
Y.K. Hahn & Associates
Economic Management, Planning Consultant
1180 N. Kumuwaina Place
Hilo, Hawaii 96720

Dear Mr. Hahn:

Subject: Environmental Assessment
Water Well and Pipeline
Kaipapa'u, Oahu
TMK: 5-4-4: 04

Thank you for allowing us to review and comment on the subject project.
We have the following comments to offer:

Nonpoint Source Pollution Concerns

We would like the assessment to address the effects of project construction on soil erosion, and, if necessary, what mitigating measures will be taken to minimize erosion during construction. Proper planning, design and use of erosion control measures can substantially reduce the total volume of runoff, sediment, and the potential of nonpoint source pollution. The following are suggested measures that can be taken to minimize erosion during construction:

- a. Conduct grubbing and grading activities during low rainfall months (April - October).
- b. Replant or cover bare areas as soon as grading or construction is completed. New plantings will require soil amendments, fertilizers, and temporary irrigation to become established. Use high seeding rates to ensure rapid stand establishment.

A grading permit will be required for this project if: fifty (50) or more cubic yards of soil will be disturbed; any cut or fill is three (3) feet or more in height; or if a change in drainage pattern will result due to construction activities. Grading permits can be obtained from the City and County of Honolulu, Department of Public Works, Service Section (523-4921). The permit will include conditions that must be observed to minimize erosion.

We would also like the assessment to address the effects of any planned structures on runoff and erosion, and, if necessary, what mitigating measures will be employed.

Mr. Youngki Hahn, Ph.D.
February 28, 1994
Page 2

If you should have any questions on this matter, please contact
Ms. Gail Ichikawa of the Environmental Planning Office at 586-4345.

Very truly yours,

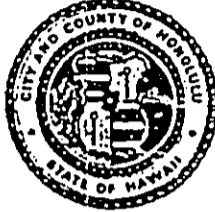


JOHN C. LEWIN, M.D.
Director of Health

c: Environmental Planning Office

PLANNING DEPARTMENT
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR



ROBIN FOSTER
CHIEF PLANNING OFFICER
ROLAND D. LIBBY, JR.
DEPUTY CHIEF PLANNING OFFICER
ET 1/94-3045

February 3, 1994

Mr. Youngki Hahn, Ph.D.
Y.K. Hahn and Associates
1180 Kumuwaina Place
Hilo, Hawaii 96720

Dear Mr. Hahn:

Pre-Environmental Assessment Consultation
for Water Well and Pipeline at Kaipapa'u
Oahu, Hawaii, Tax Map Key 5-4-4: portion of 4

In response to your letter of January 26, 1994, we have the following comments to offer:

1. Possible impacts to stream flows within the area should be included in your investigation and discussion.
2. The Kaipapau Well is designated as site undetermined, within six years, on the Koolauloa Development Plan Public Facilities Map (DPPFM). Before the project is funded, the Koolauloa DPPFM should be amended to depict a well symbol as site determined, within six years.
3. The EA should discuss the measures to be taken to minimize the visual impact of this facility in its rural environment, especially public views of the gulch from Kamehameha Highway.

Should you have any questions, please contact Eugene Takahashi of our staff at 527-6022.

Sincerely,

Robin Foster
FOR ROBIN FOSTER
Chief Planning Officer

RF:lh



DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

February 9, 1994

Planning Division

Dr. Youngki Hahn, Principal
Y. K. Hahn and Associates
1180 N. Kumuwaina Place
Hilo, Hawaii 96720

Dear Dr. Hahn:

Thank you for the opportunity to review and comment on the Environmental Assessment for the Water Well and Pipeline at Kaipapau, Oahu (TMK 5-4-4: 4). The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act.

a. The information provided was not sufficient to determine DA permit requirements. Please contact Ms. Suzanne Baba of our Operations Division at 438-9258 and refer to file NP93-034 for further information.

b. According to the enclosed Federal Emergency Management Agency's Flood Insurance Rate Map, panel number 150001-0015-C dated September 28, 1990, the project is located in Zone X (unshaded; areas determined to be outside of the 500-year flood plain).

Sincerely,

Thomas M. Uehijima, H.E.
Acting Director of Engineering

Enclosure

DOCUMENT CAPTURED AS RECEIVED

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

ZONE AH Flood depths of 1 to 3 feet (mostly areas of ponding); base flood elevations determined.

ZONE AO Flood depths of 1 to 3 feet (mostly sheet flow on sloping terrain); average depths determined; for areas of sheet flow flooding, whether the determined.

ZONE A99 To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500-year flood plain.

ZONE D Areas in which flood hazards are undetermined.

Legend:

- Flood Boundary
- - - Floodway Boundary
- - - Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 Base Flood Elevation Line: Elevation in Feet*
- (E) — (E) Cross Section Line
- (E) (E) Base Flood Elevation in Feet Where Uniform Within Zone*
- RM7x Elevation Reference Mark

referenced to the National Geodetic Vertical Datum of 1929


NOTES
 This map is for use in administering the National Flood Insurance Program; it does not necessarily identify an area subject to flooding.

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP


CITY AND COUNTY OF HONOLULU, HAWAII

PANEL 15 OF 135
 (SEE MAP INDEX FOR PANELS NOT PRINTED)



PANEL LOCATION
COMMUNITY-PANEL NUMBER
 150001 0015C

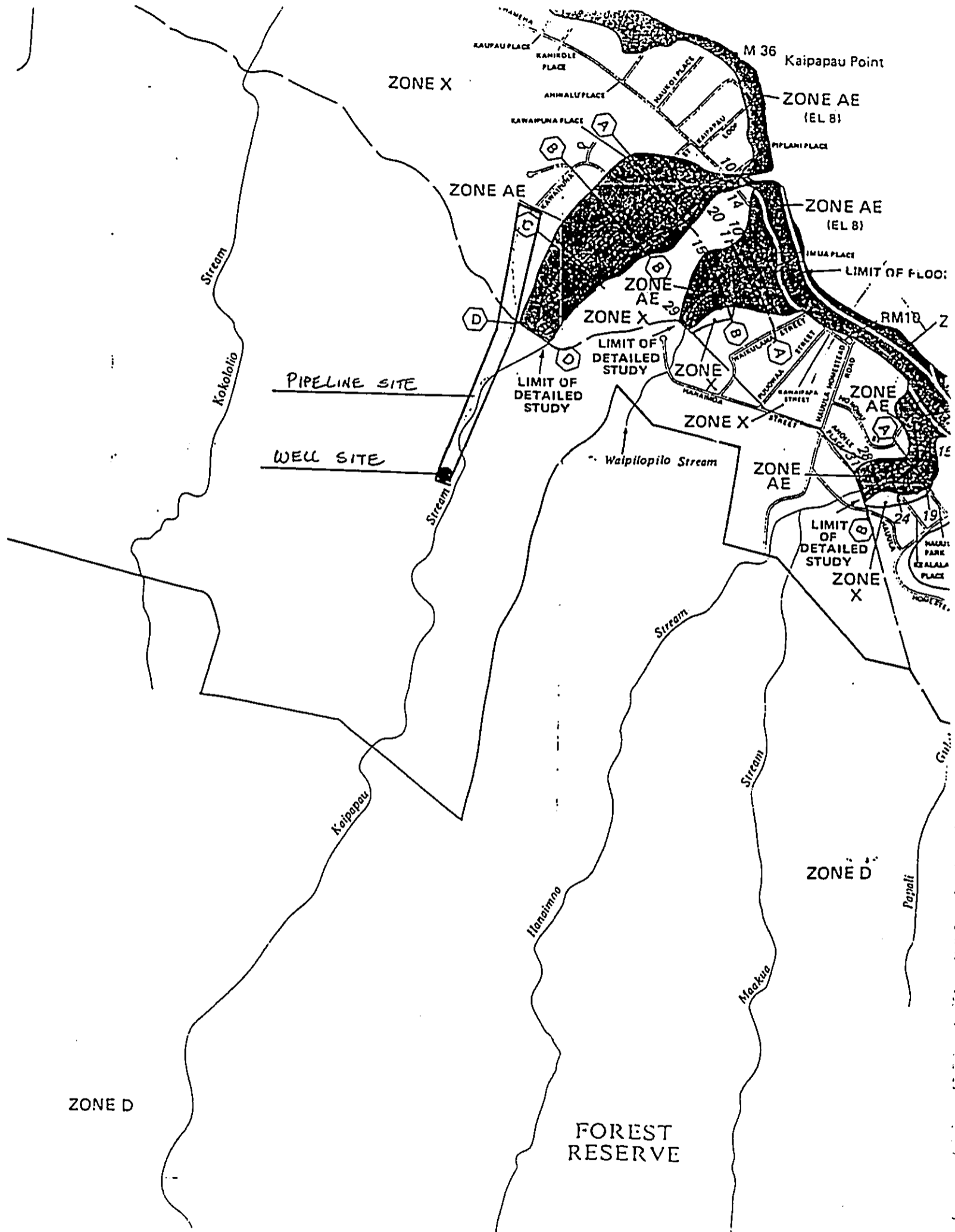
MAP REVISED:
 SEPTEMBER 28, 1990



Federal Emergency Management Agency

CUSTOMER COPY

DOCUMENT CAPTURED AS RECEIVED





United States
Department of
Agriculture

Soil
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

February 14, 1994

Dr. Youngki Hahn
Y.K. Hahn & Associates
1180 Kumuwaina Place
Hilo, Hawaii 96720

Dear Dr. Hahn:

Subject: Environmental Assessment - Water Well and Pipeline
Kaipapa'u, Oahu TMK 5-4-4:4

The community of Hauula Oahu is sensitive to the all projects which may adversely impact the water quality of streams and the nearshore marine environment. Special precaution must be taken during construction of the access road to the proposed well site. This area is known for high intensity storms; as such, the road may increase runoff and sediment into Kaipapa'u Stream.

The Environmental Impact Statement should address the issue of soil erosion and its possible impact water quality of Kaipapa'u Stream and the nearshore marine environment. Thank you for the opportunity to provide comment. Should you have any questions, please contact Michael C. Tulang (808) 541-2606.


NATHANIEL R. CONNER
State Conservationist

cc: Michael Bajinting, District Conservationist, Honolulu Field Office



"To lead the way in helping our customers conserve, sustain, and enhance Hawaii's natural resources through efficient service of the highest quality."



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Office
P.O. Box 50167
Honolulu, Hawaii 96850



In Reply Refer To: AAP

APR 06 1994

Dr. Youngki Hahn
Y.K. Hahn & Associates
1180 N. Kumuwaina Place
Hilo, Hawaii 96720

Re: Request for environmental information for the preparation of an Environmental Assessment for a water well and pipeline at Kaipapa'u, Oahu, Hawaii TMK 5-4-4:4

Dear Dr. Hahn:

The U.S. Fish and Wildlife Service (Service) has reviewed the request for environmental information that may be incorporated in an Environmental Assessment (EA) for a permanent water well and pipeline system at Kaipapa'u Gulch, Oahu, Hawaii. The EA will identify impacts associated with the creation of a permanent well system, pipeline and access road at the Kaipapa'u site. The Service offers the following comments for your consideration.

Although our maps do not indicate the presence of rare, threatened, or endangered plant species on the project site, our National Wetlands Inventory (NWI) Maps, which designate wetland locations and types, indicate a wetland that may be affected by runoff from the construction of the access road along the Kaipapa'u Gulch. Protection of the wetland is a concern because potential habitat for migratory shorebirds and endangered waterbirds as well as water quality conditions of the Kaipapa'u Gulch may be affected. The EA should discuss all impacts associated with the road construction and provide mitigative measures if the project will impact the wetland.

We have enclosed a copy of a portion of the NWI map that indicates the wetland and its relation to the access road. The NWI maps are also available for review at our Annex Office located at Three Waterfront Plaza, 500 Ala Moana Blvd, Suite 580. If you have questions concerning this information, please contact Arlene Pangelinan at (808)/541-3441.

We appreciate the opportunity to provide these comments.

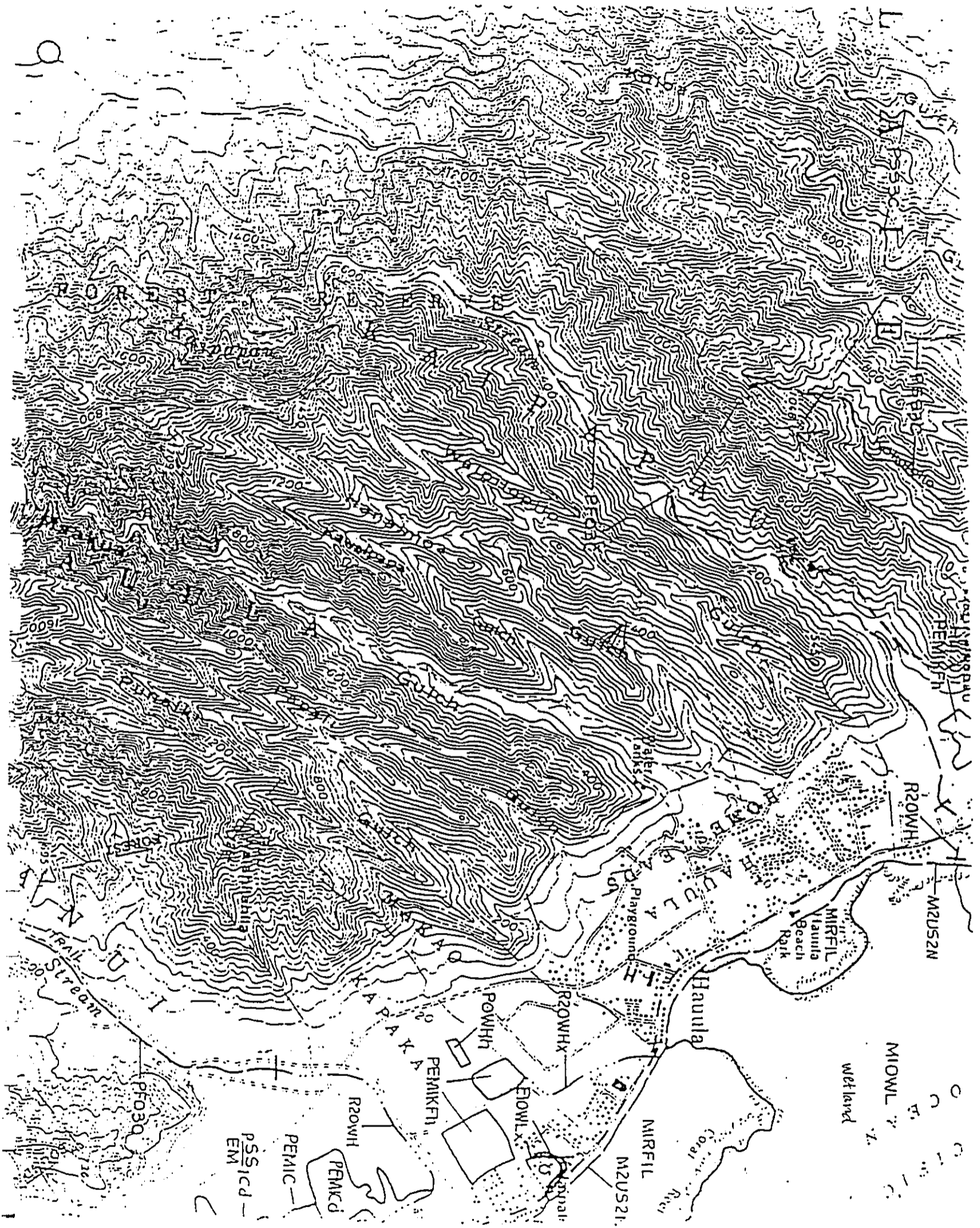
Sincerely,

Brooks Hayes

Robert P. Smith
Field Supervisor
Pacific Islands Office

Enclosure

DOCUMENT CAPTURED AS RECEIVED



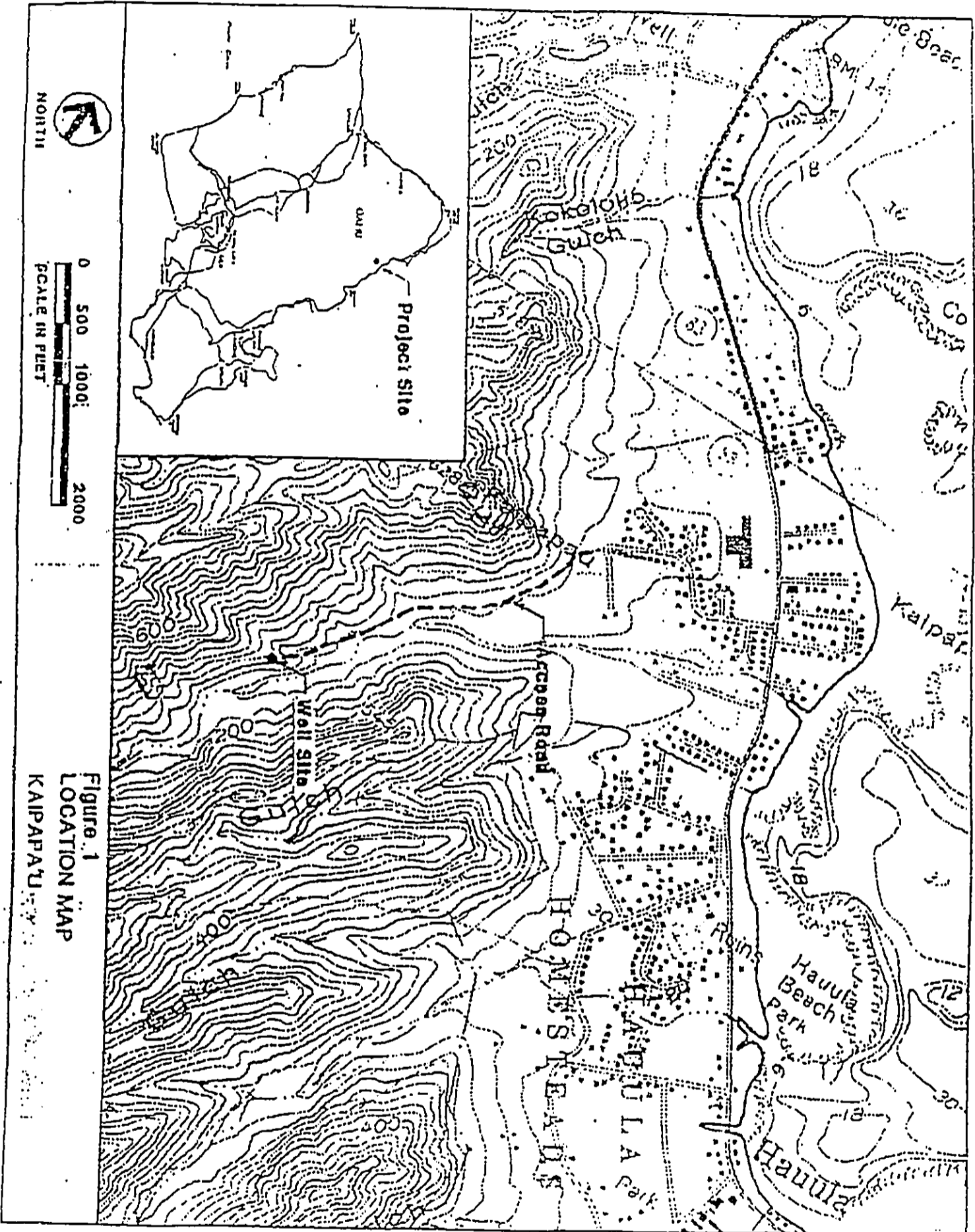


Figure 1
LOCATION MAP
KAIPAPA'U



STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813
Telephone: 587-3822

February 2, 1994

SUBJECT: Director's Referral No. 94-034-C
Letter Regarding the Draft Environmental Assessment
(EA) for Water Well and Pipeline at Kaipapau, Oahu,
Hawaii, TMK: 5-4-4: 3, 4, 24

We have reviewed the letter dated January 26, 1994,
regarding the subject draft EA and have the following comments
to offer:

1. Based on Figure 1, the Tax Map Keys for the project site and the access road are in the following State Land Use Districts:

TMK: 5-4-4: 4 State Land Use Conservation & Urban Districts

TMK: 5-4-4: 24 State Land Use Urban District

TMK: 5-4-4: 3 State Land Use Conservation & Agricultural Districts
2. We suggest that the Draft EA include a map showing the project site and access road in relation to the State Land Use Districts.
3. If the proposed project involves the use of land in the State Land Use Conservation District, we suggest that a request for a Boundary Interpretation be submitted to our office, as this may be required as part of the Department of Land and Natural Resources Conservation District Use Application process.
4. The first paragraph of your letter references Halaula Town, this should read Haaula Town.

We have no other comments to offer at this time.

EU:KM:th



DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT & TOURISM

Central Pacific Plaza, 220 South King Street, 11th Floor, Honolulu, Hawaii
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804 Telephone: (808) 586-2406 Fax: (808) 586-2377

JOHN WAJH
Governor
MUFU HANNEMANN
Director
JEANNE K. SCHL
Deputy Director
RICK EGG
Deputy Director
TAKESHI YOSHIHARA
Deputy Director

February 14, 1994

Youngki Hahn, Ph. D.
Principal
Y.K. Hahn & Associates
1180 N. Kumuwaina Place
Hilo, Hawaii 96720

Dear Dr. Hahn:

The Department of Business, Economic Development & Tourism is pleased to submit the enclosed comments on the Draft Environmental Assessment for Water Well and Pipeline at Kaipapau.

The comments were provided by the Land Use Commission. Questions regarding these comments may be directed to Esther Ueda, LUC Executive Officer, at 587-3826.

Thank you for the opportunity to comment.

Sincerely,


Mufu Hannemann

Enclosure

JOHN WAIHEE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

March 10, 1994

KEITH W. I. I., CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

JOHN P. KEPPELER, II
DONA L. HANAIKE

AQUACULTURE DEVELOPMENT
PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN
RECREATION
CONSERVATION AND
ENVIRONMENTAL AFFAIRS
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
PROGRAM
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

Ron Terry, Ph.D.
Y.K. Hahn & Associates
1180 North Kumuwaina Place
Hilo, HI 96720

Dear Mr. Terry:

Subject: EA Water Will and Pipeline at Kaipapa'u Oahu,
Hawaii, TMK: 5-4-4:4

As per your January 13, 1994, there are two hiking trails in
the area that are used by hunters. Enclosed is a description of
the two trails in the area.

If you have any questions, please do not hesitate to write
or call my staff member Christina Meller by dialing governor's
toll free 1-800-468-4644 extension 7-0058.

Sincerely,

A handwritten signature in cursive script, appearing to read "Michael G. Buck".

MICHAEL G. BUCK
Administrator

Enclosure

cc: Curt Cottrell
Wayne Ching

NA ALA HELE TRAIL AND ACCESS INVENTORY

Island: Oahu
Map: 08
District: Koolauloa

Trail #: OA 08 014
Pub. Access: N

Popular Name: Kaipapau Ridge (Kahuku)
Local Name: None
Owner: Corporate, State
Manager: Plumbers 675, Zion, DOFAW
Start: Kaipapau Gulch
End: Kaipapau Ridge to Bunker
Start Access: Foot
Transport: Foot
Climate: Mild

Source:
Year: Unknown
Start TMK: 1-5-4-04:4
End TMK: 1-5-4-06:1
Network: N
Length: 2.00
Elev. Range: 2400
Standard: Difficult
Condition: Unmaint.

Features: Hike, Nature Study, Hunt
Amenities: None
Hazards: Footing, Hunters, Cliffs
Restrictions: Private Access
Comments: No distinct trail - F.R. access

emo:

CORRECTION

THE PRECEDING DOCUMENT(S) HAS
BEEN REPHOTOGRAPHED TO ASSURE
LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

NA ALA HELE TRAIL AND ACCESS INVENTORY

Island: Oahu
County: O8
District: Koolauloa

Trail #: OA 08 014
Pub. Access: N

Popular Name: Kaipapau Ridge (Kahuku)
Local Name: None
Owner: Corporate, State
Manager: Plumbers 675, Zion, DOFAW
Start: Kaipapau Gulch
End: Kaipapau Ridge to Bunker
Start Access: Foot
Transport: Foot
Climate: Mild

Source:
Year: Unknown
Start TMK: 1-5-4-04:4
End TMK: 1-5-4-06:1
Network: N
Length: 2.00
Elev. Range: 2400
Standard: Difficult
Condition: Unmaint.

Features: Hike, Nature Study, Hunt
Utilities: None
Hazards: Footing, Hunters, Cliffs
Restrictions: Private Access
Comments: No distinct trail - F.R. access

emo:

DOCUMENT CAPTURED AS RECEIVED

NA ALA HELE TRAIL AND ACCESS INVENTORY

<u>Island:</u>	Oahu	<u>Trail #:</u>	OA 08 015
<u>Quad:</u>	08	<u>Pub. Access:</u>	N
<u>District:</u>	Koolauloa		
<u>Popular Name:</u>	Kaipapau Gulch Trail	<u>Source:</u>	.
<u>Trad. Name:</u>	Kaipapau Gulch	<u>Year:</u>	Unknown
<u>Owner:</u>	Corporate, State	<u>Start TMK:</u>	1-5-4-04:4
<u>Manager:</u>	Plumbers 675, Zion, DOFAW	<u>End TMK:</u>	1-5-4-06:1
<u>Start:</u>	End Kawaipuna Rd.	<u>Network:</u>	Y
<u>End:</u>	Waterfall	<u>Length:</u>	5.00
<u>Start Access:</u>	2-wheel drive	<u>Elev. Range:</u>	50
<u>Transport:</u>	Foot	<u>Standard:</u>	Moderate
<u>Climate:</u>	Mild	<u>Condition:</u>	Unmaint.
<u>Features:</u>	Hike, Nature Study, Hunt, Stream		
<u>Amenities:</u>	None		
<u>Hazards:</u>	Floods, Hunters, Footing		
<u>Restrictions:</u>	Private Access		
<u>Comments:</u>	Access under negotiation. No distinct tr		
<u>emo:</u>	Possible public access from ridge (Hauula Loop) - steep.		



University of Hawaii at Manoa

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawaii 96822
Telephone: (808) 956-7361

February 16, 1994
EA:00044

Mr. Ron Terry
Y. K. Hahn & Associates
1180 North Kumuwaina Place
Hilo, Hawaii 96720

Dear Mr. Terry:

Pre-Assessment Consultation
(Kaipapau) Water Well and Pipeline
Kaipapau, Oahu

This project involves the creation of a permanent well system, pipeline, and access road at the Kaipapau site.

Our review was prepared with the assistance of Chris Welch of the Environmental Center.

The site you are tasked with assessing seems to have been the focus of a recent Environmental Impact Statement (EIS). In an adjacent area the Board of Water Supply proposed construction of a reservoir and booster station. Although the Final EIS has not been published, the Draft EIS addresses many of the issues pertinent to the area. The Draft EIS is titled "Hauula 180 Reservoir and Booster Station," (TMK 5-4-4:4 and TMK 5-4-19:54). It was prepared by Engineering Design Group, Inc., 1525 Young Street, Honolulu, Hawaii 96826. We have also attached a copy of our review of the Draft EIS for your information.

Thank you for the opportunity to assist in the consultation.

Sincerely,

A handwritten signature in cursive script that reads "Jacquelin N. Miller".

Jacquelin N. Miller
Associate Environmental Coordinator

cc: OEQC
Roger Fujioka
Chris Welch



172.1/11/1993

University of Hawaii at Manoa

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawaii 96822
Telephone: (808) 956-7361

January 7, 1993
RE:0616

Mr. Bert Kuioka
Honolulu Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii'i 96843

Dear Mr. Kuioka:

Draft Environmental Impact Statement (DEIS)
Hau'ula 180 Reservoir and Booter Station
Ko'olauloa, O'ahu

This project proposes to construct a 1.0 million-gallon (MG) reservoir with booster pump station, access roadway from Kawaipuna Street, transmission mains and other appurtenant features to connect the reservoir to the existing water system. This reservoir is needed to: 1) adjust for the normal daily fluctuations which occur in demand; (2) to provide enough capacity for fire fighting; and (3) to stabilize water pressure in the existing water system by controlling pressure surges in major water transmission mains which occur when pumps are turned on and off and to keep transmission mains full of water when pumps are turned off. Mitigative measures are proposed to reduce construction-related fugitive dust and to limit the hours of construction. The developers intend for the completed reservoir to be painted with a color that blends well with the surrounding environment.

The Environmental Center has reviewed the referenced DEIS with the assistance of Paul Ekern, (Emeritus) Water Resources Research Center; and Alex Buttaro of the Environmental Center.

Visual Resources

- 1) What color will the reservoir be painted to best blend with the surrounding environment?
- 2) Are the reservoir and road expected to be aesthetically comparable to the existing landscape?
- 3) Is painting of the reservoir expected to totally mitigate the adverse visual impact this project will have?

4) Why did the Summary of Unavoidable Impacts neglect to mention visual impacts (page V-1)?

5) We acknowledge that painting the reservoir may help to mitigate some visual impacts in the short-term, but has consideration been given to the possibility of landscaping the road and reservoir with trees and shrubs as a long-term mitigative strategy?

Archaeology

The archaeological inventory survey report (Appendix B) states with regard to apparent terracing, "the talus has stabilized into what often appears on initial examination to be constructed stacking but upon close examination it becomes evident are natural erosion terraces" (Appendix B, page B14).

1) What evidence did "close examination" of the terraces yield that led to the conclusion that they were natural?

2) Is it possible that manmade terraces may appear natural after hundreds of years of erosion and talus sedimentation from natural processes?

3) How might natural terraces be differentiated from man-made terraces that have been subject to physically altering erosion and sedimentation processes?

The archaeology reports recommends that an archaeologist monitor construction excavation during the phases leading from the project start line of the existing road for the first 1200 feet of the access road and that an archaeologist be on standby for the remainder of subsurface activities (Appendix B, page B19-B20).

4) Does the developer intend to implement these recommendations?

Water Quality

The DEIS states that "the proposed reservoir will be used to store and improve the distribution capability for the existing water system in the area but does not involve the additional withdrawal of water" (page II-4).

1) Is it possible that the withdrawal rates of wells feeding this reservoir will increase at times, due to the additional storage and usage capacity provided?

2) How is the water balance of this area expected to be affected?

3) How is the development of Kaipapa'u well connected to this reservoir?

4) Considering the possible indirect impacts associated with possible increased use due to increased capacity and the extent to which the increased use will increase pumpage of aquifer sources, what are the

Mr. Bert Kuiuoka
January 7, 1993
Page 3

potential impacts to those streams and aquifers which are in various ways interrelated to the project (e.g. dewatering, sustainable yields)?

This DEIS states that "the proposed project's impact is sufficiently far from Kaipapau Stream that no impacts to the stream are anticipated; no construction debris or graded material will enter the stream" (pages IV-1 to page IV-2).

5) Our reviewers note that the proposed road runs along Kaipapa'u, and appears to be within approximately 75 feet of the stream. How far are the access road and reservoir from the stream?

6) Why is the project considered sufficiently far from the stream so as not to entail impacts?

7) How might adverse impacts resulting from erosion be mitigated?

This DEIS mentions that the proposed project is part of the Windward O'ahu Regional Water System, yet does not expound on their interrelationship and the extent to which this project participates in the cumulative impacts of the Windward O'ahu Regional Water System.

8) To what extent and in what ways does this project contribute and interrelate to the cumulative environmental impacts of the Windward O'ahu Regional Water System Improvements?

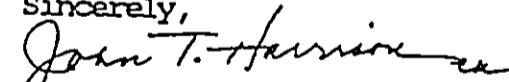
9) Might this project have any "downstream" effects on adjacent and interrelated stream flows, durations, fauna, or uses, and if so, what possibilities exist?

Summary

This DEIS appears to adequately address many of the potential impacts associated with the proposed development. However, our reviewers expressed concern that aquifer pumpage and use may increase as a result of the increased storage capacity. If increased use is a possibility, this EIS should better assess the cumulative effects this reservoir may have on adjacent and interrelated resources.

Thank you for the opportunity to review this document and we hope our comments are helpful.

Sincerely,


John T. Harrison, Ph.D.
Environmental Coordinator

cc: OEQC
Edgar Lee, Engineering Design Group, Inc.
Roger Fujioka
Paul Ekern
Dave Penn
Alex Buttarro

Final Environmental Assessment

Kaipapa`u Well and Associated Facilities

APPENDIX 1B

COMMENT LETTERS ON DRAFT EA AND RESPONSES

BENJAMIN J. CAYETANO
Governor of Hawaii



952632

Chairperson
MICHAEL D. WILSON
Board of Land and Natural Resources

RECEIVED
BD OF WATER SUPPLY

AUG 30 1 00 PM '95

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

Deputy Director
GILBERT COLOMA-AGARAN

Aquaculture Development
Aquatic Resources
Boating and Ocean Recreation
Bureau of Conveyances
Conservation and Environmental Affairs
Conservation and Resources Enforcement
Forestry and Wildlife
Historic Preservation
Land Management
State Parks
Water and Land Development

P. O. Box 621
Honolulu, Hawaii 96809

ref: OCEA/DH
file no. 96-076

AUG 28 1995

The Honorable Raymond H. Sato
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Sato,

Subject: Draft Environmental Assessment for the Proposed Kaipap'u Well at
Kaipapau, Oahu, TMK 5-5-4: 4

Our Division of Aquatic Resources offer the following comments on the subject
environmental assessment:

We are concerned that this proposed project may have deleterious effects on the stream
ecology of Kaipapau stream by impacting the stream flow. Further biological surveys are
necessary to determine what other native freshwater fish and insect species are present.
The further collection of hydrologic data and gaging of the stream is necessary to
determine whether the exploratory well will have an effect on stream flow and the
stream estuary.

Our Office of Conservation and Environmental Affairs advises you to file a new
Conservation District Use Application for this permanent well and associated
development in the Conservation District.

An amendment to the interim instream flow standard will also be required.

Please contact the Office of Conservation and Environmental Affairs at 587-0377 if there
is any question on this matter.

Aloha,

Michael D. Wilson, Chairperson

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843



March 6, 2001

JEREMY HARRIS, Mayor

EDDIE FLORES, JR., Chairman
CHARLES A. STED, Vice-Chairman
JAN M.L.Y. AMII
HERBERT S.K. KAOPUA, SR.
BARBARA KIM STANTON

BRIAN K. MINAJI, Ex-Officio
ROSS S. SASAMURA, Ex-Officio

CLIFFORD S. JAMILE
Manager and Chief Engineer

Mr. Gilbert Coloma-Agaran, Chairperson
Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Attention: Division of Aquatic Resources

Dear Mr. Coloma-Agaran:

Subject: Draft Environmental Assessment for the Proposed Kaipapa'u Well,
Breaker Reservoir, Control Station, Pipeline, and Access
Road Development at Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 04

Thank you for your letter regarding the Draft Environmental Assessment for the proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development at Kaipapa'u, Oahu. We apologize for the delay in our response to your comment letter.

We have the following response to your comments:

1. We recognize the pristine nature of Kaipapau Stream and its importance as one of the most important watersheds for the preservation of native biota on Oahu and also for the State of Hawaii. Due to the presence of rare native species such as the o'opu nakea and o'opu napili, and the Oceanic Hawaiian damselfly, which is a Category I candidate for federal listing, we have prepared a native and exotic stream organisms survey of Kaipapau Stream, which is enclosed for your use. The survey revealed the high quality of Kaipapau Stream by verifying the presence of adult populations of native goby fish and an abundance of rare insect species established amidst relatively undisturbed riparian surroundings.

Mr. Gilbert Coloma-Agaran
March 6, 2001
Page 2

2. We note your concern that well pumpage may affect the stream ecology of Kaipapau Stream by impacting stream flow. In the vicinity of Kaipapau Well, temporary or permanent water tables may occur in the alluvium but are perched over 100 feet above and, therefore, are not connected with the underlying dike basal conditions of Kaipapau Well where the water table is 17 feet above sea level. Kaipapau Stream is perched upon the coastal plain sediments and thickened alluvium in excess of 100 feet above the basal aquifer at the estuary. Therefore, withdrawals from Kaipapau Well will not affect the stream or estuary.
3. We acknowledge that a Conservation District Use Permit will be required for the proposed project prior to any construction activities. In addition, we note that an amendment to the interim instream flow standard will be required.

If you have any questions, please contact Scot Muraoka at 527-5221.

Very truly yours,



FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

Enclosure

SM: is
cc: B. Usagawa

95-2434



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Office

P.O. Box 50167

Honolulu, Hawaii 96850

Tel: (808) 541-3441 Fax: (808) 541-3470

TAKE
PRIDE IN
AMERICA

Mar F
Dep
FE

AUG 30 1995

In Reply Refer To: AAP

AUG 24 1995

Mr. Raymond H. Sato
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Re: May 1995 Draft Environmental Assessment for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline and Access Road Development at Kaipapa'u, Oahu, Hawaii TMK: 5-4-4:4

Dear Mr. Sato:

The U.S. Fish and Wildlife Service (Service) has reviewed the May 1995 draft Environmental Assessment (EA) for the proposed Kaipapa'u well, breaker reservoir, control station, pipeline and access road development at Kaipapa'u, Oahu, Hawaii. The project sponsor is the City and County of Honolulu Board of Water Supply (BWS). The Service offers the following comments for your consideration.

The purpose of the draft EA is to address specific environmental conditions and the potential impacts to the Kaipapa'u area resulting from the conversion of an existing exploratory well into a production well. The project features include a permanent well site, access road, a well/reservoir pad, a control building, a pump building, a 10,000 gallon concrete breaker reservoir, improvements to the existing access road, and additional grading and trenching on the current temporary access road and well pad.

Kaipapa'u Stream is a nearly pristine Hawaiian stream, with no alien fishes and several rare native species. It contains excellent habitat in the upper reaches for two species of native gobies, the 'o'opu nākea (*Awaous guamensis*) and the 'o'opu nāpili (*Sicyopterus stimpsoni*), and an aquatic insect, the Oceanic Hawaiian damselfly (*Megalagrion oceanicum*), which is a Category 1 candidate for federal listing. These species could be adversely affected by reductions in stream flow, siltation in the stream reaches, and/or changes in water quality at the stream mouth. Because the gobies' life cycles involve larval transit through the lower stream and estuary, these species are especially sensitive to degradation of these habitats.

DOCUMENT CAPTURED AS RECEIVED

Draft EA
Kaipapa'u Well and Associated Features
Kaipapa'u, Hawaii

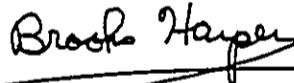
The Service is concerned that inadequate data exist to determine the effects of the project on the native aquatic fauna. Although the habitat for the damselfly and the adult gobies is above the tapped aquifer and should be unaffected by well withdrawals, the basal aquifer may contribute water to the estuary. If basal aquifer input is present in the estuary, reduction in that input due to pumping could adversely affect transiting larvae and reduce the populations of native stream animals. Data on salinity levels and indicators of aquifer input to the estuary should be presented to support the BWS's contention that the contribution of basal water to the estuary of Kaipapa'u Stream is negligible.

The Service cannot adequately evaluate impacts to the aquatic communities from implementation of the proposed project until review of additional hydrologic data can verify that withdrawals from the proposed well will not affect the stream or estuary.

With regard to sedimentation, the mitigation measures listed in the draft EA, if closely followed, should minimize or eliminate sedimentation in the stream bed during and after construction. An additional mitigative measure, not mentioned in the draft EA, would be to confine construction activities to the dry season.

We appreciate the opportunity to comment. If you have questions regarding these comments, please contact Fish and Wildlife Biologists Arlene Pangelinan or Jeff Burgett at 808/541-3441.

Sincerely,



Brooks Harper
Field Supervisor
Ecological Services

cc: DAR, Honolulu

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843



March 1, 2001

JEREMY HARRIS, Mayor

EDDIE FLORES, JR., Chairman
CHARLES A. STED, Vice-Chairman
JAN M.L.Y. AMII
HERBERT S.K. KAOPUA, SR.
BARBARA KIM STANTON

BRIAN K. MINAII, Ex-Officio
ROSS S. SASAMURA, Ex-Officio

CLIFFORD S. JAMILE
Manager and Chief Engineer

Mr. Brooks Harper, Field Supervisor
United States Department of the Interior
Fish and Wildlife Service
P. O. Box 50167
Honolulu, Hawaii 96850

Dear Mr. Harper:

Subject: Draft Environmental Assessment for the Proposed Kaipapa'u Well,
Breaker Reservoir, Control Station, Pipeline, and Access Road
Development at Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 04

Thank you for your letter regarding the Draft Environmental Assessment (EA) for the proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development at Kaipapa'u Oahu. We apologize for the delay in our response to your comment letter.

We have the following response to your comments:

1. We acknowledge the pristine nature of Kaipapau Stream and its importance as one of the most important watersheds for the preservation of native biota on Oahu and also for the State of Hawaii. Due to the presence of rare native species such as the o'opu nakea and o'opu napili, and the Oceanic Hawaiian damselfly, which is a Category I candidate for federal listing, we have prepared a native and exotic stream organisms survey of Kaipapau Stream, which is enclosed for your use. The survey revealed the high quality of Kaipapau Stream by verifying the presence of adult populations of native goby fish and an abundance of rare insect species established amidst relatively undisturbed riparian surroundings.
2. Due to the presence of many rare aquatic species, we recognize your concerns regarding the potential impacts of the well project on the native stream biota. We note your concern that well pumpage may affect the basal aquifer which may, in turn, contribute water to the estuary. In the vicinity of Kaipapau Well, temporary or permanent water tables may occur in the alluvium but are perched over 100 feet above and, therefore, are not connected with the underlying dike basal conditions of Kaipapau Well where the water table is 17 feet above sea level. Kaipapau Stream is perched upon the coastal plain sediments and thickened

Mr. Brooks Harper
March 1, 2001
Page 2

alluvium in excess of 100 feet above the basal aquifer at the estuary. Therefore, withdrawals from Kaipapau Well will not affect the stream or estuary.

3. The Final EA will incorporate your additional mitigative measure to confine construction activities to the dry season to further minimize potential construction impacts.

If you have any questions, please contact Scot Muraoka at 527-5221.

Very truly yours,



FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

Enclosure

SM:vk
cc: B. Usagawa

05-2595

DOCUMENT CAPTURED AS RECEIVED



RECEIVED
AUG 9 1995

University of Hawai'i at Mānoa KAHARA, & ASSOC., INC.

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

August 4, 1995
EA:0126

Mr. Barry Usagawa
City and County of Honolulu
Board of Water Supply
630 South Beretania
Honolulu, Hawaii 96843

Dear Mr. Usagawa:

COPY
ORIGINAL FILED
IN 92034

Draft Environmental Assessment
Kaipapau Well
Kaipapau, Oahu

The City and County of Honolulu Board of Water Supply proposes to convert the Kaipapau Exploratory Well to a production facility. The well site will consist of a control building, a pump building, a 10,000 gallon concrete breaker reservoir, and an access road. The well, which is located on the north slope of Kaipapau Gulch, mauka of Hauula town, will have a capacity of one million gallons per day (mgd).

We reviewed this Draft Environmental Assessment (EA) with the assistance of Paul Ekern, Emeritus, Agronomy and Soil Science; and Paul Berkowitz of the Environmental Center.

Hydrological Effects

Since the exploratory well was drilled in 1993, we assume that the Board of Water Supply has performed the necessary pump tests to examine the potential effects of the proposed withdrawal of water on the surrounding hydrological features. Unfortunately, none of this information is presented in the Draft Environmental Assessment. We do note that the stream is of unique quality and exceptionally pristine, making the need to carefully assess the impacts of withdrawal even more important. Has stream flow been monitored during pump tests? Has the water level in nearby wetlands been examined during pump tests? These types of questions surely need to be addressed to determine whether the production well is likely to affect adjacent hydrological features. If these

Mr. Barry Usagawa
August 4, 1995
Page 2

sorts of studies were carried out, then the results need to be presented in the Draft EA. If they have not been undertaken, then this document should be withdrawn until the pertinent information becomes available. Given that a determination of the potential environmental significance of the development of this well will be greatly influenced by its impacts on flora, fauna, and hydrological features, it is essential that the various impacts to the stream be documented.

Erosion

Section 2.1.1 discusses the "chemical weathering and mass wasting of the side walls of the canyon." Later in Section 6, the Draft EA concludes that the site is not in an environmentally sensitive area such as an erosion-prone area. These two sections appear inconsistent and require further clarification.

Soil Stability

Section 3.2.2 mentions the problems with soil stability, yet fails to identify what soils are present. Given that the issue of soil stability is unresolved and that the Board of Water Supply has hired a geotechnical consultant, it seems vital to include information on the soil types and their properties in the Environmental Assessment.

Seismic Hazards

In terms of hazards, the seismic dangers should always be discussed for any infrastructure project. This pertains especially to the reservoir portion of the proposed project.

Fog Drip

When considering the water balance for the area, fog drip particularly in the upper reaches probably should be mentioned. ~~This is often an important factor on the~~ windward side of the Hawaiian islands.

Conclusion

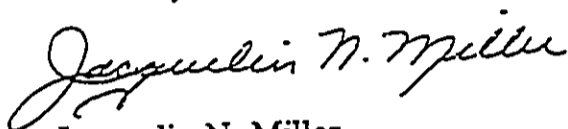
In summary, we are most concerned about the potential hydrological impacts of the proposed project. If stream flow or wetland water supplies are impacted, then the proposed project may entail significant environmental consequences, as outlined in Section 11-200-12 of the Hawaii Administrative Rules. According to this section, it appears that the project may (1) "involve a substantial degradation of environmental quality," and (2) "affect an environmentally sensitive area." Before continuing further with the project, these potential impacts need to be addressed and clarified. It is

Mr. Barry Usagawa
August 4, 1995
Page 3

essential that findings in this EA be supported with experimental data from pump tests. Further clarifications should also be included in the areas of erosion, soil stability, seismic hazards, and fog drip.

Thank you for the opportunity to review this Draft EA.

Sincerely,



Jacquelin N. Miller
Associate Environmental Coordinator

cc: OEQC
Roger Fujioka
Glen Suzuki ✓
Paul Ekern
Paul Berkowitz

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843



COPY

December 30, 2005

MUFI HANNEMANN, Mayor

EDDIE FLORES, JR., Chairman
HERBERT S. K. KAOPUA, SR.
DAROLYN H. LENOIO
RANDALL Y. S. CHUNG
SAMUEL T. HATA

RODNEY K. HARAGA, Ex-Officio
LAVERNE HIGA, Ex-Officio

DONNA FAY K. KIYOSAKI
Deputy Manager and Chief Engineer

Ms. Jacquelin N. Miller
Associate Environmental Coordinator
University of Hawaii at Manoa
Environmental Center
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

COPY
ORIGINAL FILED

92034
RECEIVED

JAN 5 - 2006
OKAHARA, & ASSOC., INC.

Dear Ms. Miller:

IN 92034 B

Subject: Draft Environmental Assessment for the City and County of Honolulu Board of Water Supply's Kaipapau Well, Kaipapau, Oahu, Hawaii

Thank you for your comments regarding the Draft Environmental Assessment (EA) for the Kaipapau Well production facility. We apologize for the inconvenience of our delayed response.

The Kaipapau Well project was placed on hold over this time period while we updated the Oahu Water Management Plan. We have revised our planning approach to create watershed management plans for each of the 8 sustainable community and development plan areas established in the Oahu county general plan. This holistic approach centers on sustainability; including watershed protection, management, conservation, restoration as well as water use and development. The State Commission on Water Resource Management (CWRM) approved our watershed management plan approach and scope on March 17, 2004.

We have re-evaluated our sources in the Koolauloa water management area and plan to optimize pumpage, in part, by redistributing existing permitted use among several wells to minimize aquifer impacts, especially to our large sources in Punalu'u. This multi-faceted approach consists of advanced conservation, leak detection and repair and new wells. Under this plan, existing permitted use will be transferred from other sources within the Koolauloa water management area.

1. Hydrological Effects

We acknowledge your note of the unique and pristine nature of the Kaipapau Stream. The Draft EA states that the effects of water withdrawals from the proposed project on flow in Kaipapau Stream are expected to be negligible because of the intermittent nature of the stream. Geological data obtained during drilling of the test well indicated that the underlying

aquifer being tapped by the well is not hydraulically connected to the stream in the mid-valley. During long-term pump testing, there was no streamflow to monitor in the vicinity of the well. The water level in the estuary, located approximately 0.75 miles downgradient, was not significantly affected during the pump testing, owing to the distance and the overlying caprock formations near the coast.

Section 2.1.3, Flora and Fauna: The Draft EA indicates that the nearby wetlands are unrelated hydrologically, to the Koolauloa aquifer. According to the U.S. Fish and Wildlife Service's National Wetlands Inventory maps illustrated in Appendix 1 of the Draft EA, a wetland of approximately 10 acres in size is located approximately 200 feet north of Kaipapau Stream at an elevation of approximately 30-40 feet above mean sea level. The difference in the static water level of wellhead (17 feet above sea level) and the wetland (which is located higher than 30 feet above sea level) indicates that the wetland may derive its flow from upslope sources unrelated to the aquifer. A biological stream survey was conducted for Kaipapau Stream in the interim, which will be appended to the Final EA.

2. Erosion

Chemical weathering and mass wasting were mentioned in Section 2.1.1 in order to explain the geomorphological origin of the valley in which the project is located. The Final EA will indicate that the specific project site has been evaluated as not particularly susceptible to mass wasting hazards although these processes are ongoing in the valley. A slope hazard survey will be conducted during the project design as part of the grading and erosion control plan.

3. Soil Stability

Soil types are listed and discussed in Section 2.1.1.

4. Seismic Hazards

The Final EA will contain a discussion of the seismic context of the site location and list the appropriate engineering considerations.

5. Fog Drip

Section 2.1.2 has been revised to include a statement that fog drip also contributes surface water to the drainage basin.

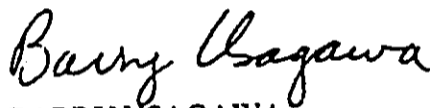
Ms. Jacquelin N. Miller
December 30, 2005
Page 3

6. Conclusion

We acknowledge your concerns about the potential hydrological impacts of the proposed project. However, we have evaluated the related issues and maintain that the proposed project will not have significant environmental effects. We will continue to work with the State Department of Land and Natural Resources and the Commission on Water Resource Management and comply with any permitting requirements, additional studies or amendments to the interim instream flow standards, if required.

If there are any questions, please contact Scot Muraoka at 748-5942.

Very truly yours,



BARRY USAGAWA
Water Resources Principal Executive

cc: Office of Environmental Quality Control
Okahara and Associates

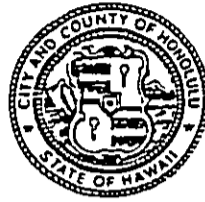
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DEPARTMENT OF TRANSPORTATION SERV. 3
CITY AND COUNTY OF HONOLULU
PACIFIC PARK PLAZA
711 KAPIOLANI BOULEVARD, SUITE 1200
HONOLULU, HAWAII 96813

SEP 8 3 14 PM '95

JEREMY HARRIS
MAYOR



CHARLES O. SWANSON
DIRECTOR

XXXXXXXXXXXX
XXXXXXXXXXXX

September 6, 1995

PL95.1.205(lw)
(TE-3278)

MEMORANDUM

TO: RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM: CHARLES O. SWANSON, DIRECTOR

SUBJECT: KAIPAPA'U WELL, BREAKER RESERVOIR, CONTROL
STATION, PIPELINE AND ACCESS ROAD
DRAFT ENVIRONMENTAL ASSESSMENT (EA)
TMK: 5-4-4-: 4

This is in response to your memorandum requesting that the Department of Transportation Services' review and comment on the subject draft EA.

Based on our review, we have no objections or comments to offer at this time.

Should you have any questions, please contact Lance Watanabe of my staff at 523-4199.

CHARLES O. SWANSON

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

September 18, 1995

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IN 92034

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SEP 19 1995

OKAHARA, & ASSOC., INC.

TO: CHARLES O. SWANSON, DIRECTOR
DEPARTMENT OF TRANSPORTATION SERVICES

FROM: *For* RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY 

SUBJECT: YOUR MEMORANDUM OF SEPTEMBER 6, 1995 REGARDING THE
DRAFT ENVIRONMENTAL ASSESSMENT (EA) FOR THE PROPOSED
KAIPAPA'U WELL, BREAKER RESERVOIR, CONTROL STATION, PIPELINE
AND ACCESS ROAD DEVELOPMENT AT KAIPAPA'U, OAHU, HAWAII,
TMK: 5-4-4:04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development at Kaipapa'u.

We acknowledge that you have no objections or comments to the proposed project.

If you have any questions, please contact Barry Usagawa at 527-5235.

cc: Okahara & Associates, Inc.

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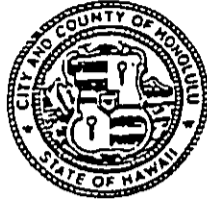
FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU

3375 KOAPAKA STREET, SUITE H425
HONOLULU, HAWAII 96819-1869

952068
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JUL 14 3 32 PM '95

JEREMY HARRIS
MAYOR



ANTHONY J. LOPEZ, JR.
FIRE CHIEF
ATTILIO K. LEONARDI
FIRE DEPUTY CHIEF

July 13, 1995

TO: RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM: ANTHONY J. LOPEZ, JR., FIRE CHIEF

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED
KAIPAPA'U WELL, BREAKER RESERVOIR, CONTROL STATION,
PIPELINE AND ACCESS ROAD DEVELOPMENT AT KAIPAPA'U,
OAHU, HAWAII. TMK: 5-4-4: 4

We have reviewed the subject material provided and foresee no adverse impact in Fire Department facilities or services.

Access for fire apparatus, water supply and building construction shall be in conformance to existing codes and standards.

Should you have any questions, please call Acting Assistant Chief Alvin Tomita of our Administrative Services Bureau at 831-7775.

ANTHONY J. LOPEZ, JR.
Fire Chief

CW:ny

②

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

August 3, 1995

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OKAHARA, & ASSOC., INC.



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IN Hilo cc: 92034 (Am)

TO: ANTHONY J. LOPEZ, JR., FIRE CHIEF
HONOLULU FIRE DEPARTMENT

FROM: RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY *Raymond H. Sato*

SUBJECT: YOUR MEMORANDUM OF JULY 13, 1995 REGARDING THE DRAFT
ENVIRONMENTAL ASSESSMENT (EA) FOR THE PROPOSED KAIPAPA'U
WELL, BREAKER RESERVOIR, CONTROL STATION, PIPELINE AND
ACCESS ROAD DEVELOPMENT AT KAIPAPA'U, OAHU, HAWAII,
TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development.

We acknowledge that the proposed project will have no adverse impact to Fire Department facilities or services. Access for fire apparatus, water supply and building construction shall be in conformance to existing codes and standards.

If you have any questions, please contact Barry Usagawa at 527-5235.

✓ cc: Okahara & Assoc., Inc.

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DEPARTMENT OF WASTEWATER MANAGEMENT

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

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JEREMY HARRIS
MAYOR



FELIX B. LIMTIACO
DIRECTOR

CHERYL K. OKUMA-SEPE
DEPUTY DIRECTOR

WPP 95-345

July 13, 1995

MEMORANDUM

TO: MR. RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM: FELIX B. LIMTIACO, DIRECTOR
DEPARTMENT OF WASTEWATER MANAGEMENT

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED
KAIPAPA'U WELL, BREAKER RESERVOIR, CONTROL STATION,
PIPELINE AND ACCESS ROAD DEVELOPMENT AT KAIPAPA'U,
OAHU, HAWAII, TMK: 5-4-4:4

Hilo

We have reviewed the subject draft environmental assessment and comment as follows:

- * The City has no sewer system in the area. Thus, any private system, such as a septic tank system, falls under the jurisdiction of the Department of Health.

Thank you for the opportunity to review the subject project. Should you have any questions, please contact Keith Sugihara of the Division of Planning and Service Control at 527-5398.

Cheryl K. Okuma-Sepe
FELIX B. LIMTIACO
Director

(Handwritten mark)

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

August 4, 1995

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AUG 4 1995

OKAHARA, & ASSOC., INC.

TO: FELIX B. LIMTIACO, DIRECTOR
DEPARTMENT OF WASTEWATER MANAGEMENT ORIGINAL FILED *Helo*

FROM: *For* RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY *Barry Usagawa* IN 92034

SUBJECT: YOUR MEMORANDUM OF JULY 13, 1995 REGARDING THE DRAFT ENVIRONMENTAL ASSESSMENT (EA) FOR THE PROPOSED KAIPAPA'U WELL, BREAKER RESERVOIR, CONTROL STATION, PIPELINE AND ACCESS ROAD DEVELOPMENT AT KAIPAPA'U, OAHU, HAWAII, TMK: 5-4-4:04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development.

We acknowledge that the City has no sewer system in the area and that any private septic tank system is within the jurisdiction of the Department of Health.

If you have any questions, please contact Barry Usagawa at 527-5235.

✓cc: Okahara & Associates, Inc.

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BD OF WATER

CITY AND COUNTY OF HONOLULU

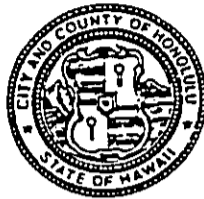
BUILDING DEPARTMENT
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

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JUL 10 1 37 PM '95

JEREMY HARRIS
MAYOR



RANDALL K. FUJIKI
DIRECTOR AND BUILDING SUPERINTENDENT
ISIDRO M. BAQUILAR
DEPUTY DIRECTOR AND BUILDING SUPERINTENDENT

PB 95-485

July 7, 1995

lit

MEMO TO: RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM: RANDALL K. FUJIKI
DIRECTOR AND BUILDING SUPERINTENDENT

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED
KAIPAPA'U WELL, BREAKER RESERVOIR, CONTROL STATION,
PIPELINE AND ACCESS ROAD DEVELOPMENT AT KAIPAPA'U,
OAHU, HAWAII, TMK: 5-4-4:4

This is in response to your memo dated July 5, 1995.

We have reviewed the draft environmental assessment for the
subject project and have no objections.

A handwritten signature in black ink, appearing to read "Randall K. Fujiki".

RANDALL K. FUJIKI
Director and Building Superintendent

cc: G. Tamashiro

J

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

August 4, 1995


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AUG 4 1995

OKAHARA, & ASSOC., INC.

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TO: RANDALL K. FUJIKI, DIRECTOR AND BUILDING SUPERINTENDENT
BUILDING DEPARTMENT

FROM: ^{For} RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY 

SUBJECT: YOUR MEMORANDUM OF JULY 7, 1995 REGARDING THE DRAFT
ENVIRONMENTAL ASSESSMENT (EA) FOR THE PROPOSED KAIPAPA'U
WELL, BREAKER RESERVOIR, CONTROL STATION, PIPELINE AND
ACCESS ROAD DEVELOPMENT AT KAIPAPA'U, OAHU, HAWAII,
TMK: 5-4-4:04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development.

We acknowledge that you have no objections to the proposed project.

If you have any questions, please contact Barry Usagawa at 527-5235.

✓ cc: Okahara & Associates, Inc.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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MICHAEL D. WILSON
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT S. COLOMA-AGARAN

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Oruy

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

July 3, 1995

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT
WATER RESOURCE MANAGEMENT

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Mr. Raymond H. Sato
Manager-Chief Engineer
City and County of Honolulu
Board of Water Supply
630 S. Beretania Street
Honolulu, HI 96843

Dear Mr. Sato:

SUBJECT: Draft Environmental Assessment for the Proposed Kaipapa'u Well,
Breaker Reservoir, Control Station, Pipeline and Access Road Development
at Kaipapa'u, Oahu, Hawaii TMK: 5-4-4: 4

We have had the opportunity to comment of the above subject matter and have the following comments:

- (1) The two trails which are mentioned in Section 2.2.3 may be low-use trails, but there is activity within the area. The trails do cross over several land ownerships. According to maps of the draft EA, the trails do come close to the service roads. I suspect you may have unwanted traffic on the service road because of this and you should be aware.
- (2) The construction of the project, should it be approved, should in no way hinder access to the trails.
- (3) Section 3.2.10 addresses the need for a fire contingency plan approved by the Division of Forestry and Wildlife prior to the construction of the project should it be approved. Thank you for addressing this important issue.

Should you have any further questions regarding our comments, please call Mr. Wayne F. Ching of my staff at 587-0166. Thank you for the opportunity to comment.

Very truly yours,

Michael G. Buck
Administrator

cc: Oahu Branch
NAH Program Manager



COPY

Clay Hule

August 3, 1995

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FAUS 7 1995

OKAHARA, & ASSOC., INC.

Mr. Michael G. Buck
Division of Forestry and Wildlife
Department of Land and Natural Resources
State of Hawaii
1151 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Buck:

Subject: Your Letter of July 3, 1995 Regarding the Draft Environmental Assessment (EA) for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline, and Access Road Development at Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development. We provide the following comments to your concerns:

1. We understand the access roadway is adjacent to existing hiking trails which may attract hikers. Although the roadway will be accessible, the well site will be secured by fencing.
2. Our contractor will be required to ensure that access to the hiking trails will not be hindered.
3. A fire contingency plan will be submitted to the Division of Forestry and Wildlife for review and approval prior to construction.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

RAYMOND H. SATO
Manager and Chief Engineer

✓cc: Okahara & Assoc., Inc.

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IN 92034

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU

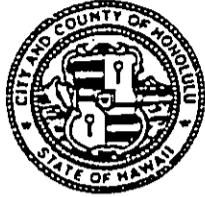
801 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96813 - AREA CODE (808) 529-3111

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JUL 18 1995 *pt*

JUL 17 09 PM '95
MAYOR

Orig Hds



MICHAEL S. NAKAMURA
CHIEF

HAROLD M. KAWASAKI
DEPUTY CHIEF

OUR REFERENCE BS-DL

July 13, 1995

TO: RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM: MICHAEL S. NAKAMURA, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED
KAIPAPA'U WELL, BREAKER RESERVOIR, CONTROL STATION,
PIPELINE, AND ACCESS ROAD DEVELOPMENT AT KAIPAPA'U,
OAHU, HAWAII, TMK: 5-4-4: 4

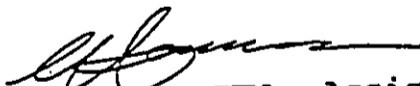
This is in response to your memorandum of July 5, 1995,
requesting comments on a draft environmental assessment for the
subject project.

This project should have no significant impact on the operations
of the Honolulu Police Department.

Thank you for the opportunity to comment.

Sincerely,

MICHAEL S. NAKAMURA
Chief of Police

By 
EUGENE UEMURA, Assistant Chief
Administrative Bureau

DOCUMENT CAPTURED AS RECEIVED

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



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Orig H/s

August 3, 1995

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AUG 7 1995

TO: MICHAEL S. NAKAMURA, CHIEF
POLICE DEPARTMENT

OKAHARA, & ASSOC., INC.

FROM: RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER,
BOARD OF WATER SUPPLY *Raymond H. Sato*

SUBJECT: YOUR MEMORANDUM OF JULY 13, 1995 REGARDING THE DRAFT
ENVIRONMENTAL ASSESSMENT (EA) FOR THE PROPOSED KAIPAPA'U
WELL, BREAKER RESERVOIR, CONTROL STATION, PIPELINE AND
ACCESS ROAD DEVELOPMENT AT KAIPAPA'U, OAHU, HAWAII,
TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development at Kaipapa'u.

We acknowledge that the proposed project should have no significant impact on the operations of the Honolulu Police Department.

If you have any questions, please contact Barry Usagawa at 527-5235.

cc: Okahara & Assoc., Inc.

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PLANNING DEPARTMENT

952360

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET.
HONOLULU, HAWAII 96813

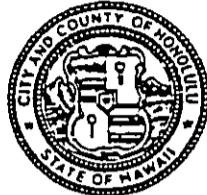
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JEREMY HARRIS
MAYOR

Orig. file



CHERYL D. SOON
CHIEF PLANNING OFFICER

CAROLL TAKAHASHI
DEPUTY CHIEF PLANNING OFFICER

MH 6/95-1243

July 21, 1995

MEMORANDUM

TO: RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM: CHERYL D. SOON, CHIEF PLANNING OFFICER
PLANNING DEPARTMENT

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (DEA) FOR THE PROPOSED
KAIPAPA'U WELL, BREAKER RESERVOIR, CONTROL STATION,
PIPELINE AND ACCESS ROAD DEVELOPMENT AT KAIPAPA'U,
OAHU, HAWAII, TAX MAP KEY: 5-4-4: 4

In response to your agency's request of June 16, 1995, we have reviewed the subject DEA and have the following comments to offer:

1. - We confirm that the subject site is designated for Preservation use on the Koolauloa Development Plan Land Use Map.
2. The Final Environmental Assessment should state that the proposed project is consistent with the Koolauloa Development Plan Public Facilities Map, which shows a symbol for a publicly funded well, site determined, within six years, for the proposed Kaipapa'u Well project (Ordinance No. 94-65).
3. We have no objections to the proposed Kaipapa'u Well project.

Should you have any questions, please contact Matthew Higashida of our staff at 527-6056.

Cheryl D. Soon
CHERYL D. SOON
Chief Planning Officer

CDS:js

cc: Y.K. Hahn & Associates
Office of Environmental Quality Control

js



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Orig. file

August 3, 1995

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AUG 7 1995

OKAHARA, & ASSOC., INC.

TO: CHERYL D. SOON, CHIEF PLANNING OFFICER
PLANNING DEPARTMENT

FROM: RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY *Raymond H. Sato*

SUBJECT: YOUR MEMORANDUM OF JULY 21, 1995 REGARDING THE DRAFT
ENVIRONMENTAL ASSESSMENT (EA) FOR THE PROPOSED KAIPAPA'U
WELL, BREAKER RESERVOIR, CONTROL STATION, PIPELINE AND
ACCESS ROAD DEVELOPMENT AT KAIPAPA'U, OAHU, HAWAII,
TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development. We provide the following response to your comments:

1. We acknowledge your confirmation that the subject site is designated for preservation use on the Koolauloa Development Plan Land Use Map.
2. The Final EA will indicate that the proposed project is consistent with the Koolauloa Development Plan Public Facilities Map, which shows a symbol for a publicly funded well, site determined, within six years, for the proposed Kaipapa'u Well project.

If you have any questions, please contact Barry Usagawa at 527-5235.

✓cc: Okahara & Assoc., Inc.

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IN 92034

BENJAMIN J. CAYETANO
GOVERNOR

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BOARD OF WATER SUPPLY

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SAM CALLEJO
COMPTROLLER

MARY PATRICIA WATERHOUSE
DEPUTY COMPTROLLER

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P. O. BOX 119, HONOLULU, HAWAII 96810

LETTER NO. (P) 1490.5

JUL 13 1995

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JUL 17 1995

Mr. Raymond H. Sato
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Attention: Mr. Barry Usagawa

Dear Mr. Sato:

Subject: Proposed Kaipapau Well, Breaker Reservoir,
Control Station, Pipeline and Access Road
Development at Kaipapau, Oahu, Hawaii
Draft Environmental Assessment

Thank you for the opportunity to review the subject document. The proposed project will have no impact on our facilities. Therefore, we have no comments to offer and would have no objection to a negative declaration being filed for this project.

If there are any questions, please have your staff contact Mr. Ralph Yukumoto of the Planning Branch at 586-0488.

Very truly yours,

Gordon Matsuoka
GORDON MATSUOKA
State Public Works Engineer

RY:jk

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

Orig Hb

August 3, 1995

Mr. Gordon Matsuoka
Department of Accounting and General Services
State of Hawaii
P. O. Box 119
Honolulu, Hawaii 96810

RECEIVED

AUG 11 1995

OKAHARA, & ASSOC., INC.

Dear Mr. Matsuoka:

Subject: Your Letter of July 13, 1995 Regarding the Draft Environmental Assessment (EA) for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline, and Access Road Development at Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development at Kaipapa'u.

We acknowledge that you have no objections to the proposed project.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

RAYMOND H. SATO
Manager and Chief Engineer

cc: Okahara & Assoc., Inc.

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IN 92034



United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P-415/95
P. O. Box 50004
Honolulu, HI
96850-0001

Hib

July 24, 1995

Mr. Barry Usagawa
Honolulu Board of Water Supply
630 South Beretania St.
Honolulu, HI 96843

Dear Mr. Usagawa:

Subject: Draft Environmental Assessment Kaipapa'u Well
Breaker Reservoir, Control Station, Pipeline and
Access Road Development at Kaipapa'u, Oahu

We have reviewed the Draft Environmental Assessment for the
project and have found that our water quality concerns have been
adequately addressed in the DEA.

Thank you for the opportunity to review the Draft Environmental
Assessment for this project.

Sincerely,

Kenneth M. Kaneshiro ACTING
KENNETH M. KANESHIRO
State Conservationist

cc: Mike Bajinting, District Conservationist, Honolulu F.O.

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

Orig. H. 6

August 3, 1995

Mr. Kenneth M. Kaneshiro
State Conservationist
United States Department of Agriculture
Natural Resources Conservation Service
P. O. Box 5004
Honolulu, Hawaii 96850-0001

RECEIVED

AUG 7 1995

OKAHARA, & ASSOC., INC.

Dear Mr. Kaneshiro:

Subject: Your Letter of July 24, 1995 Regarding the Draft Environmental Assessment (EA) for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline, and Access Road Development at Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development.

We acknowledge that your surface water quality concerns have been adequately addressed in the Draft EA.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

RAYMOND H. SATO
Manager and Chief Engineer

✓ cc: Okahara & Assoc., Inc.

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IN 92039

BENJAMIN CAYETANO
GOVERNOR

RECEIVED
BD OF WATER SUPPLY



JUL 17 1 14 PM '95

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

952084

KAZU HAYASHIDA
DIRECTOR
DEPUTY DIRECTORS
GLENN M. OKIMOTO

IN REPLY REFER TO:

STP 8.6864

Orig. Hib

July 11, 1995

Mr. Raymond H. Sato
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Sato:

Subject: Draft Environmental Assessment (DEA) for the
Proposed Kaipapa'u Well, Breaker Reservoir, Control
Station, Pipeline and Access Road Development at
Kaipapa'u, Oahu, Hawaii
TMK: 5-4-4: 4

Thank you for your letter dated July 5, 1995.

The proposed development will not impact on our state transportation facilities.

We appreciate the opportunity to provide comments.

Very truly yours,

Handwritten signature of Kazu Hayashida in cursive.
KAZU HAYASHIDA
Director of Transportation



COPY

Orig Hib.

August 4, 1995

Mr. Kazu Hayashida
Director
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

RECEIVED

AUG 7 1995

OKAHARA, & ASSOC., INC.

Dear Mr. Hayashida:

Subject: Your Letter of July 11, 1995 Regarding the Draft Environmental Assessment (EA) for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline, and Access Road Development at Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development at Kaipapa'u.

We acknowledge that the proposed project will not impact any State transportation facilities.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

RAYMOND H. SATO
Manager and Chief Engineer

cc: Okahara & Assoc., Inc.

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IN 92034

9
BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

RECEIVED
BO OF WATER SUPPLY

JUL 10 9 21 AM '95



STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801

952096

LAWRENCE MIKE
DIRECTOR OF HEALTH

JUL 10 1995
R MUR
PE

In reply, please refer to:
EMD / SOWB

Orig file

July 10, 1995

Mr. Raymond Sato
Manager and Chief Engineer
Honolulu Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Attn: Mr. Barry Usagawa

Dear Mr. Sato:

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED
KAIPAPA'U WELL, BREAKER RESERVOIR, CONTROL STATION,
PIPELINE AND ACCESS ROAD DEVELOPMENT AT KAIPAPA'U,
OAHU, HAWAII
TMK: 5-4-4: 4

Thank you for the opportunity to review and comment on the
subject document. We have examined the draft environmental
assessment (EA) and have the following comments:

1. Federal and state regulations define a public water system as a system that serves 25 or more individuals at least 60 days per year or has at least 15 service connections. All public water system owners and operators are required to comply with Hawaii Administrative Rules, Title 11, Chapter 20, Rules Relating to Potable Water Systems.
2. The draft EA indicates that the exploratory well will be converted to a production well. Section 11-20-29 of Chapter 20 requires that all new sources of potable water serving a public water system (PWS) be approved by the Director of Health prior to its use. Such an approval is based primarily upon the submission of a satisfactory engineering report which addresses the requirements set in Section 11-20-29.

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Mr. Raymond Sato
July 10, 1995
Page 2

3. The engineering report must identify all potential sources of contamination and evaluate alternative control measures which could be implemented to reduce or eliminate the potential for contamination, including treatment of the water source. In addition, water quality analyses, performed by a laboratory certified in the State of Hawaii, must be submitted as part of the report to demonstrate compliance with all drinking water standards. Additional tests may be required by the Director upon his review of the information submitted.

If you should have any questions, please contact the Safe Drinking Water Branch, Engineering Section, at 586-4258.

Sincerely,

Ann Takushi Zane

for WILLIAM WONG, P.E., Chief
Safe Drinking Water Branch
Environmental Management Division

QT:la



COPY

August 3, 1995

Mr. William Wong, P.E., Chief
Safe Drinking Water Branch
Department of Health
State of Hawaii
P. O. Box 3378
Honolulu, Hawaii 96801

RECEIVED

AUG 7 1995

OKAHARA, & ASSOC., INC.

Orig. file

Dear Mr. Wong:

Subject: Your Letter of July 10, 1995 Regarding the Draft Environmental Assessment (EA) for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline, and Access Road Development at Kaipapa'u, Oahu, Hawaii,
TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development and for providing the requirements for an acceptable engineering report.

We understand our proposed project is required to comply with the Hawaii Administrative Rules, Section 11-20-29, Rules Relating to Potable Water Systems. We shall comply with all Department of Health requirements, including the submission of an acceptable engineering report to obtain certification of the well.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

RAYMOND H. SATO
Manager and Chief Engineer

✓cc: Okahara & Assoc., Inc.

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BD OF WATER SUPPLY

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

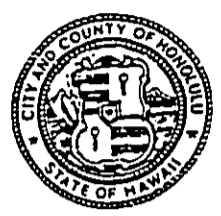
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

RES Mgr
Dep
JUL 27 1995

JUL 26 11 34 AM '95

JEREMY HARRIS
MAYOR

Hwb Craig



KENNETH E. SPRAGUE
DIRECTOR AND CHIEF ENGINEER
DARWIN J. HAMAMOTO
DEPUTY DIRECTOR
ENV 95-210

July 25, 1995

MEMORANDUM:

TO: RAYMOND SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM: *for* KENNETH E. SPRAGUE
DIRECTOR AND CHIEF ENGINEER *Just*

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (DEA)
KAIPAPAU WELL, BREAKER RESERVOIR, CONTROL STATION,
PIPELINE AND ACCESS ROAD DEVELOPMENT
TAX MAP KEY: 5-4-4: 4

We have reviewed the subject DEA and have the following comment:

The DEA should address best management practices (BMPs) to be implemented during hydrotesting of the pipeline.

Should you have any questions, please contact Mr. Alex Ho, Environmental Engineer, at Local 4150.

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AUG 14 1995

August 9, 1995

OKAHARA, & ASSOC., INC.

Hilo Originals

TO: KENNETH E. SPRAGUE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY *Raymond H. Sato*

SUBJECT: YOUR MEMORANDUM OF JULY 25, 1995 REGARDING THE DRAFT
ENVIRONMENTAL ASSESSMENT (EA) FOR THE PROPOSED KAIPAPA'U
WELL, BREAKER RESERVOIR, CONTROL STATION, PIPELINE AND
ACCESS ROAD DEVELOPMENT AT KAIPAPA'U, OAHU, HAWAII,
TMK: 5-4-4:04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development.

Best management practices such as screening and dechlorination procedures will be implemented during the hydrotesting of the pipeline to minimize potential pollution of receiving waters.

If you have any questions, please contact Barry Usagawa at 527-5235.

/cc: Okahara & Associates, Inc.

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 BD OF WATER SUPPLY DEPARTMENT OF THE ARMY
 PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
 FORT SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF 27 9 07 AM '95 July 21, 1995



PE

Planning Division

Mr. Raymond H. Sato
 Manager and Chief Engineer
 City and County of Honolulu
 Board of Water Supply
 650 South Beretania Street
 Honolulu, Hawaii 96843

Dear Mr. Sato:

Thank you for the opportunity to review and comment on the Draft Environmental Assessment for the Proposed Kaipapau Well, Breaker Reservoir, Control Station, Pipeline and Access Road Development at Kaipapau, Oahu (TMK: 5-4-4: 4). The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act.

a. Based on the information provided, a DA permit will not be required for the project.

b. The flood hazard information provided on page 21 of the draft environmental assessment is correct.

Sincerely,

Ray H. Jyo, P.E.
 Director of Engineering

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

August 22, 1995

RECEIVED
AUG 25 1995

Mr. Ray H. Jyo, P.E.
Pacific Ocean Division, Corps of Engineers
Department of the Army
Fort Shafter, Hawaii 96858-5440

OKAHARA, & ASSOC., INC.

Dear Mr. Jyo:

Subject: Your Letter of July 21, 1995 Regarding the Draft Environmental Assessment (EA) for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline, and Access Road Development at Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development at Kaipapa'u.

We acknowledge that a Department of the Army permit will not be required and the flood hazard information provided is correct.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

RAYMOND H. SATO
Manager and Chief Engineer

✓cc: Okahara and Associates, Inc.

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Benjamin J. Cayetano
GOVERNOR

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OFFICE OF WATER SUPPLY

JUL 27 9 04 AM '95



STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2380
HONOLULU, HAWAII 96804

552237
PE

HERMAN M. AIZAWA, PH.D.
SUPERINTENDENT



OFFICE OF THE SUPERINTENDENT

July 19, 1995

Mr. Raymond H. Sato
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Sato:

SUBJECT: Draft Environmental Assessment for the Proposed Kaipapa'u
Well, Breaker Reservoir, Control Station, Pipeline and
Access Road Development at
Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 4

We have reviewed the draft environmental assessment and have no
comment on the proposed well and related developments on the site.

Thank you for the opportunity to comment.

Sincerely,

Herman M. Aizawa, Ph.D.
Superintendent

HMA:jml

cc: A. Suga
R. Hiraishi

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

August 22, 1995

RECEIVED
AUG 25 1995

Mr. Herman M. Aizawa, Superintendent
Department of Education
State of Hawaii
P. O. Box 2360
Honolulu, Hawaii 96804

OKAHARA, & ASSOC., INC.

Dear Mr. Aizawa:

Subject: Your Letter of July 21, 1995 Regarding the Draft Environmental Assessment (EA) for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline, and Access Road Development at Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development at Kaipapa'u.

We acknowledge that you have no comments or objections to the proposed project.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

RAYMOND H. SATO
Manager and Chief Engineer

cc: Okahara and Associates, Inc.

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BENJAMIN J. CAYetano
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

MICHAEL D. WILSON, CHAIRMAN
BOARD OF LAND AND NATURAL RESOURCES

-456/95 DEPUTY
GILBERT COLOMA-AGARAN

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES CONSERVATION AND ENVIRONMENTAL AFFAIRS CONSERVATION AND RESOURCES ENFORCEMENT CONVEYANCES
FORESTRY AND WILDLIFE HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

August 7, 1995

Raymond H. Sato
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

LOG NO: 14917 ✓
DOC NO: 9508TD09

AUG 11 10 02 AM '95

Dear Mr. Sato:

**SUBJECT: Draft Environmental Assessment (DEA) for the Proposed Kaipapa`u Well, Breaker Reservoir, Control Station, Pipeline and Access Road Development
Kaipapa`u, Ko`olauloa, O`ahu
TMK: 5-4-4: 4**

Thank you for the opportunity to review this DEA, which includes as Appendix II an unacceptable inventory survey report (Bordner 1992). Our concerns with this report are detailed in my April 1995 letter to you (LOG NO: 14269). The meetings among our staff and with the archaeological contractors suggested in that letter are taking place. Most recently, Tom Dye of my staff met with Richard Bordner and Dave Cox at our office on August 2nd. Several of the issues noted in my letter are still outstanding. As correctly noted in the DEA at page 36, we must accept the inventory survey report and concur with significance determinations before construction begins.

If you have any questions please call Tom Dye at 587-0014.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

TD:jk

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

August 31, 1995

Mr. Don Hibbard, Administrator
State Historic Preservation Division
Department of Land and Natural Resources
State of Hawaii
33 South King Street, 6th Floor
Honolulu, Hawaii 96813

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SEP 8 1995

OKAHARA, & ASSOC., INC.

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Dear Mr. Hibbard:

Subject: Your Letter of August 7, 1995 Regarding the Draft Environmental Assessment (EA) for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline, and Access Road Development at Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development.

We acknowledge that the archaeological inventory survey report should be revised and accepted by your agency before construction begins. The inventory survey report is presently being revised for your acceptance.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

RAYMOND H. SATO
Manager and Chief Engineer

cc: Okahara and Associates, Inc.

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BD OF WATER SUPPLY

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

JUL 18 11 22 AM '95



STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801-3378

952106

PE

LAWRENCE MIIKE
DIRECTOR OF HEALTH

In reply, please refer to:
EMD/CWB

July 10, 1995

P0709HC

Mr. Raymond H. Sato
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, HI 96843

Dear Mr. Sato:

Subject: Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline and Access Road Development at Kaipapa'u, Oahu, Hawaii

The Department of Health acknowledges the receipt of your letter and Draft Environmental Assessment (EA) for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline and Access Road Development at Kaipapa'u, Oahu, Hawaii (TMK: 5-4-4:4), and has the following comments:

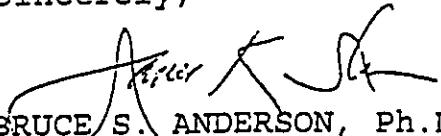
1. The applicant should contact the Army Corps of Engineers (COE) to identify whether a Federal permit (including a Department of Army (DA) permit) is required for this project. A Section 401 Water Quality Certification (WQC) is required for "Any applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters..." pursuant to Section 401(a)(1) of the Federal Water Pollution Act (commonly known as the "Clean Water Act (CWA)").
2. If the project involves the following activities with discharges into State waters, an NPDES general permit is required for each activity:
 - a. Discharge of storm water runoff associated with construction activities, including clearing, grading, and excavation that result in the disturbance of equal to or greater than five (5) acres of total land area;

Mr. Raymond H. Sato
July 10, 1995
Page 2

- b. Construction dewatering effluent;
 - c. Non-contact cooling water;
 - d. Hydrotesting water; and
 - e. Treated contaminated groundwater from underground storage tank remedial activity.
3. If there is any type of process wastewater discharge from the facility into State waters, the applicant may be required to apply for an Individual NPDES permit.

Should you have any further questions regarding this matter, please contact Ms. Hong Chen, Engineering Section of the Clean Water Branch, at 586-4309.

Sincerely,

for 
BRUCE S. ANDERSON, Ph.D.
Deputy Director for
Environmental Health

HC/sl

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

August 22, 1995

RECEIVED
AUG 25 1995

Bruce S. Anderson, Ph.D.
Deputy Director for Environmental Health
Department of Health
State of Hawaii
P. O. Box 3378
Honolulu, Hawaii 96801-3378

OKAHARA, & ASSOC., INC.

Dear Dr. Anderson:

Subject: Your Letter of July 10, 1995 Regarding the Draft Environmental Assessment (EA) for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline, and Access Road Development at Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development at Kaipapa'u. We have the following comments to your concerns:

1. The Army Corps of Engineers has indicated by letter that a Department of the Army permit will not be required for the subject project.
2. We acknowledge that an NPDES general permit will be necessary only for hydrotesting of the transmission main.
3. There will be no processed wastewater discharged from the subject project into State waters.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

RAYMOND H. SATO
Manager and Chief Engineer

Attachment

cc: Department of Health-Clean Water Branch
✓ Okahara and Associates, Inc.

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IN 92034

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

SEP 10 12 55 PM '95



SEP 20 1995

*mgr
Dep
PE*

952834

MICHAEL D. WILSON
CHAIRPERSON
ROBERT G. GIRALD
DAVID A. NOBRIGA
LAWRENCE H. MIKE
RICHARD H. COX
HERBERT M. RICHARDS, JR.
RAE M. LOUI, P.E.
DEPUTY

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P. O. BOX 621
HONOLULU, HAWAII 96809
SEP 18 1995

Mr. Raymond Sato, Manager & Chief Engineer
Honolulu Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Sato:

SUBJECT: Draft EA for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station,
Pipeline, and Access Road Development at Kaipapa'u, Oahu, Hawaii:
TMK 5-4-4:4

FILE NO.: None

Thank you for the opportunity to review the subject document. We apologize for taking so long to respond, but we normally wait until the Office of Conservation and Environmental Affairs or the Office of Environmental Quality Control forwards these documents to us. Our comments related to water resources are marked below.

In general, the CWRM strongly promotes the efficient use of our water resources through conservation measures and use of alternative non-potable water resources whenever available, feasible, and there are no harmful effects to the ecosystem. Also, the CWRM encourages the protection of water recharge areas which are important for the maintenance of streams and the replenishment of aquifers.

- [X] We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.
- [] We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.
- [X] A Pump Installation Permit from the Commission on Water Resource Management would be required before ground water is developed as a source of supply for the project.

+

- [X] The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit from the CWRM would be required prior to use of this source.
- [X] Groundwater withdrawals from this project may that affect streamflows. This may require an instream flow standard amendment.
- [] We recommend that no development take place affecting highly erodible slopes which drain into streams within or adjacent to the project.
- [] If the proposed project diverts additional water from streams or if new or modified stream diversions are planned, the project may need to obtain a stream diversion works permit and petition to amend the interim instream flow standard for the affected stream(s).
- [] Based on the information provided, it appears that a Stream Channel Alteration Permit pursuant to Section 13-169-50, HAR will be required before the project can be implemented.
- [] Based on the information provided, it does not appear that a Stream Channel Alteration Permit pursuant to Section 13-169-50, HAR will be required before the project can be implemented.
- [X] An amendment to the instream flow standard from the CWRM would be required before any streamwater is diverted.
- [X] OTHER:

This well is State Well No. 3655-03 which received a well construction permit from the Commission on 1/29/93. The well was completed on 6/4/93. According to our records the well is fitted with perforated casing from the 270 ft to 370 ft depth rather than the open hole as reported in the EA and this discrepancy should be clarified.

A pump installation permit application has yet to be submitted.

The Board applied for a water use permit on 7/29/92 which has been deferred by the Commission until the well was constructed. The well resides in the Koolauloa Ground Water Management Area on Oahu. To date, the permitting of existing uses has not been completed in this area with a major user, Hawaii Reserves Inc., going to a public hearing in November 1995.

Mr. Raymond Sato
Page 3
SEP 18 1995

Concerns about the possible affect of pumping on streamflow, thus aquatic resources, have been raised by various agencies. However, there is a lack of consensus between biologists and hydrologists on how the issue can be properly addressed. The EA states there is no stream gage data with which to determine the issue. While this may be true the Commission has a standard condition on all well construction and pump installation permits known as the aquifer pump test protocol. It is believed by staff that this protocol may aid in determining the impact of the well on the stream in lieu of a stream gage. The pump installation permit and/or water use permit will be conditioned to include this test.

We suggest that the BWS provide further information or hydrologic analysis which could supplement the pump test protocol procedures in the attempt to analyze pumping impact on the Kaipapau Stream.

If there are any questions, please contact Roy Hardy of the Commission staff at 597-0274.

Sincerely,



RAE M. LOUI
Deputy Director

RH:ss

November 20, 1995

Ms. Rae M. Loui, Deputy Director
Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Loui:

Subject: Your Letter of September 18, 1995 Regarding the Draft Environmental Assessment (DEA) for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline, and Access Road Development at Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 04

Thank you for reviewing the DEA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development at Kaipapa'u. We provide the following comments to your concerns:

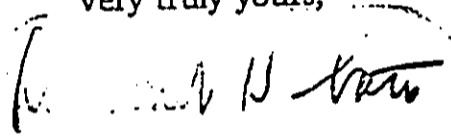
1. The Kaipapa'u Well project is already included in the draft Oahu Water Management Plan, which is the county's Water Use and Development Plan.
2. Our records indicate that we submitted applications for a water use permit and a pump installation permit to your agency in 1993.
3. Kaipapa'u Stream is intermittent and only flows after heavy rains and sustained periods of rainfall. The water table is located in excess of 100 feet below the invert of the stream in the vicinity of the well such that pumping should not affect any streamflows. As the stream nears the coastal plain, it becomes perched upon the coastal plain sediments and thickened alluvium. Therefore, there is no reliable streamflow data to base amendments to the instream flow standards.
4. The DEA will be revised to indicate that the well is fitted with perforated casing from the 270 feet to 370 feet depth rather than just an open hole.

Ms. Rae M. Loui
Page 2
November 20, 1995

5. We understand that the permitting of existing uses has not been completed in the Koolauloa Groundwater Management Area to date. Water use permits for future uses are being deferred pending action by the Commission on Water Resource Management on existing permits.
6. We acknowledge that there have been concerns raised by various agencies on the effects to the aquatic resources within this intermittent stream. We realize there are varying views among biologists and hydrologists but we intend to adequately address their concerns. We are willing to discuss any hydrologic analysis and test pumping protocol procedures with your staff and understand that our pump installation permit and/or water use permit will be conditioned to include these procedures.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,



RAYMOND H. SATO
Manager and Chief Engineer

Attachment

cc: Fish and Wildlife Service (U. S. Department of the Interior)
Division of Aquatic Resources (Department of Land and Natural Resources)

SM/BU:js

cc: R. Sato
B. Usagawa

95-2834

(1/27)

Final Environmental Assessment

Kaipapa`u Well and Associated Facilities

APPENDIX 2A

1993 TERRESTRIAL BIOLOGY REPORT

BIOLOGICAL SURVEY
WELL SITE, ACCESS ROAD & PIPELINE ROUTE
KAIPAPA'U, O'AHU, HAWAI'I

Lani Stemmermann
November 1993

BIOLOGICAL SURVEY
WELL SITE, ACCESS ROAD & PIPELINE ROUTE
KAIPAPA'U, O'AHU, HAWAI'I

SUMMARY

The Kaipapa'u well site, access road and pipeline route is situated on the east facing slope of Kaipapa'u gulch which is vegetated by a combination of native and alien plant communities. None of the plants, vegetation types or animals at the site are legally protected or require special planning consideration, though a few native plant species are considered interesting and can be easily protected as part of the project development.

METHODS

The site was surveyed ^{for} vascular plants and wildlife on 18 November 1993. At that time the well site and access road had been bulldozed. A walk-through survey was conducted and notes were taken of species presence and abundance, and community composition. The survey was conducted mid-day, and no animal trapping methods were used. Nomenclature used conforms to standard references on the Hawaiian biota (Wagner, Herbst and Sohmer 1990, Hawai'i Audubon Society 1993).

RESULTS

Plant species seen at the site are listed in Table 1. Several plant communities can be recognized: 1) an open canopy native/alien shrubby vegetation with common guava, 'ohi'a, 'u'u'ulei, 'akia, and broom sedge; 2) a low stature closed canopy alien forest dominated by Christmas berry with an understory of Ti and laua'e fern; 3) a low stature closed canopy alien forest dominated by the obovoid-fruited waiawi guava with an understory of sword and laua'e fern; 4) hau thickets; 5) the gulch-bottom forest with Christmas berry and mango on alluvial debris; and 6) the ruderal community associated with the roadside disturbance. Most of these communities are not clearly delineated, but are described to indicate the degree of habitat heterogeneity at the site. The native/alien shrubby vegetation and the hau thickets are dominated by plant species native to Hawai'i. When possible as the site is developed it would be appropriate to minimize disturbance to the native shrubby community. This community appears to occur on nutrient limited sites where vegetation recovery is slow, and where significant erosion may occur if the present vegetation is removed. Microsites of greater site potential for recovery tend to be dominated by the alien forest communities, and they are considered less biologically valuable since they lack native elements.

Though not legally protected, two plant species were seen which are considered biologically interesting. A few small sandalwood plants occur along the access road not far from the reservoir site. Sandalwood often spreads by root runners, and the bulldozed road has possibly stimulated some new growth. As long as extensive roadwork is avoided, these plants should not be adversely affected. The other interesting plants were a couple of juvenile loulou palms in the river gulch downslope of the well site. These were only tentatively identified as they were young and sterile. These native fan palms are not uncommon throughout the Ko'olau range, and seeds could have been washed down stream, though their occurrence at this low elevation is an anomaly. Since construction activity will not occur in the river, these plants will not be affected.

No native Hawaiian forest birds were seen or expected, though amakihi may venture into the native scrub during times of heavy lehua bloom. An auku'u was once seen flying from the site, and may spend time in the gulch, but it is not prime heron habitat, and more likely this bird was wandering from nearby wetlands. No mammals were seen, though undoubtedly mongooses, rats, mice, cats, dogs, and maybe even goats and pigs could be expected at the site. None of these are native or require protection. The native shrubby vegetation would have been habitat for the now endangered O'ahu land snail, *Achatinella*. However, the presence at the site of *Euglandina*, the introduced predatory snail which is considered one of the primary factors effecting a decline of the native species, is a good indicator that the native snail is now absent.

ADEQUACY OF SURVEY

The subcontractor believes there was sufficient opportunity to determine that there will be minimal biological impacts of well, road and pipeline construction. While undoubtedly plant and animal species have been overlooked it is highly unlikely that any species requiring special planning consideration have been missed. The reservoir site is not covered by this report.

RECOMMENDATIONS

Aside from biological impacts of the proposed project, the steepness of the gulch walls, consequent stability of construction, and erosion, appear to be the major planning limitations of this project. Erosion is likely to be reduced if disturbance to the native shrub community is avoided since these sites appear to recover very slowly. Any turn-about, or focal points of disturbance might best be situated where recovery of vegetation cover is likely to be relatively rapid. This will result in minimal soil loss due to erosion. Such sites are vegetated by the low stature closed canopy alien forests at the present.

Further, impacts to the sandalwood (bushes) and loulou palm should be avoided.

REFERENCES

Hawai'i Audubon Society. 1993. Hawai'i's Birds. Fourth Edition. Honolulu, Hawai'i.

Wagner, W. L., D. R. Herbst and S. H. Sohmer. 1990. Manual of the Flowering Plants of Hawai'i. Bishop Museum Press and the University of Hawai'i Press. Honolulu, Hawai'i.

Table 1 -- Plant Species: Kaipapa'u well site, access road and pipeline route.

PLANTS		Life	Status ²
Family, Species and Common Name		Form ¹	
FERNS			
<i>Blechnum occidentale</i>		F.	X
<i>Dryopteris dentata</i>	oak fern	F	X
<i>Nephrolepis exaltata</i>	sword fern	F	X
<i>Pityrogramma calomelanos</i>	silver fern	F	X
<i>Polypodium scolopendria</i>	laua'e	F	X
<i>Sphenomeris chusana</i>	pala'a	F	I
GYMNOSPERMS			
<i>Araucaria heterophylla</i>	Norfolk Pine	T	X
MONOCOTYLEDONS			
Agavaceae--Agave family			
<i>Cordyline fruticosa</i>	Ti	S	P
Commelinaceae--Spiderwort family			
<i>Commelina diffusa</i>	honohono	H	X
Cyperaceae--Sedge family			
<i>Kyllinga brevifolia</i>	kili'o'opu	G	X
Gramineae--Grass family			
<i>Andropogon virginicus</i>	broomsedge	G	X
<i>Brachiaria mutica</i>	California grass	G	X
<i>Chrysopogon aciculatus</i>	golden beard grass	G	X
<i>Cynodon dactylon</i>	manienie	G	X
<i>Digitaria insularis</i>	sour grass	G	X
<i>Eleusine indica</i>	goose grass	G	X
<i>Oplismenus compositus</i>	basket grass	G	X
<i>Paspalum conjugatum</i>	Hilo grass	G	X
<i>Paspalum scrobiculatum</i>	ricegrass	G	X
<i>Setaria gracilis</i>	yellow foxtail	G	X
Musaceae--Banana Family			
<i>Heliconia</i> sp.		H	X

Orchidaceae--Orchid family			
<i>Spathoglottis plicata</i>	Philippine ground orchid	H	X
Palmae--Palm family			
<i>Cocos</i> ? seedlings	coconut	T	P
<i>Phoenix</i> sp.	datepalm	T	X
<i>Pritchardia martii</i>	Loulu	T	E
Pandanaeae--Pandanus family			
<i>Pandanus tectorius</i>	hala	T	I
Zingiberaceae--Ginger family			
<i>Zingiber zerumbet</i>	'awapuhī	H	P
DICOTYLEDONS			
Amaranthaceae--Amaranth family			
<i>Achyranthes asper</i>		H	X
<i>Amaranthus spinosus</i>	pig weed	H	X
Anacardiaceae--Mango family			
<i>Mangifera indica</i>	mango	T	X
<i>Schinus terebinthifolius</i>	Christmas berry	T	X
Araliaceae--Ivy family			
<i>Schefflera actinophylla</i>	octopus tree	T	X
Buddleiaceae--Butterfly bush family			
<i>Buddleia asiatica</i>		S	X
Casuarinaceae--Casuarina family			
<i>Casuarina equisetifolia</i>	ironwood	T	X
Compositae--Daisy family			
<i>Ageratina riparia</i>	Hamakua pamakani	H	X
<i>Bidens alba</i>		H	X
<i>Conyza canadensis</i>	horseweed	H	X
<i>Crassocephalum crepidioides</i>		H	X
<i>Emilia sonchifolia</i>	Flora's paintbrush	H	X
<i>Pluchea symphytifolia</i>	sourbush	S	X

Cucurbitaceae--Mellon family			
<i>Momordica charantia</i>	bitter melon	V	X
Euphorbiaceae--Spurge family			
<i>Aleurites moluccana</i>	kukui	T	P
<i>Macaranga tanarius</i>		T	X
<i>Phyllanthus debilis</i>		H	X
Leguminosae--Bean family			
<i>Acacia confusa</i>	Formosan koa	T	X
<i>Chamaecrista nictitans</i>	lauki	H	X
<i>Crotalaria</i> sp.	rattlepod	H	X
<i>Desmodium triflorum</i>		H	X
<i>Desmodium</i> sp.		V	X
<i>Indigofera suffruticosa</i>	indigo	S	I
<i>Leucaena leucocephala</i>	koa haole	S	X
<i>Mimosa pudica</i>	sleeping grass	H	X
Malvaceae--Hibiscus Family			
<i>Hibiscus tiliaceus</i>	hau	T	I
<i>Malvastrum coromandelianum</i>		H	X
<i>Sida fallax</i>	'ilima	S	I
<i>Sida rhombifolia</i>		S	I?
Melastomataceae--Melastoma Family			
<i>Clidemia hirta</i>	Koster's curse	S	X
Myrtaceae--Myrtle Family			
<i>Metrosideros polymorpha</i>	'ohi'a	S	E
<i>Psidium cattleianum</i> var. <i>littorale</i>	waiawi	T	X
<i>Psidium guajava</i>	common guava	T	X
<i>Syzygium cumini</i>	Java plum	T	X
Oxalidaceae--Sorrel Family			
<i>Oxalis corniculata</i>	wood sorrel	H	I
Passifloraceae--Passion Fruit family			
<i>Passiflora edulis</i>	passion fruit	V	X
<i>Passiflora suberosa</i>	huehue haole	V	X

Rosaceae--Rose family			
<i>Osteomeles anthyllidifolia</i>	'u'ulei	S	I
Rubiaceae--Coffee Family			
<i>Canthium odoratum</i>	alahe'e	T	I
<i>Morinda citrifolia</i>	noni	S	P
Santalaceae--Sandalwood Family			
<i>Santalum freycinetianum</i>	'iliahi	T	E
Solanaceae--Tomato Family			
<i>Solanum americanum</i>	popolo	H	X
Sterculiaceae--Chocolate family			
<i>Waltheria incisa</i>	hi'aloa	S	I
Thymelaeaceae--Daphne family			
<i>Wikstroemia</i> sp.	'aki'a	S	E
Ulmaceae--Elm Family			
<i>Trema orientalis</i>	gunpowder tree	T	X
Umbelliferae--Parsley family			
<i>Centella asiatica</i>	asiatic pennywort	H	X
Verbenaceae--Verbena family			
<i>Lantana camara</i>	lantana	S	X
<i>Stachytarpheta</i> sp.	owi	H	X

1 G-Grass; S-Shrub (0.5-2 m tall); H-Herb (0-0.5 m tall); T-Tree (> 2 m tall); V-Vine.

2 E-Endemic (unique to Hawai'i); I-Indigenous to Hawai'i (native to Hawai'i and elsewhere); P-Polynesian Introduction to Hawai'i, many of these have traditional uses; X-Exotic, brought to Hawai'i following western contact.

Table 2 -- Birds observed at the Kaipapa'u well and access road.

BIRDS--Species and Common Name	
<i>Cardinalis cardinalis</i>	Northern cardinal
<i>Copsychus malabaricus</i>	Shama thrush
<i>Garrulax canorus</i>	Melodius Laughing thrush
<i>Geopelia striata</i>	Zebra dove
<i>Nycticorax nycticorax hoactli</i>	'āuku'u
<i>Zosterops japonicus</i>	Japanese white eye

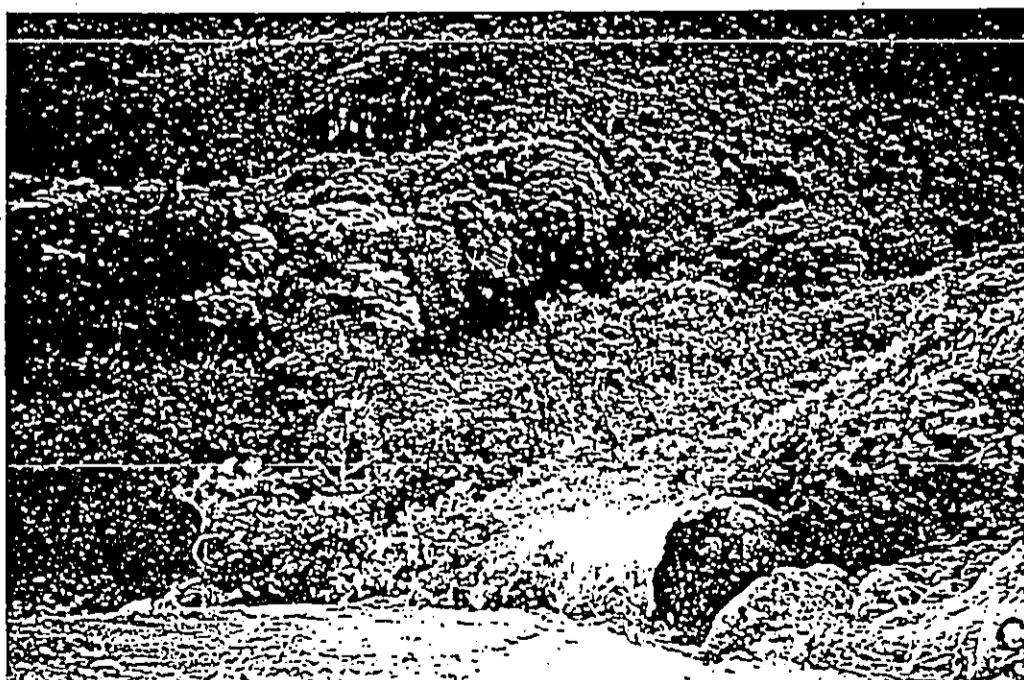
A) View looking up Kaipapa'u Gulch along access road and Pipeline route toward well site. The taller vegetation is alien forest, the lower vegetation is mixed native and alien scrub.



B) Well site, Kaipapa'u Gulch

C) Gulch downslope of well site.

Photos taken
18 November 1993



Final Environmental Assessment

Kaipapa`u Well and Associated Facilities

APPENDIX 2B

2002 FLORA REPORT

Kaipapa'u Well Botanical Survey
 Conducted on May 4th, 2002
 By Orlo C. Steele, Pacific Island Botanist

The Kaipapa'u well road follows the west side of Kaipapa'u stream through mesic low land vegetation. The area is covered by disturbed alien species along most of the proposed road site (30 feet wide), although there is a small section on the west side of the road dominated by native 'Ohia lehua, Akia, Ulei, and Pala'a. This association of native vegetation is only along a fringing scarp on the west side near piles of dirt approximately half way down the road. Other native Hawaiian plants such as Pukiawe, Hala, and Ka'e'e', were represented by only a few individuals. Hau forest dominates where the proposed road crosses one small stream with a blocked up culvert and near Kaipapa'u stream. No rare or threatened plants were seen on the site. Total species: 85 (8 Indigenous and 77 Alien).

Table 1. List of Indigenous (I) and Alien (A) species of plants found on project site.

Scientific Name	Family	Common Name	Life Form	Status
<i>Abutilon grandifolium</i>	Malvaceae	Hairy abutilon	Herb	A
<i>Acacia confusa</i>	Mimosaceae	Formosan koa	Tree	A
<i>Agave sisalana</i>	Agavaceae	Malina, Sisal	Shrub	A
<i>Aleurites moluccana</i>	Euphorbiaceae	Kukui	Tree	A
<i>Arucaria heterophylla</i>	Auracariaceae	Norfolk Island Pine	Tree	A
<i>Bidens alba</i>	Asteraceae	Beggar's tick	Herb	A
<i>Casuarina equisetifolia</i>	Casuarinaceae	Ironwood	Tree	A
<i>Cenchrus ciliaris</i>	Poaceae	Bufflegrass	Grass	A
<i>Cenchrus echinatus</i>	Poaceae	'Ome'alu, Sand bur	Grass	A
<i>Chamaecrista nictitans</i>	Caesalpinaceae	Partridge pea	Herb	A
<i>Chamaesyce hirta</i>	Euphorbiaceae	Garden spurge	Herb	A
<i>Chamaesyce hypericifolia</i>	Euphorbiaceae	Graceful spurge	Herb	A
<i>Chloris barbata</i>	Poaceae	Mau'ulei, Bermuda grass	Grass	A
<i>Chrysopogon aciculatus</i>	Poaceae	Golden beard grass	Grass	A
<i>Clidemia hirta</i>	Melastomataceae	Koster's curse	Shrub	A
<i>Clusia rosea</i>	Clusiaceae	Autograph tree	Tree	A
<i>Commelina diffusa</i>	Commelinaceae	Honohono	Herb	A
<i>Conyza bonariensis</i>	Asteraceae	Hairy horse weed	Herb	A
<i>Cordyline fruticosa</i>	Agavaceae	Ti	Shrub	A
<i>Crotalaria pallida</i>	Fabaceae	Pikakani	Shrub	A
<i>Cynodon dactylon</i>	Poaceae	Manienie	Grass	A
<i>Desmanthus vigatus</i>	Mimosaceae	Slender mimosa	Shrub	A
<i>Desmodium incanum</i>	Fabaceae	Ka'imi	Herb	A
<i>Desmodium tortuosum</i>	Fabaceae	Florida beggarweed	Shrub	A
<i>Desmodium triflorum</i>	Fabaceae		Herb	A
<i>Digitaria insularis</i>	Poaceae	Sour grass	Grass	A
<i>Digitaria setigera</i>	Poaceae	Kukae pua'a	Grass	A
<i>Eleusine indica</i>	Poaceae	Goose grass	Grass	A

<i>Emilia fosbergii</i>	Asteraceae	Flora's paintbrush	Herb	A
<i>Glycine wightii</i>	Fabaceae		Vine	A
<i>Grevillea robusta</i>	Proteaceae	Silk oak	Tree	A
<i>Hibiscus tiliaceus</i>	Malvaceae	Hau	Tree	A
<i>Indigofera suffruticosa</i>	Fabaceae	Indigo	Shrub	A
<i>Ipomoea obscura</i>	Convolvulaceae		Vine	A
<i>Lantana camera</i>	Verbenaceae	Lantana	Shrub	A
<i>Leucaena leucocephala</i>	Fabaceae	Haole koa	Tree	A
<i>Macaranga tanarius</i>	Euphorbiaceae		Tree	A
<i>Malvastrum coromandelianum</i>	Malvaceae	False mallow	Herb	A
<i>Melaleuca quinquenervia</i>	Myrtaceae	Paperbark Tree	Tree	A
<i>Melinis minutiflora</i>	Poaceae	Molasses grass	grass	A
<i>Metrosideros polymorpha</i>	Myrtaceae	'Ohia lehua	Tree	A
<i>Microsorium sylvaticum</i>	Polypodiaceae	Lau'ae fern	Fern	A
<i>Mimosa pudica</i>	Fabaceae	Sensitive plant	Herb	A
<i>Morinda citrifolia</i>	Rubiaceae	Noni, Indian mulberry	Tree	A
<i>Mucuna gigantea</i>	Fabaceae	Ka'e'e, Sea bean	Vine	I
<i>Nephrrolepis multiflora</i>	Davalliaceae	Scaly swordfern	Fern	A
<i>Oplismenus compositus</i>	Poaceae	Basket grass	Grass	A
<i>Osteomeles anythillidifolia</i>	Rosaceae	'Ulei	Shrub	I
<i>Pandanus tectorius</i>	Pandanaceae	Hala, Screwpine	Tree	I
<i>Paspalum conjugatum</i>	Poaceae	Hilo grass	Grass	A
<i>Paspalum frimbriatum</i>	Poaceae	Panama grass	Grass	A
<i>Passiflora laurifolia</i>	Passifloraceae	Yellow granadilla	Vine	A
<i>Passiflora suberosa</i>	Passifloraceae	Huehue haole	Vine	A
<i>Phyllanthus amarus</i>	Euphorbiaceae		Herb	A
<i>Pluchea carolinensis</i>	Asteraceae	Sour bush	Shrub	A
<i>Psidium cattleianum</i>	Myrtaceae	Strawberry guava	Tree	A
<i>Psidium guajava</i>	Myrtaceae	Guava	Tree	A
<i>Schefflera actinophylla</i>	Araliaceae	Octopus tree	Tree	A
<i>Schinus terebinthifolius</i>	Anacardiaceae	Christmas berry	Tree	A
<i>Senna surrattensis</i>	Cesalpiniaceae	Kolomona	Tree	A
<i>Sida fallax</i>	Malvaceae	'Ilima	Shrub	I
<i>Sphenomeris chinensis</i>	Lindsaeaceae	Pala'a, Lace fern	Fern	I
<i>Sporobolus diander</i>	Poaceae	Indian dropseed	Grass	A
<i>Sonchus oleraceus</i>	Asteraceae	Sow thistle	Herb	A
<i>Sorghum sudanense</i>	Poaceae	Sudan sorghum	Grass	A
<i>Spathoglottis plicata</i>	Orchidaceae	Philippine ground orchid	Herb	A
<i>Stachytarpheta urticifolia</i>	Verbenaceae	Blue rat's tail	Herb	A
<i>Styphelia tameiameia</i>	Epacridaceae	Pukiawe	Shrub	I
<i>Syzygium cumini</i>	Myrtaceae	Java plum	Tree	A
<i>Trema orientalis</i>	Ulmaceae	Gunpowder tree	Tree	A
<i>Verbena litoralis</i>	Verbenaceae	Owi, Verbena	Shrub	A
<i>Veronia cinera</i>	Asteraceae	Little ironweed	Herb	A
<i>Waltheria indica</i>	Sterculiaceae	'Uhaloa	Herb	I
<i>Wikstroemia oahuensis</i>	Thymelidaceae	Akia	Shrub	I

Final Environmental Assessment

Kaipapa`u Well and Associated Facilities

APPENDIX 3

STREAM SURVEY



Oceanit.
Innovation through engineering and scientific excellence.

Native and Exotic Stream Organisms Survey,
Kaipapa'u Stream
Hau'ula, O'ahu
Ko'olauloa-Kaipapa'u Well Project

Submitted to:

Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawai'i 96843

Submitted by:

Oceanit Laboratories, Inc.
1001 Bishop St.
Pacific Tower, Suite 2970
Honolulu, Hawai'i 96813

Tel: (808) 531-3017
Fax: (808) 531-3177

Contact Person: Robert E. Bourke

January 2001

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A. Introduction

A proposed Honolulu Board of Water Supply (BWS) project would install a new well in the lower Kaipapa'u valley to meet increased water demand on windward O'ahu. Biological characterization of Kaipapa'u Stream is necessary to understand potential impacts from the proposed well system. Results of this Phase I study will provide information on species present and their distribution and relative abundance within the stream system. This study will also provide insight to further information that may be required during post construction periods. The purpose of this study is to establish the presence or absence of native and exotic stream organisms, including insects, in the Kaipapa'u Stream system.

Kaipapa'u Stream flows for approximately 6.8 miles and originates in the northern section of the windward Ko'olau Mountains. Kaipapa'u Stream begins as a series of sinuate and gradually descending headwater streams originating at an elevation of 2600 ft in a bowl-like catchment southeast of Pu'uka'inapua'a, an area containing dense mountain native forest (Polhemus, 1995). At approximately 1400 ft elevation the stream becomes more incised and begins to plunge over a series of 30-50 ft high waterfalls (Polhemus, 1995). The last 60-foot waterfall drops from an elevation of about 860 ft and marks the upper limit of the stream survey accessible by foot. Stream flow below this point steadily and naturally seeps into the alluvium and becomes intermittent at an elevation of approximately 300 ft. This stream drains an undeveloped native forest, and the very clear stream flow reflects the undisturbed nature of this catchment.



Kaipapa'u Stream Overlook
at BWS 180 Reservoir up into valley

The BWS directed Oceanit to answer the following questions:

1. What is the present pattern of distribution and abundance of native and alien fish, stream invertebrates, and insects in the stream?
2. Has this pattern changed perceptibly since the prior stream survey conducted in 1992 by Environmental Technologies International?
3. How are these patterns correlated with stream flow?

In order to answer these questions, Oceanit surveyed Kaipapa'u Stream on September 17 and October 1, 2000 along 5 reaches from the headwater falls at an elevation of about 800 ft down to approximately 200 ft where stream flow became minimal. In addition, a cursory survey was performed at the stream mouth. This information will be used to differentiate populations of native and exotic stream insects, crustaceans, mollusks, and fishes in the lower, mid, and upper reaches of the stream. Data on stream flow and habitat were taken to correlate with biological data.

A note here is necessary concerning access to the site. Initially, use of a helicopter was planned to ferry personnel and gear to the upper stream at the base of Kaipapa'u Falls. However, one day prior to the field trip, the helicopter pilot surveyed the site and found that a large branch of guava tree had grown into the opening below the falls, blocking the landing site. Therefore the survey began with a 3.8-mile uphill hike past the existing BWS 180 Reservoir, up the valley to the base of the falls.

B. Acknowledgements

Oceanit would like to acknowledge the work of Mr. Ron Englund who performed the insect portion of the survey under the auspices of the Bishop Museum and Mr. Charles Chong who performed the aquatic animal survey. Mr. Englund made the observations for the ETI report in 1992 referenced in subsequent BWS concerning Kaipapa'u Stream, and his previous knowledge of the site was invaluable. Mr. Englund is presently working for the Bishop Museum as he pursues studies towards a Ph.D. in Entomology at the University of

Hawai'i. Mr. Chong is a recent graduate from the M.Sci program at the University of Hawai'i, where he studied Hawaiian stream ecology. Mr. Robert E. Bourke coordinated the project for Oceanit and conducted the physical stream measurements.

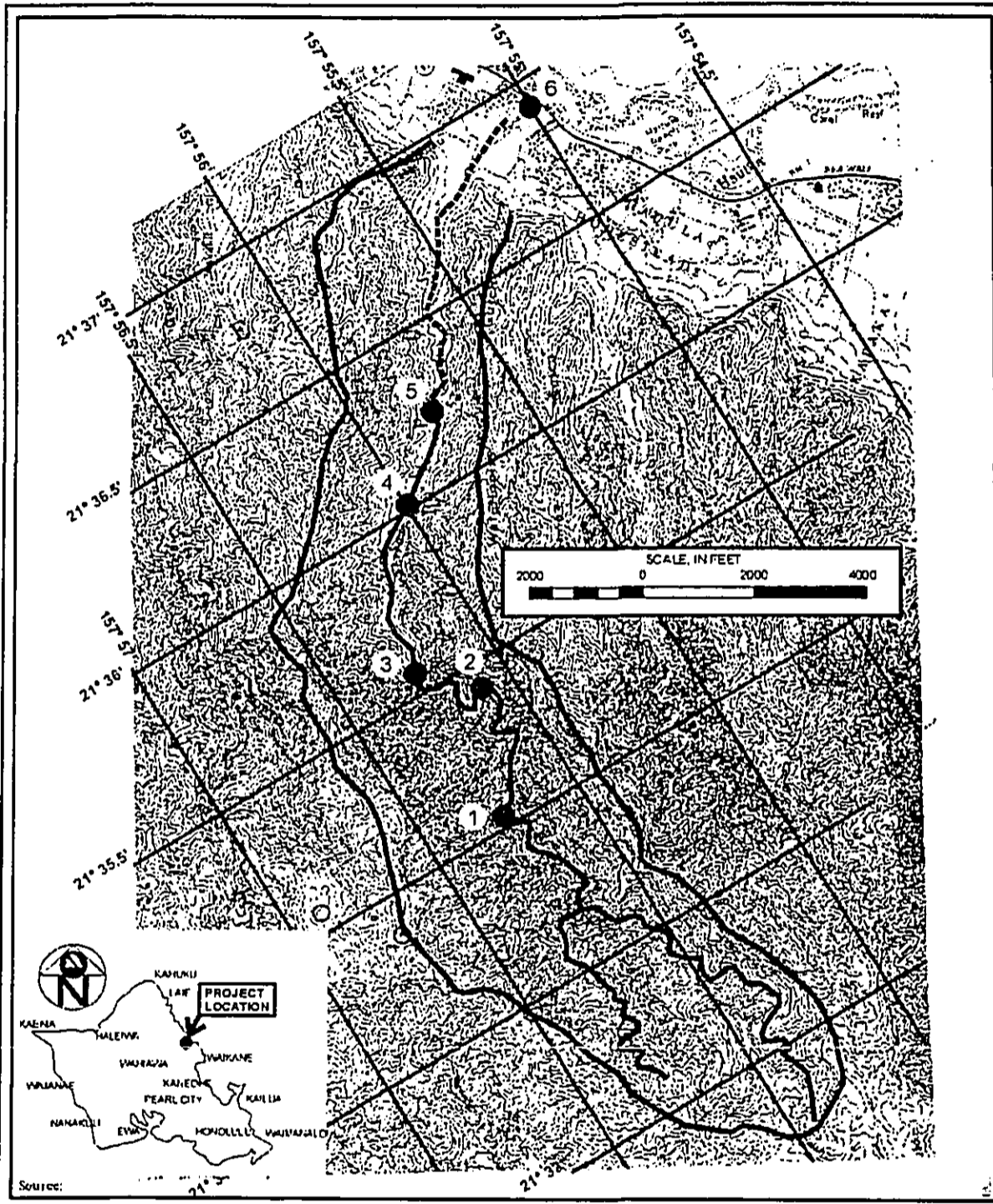


FIGURE 1. SITE MAP

BWS KO'OLAULOA - KAIPAPA'U WELL PROJECT



C. Methods

To accomplish the goals of this project, three separate sets of tasks were defined:

- Physical stream measurement and photo-documentation
- Aquatic insect survey
- Aquatic organism survey

Physical Stream Measurement and Photo-Documentation

September 17, 2000 was chosen as the sample date based upon observations of weather patterns during the previous 6 weeks. This date offered an opening of good weather following a period of several weeks of rain. Dry weather is preferred for stream observations because certain insects are not observable during wet weather, and the threat of flash floods threatens observer safety.

Five sites were selected at roughly even intervals along the stream; from the headwater falls at an elevation of about 800 ft, down to the lowest station where stream flow ceased, at an elevation of about 200 ft. Specific site selection was based upon the presence of a variety of sampling habitats at each site including falls, riffles, pools, and plunge pools. Each site was located on a USGS "quad" map (Hau'ula, Hawai'i, N2130-W15754/7.5) using a field compass and reference to physical geological characteristics. The latitude and longitude shown on the location map in Figure 1 have been corrected according to the North American Datum of 1983. GIS measurements were taken at each site utilizing a Madgellan GPS NAV 5000D set to WGS84 map datum. Site elevations are approximate to the nearest 50 ft and consist of a compromise between what was read on a hand-held altimeter and the elevation given on the USGS quad map. Elevations given by the hand-held GPS unit are not judged accurate enough to be reported in this survey.

Table 1
Site Description

Site Name	Approximate Elevation (feet)	Distance Upstream (miles)
1. The Falls	800 ft	1.1 mi
2. The Wall	600 ft	1.5 mi
3. Small Wall	450 ft	2.3 mi
4. <i>Schinus</i> Trees	300 ft	2.7 mi
5. Low Flow	200 ft	3.2 mi

An assessment of physical stream characteristics was made at each site. At each site a series of pools, plunges, and riffles was photographed and videotaped. Air photographs were not possible because no helicopter access to the site was available. In-stream photographs were made at all five sites using a Nikonos underwater camera. A second camera with an attached flash malfunctioned at the upper three sites (1,2,3) but provided additional photos at sites 4 and 5. Video footage was taken upstream and downstream from each sample site. At each site an estimate of stream cross-sectional depth and velocity was made to estimate stream volume flow at the time of survey. A Marsh-McBery velocity flow meter was used to measure surface and mid-water velocity, and depth at intervals across a stream section where water flow was judged to be laminar.

Aquatic Insect Survey

Aquatic insects were sampled at five stations for this assessment with the highest station sampled located at the terminal falls lying at approximately (Site 1 - The Falls) 800 ft, and at (Site 2 - The Wall) 600 ft, (Site 3 - Small Wall) 450 ft, (Site 4 - *Schinus* Trees) 300 ft, and (Site 5 - Low Flow) 200 ft in elevation. Because of the narrow nature of the streambed in most locations it was not possible for the other members of the survey team to detour around a sample location while the entomologist (Englund) collected specimens. As an alternate method, the entomologist was the first one up the stream, the last to descend, and remained intentionally separated from other team members during most collections.

Sampling consisted of aerial netting of adult aquatic insects, visual observations, and benthic sampling of immature stages of aquatic insects, and was conducted according to Englund et al. (2000). *Megalagrion* damselflies were the focus species of this survey as they are generally accepted as an indicator species to assess the health of the arthropod fauna. Other aquatic insects encountered, including both endemic and alien species, were collected. Randomly selected benthic samples were made in different stream habitats by disturbing the substrate through kicking and scraping rocks together while holding an aquatic net downstream of the disturbed stream area. However, most aquatic insect species were captured through aerial netting around aquatic habitats near riffles and cascade splash-zone areas. Some aquatic insect species (e.g., *Saldula exulans*) were also manually collected with a hand aspirator, as these species were not readily captured through either aerial netting or benthic sampling. Although all aquatic habitats around the stream corridor were sampled, emphasis was placed on sampling riffle, cascade, rheocrene (seep), and waterfall areas. Previous research (Howarth and Polhemus, 1991) has shown that the majority of native taxa in Hawaiian streams are found in these high-energy zones as most species have evolved from wave-swept marine areas. Specimens collected were preserved in Ethyl alcohol for species determination in the lab. Aquatic insect species determinations were made by R. Englund, K. Arakaki, and N.L. Evenhuis of the Hawai'i Biological Survey, Bishop Museum.

Aquatic Organism Survey

Methods have been developed for surveying gobies in Hawaiian streams (Baker and Foster, 1991). The survey method was derived from the Modified Quadrant Method and adapted to the specific characteristics of the stream. The density of key species of native and alien fish, crustaceans, and gastropods were assessed at five sites. The five primary sample sites were spaced evenly along the stream from the highest accessible point at Kaipapa'u Falls to the lowest elevation exhibiting water flow. Five sample quadrants were measured at each of the five stream sites. Because the stream width was less than 1 meter and the depth less than 20 centimeters in many areas, the five stations within each site were not randomized. Instead, the entire habitat that could be surveyed (i.e. was

deep enough to snorkel or where fishes could clearly be seen from outside the water) at five adjacent stations was sampled. Stations consisted of pools (and plunge pools at higher elevations) where experience has shown that these fish tend to occupy habitat. The five stations at each site were contained along an approximate 200 ft length of stream.

One person (Chong) observed all sample quadrants utilizing the Modified Quadrant Method, as presented in Baker and Foster (1992). This method involves counting fish and invertebrates within a number of small quadrants, or points - five per sample site in the case of this study. However, as stated previously, the points were not randomly selected; the quadrant position was limited to pools. Point sizes are determined according to structural features of the stream or, where these are absent, according to site visibility. A diver in the water or observer out of the water (in shallow areas partially screened by a boulder or similar object if possible) determines numbers, sexes, and sizes of biota within each point over a specified time period of three minutes (see Figure 3). At the end of each count, the diver then moves slowly into the point to search quickly for individuals that may have been missed, particularly behind boulders that blocked the diver's view during the count. Finally, the dimensions of the point are measured, and all data are recorded. An attempt was made to either photograph or make a simple sketch of each sample site.

Statistical Methods

Density estimates derived from point counts were used for comparisons among habitats, reaches, streams and flow velocity. For example, a count of 5 fish within a 5-meter by 4-meter point would yield a density of 0.25-fish/square meter. This initial conversion of counts is necessary because points vary in size. The next step in data compilation involves averaging all samples taken from a single site to produce a single value for that site. Similar averages are then made for all units of a particular habitat type within each reach, for all habitats within each reach, and for all reaches within each stream.

Size estimates are made by recording an observed individual as belonging to a 2 cm size class i.e. 2-4 cm, 4-6 cm, etc. The number of fish in each size-class can then be compared

using a chi-square test applied to each species by site. The analysis relates the number of fish of a given species in a particular size-class to the site where it was observed by comparing an expected number of fish in a size-class to the actual number counted. The expected number of fish in a size-class is calculated based on the assumption that there is no difference in the size distributions of fish between sites. If this is true, the percentage of fish in a given size-class should be roughly similar between sites. Fish from one site can be compared to fish from another by calculating the probability (p) that the distribution of fish sizes is different between sites.

The resulting comparisons can be of use in subsequent sampling surveys, for determination of both direct and indirect impacts of stream alteration on stream fauna. For example, if the most striking and measurable difference is attributable to habitat type rather than stream reach, subsequent surveys could place less stress on certain sampling sites and more stress on others, thus improving the focus and resolution of resulting data.

D. Results

General Notes on Kaipapa'u Valley Habitat

The quality of a stream is directly linked to the quality of the surrounding watershed area. Kaipapa'u Valley is listed as a State of Hawai'i Forest Reserve, and this listing appears to be justified by the general condition of the valley's forest and stream habitats. The lower portion of the valley, up to about the 200 foot level, appears to be often visited and well used by local residents. However, above this level the path, although well flagged, is obviously little used and the upper valley shows little recent impact from human use. Part of the reason for this may be the threat of rock falls. In the narrow portions of the valley, the smoothness of the algae covered stream boulders was interrupted in several locations by the presence of broken, cracked and shattered rocks (and boulders), obviously the result of recent rock falls from the cliffs above.

The riparian vegetation of Kaipapa'u Stream was noteworthy in that a scattering of remnant native loulu (*Pritchardia martii*) palms lined the banks in many areas, and this

further reflects the unusual undisturbed state of the upper watershed. Loulu palms were found at an unusually low elevation starting at nearly 200 ft and were common to the terminal waterfalls at 800 ft elevation. Other native plants that were common along the upper reaches of the stream included 'ākōlea (*Boehmeria grandis*), 'ōhi'a (*Metrosideros polymorpha*), and māmaki (*Pipturus albidus*), while an introduced overstory of guava (*Psidium* sp.) and mango predominated in many upstream areas. Christmas-berry tree (*Schinus terebinthifolius*) is interspersed by stands of hau (*Hibiscus tiliaceus*) and mango along the riparian zone in the lower valley. Almost no feral ungulate damage was observed throughout the area of Kaipapa'u Stream surveyed, and pig hunters appear to have reduced pig populations enough to eliminate any visible pig damage. Feral pigs can lead to increased sedimentation in the watershed and affect native aquatic species that are sensitive to sedimentation.

Physical Stream Measurement and Photo-Documentation

The site locations in Figure 1 are based solely upon field information from noting geological reference points and a field compass. GIS measurements taken at each site referenced to the WG584 datum were not deemed accurate to within about a thousand feet of the true position given by USGS Quad maps. The inaccuracy is probably due to the very limited view of the sky offered at the bottom of these very steep canyons, high cliffs, and overhanging trees. The difference between the NAD '83 datum of the USGS Quad maps (Old Hawaiian Datum) and the WG584 datum referenced by the GPS unit should be less than 120 ft at this latitude and longitude.

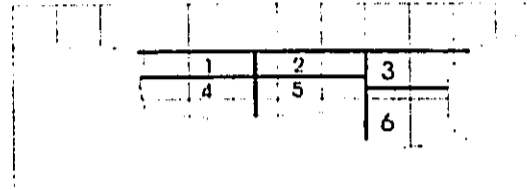
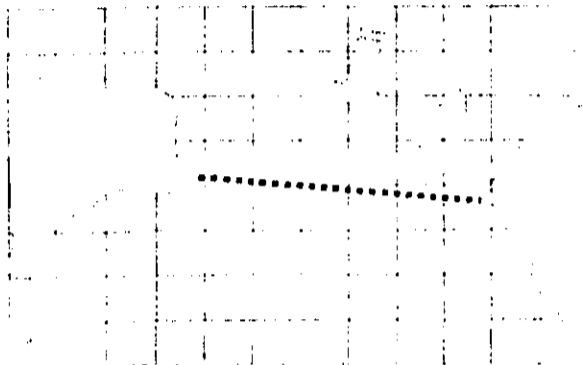
For the purpose of flow measurement, stream cross-sections were measured and sketched in the field. Flow rates were calculated as shown in Figure 2 from multiple velocity measurement taken across the section. The results are shown below in Table 2.

Table 2
Kaipapa'u Stream Site Locations and Flow

Site #	Site Name	Latitude : Longitude (GPS data, not reliable) Position from USGS map	Elevation ft (approx.)	Flow cfs	Distance from Stream Mouth (miles)
1	The Falls	(21°35.17 N : 157° 56.08 W)	800	1.659	1.1
2	The Wall	(21°35.42 N : 157° 55.90 W)	600	1.074	1.5
3	Small Wall	(21°35.66 N : 157° 56.25 W)	450	0.978	2.3
4	<i>Schinus</i> Trees	(21°36.05 N : 157° 56.00 W)	300	0.493	2.7
5	Low Flow	(21°35.75 N : 157° 55.79 W)	200	0.005	3.2

Figure 1
Stream flow Calculations

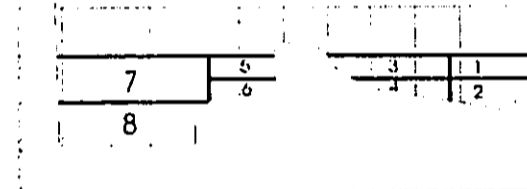
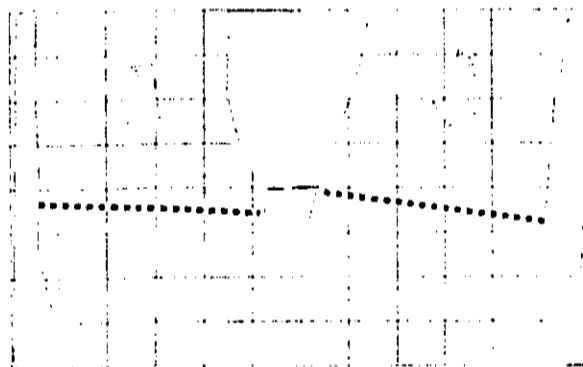
Site 1 The Falls



Area	Fl. sec	Area (ft ²)	Q ft ³ / sec
1	0.75	3.5' x 16' / 144	0.291
2	0.65	3.5' x 15' / 144	0.236
3	0.91	5' x 12' / 144	0.379
4	0.72	3.5' x 15' / 144	0.262
5	0.37	3.5' x 15' / 144	0.134
6	0.88	5' x 13' / 144	0.357

Total 1.659 ft³ / sec

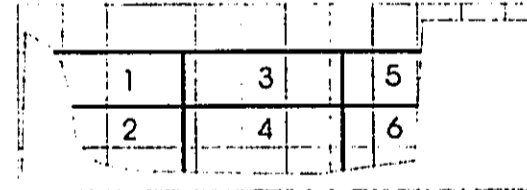
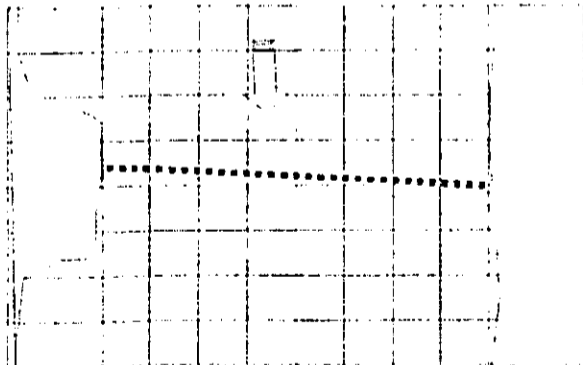
Site 2 The Wall



Area	Fl. sec	Area (ft ²)	Q ft ³ / sec
1	0.11	3' x 14' / 144	0.032
2	0.20	3' x 12' / 144	0.050
3	0.12	3' x 13' / 144	0.032
4	0.33	2' x 10' / 144	0.046
5	0.43	2.5' x 9' / 144	0.067
6	0.38	3' x 9' / 144	0.071
7	0.48	6' x 19' / 144	0.380
8	0.50	6' x 19' / 144	0.396

Total 1.074 ft³ / sec

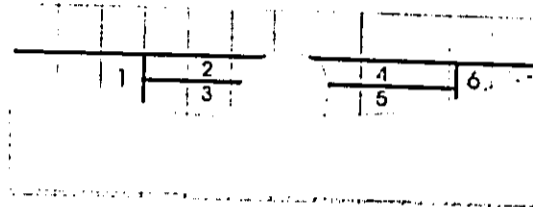
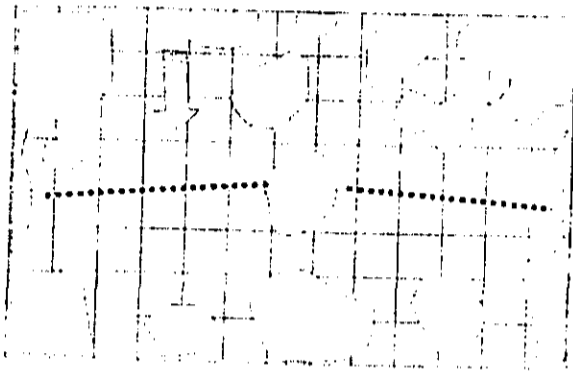
Site 3 Small Wall



Area	Fl. sec	Area (ft ²)	Q ft ³ / sec
1	0.75	7.5' x 17' / 144	0.301
2	0.65	7.5' x 16' / 144	0.200
3	0.91	7' x 19' / 144	0.166
4	0.72	7' x 19' / 144	0.203
5	0.37	7' x 11' / 144	0.064
6	0.88	7' x 10' / 144	0.044

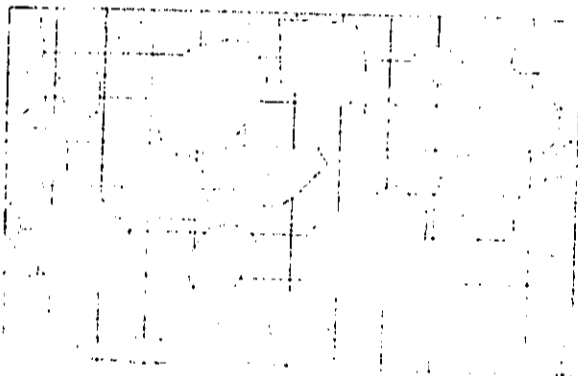
Total 0.978 ft³ / sec

Site 4 Schinus Trees

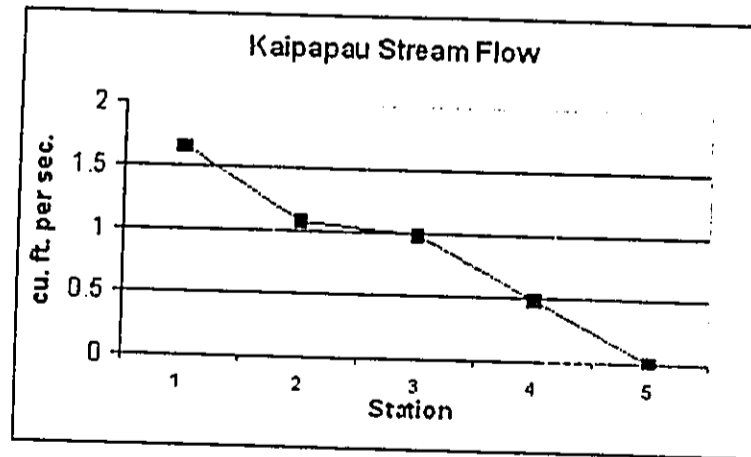


Area	Fl. sec	Area (ft ²)	Q (ft ³ /sec)
1	0.75	6'2" x 15" / 144	0.0375
2	0.65	4" x 17" / 144	0.0803
3	0.91	3.5" x 16" / 144	0.0855
4	0.72	3" x 21" / 144	0.1959
5	0.37	3" x 21" / 144	0.1575
6	0.88	5'2" x 10" / 144	0.0208
Total			0.493 ft ³ /sec

Site 5 Low Flow



Visual estimate of 0.05 cfs.



Site 1 The Falls – Elev. 800 ft

Kaipapa'u Falls drops an estimated 60 ft down an almost vertical face into a small pool at an elevation of about 800 ft. Passage above the falls is not possible without scaling this cliff. These falls are not noted or marked on the USGS topographical "quad" map, nor do the topographic lines on the map correspond precisely to actual features noted on the ground. This is a common problem in Hawaiian topo maps where the *orthographic techniques used to create the maps* were not amenable to the rough terrain and deep shadows created in the aerial photographs.



The pool at the base of the falls measures approximately 60 ft across the base of the falls and 35 ft away from the falls with an average depth of 4 ft. Flow from the pool discharges along the left hand face of the valley wall at about 1.6 cfs (left and right directions are standardized facing down stream) where it coalesces with observable ground flow from the base of the valley wall and with a small tributary entering from the right side of the valley. The valley walls are close to both sides of the stream below the falls affording no room for a path other than the streambed. Stream substrates in the upper areas consisted of a mixture of boulders, large rocks, cobbles and gravel, with seeping bedrock exposures especially common in the area of the waterfalls and the uppermost sampling station. Stream depth was variable, but averaged approximately one foot in riffle areas and 3 ft deep in larger pools. Below the waterfalls the stream exhibited a typical riffle and pool pattern.

The overstory vegetation at Site 1 was primarily guava and kukui in the immediate riparian zone. Native 'ōhi'a and uluhe were dominant on the banks above the guava and kukui. The under story in the immediate riparian zone consisted primarily of ginger and ferns with some ti and māmaki.

Site 2 The Wall - Elev. 600 ft

Below the falls the stream winds through a deep and relatively steep convoluted gorge, leaving no path other than the boulder-strewn streambed. Many large cascades from the Falls (Site 1) down to the Wall (Site 2) provide excellent habitat for stream fish and insects. The tree canopy, beginning about 200 ft below the falls, consists largely of guava and kukui and covers about 50% of the sky above the stream.



Small waterfalls (2-3') are common along the streambed between small pools and riffles. Approximately a 1/2-hour hike below the falls the stream forms a long (30-foot) pool as it courses along the right side (facing down stream) of the canyon against a vertical rock face. The vertical rock wall extends about 40 ft above the streambed. Stream flow in this pool was measured at slightly greater than 1 cfs.

Site 3 Small Wall - Elev. 450 ft

Downstream of Site 2 the slope of the stream is somewhat diminished and the sides of the canyon open occasionally allowing the hiking path to come out of the streambed, particularly around bends in the canyon. There are occasional small falls (2-3') over boulder piles but riffles are more common between pools.

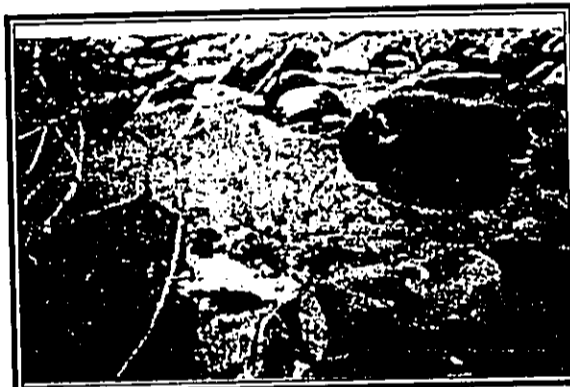


About halfway in between Sites 2 and 3 at an elevation of approximately 500 ft, it was noted that the streambed began to lose its abundance of permanent algae mat. Whether this indicates the lowest elevation of permanent water flow or there is some other factor affecting algae growth is not known. About a 1/2-hour hike below Site 2 the stream falls against the left side of the canyon forming a small vertical wall on the left stream bank. This vertical wall extends no more than 10 ft above the surface of the stream. Water flow through these small pools was measured at just less than 1 cfs.

Site 4 *Schinus* Trees – Elev. 300 ft

Downstream of Site 3, the stream slope decreases with few small waterfalls and more long riffles between pools. The valley opens up considerably with most of the hiking path in the woods adjacent to the stream and only crossing the stream at bends. The lands to both sides of the stream support open wooded areas and what appear to be occasional remnants of stonewalls or terraces.

The tree canopy covers about 80% of the sky above the stream along this reach. About a 1/2-hour hike below Site 3 the stream



courses into the first thicket of hau trees. Site 4 is along a straight section of stream with



95% shade canopy from overhanging *Schinus* (Christmas-berry) trees. The slope of the streambed is quite low with only shallow riffles between pools and a flow rate of only about 1/2 cfs. The lack of algae or any visible biota other than mollusks indicates that stream flow along this reach is probably not permanent. Between Sites 4 and 5, passage

along the streambed is greatly impeded by a hau thicket.

Site 5 Low flow – Elev. 200 ft

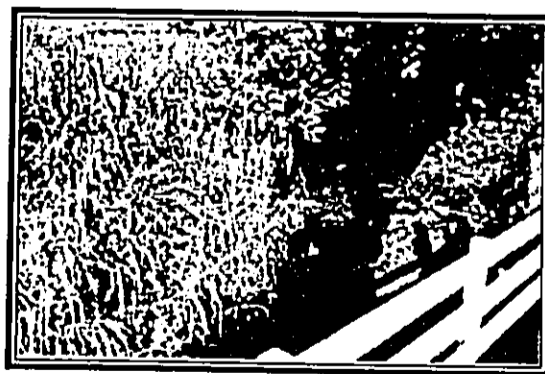
This site was chosen during the first survey as the lowest elevation where flow was still visible in the streambed without stagnant water. The flow estimate of 0.05 cfs is only a visual estimate. Flow was visible at the site, but was so diffuse around the many stones on the streambed as to prevent reasonable



measurement. On the morning of the second survey day there was significant, albeit temporary flow at this site. The sky above the stream in this area is 100% covered by tree canopy dominated by *Schinus* (Christmas-berry) trees at the site and a hau thicket upstream between Sites 4 and 5. The absence of algae or any visible macro-organisms in the water other than one unidentified snail species suggest that this reach of the stream probably does not support continuous water flow. This observation is further substantiated by a water level drop of approximately 10 cm in 4 hours on Day 2 of the macro faunal survey, indicating a short water retention time for this area of the stream.

Site 6 Stream Mouth

Below Site 5 the streambed courses along a relatively clean boulder streambed. The streambed runs past a small agricultural field, a residential neighborhood, under the Kamehameha Highway and into the ocean. Observations from the bridge down to the ocean show that this mouth is heavily influenced by saltwater, as a number of marine species were present. Above the bridge the streambed is heavily overgrown with tall grasses.



Insect Survey Results

A total of seventeen (17) aquatic insect species were collected or observed in Kaipapa'u Stream during approximately 8 hours of sampling on September 17, 2000 (Table 3). Of the 17 aquatic insect taxa collected during the current study, 82% were native species, which is similar to the 83% native aquatic insect species collected in Kaipapa'u Stream during an earlier survey. Previous Bishop Museum surveys were conducted mainly in the upper Kaipapa'u Stream falls and stream area, which correlates with Site 1 (800 ft) of the present study. The introduced aquatic insect species currently found in Kaipapa'u Stream (Table 1) should be considered relatively innocuous.

Another important finding of this survey was the discovery of one of the rarest native aquatic insect species, the giant midge *Telmatogeton williamsi*. This species was not found in Kaipapa'u Stream during previous Bishop Museum surveys but was relatively common from the waterfalls at Site 1 to Site 2 (600 ft) during the present study. *Telmatogeton williamsi* is an O'ahu endemic and, although formerly common, is currently only known from one other stream. Although this species is currently not a candidate for listing under protection of the Endangered Species, it is in fact one of the rarest aquatic insect species in the Hawaiian Islands.

Native damselflies are considered sensitive to disturbance and are a good indication of the health of the native aquatic ecosystem (Polhemus and Asquith, 1996). Weather conditions (in the mountains only) during this survey included rain and overcast, and this undoubtedly led to the absence of any native damselflies being collected. Native damselflies and dragonflies are generally observed during periods of sunny, clear weather and poor weather conditions usually preclude their capture (Polhemus and Asquith, 1996). Previous Bishop Museum surveys in the 1990's of Kaipapa'u Stream found three rare species of stream-dwelling native damselflies *Megalagrion hawaiiense*, *M. n. nigrolineatum*, and *M. oceanicum* (Polhemus and Asquith, 1996). Two of the damselfly species (*M. n. nigrolineatum* and *M. oceanicum*) found during recent Bishop

Museum surveys in the 1990's (Polhemus, 1995) are currently listed as candidates for protection under the Endangered Species Act. It is highly likely these damselfly species are still found in Kaipapa'u Stream because this stream lacks introduced fish species and the watershed is lacking in feral ungulate damage. Many other rare native aquatic insect species such as *Telmatogeton williamsi* and *Eurynogaster minor* were found during the current survey and are still extant in this watershed.

Table 3
Aquatic insect species collected or observed in Kaipapa'u Stream, September 17, 2000,
and Threatened, Endangered, Species of Concern, or Candidate Status for listing
on the Federal Register (updated as of November 29, 1999)

Taxon	Station (Elevation - ft)					Threatened, Endangered or Candidate Status ²	Biogeographic Status
	1 (800)	2 (600)	3 (450)	4 (300)	5 (200)		
Aquatic Insects							
Dragonflies & Damselflies (Odonata)							
<i>None Observed¹</i>							
True flies (Diptera)							
Canacidae							
<i>Procanace bifurcata</i>	X					None	Endemic
Ceratopogonidae							
<i>Dasyhelea hawaiiensis</i>	X					None	Endemic
Chironomidae							
<i>Micropsectra prob. hawaiiensis</i>	X					None	Endemic
<i>Telmatogeton williamsi</i>	X	X				None	Endemic
Culicidae							
<i>Aedes albopictus</i>	X	X	X	X	X	-	Introduced
Dolichopodidae							
<i>Campsicnemus brevipes</i>			X	X		None	Endemic
<i>Chrysotus longipalpus</i>	X					-	Introduced
<i>Eurynogaster minor</i>	X					None	Endemic
Ephydriidae							
<i>Scatella cilipes</i>	X	X	X	X	X	None	Endemic
<i>Scatella hawaiiensis</i>	X	X	X			None	Endemic
<i>Scatella oahuense</i>	X					None	Endemic
Tipulidae							
<i>Limonia advena</i>	X	X					
<i>Limonia jacobae</i>	X	X	X	X		None	Endemic
<i>Limonia stygipennis</i>	X					None	Endemic
Aquatic Moths (Lepidoptera)							
<i>Hyposmocoma sp.</i>	X	X	X	X	X	None	Endemic
Caddisflies (Trichoptera)							
<i>Cheumatopsyche pettiti</i>	X	X	X	X	X	-	Introduced
True bugs (Heteroptera)							
<i>Saldula exulans</i>	X	X	X			None	Endemic

¹Rainy and overcast weather likely led to no Odonata being observed, see text for further details.

²Species status: E = Endangered; T = Threatened; C = Candidate for listing; SOC = species of concern (USFWS 1999).

Aquatic Organism Survey Results

Fishes

Of the five sites surveyed, fishes were observed only at the two highest elevations (Sites 1 and 2) and the stream mouth. The same two native gobiid species, *Awaous guamensis* ('o'opu näkea) and *Sicyopterus stimpsoni* ('o'opu nöpili), were found at both Sites 1 and 2. This agrees with the 1992 reconnaissance findings of Environmental Technologies International for Kaipapa'u stream. These were the only two fish species observed at any of the surveyed sites and the valley continues to be free of introduced species above 200 ft. elevation. The mean densities for the combined species were 1.38 fishes/m² and 2.59 fishes/m² for Sites 1 and 2 respectively. Mean densities of *A. guamensis* were 0.54 fish/m² and 1.52 fish/m² and the mean densities of *S. stimpsoni* were 0.84 fish/m² and 1.07 fish/m² for Sites 1 and 2 respectively (Table 4). Although the mean density of fish is higher at Site 2 for both species, a pair wise comparison of the sites shows no statistical difference between the sites because of large variability in fish densities within each site. This is expected when habitat quality, in terms of flow velocity, light (which affects algal production), and depth is highly variable, as was the case in this stream. Field data and statistical calculations are given in Table 5. Because of the small sample size and variability between samples, the value of statistical analyses is somewhat limited. Standard error for all site means are greater than the means and are not reported here. Graphics in Figures 2 through 4 depict the length distribution of both gobies and their distribution over sample quadrants at Sites 1 and 2.

A chi-square test of the visually estimated sizes classes of fish between Sites 1 and 2 shows statistical significance for *A. guamensis* ($p < .05$) and also for *S. stimpsoni* ($p < .05$); although use of this statistical test in this situation is not quite appropriate because there were no fish in some of the size classes for both sites. No fish smaller than 2 cm was observed at either site, and the only juveniles seen were four *A. guamensis* in the splash pool of the waterfall at Site 1. All statistical analyses were computed using Minitab® Release 11.0. The small size of the data set does not lend itself well to statistical analyses and should be considered with caution.

Table 4
Fish and Invertebrate Species

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
	The Falls	The Wall	Small Wall	Schinus Trees	Low Flow	Stream Mouth
Fish						
Goby <i>Awaous guamensis</i> 'O'opu näkea	7 (0.54/m ²)	17 (1.52/m ²)	0 (0.0/m ²)	0 (0.0/m ²)	0 (0.0/m ²)	ns
Goby <i>Sicyopterus stimpsoni</i> 'O'opu nöpili	11 (0.84/m ²)	12 (1.07/m ²)	0 (0.0/m ²)	0 (0.0/m ²)	0 (0.0/m ²)	ns
Goby <i>Stenogobius hawaiiensis sp.</i>	ns	ns	ns	ns	ns	present
Goby <i>Eleotris sandwicensis sp.</i>	ns	ns	ns	ns	ns	present
Flagtail <i>Kuhlia sandvicensis</i> äholehole	ns	ns	ns	ns	ns	present
Western Mosquitofish <i>Gambusia affinis</i>	ns	ns	ns	ns	ns	present
Guppy <i>Poecilia reticulata</i>	ns	ns	ns	ns	ns	present
Tilapia <i>Tilapia melanotheron</i>	ns	ns	ns	ns	ns	present
TOTAL FISH DENSITY/sq METER	1.37	2.56	0	0	0	na
Crustacea						
Shrimp <i>Atyoida bisulcata</i> 'Öpae	ns	ns	ns	ns	ns	ns
Shrimp <i>Palaemon debilis</i>	ns	ns	ns	ns	ns	present
Prawn <i>Macrobrachium lar</i>	2 (0.12/m ²)	7 (0.68/m ²)	1 (1.08/m ²)	0	0	ns

Notes: Numbers are expressed as total individuals seen at all 5 quadrants at a site
Results for Site 6 are qualitative only and are expressed as either present or not seen
ns: not seen
na: not applicable

Table 5
Fish and Invertebrate Counts at All Sites
Kaipa'pau Stream 2000

Quad Designation	Length meters	Width meters	area (m2)	# Fish Total	density T.fish/m2	<i>Awaous guamensis</i>	Density A.g./m2	<i>Sicyopterus stimpsoni</i>	Density S.s./m2	<i>Macrob. lar</i>	Density M.l./m2	
THE FALLS	1.1	2.3	1.45	3.335	6	1.80	6	1.80	0	0.00	2	0.60
	1.2	2.1	1.4	2.94	1	0.34	1	0.34	0	0.00	0	0.00
	1.3	1.6	1.5	2.08	0	0.00	0	0.00	0	0.00	0	0.00
	1.4	1.55	1.45	2.2475	6	2.67	0	0.00	6	2.67	0	0.00
	1.5	1.55	1.6	2.48	5	2.02	0	0.00	5	2.02	0	0.00
Totals			13.08	18			7		11		2	
Average					1.38		0.54		0.84		0.15	
THE WALL	2.1	1.6	1.4	2.24	3	1.34	0	0.00	3	1.34	0	0.00
	2.2	1.5	1.5	2.25	4	1.78	1	0.44	3	1.33	2	0.89
	2.3	1.65	1.4	2.31	3	1.30	1	0.43	2	0.87	1	0.43
	2.4	1.65	1.5	2.475	13	5.25	11	4.44	2	0.81	0	0.00
	2.5	1.6	1.2	1.92	6	3.13	4	2.08	2	1.04	4	2.08
Totals			11.20	29			17		12		7	
Average					2.59		1.52		1.07		0.63	
SMALL WALL	3.1	1.9	1.1	2.09	0	0.00	0	0.00	0	0.00	1	0.48
	3.2	2.1	1.9	3.99	0	0.00	0	0.00	0	0.00	0	0.00
	3.3	1.8	1.05	1.89	0	0.00	0	0.00	0	0.00	0	0.00
	3.4	1.5	1.4	2.1	0	0.00	0	0.00	0	0.00	0	0.00
	3.5	1.6	1.4	2.24	0	0.00	0	0.00	0	0.00	0	0.00
Totals			12.31	0			0		0		1	
Average					0.00		0.00		0.00		0.08	
SCHINUS TREES	4.1	1.6	1.5	2.4	0	0.00	0	0.00	0	0.00	0	0.00
	4.2	1.7	1.5	2.55	0	0.00	0	0.00	0	0.00	0	0.00
	4.3	1	1	1	0	0.00	0	0.00	0	0.00	0	0.00
	4.4	2	1.4	2.8	0	0.00	0	0.00	0	0.00	0	0.00
	4.5	1.8	1.2	2.16	0	0.00	0	0.00	0	0.00	0	0.00
Totals			10.91	0			0		0		0	
Average					0.00		0.00		0.00		0.00	
LOW FLOW	5.1	1.7	1.3	2.21	0	0.00	0	0.00	0	0.00	0	0.00
	5.2	1.2	1.2	1.44	0	0.00	0	0.00	0	0.00	0	0.00
	5.3	1.6	1.5	2.4	0	0.00	0	0.00	0	0.00	0	0.00
	5.4	1.8	1.7	3.06	0	0.00	0	0.00	0	0.00	0	0.00
	5.5	1.9	1.4	2.66	0	0.00	0	0.00	0	0.00	0	0.00
Totals			11.77	0			0		0		0	
Average					0.00		0.00		0.00		0.00	

Size Distribution by Site

	Site 1 The Falls		Site 2 Large Wall	
	<i>A. guamensis</i> <i>stimpsoni</i>	<i>S. stimpsoni</i>	<i>A. guamensis</i> <i>stimpsoni</i>	<i>S. stimpsoni</i>
2-4 cm	4	2	1	0
4-6 cm	0	5	2	1
6-8 cm	2	3	3	7
8-10 cm	0	1	6	4
> 10 cm	1	0	5	0

Chi square of size vs site

	Site 1		Site 2		expect	1-exp	2-exp
	actual	exp	actual	exp			
2-4 cm	57.1	5.9	18.2	0	18.20	2.002	2.184
4-6 cm	0	11.8	45.4	8.33	53.73	5.9103	6.4476
6-8 cm	28.6	17.6	27.3	58.34	85.64	9.4204	10.2768
8-10 cm	0	35.3	9.1	33.33	42.43	4.6673	5.0916
> 10 cm	14.3	29.4	0	0	0.00	0	0
						14	34.00
1-Ag	actual	exp					
	4	4.41			0.168		
	0	0.826			0.682		
	2	3.234			1.523		
	0	2.471			6.106		
	1	3.059			4.239		
					12.718		

Figure 2. Fish Densities at Sites 1 and 2

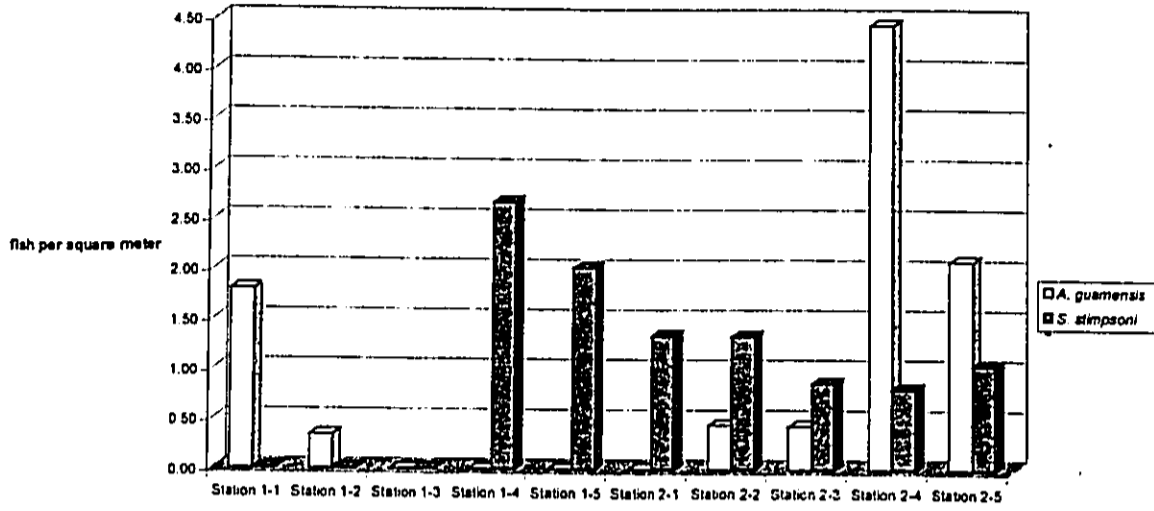


Figure 3. *A. guamensis* lengths for Sites 1 and 2

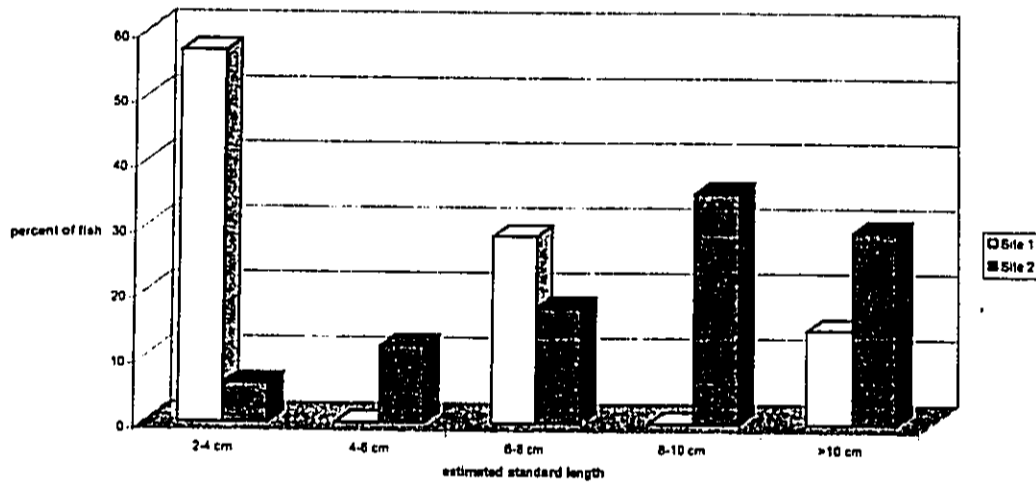
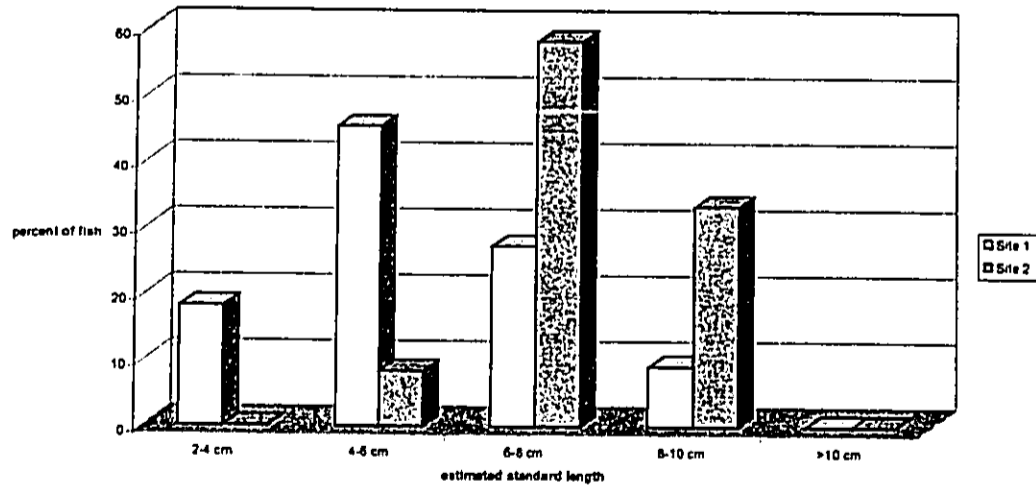


Figure 4. *S. stimpsoni* lengths for Sites 1 and 2



The stream reach adjacent to the ocean was observed to have many non-native as well as native stream organisms although it was not formally surveyed. Fishes of the introduced genera *Tilapia*, *Gambusia*, and *Poecilia* were observed to be common in this reach, as were the native genera *Kuhlia*, *Stenogobius*, and *Eleotris*. It is unknown how far inland the ranges of these fishes extended, but they have not colonized the area of Site 5 at 200 ft elevation, probably because the flow becomes intermittent somewhere below that elevation. The stream reach adjacent to the ocean appears to have perennial flow, even though it may be quite minimal during dry periods.

Crustaceans and Mollusks

One species of crustacean, the introduced Tahitian prawn *Macrobrachium lar*, was found in the three highest elevation sites surveyed. One individual was seen at Site 3, seven at Site 2, and two at Site 1. No other crustaceans were seen in the upper watershed including the native 'öpae, *Atyoida bisulcata*. Immediately upstream of Site 3, *M. lar* became more common and the presence of gobies was also observed. Mean density of *M. lar* at Site 2 was 0.63/m² and 0.15/m² at Sites 1 and 2 respectively. No statistical comparison of *M. lar* densities was valid because of the small sample size. All of the *M. lar* seen were adults, and no size-class analysis was conducted for the same reason.

Although not quantified, Grapsid crabs and the shrimp *Palaemon debilis* were observed near the mouth of the stream. No *M. lar* were seen in this area but may have gone undetected.

Sites 4 and 5 had no macrofaunal organisms except frogs, which were observed to be present outside the sample areas, and two species of mollusks. The introduced Thiarid snail *Tarebia* was found at a density of approximately 1.5/m² at Site 5, although this is probably an underestimate because they are small (1 cm long) and can be under rocks or wedged into crevices where they escape detection. None, however, were found at Site 4 despite the presence of another snail species. The unidentified snail may be in the genus *Physa* and is

very small (<3 mm). It occurred at both Sites 4 and 5, but because of its size, any estimate of its density within quadrants of the scale used would be inaccurate. Mollusks were not counted at the three upstream sites due to the focus on other taxa that have been more thoroughly studied and can be used for comparisons to other streams and indicators of biologic integrity.

Native Neritid snails were common near the mouth of the stream. Large individuals of *Neritina granosa* (hihiwai or wi) were observed along with numerous egg capsules on the rocks. Where tidal influence was present, *Neritina vespertina* (hapawai) was abundant and also producing many egg capsules.

E. Discussion

Previous studies in the Kaipapa'u valley have been conducted by The Bishop Museum and others, but none of this data has been published. The 1992 "survey" by Englund was actually a letter to BWS summarizing observations made based upon a single incursion into the valley and limited non-systematic collections. Studies by Polhemus (1995) were conducted mainly in the upper Kaipapa'u Stream falls and stream area, which correlates with Site 1 (800 ft) of the present study.

The riparian vegetation of Kaipapa'u Stream was noteworthy in that a scattering of remnant native loulu (*Pritchardia martii*) palms lined the banks in many areas, and this further reflects the unusual undisturbed state of this watershed. Loulu palms were found at an unusually low elevation starting at nearly 200 ft and were common to the terminal waterfalls at 800 ft elevation. Other native plants that were common along the upper reaches of the stream included 'ākōolea, 'ōhi'a, and māmaki, while an introduced over story of guavas predominated in many of the higher areas. Hau and Christmas-berry become predominant along the streambed in lower (< 300 ft elevation) stream areas. Almost no feral ungulate damage was observed throughout the area surveyed at Kaipapa'u Stream, and pig hunters appear to have reduced pig populations enough to completely minimize any pig damage. Feral pigs can lead to increased sedimentation in

the watershed and affect native aquatic insect species, which are sensitive to sedimentation.

Many large cascades from the 600 ft elevation upstream to the terminal falls provided excellent habitat for native aquatic insects. Stream flow above 400 ft elevation appeared to be fairly permanent in nature, while the lower stations (4 and 5) exhibited little algal growth and probably flow only intermittently. Overall, aquatic habitats above 500 ft at Kaipapa'u Stream should be considered of the highest quality on the island of O'ahu. A significant finding of this survey is the continued absence of alien fish species, with the crustacean *Macrobrachium lar* currently the only species of introduced macro fauna known to occur in Kaipapa'u Stream above the 300 ft elevation level. Flow volume of the stream was seen to decrease steadily from The Falls at about 1.6 cfs to zero flow at Site 5, elevation 200 ft. As fish were only seen at the upper two sites it is difficult to "correlate" stream flow to species abundance. However, it was interesting to note that no fish were recorded from Site 3, water flow only slightly less than Site 2.

The densities of the goby fish *Awaous guamensis* and *Sicyopterus stimpsoni* are comparable to those reported by A. Brasher (1996) for Waikolu stream on the island of Moloka'i. Although it may be impacted by a diversion, Waikolu is thought to contain relatively robust populations of gobies compared to other streams in Hawai'i (Brasher, 1996). The higher fish densities at Site 2 compared to Site 1 may be an artifact of sample size and the fact that the splash pool of the large waterfall at Site 1 is not the type of habitat preferred by *S. stimpsoni* (Brasher, 1996). In general, it can be said that the two species are fairly abundant from just downstream of Site 2 to the terminal waterfall at Site 1.

The change in size distributions of *A. guamensis* and *S. stimpsoni*, according to elevation, correspond to Brasher's data for the same species on Moloka'i. In both Waikolu and Kaipapa'u streams these species tend to be smaller at higher elevations, although the fish in Kaipapa'u are larger on average than those in Waikolu stream. This can be explained by the scarcity of juvenile fish in Kaipapa'u. The population of

gobies in Kaipapa'u are likely recruitment limited and are therefore comprised of large, older individuals.

The low level of recruitment can be attributed to the known flow regime of the stream. Intermittent flow in the lower reaches prevents upstream migration of post-larvae and juveniles, which have been shown to be amphidromous, i.e. have obligatory marine larval phases (Radtke, 1988). Recruitment of Hawaiian stream gobies tends to be episodic in nature and occurs mostly in the spring and early summer (Nishimoto and Kuamo'o, 1997; Chong, 2000) so it is not surprising that post-larval fishes were absent during this survey. The four juveniles at the large waterfall were likely recruited earlier this year judging from their size (the observed fish were approximately 2.5 cm long, whereas post-larval *A. guamensis* are about 1.7 cm long). This indicates that recruitment is restricted to times when flow is uninterrupted to the ocean and young fishes are abundant near the mouth of the stream.

The species composition and distribution of adult fish populations also relate to general stream conditions. The lack of fishes at Site 3 shows that, even though there appeared to be perennial flow at the site, it is unsuitable habitat either because colonizers die during low flow or because the fish choose not to remain there. It may be unfavorable to fishes for a number of reasons including food availability and temperature, both of which can be related to unstable flow conditions. The only native goby not observed in the watershed was *Lentipes concolor*. This typically higher elevation species was once thought to be extinct on O'ahu but has since been found in a number of streams on the island (Higashi and Yamamoto, 1993). In streams where it was recently recorded on O'ahu, *L. concolor* has inhabited difficult-to-access upstream reaches, often above high waterfalls. *Lentipes concolor* has been used as an indicator of biologic integrity and therefore deemed important to mention. It may exist in Kaipapa'u stream at higher elevations than were surveyed.

Like the fishes, the population of *Macrobrachium lar* in Kaipapa'u stream appears to be recruitment limited. Its densities are low in this stream compared to other streams studied in Hawai'i (densities of 5/m² are not uncommon) and the individuals seen were all adults. Its range in Kaipapa'u stream roughly matches that of *A. guamensis* and *S. stimpsoni*, but may extend slightly lower. *Macrobrachium lar* was observed at Site 3 and it generally prefers slower moving water than the fishes.

The fact that snails are present in the lower elevation sites (4 and 5 of this survey) suggests that there is permanent standing water at those sites, even if flow is intermittent. Their populations are unlikely to persist unless some standing water is available. In fact, on the first day of the survey when flow ceased downstream of Site 5, there were pools of water in the streambed. The area downstream of that site, however, was observed to be completely dry and one would not expect to find snails resident from Site 5 until near sea level where water percolates above ground again.

In summary, the intermittent flow below approximately 400 ft prevents native species from inhabiting these reaches, but also protects the upper stream from invasion by alien species present at the stream mouth. The limited nature of these two site visits makes it difficult to estimate the extent of permanent flow in this stream. Similarly, the nature of our observations does not lend themselves to the prediction of any changes in stream flow regime due to wells or other site modifications. The distribution and abundance of native fishes seen is consistent with that observed during previous surveys by Polhemus (1995) and Englund (1992). Water quality was not considered in this survey as a factor in determining the distribution and abundance of native aquatic organisms. No water quality measurements were taken. However, the general condition of the streambed, the abundance of undisturbed stream bank vegetation, and the general clarity of the water suggests that water quality appears to be suitable for all aquatic taxa at present. The greatest species diversity was observed near the mouth of the stream, downstream of populated areas, where water quality is likely to be poorest in Kaipapa'u Stream.

Because of a lack of introduced fish and only a relatively few innocuous introduced aquatic insect species, Kaipapa'u Stream is one of the most important watersheds for the preservation of native biodiversity on O'ahu and also for the State of Hawai'i. For instance, native species of damselflies that have nearly become extinct and have had their ranges severely restricted on O'ahu (Englund, 1999) were abundant in Kaipapa'u Stream during Bishop Museum surveys conducted in the 1990's. Because many rare native aquatic insect species are found there, Kaipapa'u Stream should be considered to contain one of the most complete assemblages of native aquatic insects found in the Hawaiian Islands.

Because of its relatively undisturbed riparian surroundings, presence of adult populations of native goby fish, and abundance of relatively rare insect species, Kaipapa'u Stream should be considered to be of very high quality.

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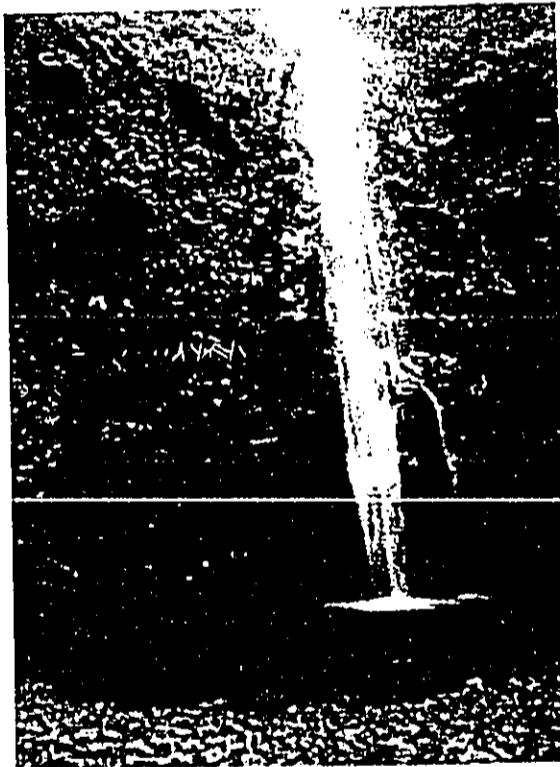
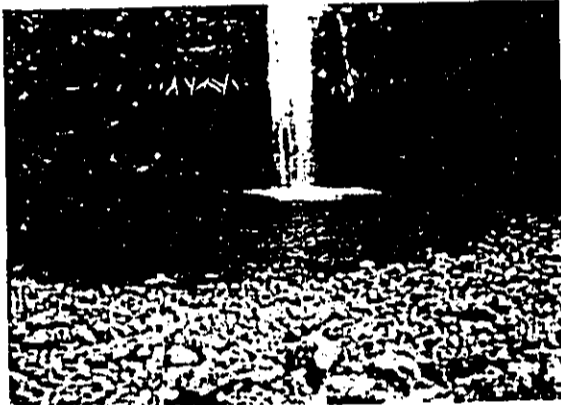
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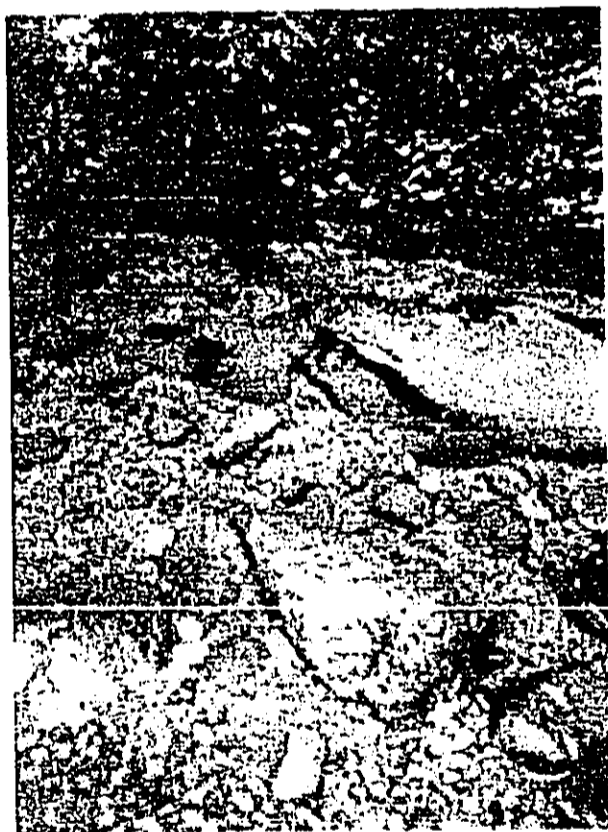
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APPENDIX A: SITE PHOTOS

Site 1 - The Falls



Site 2 – The Wall



Flow Site Near Station #4

Site 3 – Small Wall



Station #1



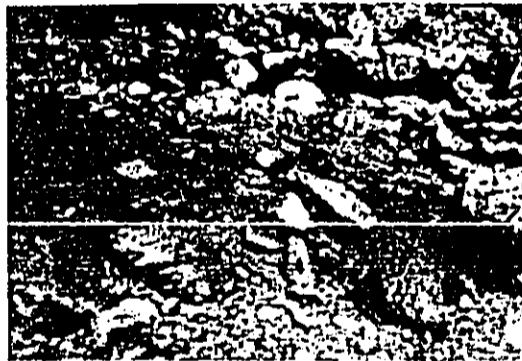
Station #2



Stations #3 & #4



Station #5



View downstream

Site 3



100 m Below Site 3



Site 3



100 m Below Site 3



Site 3



Upstream



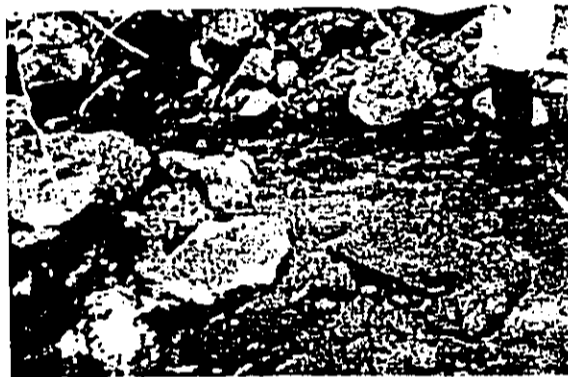
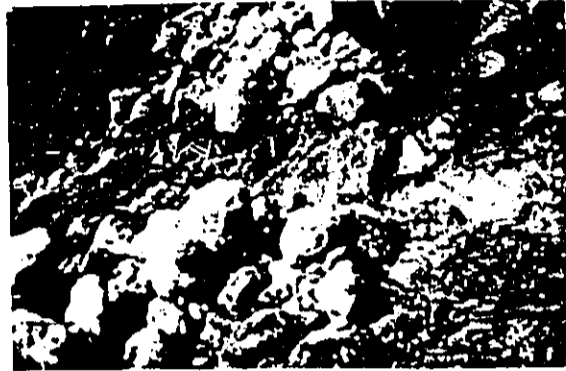
Downstream

Note: These photos were joined to form a continuous panoramic shot of Site 3 from upstream to downstream

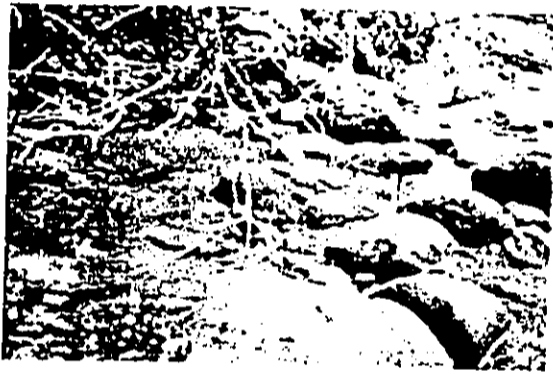
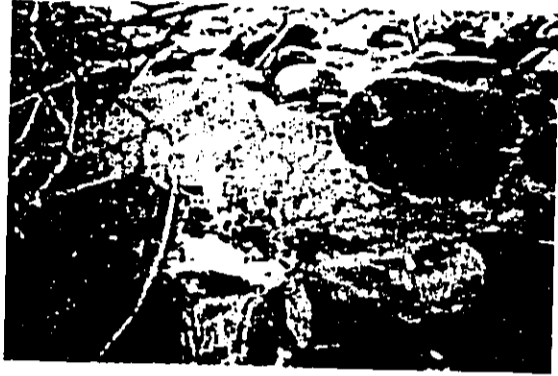
Site 4 – *Schinus* Trees



Downstream View into hau forest



Site 4

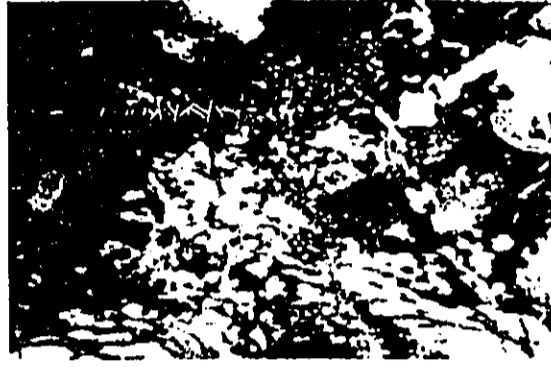


Schinus



Schinus

Site 5 – Low Flow



Final Environmental Assessment

Kaipapa`u Well and Associated Facilities

APPENDIX 4a

SRS ARCHAEOLOGICAL REPORT

DRAFT

ARCHAEOLOGICAL
INVENTORY SURVEY AND MONITORING REPORT
FOR THE
KAIPAPA'U EXPLORATORY WELL ACCESS ROAD

Conducted for the
BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

By
Social Research Systems Co-op,

David W. Cox
(with Richard Bordner)

DRAFT

August, 1995

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ABSTRACT

A rough roadway was bulldozed nearly a mile back into Kaipapa'u Valley in Hau'ula, O'ahu, in May and June of 1992 for access to the site of an exploratory deep well.

Previous work in the area at the mouth of the valley had shown the presence of a variety of stone walls, the valley trail and an historic period water tank system along the northern slope in the front of the otherwise untouched narrow part of the valley. Archaeological monitoring was undertaken in conjunction with the bulldozing and exploratory well drilling activities.

A total of nine sites, composed of twenty two features were identified in or near the construction corridor for the planned well and transmission pipeline, and the associated reservoirs. Nineteen of these features are newly discovered. The most interesting site found is near the well area, and is a cluster of six features of the remains of an agriculture exploitation and habitation site along the small stream side flat.

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Introduction

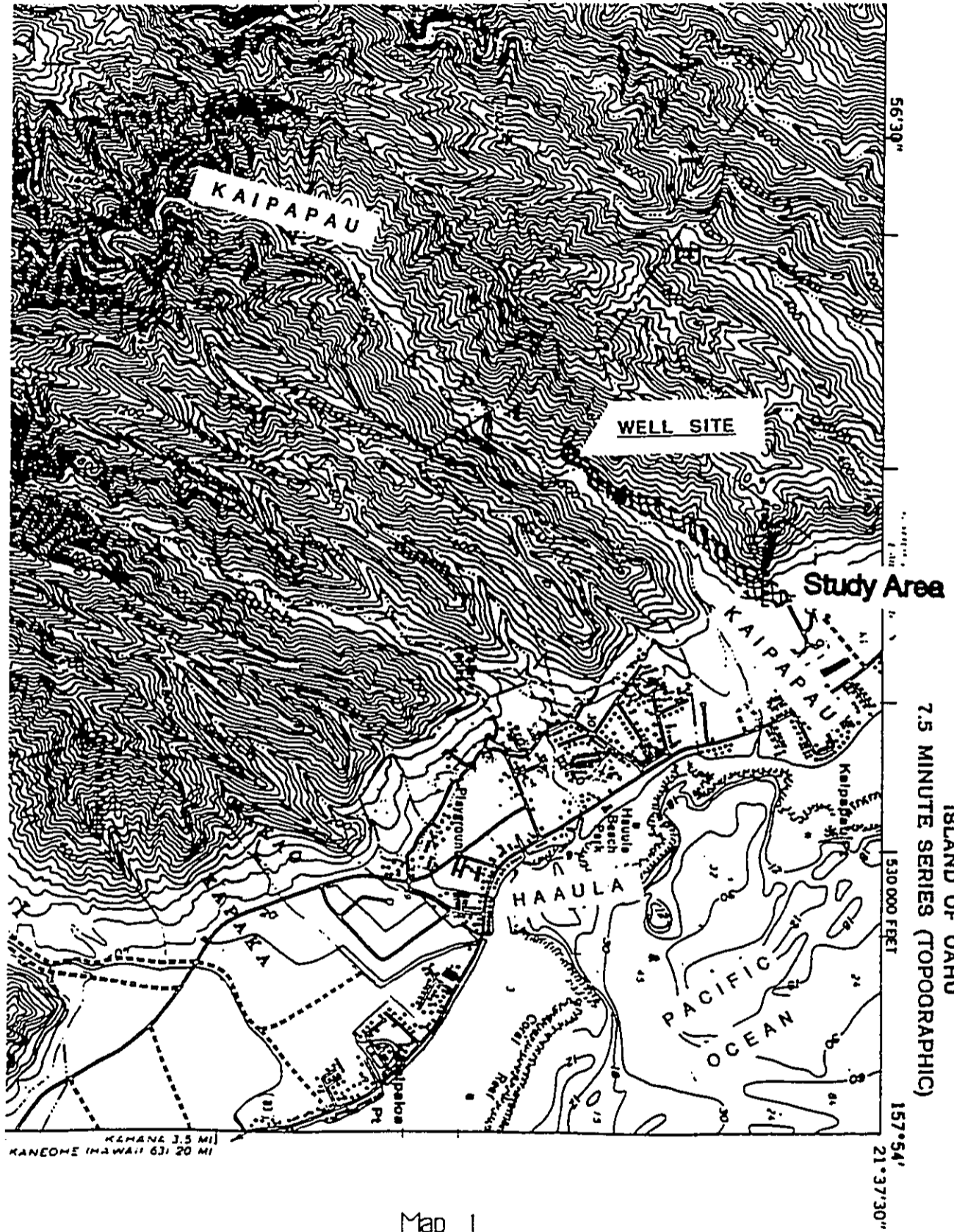
The proposed Kaipapa'u Well, and the associated Hau'ula 180 Reservoir and Pump Station, its pipelines and access road is in the process of being developed by the Board of Water Supply (The Board). These planned improvements are all to be located in an area off the upper end of Kawaipuna Street. This is on the slopes of the north side of Kaipapa'u Valley, and is near Hau'ula Village, in the district of Koolauloa, on the windward side of O'ahu, refer to Map 1, page 2, Study Area Location Map.

This report presents the results of the archaeological field monitoring performed during the clearing, grubbing and grading of the new Exploratory Well Access Trail, as required as a condition of The Board's Conservation District Use Application (C D U A), and Permit.

The water shed of Kaipapa'u Valley and the flat land area immediately to the seaward of that valley and on into the sea once constituted an important traditional land division unit, or an *Ahupua'a*. The Board's present project gives us an opportunity for the first time to investigate a significant portion of the remaining untouched or undeveloped part of this traditional land unit.

Background Research

As mentioned in the previous report, "Inventory Survey . . ." (R. Bordner, Oct. 1992:2, attached here as Appendix I), an extensive search uncovered no citations that could be found to relate directly to the specific project area in the published or unpublished literature



HAWAII - CITY AND COUNTY OF HONOLULU
 ISLAND OF OAHU
 7.5 MINUTE SERIES (TOPOGRAPHIC)

Map 1
 Study Area Location Map (a portion of U.S.G.S. Haoula Quad.)

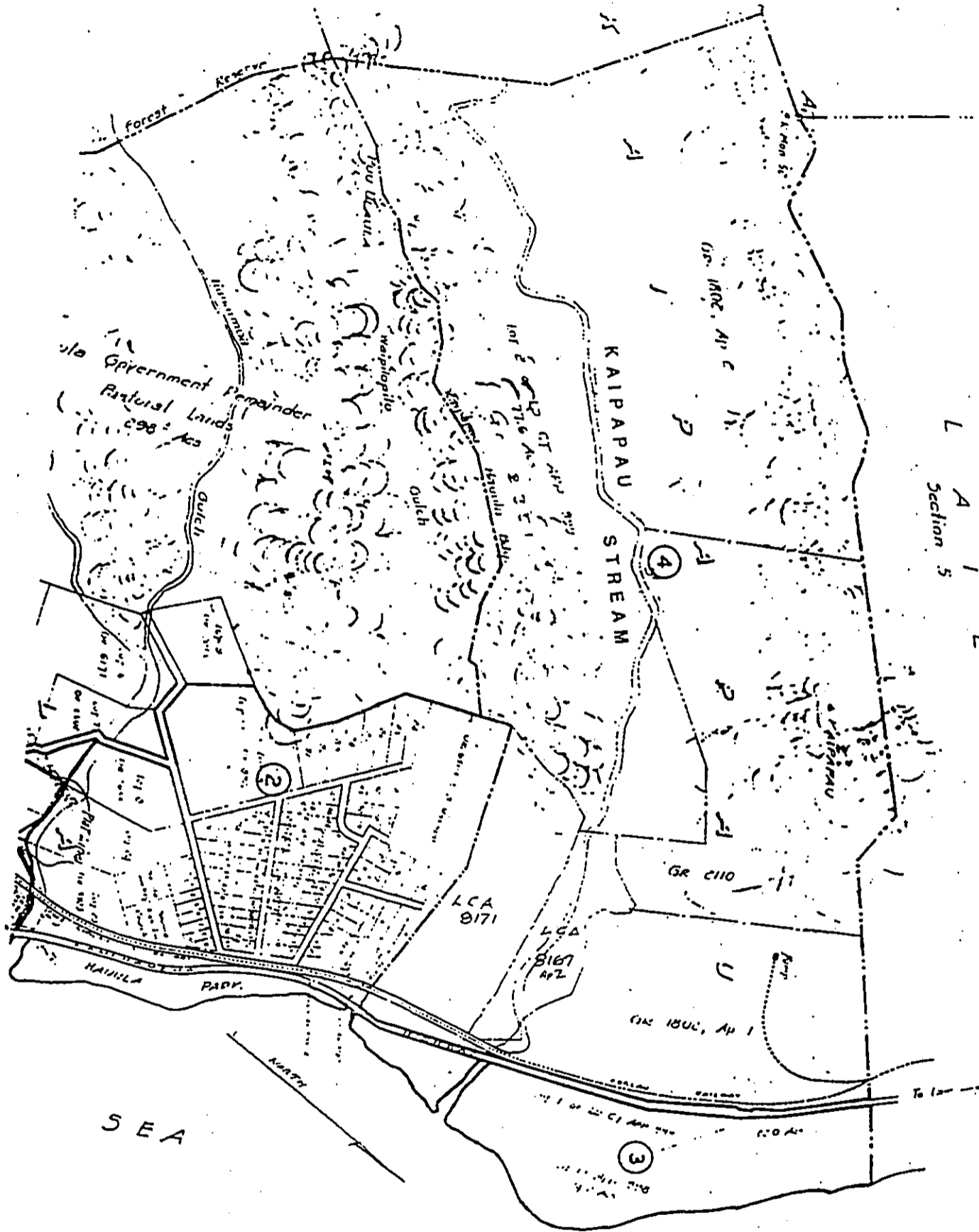
concerning traditional culture, mythology, land use or history. For a general discussion of these topics as they pertain to Kaipapa'u Ahupua'a in general, and the area of Hau'ula near Kaipapa'u see Bordner (ibid, Oct. 92:2-5). Those early records that do relate to this Ahupua'a are summarized below.

Land Records

The earliest land records for the district date to the Monarchy period, specifically to the time of the Great Mahele, that is from the Land Commission Awards [L C A s] of 1848-54. There were only two claimants receiving awards for lands they lived on, and actively farmed in the Ahupua'a of Kaipapa'u. On average this is a rather low number of claims for a typical Ahupua'a in the Koolauloa District. If one considers the relatively great distance from the then growing major population center for the island, Honolulu, on the other side of the Koolau mountains, and the low percentage of irrigateable land here (in the whole Ahupua'a), this is perhaps not too surprising.

The claims for the two (adjoining) properties are located well makai and south of the subject project area, see Map 2, page 4. This map is a partial copy of a microfilm of the earliest Tax Map for this area, a small scale map of Hau'ula area, Tax Map, Zone 5 / Sec. 4, dated May 1932, from the collection of the Hawaii State Archives.

The documentation of the transcripts of the testimony given by the claimants specifically mentions some inland use by them, as well as the parcel(s) mactually being claimed, and therefor is of potential direct intrest to this study.



Map 2
A Partial Copy of the Small Scale Map of the Hau'ula Area

The actual LCA Grant in each of these cases was allowed only for lands that were regularly and continually used (read farmed) and lived on however. Their testimony, and supporting testimony, as was presented to the Land Commissioners, (and as translated from the Hawaiian, as well as copies of the original metes and bounds, and plot plan). All from the collection of the State Archives are included here:

HIKIAU (LCA 8167) - [8.75 acres awarded, in two parcels].

[Native Register]:

Be it known to you, the Land Commissioners, that my claim for land is in the Ahupua'a of Kaipapa'u. Keaweiki has the mo'o, I only have a kula. It is bounded on the north by Kanihooi's mo'o, on the east, Hoopalahe's mo'o. I have a claim for cultivation in the upland, and in the forest, and a fishing claim, and a house lot claim.

Hikiau (N. R. : v. 5, pp 496)

[Foreign Testimony, (as given at same hearing, usually in english, in support, or rebuttal)]:

Maiiahi, sworn, says he knows the kula land claimed by Hikiau in Kaipapa'u (a Gov't land). There is but one -?- which is cultivated in potatoes, melons, etc. It is bounded on the north by the land of Kanihooi, - east by the seaside, - south by the land of Hoopalahe, - west by the konohiki. Claimant has occupied the land since before there was any law. Keawaiki is the name of the mo'o aina.

Witness knows the House Lot of the 6th[?]. It is not inclosed. It is bounded on the Waialua side by a stream - makai by a hill - Hau'ula side the same - Mauka by the land of Hoopalahe.

Kawahine, the konohiki, had no objections to make to this claim. (F or. Testimony : v. 8, pp.10)

For a copy of the original metes and bounds for this L C Award, dated 28 May, 1851, see Figure 1, page 7. Map 3, page 8 is the plot

plan that accompanied same. The plot plan, although viewed from a rather unconventional north to the left, identifies the *kula*, or dry farmed land, and the much smaller (and at a different scale) house lot. The latter was located, as labeled, *ma kai*, or 'seaward' of the *Ala Nui*, or literally - Great Way, and slightly south of the former plot.

These simple but direct descriptions and equally simple plot plans were all that was needed to file for a claim. Once the supporting testimony was presented to the Kings Commission, and a Judicial style award decision was rendered, the descriptions and simple plot plans presented there served to legally detail the claim, as in L. C. Aw. 8167.2.

Today, a comparison of these early documents and more recent ones show this 1851 award as being essentially the same as parcel 1 of Plat 04, Section 4, as shown here in Map 4, page 9. Map 4 is a partial copy from a microfilm of the medium scale Tax Map for Zone 5 / Sec. 4, which is the Hau'ula area. It was dated May 1932, and is in the State Archives collection.

A further comparison of the 1851 plot plan and the 1932 Tax Map clearly indicate that the stream shown going through the center of this later parcel has obviously changed its course somewhat to the south in the intervening 81 years. Meandering of these intermittent, but occasionally very heavy flowing streams beds is not at all unusual in flatter stretches in these (pre-Corp of Engineers) rural areas.

8167. Hikiia ana Kaipapau

Apaua 1. Pakala. E hoomaka ana ma ke
kiki aikan, a i holo ana
Ka 63. Ho 130 pauna, i pili ana i ke kōfouhiki
Ka 20. Ho 180 " " alanni
Ka 03. Ho 130 " " founhiki
Ka 20. Ho 180 " " " "
a hiki i kahi i hoomaka i 1/4 Eka.

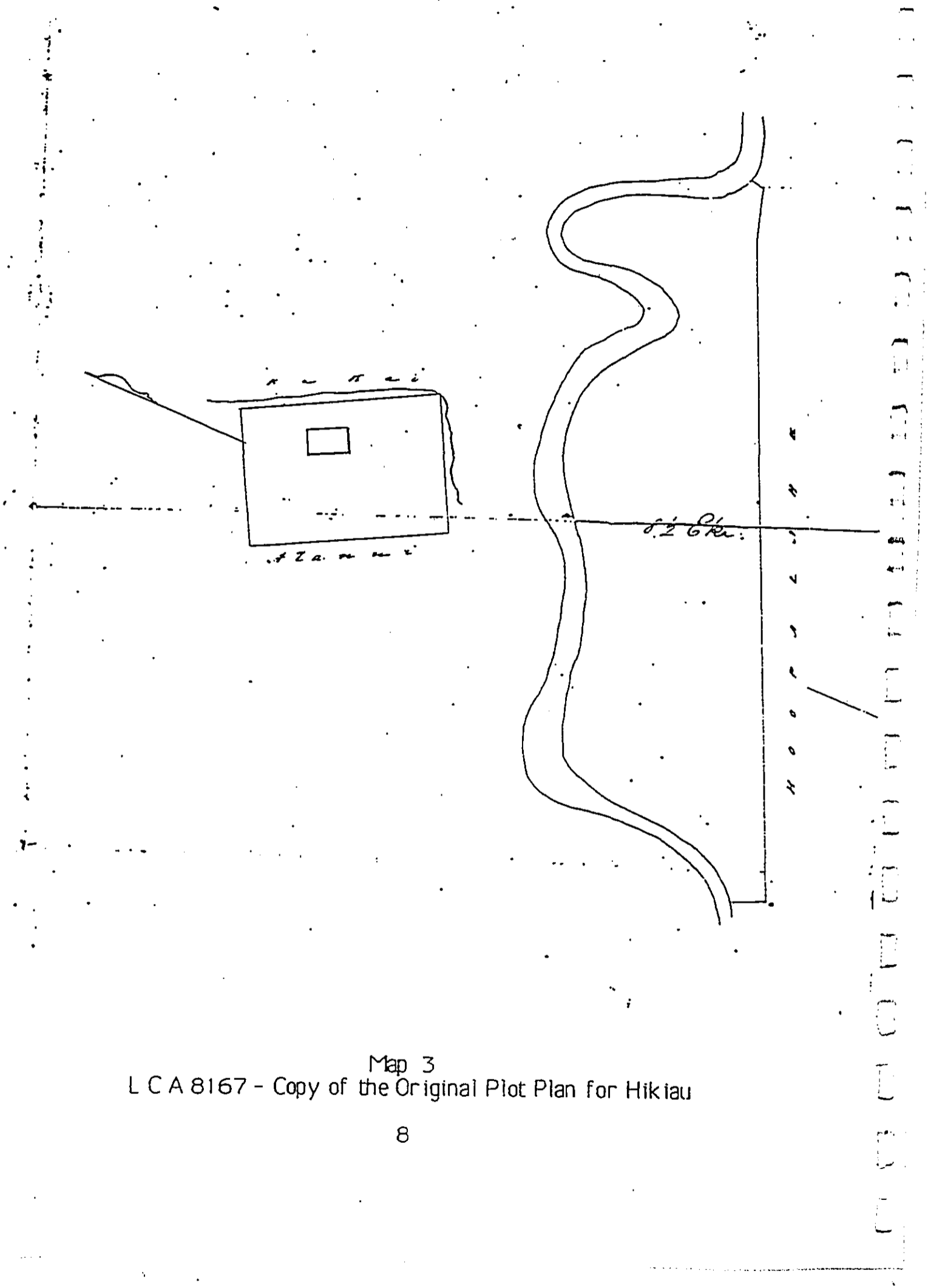
Apaua 2. Uione Uila E hoomaka ana ma
ke kiki Hikiia: a i holo ana
Ka 73 Ho 146 pauna, i pili ana i ke Hoopalaka
Ka 05. Ho 18 Ho pauna
Ka 25. Ho 100 pauna ma ke kahawai
alala, i pili ana i ke kahawai a
hiki i kahi i hoomaka i
1/2 Eka.

A. F. Fursey
Tuna ana aia

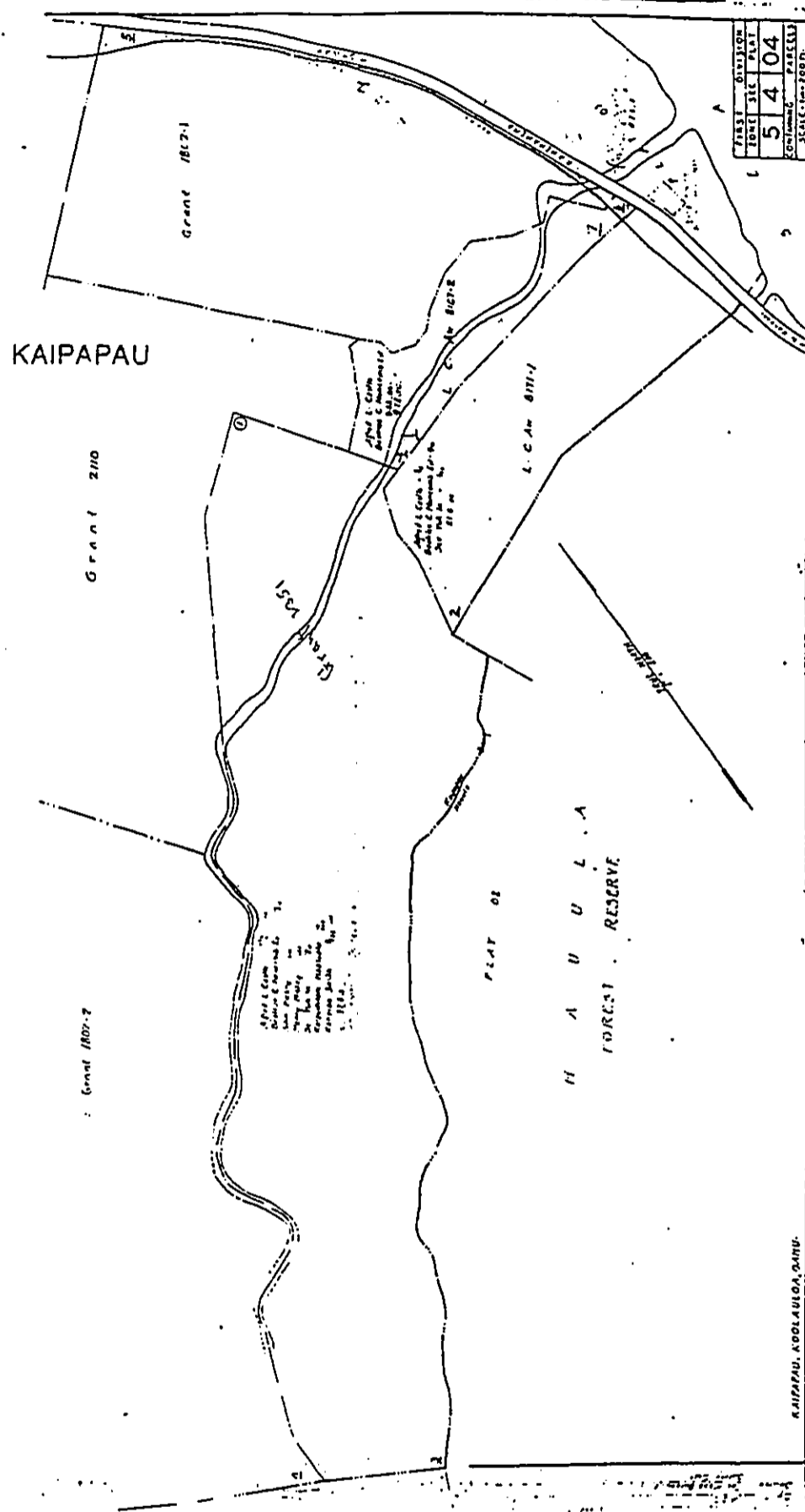
Honolulu
28th Aug 1857.

Figure 1
LCA 8167 - Copy of the Original Metes and Bounds

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Map 3
LCA 8167 - Copy of the Original Plot Plan for Hikiau



Map 4
A Partial Copy of the Medium Scale Hau'ula Area Tax Map

For a graphic analysis of this claim (and the following one), refer to the annotated plot plans in the final section of this report, Maps 17 and 18, pages 56 and 57 respectively.

The only other Mahele award in Kiapapa'u was just to the south, or toward Kaneohe from the above parcel, and was given to Hoopalahee. His testimony follows:

HOOPALAHEE (L C A 8171) - [22 acres, in a single parcel].

[Native Register]:

Be it known by the Land Commissioners that my land claim [is] in the Ahupua'a of Kaipapau. The mo'o is Kihapai, in this mo'o I have 4 lo'i, bounded on the north by a house claim, on the east by Kawainui's mo'o. I have a kula claim in this mo'o adjoining on the east [or south?] of Hikiau's mo'o kula. I cultivate in the kula of Kanihooi, and in the kula of Kawahine, and in the kula of Miaihe.

I have a claim of cultivation in the upland and in the forest. I farm in the Ahupua'a of Hauula. The mo'o is Kalaipahoa, I have 2 lo'i in it and a small kula also adjoining on the north of the lo'is in this mo'o. The boundaries are: on the north, the kula, on the east, the mo'o of the Konohikis. Those are my claims, from the Konohikis. I also have a house claim. (Nat. Reg: v. 5, pp 497)

[Foreign Testimony]:

(re) Hoopalahe: Maiiahi, sworn, says he knows the kalo land claimed by Hoopalahe in Kaipapau. There are 4 patches, forming 1 piece. Bounded on the Waialua side by the kula land of Hikiau, - makai the same, - Hauula side by the boundary of Hauula, - mauka the same. Claimant has a piece of kula land planted. It is enclosed with a fence, and Bounded on the Waialua side by Hikiau's land, - makai by the Konohiki, - Hauula side by Hauula boundary, - mauka by the hills.

Koekoe, sworn, says he knows the kalo land claimed by Hoopalahe in Hauula. There are 2 patches forming 1 piece. Bounded on the north by a stream, - east by the Konohiki, - south by Kamanu's land, - west by Hinamao'o's

lands. Witness knows the house lot claimed by Hoopalahe in Kaipapau, the stones are prepared for building a wall round it. It is bounded on the north by a stream, - east by the seaside, - south by Hauula boundary, west by claimant's kalo land.

Kawahine, the konohiki of Kaipapau, made no objection to the claim in that land. Claimant [?] has occupied since long before witness came there.

The King's Land Agent made no objection to the claim in Hauula. (For. Test. : v.10, pp 9)

Figure 2, page 12, is a copy of the original 'metes and bounds' for this award to Hoopalahee, dated 28 May, 1851. Also included here is a copy of the accompanying plot plan, Map 5, page 13.

These two LCA properties survived in essentially in their Land Court Award form, for 80 plus years, that is into the 1930's as can be seen in Map 4, page 9. This map is the copy of the first edition of the Tax Map for Kaipapau, dated May 1932. The total acreages were reduced slightly by the easements along the east, or shoreline side of each property for the Koolau Railway's Right of Way, as well as for periodic changes required by improvements to the *Ala Nui*, the government road through the District, later to be named Kamehameha Highway.

For our study area, the significance of these earliest documents is not so much the actual awarded properties, to which we can now assign the proper traditional names (*moo aina*), but it is the direct reference to traditional rights for activities and uses on other parcels in the uplands of this *ahupua'a* (unfortunately not specified), by known residents of this *ahupua'a*.



Map 5
A Reduced copy of Hoopalahee's Plot Plan for L C A 8171

Later Land Grants - 1855 -1915

Concurrent with the First Mahele (which was actually closed in 1854), the government made it possible for subjects of the Kingdom, and then later on, even resident foreigners to purchase property outright. These purchases were directly from some of the remaining extensive Government Lands. This purchase program continued in some form on past Annexation, as we will see.

There were four such purchases in the relatively small Ahupua'a of Kaipapa'u, and these consisted of virtually most of the remainder of the accessible portions of the Ahupua'a. The first three sales were to native subjects, from 1855 to 1857, or very early on in the period, right after direct purchases were allowed.

<u>Grant Number</u>	<u>Grantee</u>	<u>Acreage</u>	<u>Date of Purchase</u>
1802	Kaupea & Kauai	133.30	1855
2110	Naliili	66.66	1856
2351	Hoopalahee	123.00	1857
4855	Jas. B. Castle	282.00	1905

The first two Grants listed above are completely on the north side of Kaipapau Stream. The last of these early three was again to Hoopalahee, adding in 1857 the sizable, but generally steep section immediately in-valley of his earlier Kuleana award (LCA 8171). Again, this grant to Hoopalahee was mostly on the south side of the stream (refer again to Map 4, page 9).

The last of the four Grants was for lands in the back of the

valley (and well beyond the limits of the present Project Boundary). This Grant, Number 4855 went to a major windward O'ahu planter, rancher and land owner, occurring rather late, in 1905. Refer here to Map 6, page 16. Map 6 is a copy of part of the State Archives microfilm of the earliest small scale Tax Map for Hauula & Kaipapau [May 1932]. This property was subsequently put into Forest Reserve.

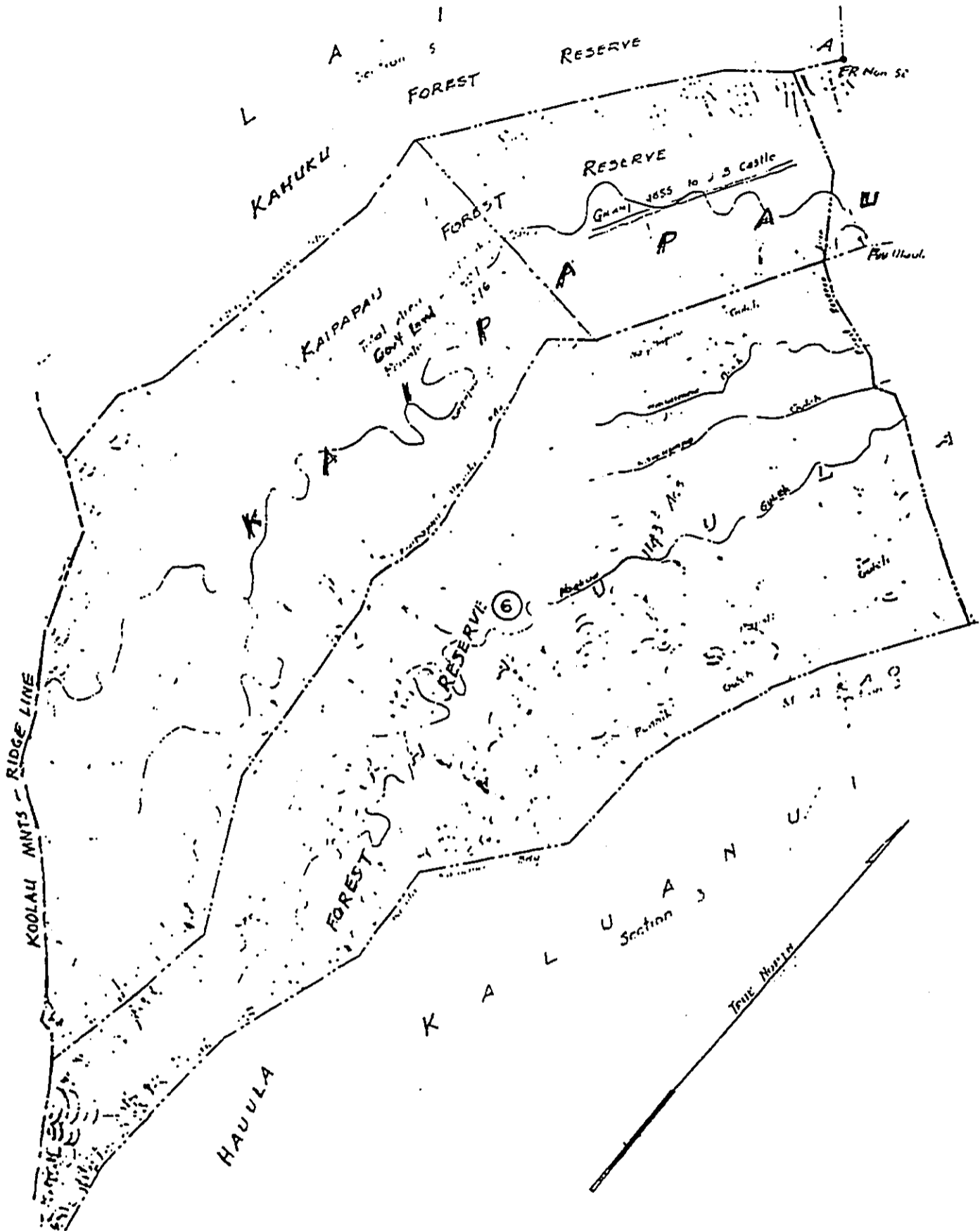
The 1855 Grant #1802, to Kaupea and Kauai, for 133.30 acres was actually for two separate parcels, or *apana*, with the second Grant to Naliilii (Grant #2110) for 66.66 acres located in between the two *apana* of #1802, refer to Map 4, page 9. The inland section of #1802, or *Apana 2*, and part of Naliilii's property (due to later subdivision, discussed below) are the actual location of the Board's present water development project, and the focus of this study.

Land Use from Territorial Times on

The work done in the 30's by E. S. Craighill Handy (Handy 1971:91) on the scope and extent of the Hawaiians' land use in general, and their agricultural systems in particular, includes a catalog of what was still known at that time about the traditional land use for each section on each island. Handy gives a scant five line mention for Kaipapau. In their later work Native Planters of Old Hawaii (1972), mostly done in the 1950's (and greatly expanding on the 1930's research), the Handys, now with Mary Kawena Pukui, add slightly to the previous single paragraph entry for Kaipapau:

. . . (going north along the coast) we find conditions less and less suitable for wet-taro . . . In Kaipapau (Shallow Sea) the

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HAUULA & KAIPAPAU, KOOLAULOA, OAHU

Map 6
Part of the 1932 Tax Map for Upper Hauula & Kaipapau
16

ahupua'a adjacent to Hauula, the upper stream valley is steep and narrow, yet natives of the district say that, making the most of a small opportunity, a few lo'i used to be worked there.

The level land to seaward may once have supported a moderate amount of terracing, but as this is all under cane when the area was studied in 1953, the extent could not be determined. (Handy et al., 1972:460)

Their second comment here bares directly on the present project area, as the statement aptly describes the physical situation, and as we will discuss below, some of the findings in upper reaches of the project. The later sentence speaks to the significant changes that large scale agri-business wrought on much of Hawaii's landscape, starting in the late 1800's and on through to the present. It was here on the relatively narrow flats between the shore and the outer reach of the ridges and valleys that provided the open areas needed for large scale commercial sugar production. As we saw above in the Mahele LCA grants in this Ahupua'a, this was the same land that was lived on, used, claimed and awarded in the mid 1800's, and was typical of where most of the residents of the Koolauloa District had lived and farmed before the sugar plantations moved them off this relatively flat and irrigateable (where enough water was available) land. For instance, note the 1932 railroad spur ending at a structure labeled PUMP, to the west side of Gr. 1802, Ap 1, Map 2, page 4.

Further land use changes on these inshore flats followed in the late 1960's, with the phased reduction of sugar acreage along this coast, and then finally the end of the Sugar Era in the District with the closing of the Kahuku Sugar Mill in 1971. Much of those sections of relatively level lands in this and adjoining areas were eventually subdivided and are still being developed, mainly for housing. To date

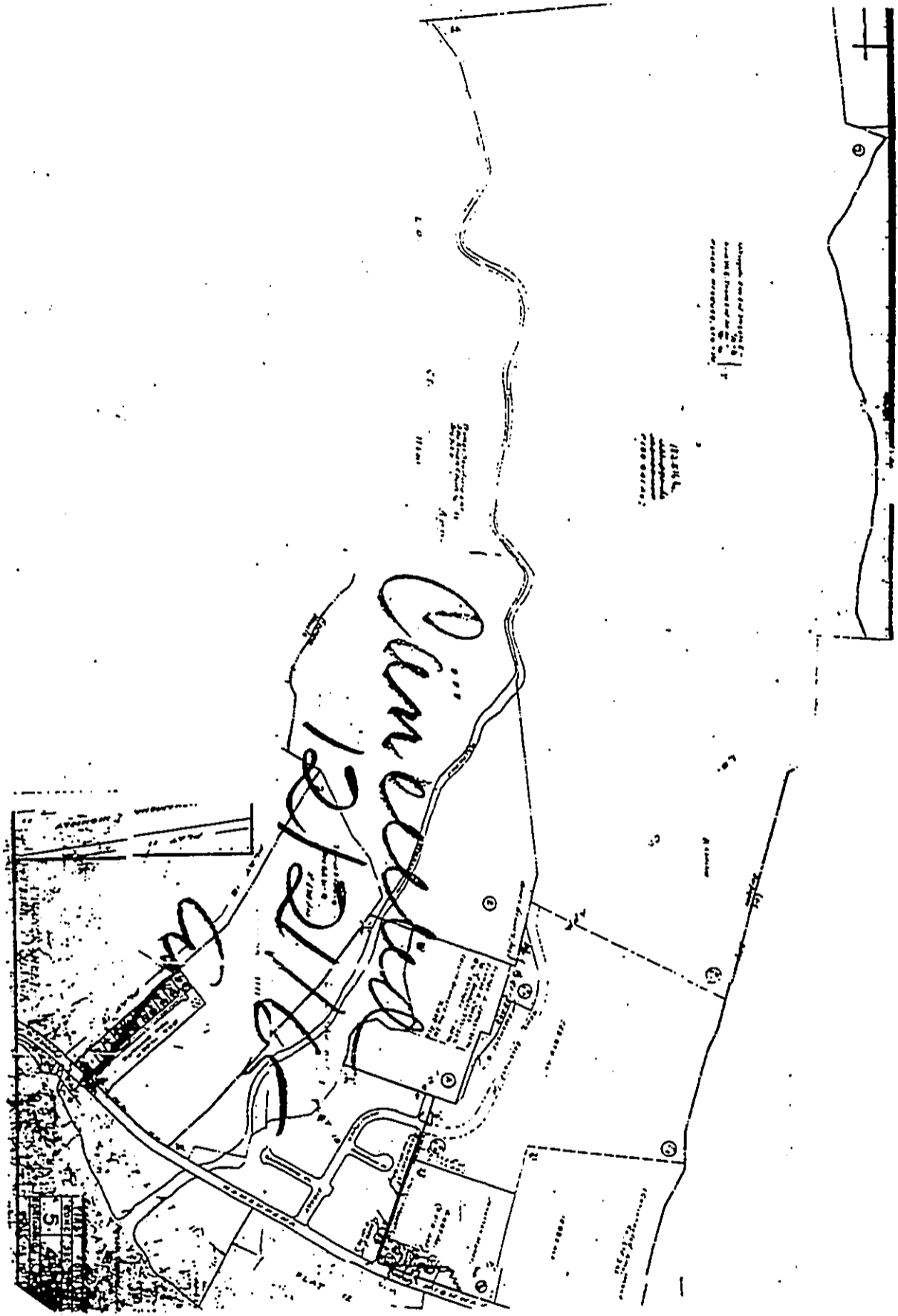
however, the narrow valleys and steep ridges along this coast line have remained almost completely untouched by any development.

Summary of Later Land Ownership

The present Board of Water Supply project is planned for the north side of the lower reaches of Kaipapau Valley. This is property that was once part of the early Land Grants numbered 1802 and 2110.

As was mentioned above Land Grant #1802 was composed of the non-contiguous parcels *Apana* 1 & 2 totaling 133.30 acres, and was purchased by Kaupea & Kauai in 1855. *Apana* 1 of this Grant is the large flat area just inshore of the *Ala Nui* (later called the Government Road, and finally named Kamehameha Highway) and nearest the boundary with Laie. With some subdividing, mostly since the 1930s, this has become the site of the present Hauula Shopping Center. This section is not affected by the planned project.

Naliili's Grant Number 2110, of 66.66 acres was directly inshore of Grant 1802 / *Apana* 1, with *Apana* 2 of Grant 1802 just in-valley of Naliili's. All of these grants are on the north side of the valley. These original grant boundaries remained unchanged from 1932, up through the Tax Map dated November 1963. Sometime after that date and before the next cancelled Tax Map available (dated October 1964) these three properties were combined when purchased by a potential developer - Glover, and then later re-subdivided, with different boundaries, as indicated in the Tax Map cancelled in December 1965 (see copy, Map 7, page 19). This last microfilm record is the same essentially for our purposes as today's. Since then



Map 7

Copy of part of Tax Map cancelled in December 1965

(post 1965) the inner-most plot, which is #1802 / *Apana* 1, plus the inland portion of about half of Grant #2110, form a large, single parcel that extends in-valley all the way to the Forest Reserve Line. That section is then virtually almost all the north side of the valley from stream center to the spur ridge, beyond the end of Kawaipuna Street. This property is now owned by the Plumbers Union, and is the location of the Boards present project (refer to Map 6, page 16).

In 1905, James B. Castle purchased Land Grant 4844. This grant was immediately west of Grant #1802 / *Apana* 2, and well up Kaipapau Valley. Grant #4844 consisted of two *apana* with one to the north, the other to the south of the stream, totaling 282 acres. It turns out that all of this 1905 grant is beyond the Well Site location, that is in-valley of the project limits, and will not be impacted by this project. The boundary between Grant #1802 / *Apana* 2 and Castles' purchase is now the Forest Reserve Line boundary (again see Map 6, page 16).

Prior Archaeological Activities

There have now been a total of four previous field surveys done on this property, all for planning level studies for this Board project. The first was a very limited preliminary reconnaissance report, with no actual field investigation, done by Chiniago Inc. in 1983-84 (for VTN Pacific). A more intensive, but still rather limited reconnaissance identified two sites. It was undertaken for Belt, Collins & Associates and was done by Alan Walker of Paul H. Rosendahl Inc. in 1988.

In 1989, Social Research Systems Co-op (SRSC) conducted a

further reconnaissance survey, attempting to relocate and confirm Walkers 1988 findings, and determine if other historic or pre-historic resources were present that might be affected by the project.

For a detailed discussion and summary of the findings and conclusions of these earlier projects refer to Bordner (ibid, pp 9-12).

A more intensive Inventory Survey was conducted by SRSC finally in January 1992. At this time, we found that all the previous workers had not gone deep enough into the valley (by a factor of at least 500 meters) to actually reach the location of the planned well site area, and had therefor not come close to investigating the complete extent of the planned project area.

Monitoring of Access Trail Construction

The clearing, grubbing and construction of the exploratory well access trail, from the upper end of Kawaipuna Street got under way 20 May 1992, and work continued as weather permitted until the new wellsite area was leveled out and completed, ready for the well drilling rig, on 24 June 1992.

The proposed well site is located on the north side of the stream bed approximately 1.25 to 1.3 kilometers back into the valley. All the road cutting work was done by one piece of equipment, a heavy Caterpillar 977, operated by Tony Toorinjian. The 977 was fitted with a large high-lift demolition type clamping bucket on the front, and a heavy three-tooth ripper on the rear.

Route Description

The first stage of the field work involved the monitoring of the grubbing and clearing of the lower portion of a new well access route completely within the Plumbers Union's property beyond the Shintaku Farms' barn, above the end of Kawaipuna Street on through to the area just beyond features of Walker's site number 418-2, the 'ditch'.

For specific feature locations in this lower section of the project, that is, up to the hook-up with the planned Hau'ula 180 Reservoir at Station Number 29+00 (Sta. 29+00), we will use the construction project station numbers as taken directly from the Hau'ula 180 Reservoir and Booster Station / Civil Details, Sheets C-4 to C-6, dated 2/18/94, as provided by Randy Hamamoto of the Barrett Consulting Group. For this section of the report, refer to our Maps 8 to 12, redrawn from the same.

In the upper section of the project, from the hook-up to the planned Hau'ula 180 Reservoir and Booster Station, at Sta. 29+00, on up to the well head, the stations were numbered independently of the former, and in reverse order by the contractor for that upper segment of the project - Control Point Surveying & Engineering, copies supplied by Glenn Suzuki of Okahara and Associates. In the interest of continuity of this report, the upper section of the project will be renumbered in our maps to conform with the lower section nomenclature (see Maps 13 - 16, also following this section).

To continue, this stage of the cultural resources field work monitoring was continuous during the clearing operations through

this lowest section, from Station Number 18+00 (Sta. 18+00) - at about 62 feet elevation, on up to the area just beyond the previously identified features, the walls of Site 418-2, which is located down slope, or to the left of Sta. 24+85.

The initial portion of the new line was through a relatively open area with thick California grass (Brachiaria mutica) and molasses grass and some scattered *koa haole* (Leucaena leucocephala), with java plum (Syzygium cumini) filling in above, further along.

From Sta. 20+00 to Sta. 21+00 the new route parallels the north property line, within a few meters of the existing fence line for the adjoining pasture. There at the top, at an elevation of 100 feet the trail swings hard left and connects to the 1960's route. Here most of the effort was spent reclearing the thick regrowth cover of christmas berry (Schinus terebinthifolius), and the indigenous yellow *kolomona*(Senna gaudichaudii) along the old dozer trail, which ended abruptly about Sta. 23+50. This section was the narrow abandoned path cut about 1960 for temporary access to the upper slope and beyond that had been identified during our second inventory survey of January 1992, and discussed in both Bordner (Oct 92:15, see copy attached, appendix I), and our letter to the Board, dated 30 May 92. Part of the latter is included here:

“. . . the Shintaku's explained that the trail had been cut right after the present property lines had been established with the subdividing of the Glover lands in the early 1960's."

Further discussions with Terry Shintaku indicated that with the subdivision of the Glover property, the two halves of the upper valley

(north and south sides of the stream) have in effect only a narrow access corridor each, like flag lots, because of the restriction caused by the steep slope beyond the end of Kawaipuna Street. As a result, the buyer of the south side of the valley, ended up with most of the more level land (now in unused pasture) that extends on behind the Shintaku's property, and all of the lower portion of the only existing trail into the valley (see Map 8 , page 30). In the early 1960's, the prospective buyers of the north side of the valley (where the new well and planned reservoir are to be developed) needed their own separate route, as the owner of the other parcel was not willing to allow an easement across their land (as is still the present case).

Once up to about the 105 foot elevation, the still relatively level path curves around the slope to the left through thick christmas berry, *kolomona* and *ti* (*Cordyline fruticosa*) plants in an area of large talus boulders and scattered walls. This is the section between the wall(s), the previous feature/Site number 418-1, mostly on the left, and the old wooden water tank & well, State Site number 4241 which is further up slope to the right at the base of the pali fronting Kaipapau Peak. This general area is discussed in detail in Bordner (ibid. pp 12-15). The abandoned well system was likely associated with the railroad spur and Pump indicated on the 1932 Tax Map, refer to Map 2 , page 5.

Once around the 'corner' the new route rises again and hugs the south property line from Sta. 22+00, to Sta. 24+25, which is at an elevation of 138 feet. This was the end of the old 1960's dozer path, and the location of Walker's site # 418-2, the 'ditch', where the

1960's operator broke all the bolts on the hardened cutting edge of the blade of his D-8, gave up leaving the blade, backed all the way down to his flat bed trailer, and left.

With extensive areas of dense basalt outcroppings bedding down, or sloping to the south (left, looking into the valley) in this area (probably the same that caused the trouble in the 1960's) and not having the services of a powder man, or a large hoe-ram, the present operator was unable to stay high on the slope as planned. The new dozer trail was forced to continue along just inside the property line, dropping down to an elevation of 124 feet, at Sta. 25+50. At this point, it was hoped he could then connect up to the lower existing valley trail. If this had been possible, then most of the effort beyond that point would only have involved simple grubbing of the thick christmas berry and *Hau-bush* (Hibiscus tiliaceus) cover along the relatively level old foot trail on the second bench, or step above the streams present course.

After running into another major blue stone outcrop, and then a very steep drop-off along the property line, at what would have been about Sta. 26+80, the only option left was to continue back up and to the right past a pair of large Date palms (Phoenix dactylifera). The resulting steep run of about 100 feet (and about 20.0% slope) ends at Sta. 27+80, at an elevation of 160 feet, where the trail levels out some what, and the going got much easier.

With the route now diverging away from the lower part of the valley floor near where the old trail, and the previously identified cultural features were found (and more were expected but not found

during the initial survey), the cultural resources monitoring proceeded on a periodic, rather than continuous basis.

Most of the route from the high spot at Sta. 27+80 on down to the first intersecting large tributary stream, at Sta. 35+00 and at an elevation of 126 feet, went relatively quickly. This is the area immediately below the planned reservoir site, and on. It is a section of the valley side that is not as precipitous, or as boulder strewn as the outer edge of the main ridge, or in most places, as thickly covered in vegetation as the narrow valley floor just below. The more open cover here is mostly shorter christmas berry bushes, well wind-carved, with some *lantana* (*Lantana camara*), *noni* (*morinda citrifolia*), 'akia (*Wikstromemia oahuensis*) and *ti*, and a few Formosan koa (*Acacia confusa*) (with many more up slope). In addition there is a low under story of *laua'e* fern (*Phymatosorus scolopendria*), *ulei* (*Osteomeles anthyllidifolia*), and occasional patches of *wauke* (*Broussonetia papyrifera*), *pepperomia* (*Pepèromia* spp.), and various grasses.

The site for the reservoir and booster station will require extensive grading here for the planned facilities.

A few newly identified features were noted in this section, these will be discussed in the following section of this report.

The general area beyond the first dry (most of the time) side stream, from Sta. 36+00 on is an area of generally greater slope. At the stream gulch there is a sizable stand of *casuarina* (ironwood / *Casuarina stricta*), with some yellow strawberry guava (*Psidium cattleianum*) and a few *schefflera* or octopus tree (*Schefflera actinophylla*) on the right, as well as the upper edge of an extensive

hau thicket just down to the left. The section of the dozer trail just around the bend to Sta. 36+50, at about the 140 foot elevation, required cutting a deep bank on the right, or uphill side, and considerable fill on the down slope side on the left.

Beyond Sta. 37+00 the general slope of the valley side gradually eases out again in the area where the dozer trail runs. Through this section, the new route gradually slopes down to the next side stream crossing at Sta. 44+00, at an elevation of 132 feet. A great deal of material went into filling the dry side gulch, and to get an acceptable grade going up beyond. Here the situation is very similar to that at the previous crossing at Sta. 35+50, with the steep spur ridge just beyond the stream gulch requiring a deeply cut bank on the right, lots of fill on the left, and another sharp short grade to Sta. 45+50, at an elevation of 162 feet. Also, as was seen in the section from Sta.s 36+00 to 38+00, there is a large area of sheet erosion wash out here on the inland or in-valley face of the spur, but here it is even more extensive in area than at the former. The area of eroded bare ground and perched boulders is perhaps as large an acre and a half, and has a few stunted *ohia* trees (*Metrosideros polymorpha*), *akia* and a variety of lacy ferns.

From this high point at Sta. 45+50, the rough roadway drops slowly again to one of the few flat areas in this section of the valley. The whole flat here was completely covered in a dense thicket of christmas berry, with a few scattered *hala* trees (*Pandanus tectorius*), and a couple of common mango trees (*Mangifera indica*). There are also a number of *kukui* trees (*Aleurites molccana*)

mixed in with the somewhat thinner christmas berry on the very steep slope to the right, or north side of the valley wall here.

The flat area is on the first stream bench or step, of about one to two meters, up from the stream bed proper, but in a couple of places is almost at the level of the main Kaipapau Stream. The flat area extends from Sta. 49+00 to Sta. 51+50 (at an elevation of 132 feet for both). More newly identified features were noted in this stream side flat.

The well site, at Station 54+00 is around a last bend and side wash gulch, on yet another prominent steep spur ridge, with another even bigger spur just beyond. The well site is at the end of a 100 meter long steep grade that is cut into the face of the valley side, which is also quite steep here. The rough finished well site proper is approximately 130 feet long by up to 50 feet wide, extends to Sta. 54+80, and is nearly flat, at an elevation of 202 to 205 ft.

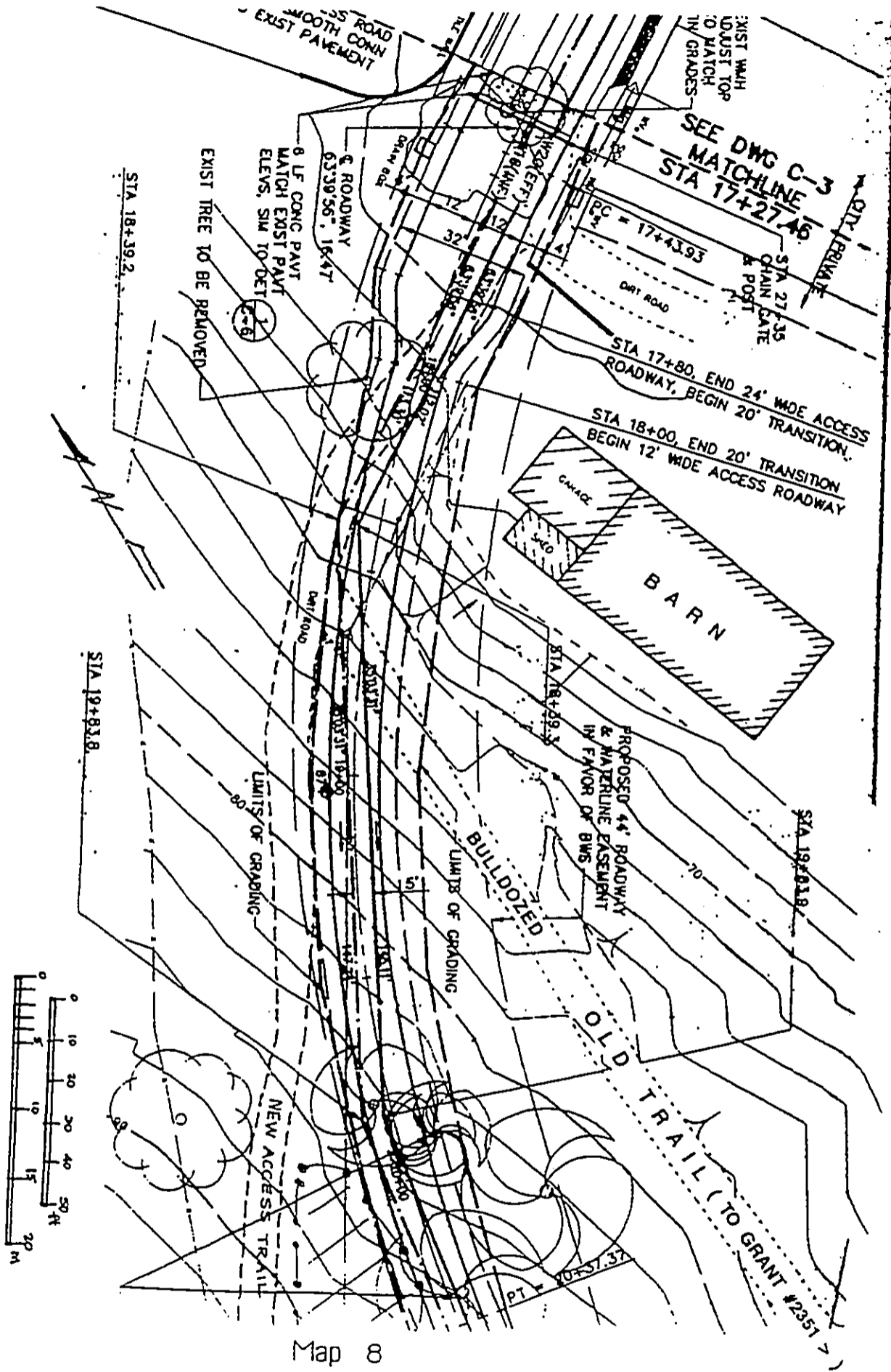
A possible cultural feature was located immediately down slope of the well head area, about half way down the new fill talus. Additional extensive grading will be required here for the planned well head facilities.

The Sites and Features

A description of each feature identified or relocated during the field monitoring follows. The feature locations are identified using the construction plan station numbers (which are given in hundreds of feet). All 'local' measurements of and within the features will use metrics, with conversions to metrics from the construction plans where needed.

The new well access trail/temporary roadway starts at Construction Station 18+00, where the planned facilities access road will start, at the end of the existing pavement at the head end of Kawaipuna Street.

The first feature worth noting is the existing main trail into the valley. This trail was, until recently, the main route for access into the back of Kaipapau Valley. The lowest section of the trail, in its present form is an obviously bulldozed path, and is used (infrequently now) as the only access to the large parcel that once was Grant #2351, and the areas beyond. The now overgrown trail diverges off to the left of the new access trail at about Sta. 18+70 (at an elevation of 72 feet), just beyond the Shintaku's barn (refer to Map 8, p. 30, New Access Trail & Old Trail, as revised from the preliminary construction plans). The old trail continues on almost due south, staying generally level for perhaps 200 meters, before angling gently down to the level of the pastures near Kaipapau Stream. The present short section of the outer end of the trail here may be only a result of the boundary changes of the 1930's, or even 60's, and therefor perhaps is not even historic. We can be certain however, that those sections beyond say Sta. 26+00 (that is, opposite this station, but of course well down slope and to the left of the new access route) are definitely older, as we have established through our field activities that this is the only pre-construction route into the back portions of this valley. The older trail (now assigned State Site Number 50-80-05-4867, or henceforth simply Site 4867) can still be followed in-valley for some distance. We were able to



Map 8

New Access Trail & Old Trail

trace it up to about opposite Sta. 48+30 where it drops down to the stream. Some sections of this trail are extremely overgrown and nearly impassable at present. Other sections were covered over during the process of cutting the new access trail, such as around Sta. 36+00, and at the well site. These sections will be mentioned below in sequence as they were identified.

Through this 'lower' part of the valley, the old trail, Site 4867 generally parallels the north side of the stream at a distance varying from 10 meters to as much as 75 meters. For almost the entire distance it remains on the second 'bench', above the present stream bed. At approximately Sta. 48+30, all traces of the old trail disappear, and the route used today by the few pig hunters going beyond here continues up valley in the stream bed itself (water flow levels permitting). Refer to Maps 13, 14, and 15, on pages 44, 47 and 48 respectively.

As our monitoring and field investigations did not extend further up valley than the new well site location, at Sta. 55+00, we were unable to find more of the trail beyond that point.

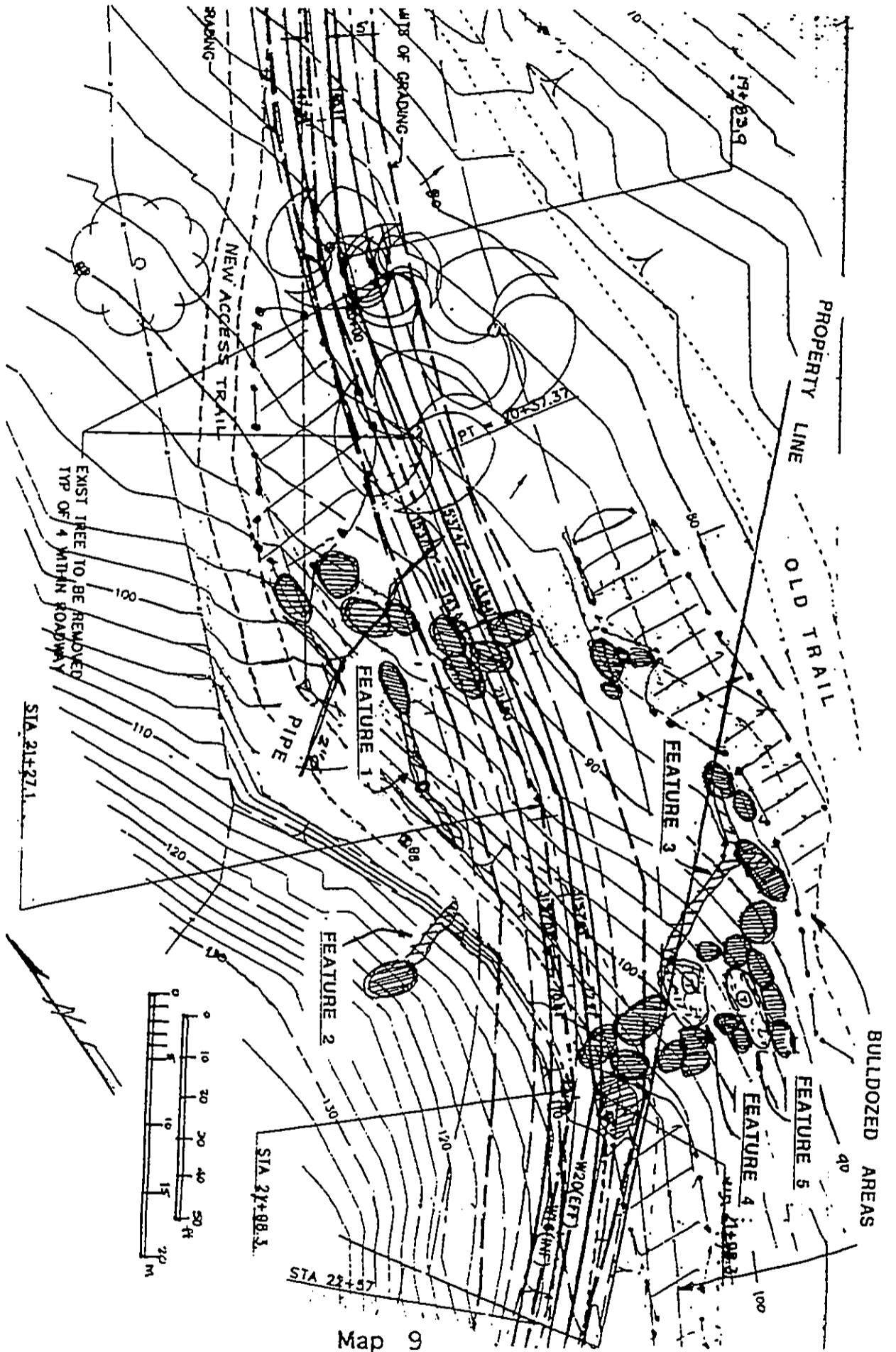
A number of scattered features were noted in close proximity to lowest portion of the new well access trail in the talus slope area below the 'front' or ocean side, and around to the steep south face of Kaipapau Peak. These features all occur from just within the present tree line, that is starting from about Station 20+80, on up to about Sta. 26+00. This part of the property will now be designated State Site Number 4242, a cluster of the remnants of prehistoric and/or early historic period agricultural exploitation. This is the narrow

area between the most easterly portion of the above mentioned old trail, Site 4867 and the short *pali* just behind the abandoned well and tank, Site 4241, and around into the mouth of Kaipapau Valley proper.

In this general area, the majority of the features noted consist of rather simple stacked walls. The more prominent of these have been described before, such as Walker's Site 418-1, and our old Site 4242 (see Bordner, *ibid.*, pp 13-16). Others noted during the monitoring may be in some cases the remains of what is left of once were more extensive prehistoric walls, after the random bulldozing that has occurred in this general area at various times in the past.

There are at least three major old dozer paths partially or wholly within the subject property area down slope between the new access trail and the old trail, Site 4867. In addition, there are numerous short interconnecting bulldozed sections in both this area, the areas toward the stream, and as well as above the new access trail. The resulting confusion of paths, pushed boulders and other material, and 'open' or untouched areas (mostly choked presently in thick christmas berry) cause a very difficult situation on the ground when trying to reconstruct the probable pre-destruction conditions here.

A short simple stacked wall was newly identified in a small section of nearly level ground (at Sta. 20+95 / 8m rt. cl / 98ft.) See Map 9, page 33. [That is in this case, that point of the feature opposite the lowest station number is eight meters to the right of the center line of the planned service roadway, at Sta 20+95, (as measured in feet), from the construction project datum, and is at a



Map 9
Lower Portion of Site 4242

ground elevation for this point of 98 feet. Also refer to the various Maps 8-12, for this section, as redrawn from the preliminary construction plan details].

This feature is a low, mostly single course wall, of sub angular and rounded basalt, of small boulders (to about 60+centimeters diameter / which is typical for all the walls noted in this site group). It meanders slightly from a large boulder at the north-east to the south-west for a distance of 11 meters(m), ending there at an elevation of 106 feet. The wall is roughly parallel to the planned Service Road center line. There is a single upright stone of 75 centimeters(cm) height at the center of the short unaltered alignment that otherwise averages 40cm high. This has been designated Feature 1, of Site 4242. This feature is out side the projects limits of grading, as indicated on the preliminary construction drawings, but not by much (less than 2m at each end) and therefor may be impacted by the planned construction activities.

The area to the west and up slope toward the new access trail gets steeper, with lots of boulders, some as big as 2+ meters long, by 1.5 meters wide, and as many high. This boulder field sits on crushed logs, and there are a few long sections of 2 inch diameter galvanized pipe jutting out from under a few of the very large rocks. Based on their general west-east, up-down slope alignment here, the pipe is assumed to have been associated with the old well and tank, Site 4241. The general haphazard accumulation of large sized material here is most probably the result of the bulldozing that occurred in the 1960's.

Across, or above the new access trail (at Sta. 21+50 / 8m rt. cl.

/ 108 ft.), is another short wall. This stacked multi-course, rough, double faced (but not corefilled) wall runs for only 6 meters, and measures from 60 to 85cm wide by up to 75cm height. It runs perpendicular to the steep slope, ending at an elevation of 116 feet against a large boulder. Judging from the condition of the lower exposed end it appears this wall continued further down slope until cut into by the 1960's bulldozing through here. This feature has been designated Feature No. 2, of Site 4242. This feature is outside the projects' limits of grading, as indicated on the preliminary construction plans.

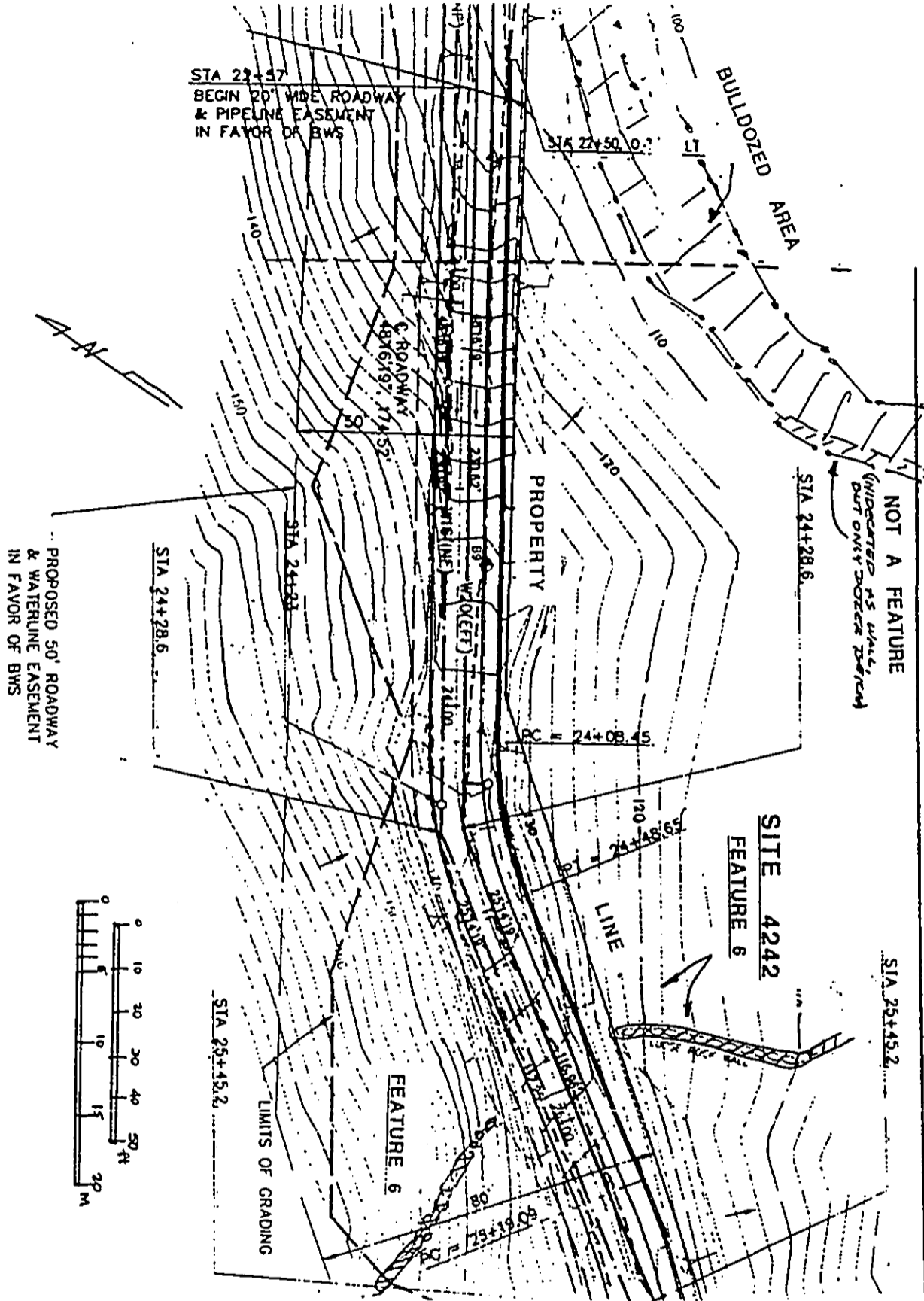
Walker's Feature 418-1 is located at Sta. 21+30, 12.5 meters left of the planned centerline, at an elevation of 87 feet. The down slope section of this 'T' shaped (not L shaped as first listed) wall spans the 7 meter distance between two large boulders, and the 11 meter long up slope portion ends just short of another larger boulder, at 98 feet elevation (see Map 9, page 33, and Bordner (ibid, p. 10) for a detailed description). This becomes Feature No. 3 of Site 4242.

Possibly associated with Feature No. 3 are two small terraces just in-valley, in the center of a cluster of large boulders. The higher terrace (at Sta. 21+67 / 7m left. cl. / 98ft.), is slightly sloped, and the larger of the two, at 5 meters by 3 meters. This new find has been assigned Feature No. 4, of Site 4242. The other newly identified small terrace is two meters from the former, (at Sta. 21+72 / 11.5m left. cl. / 95ft), and is almost level, measuring 6.5 meters by 2 meters. This lower terrace is retained on the low, or east side by a nearly continuous natural row of large boulders. This terrace has

been assigned Feature No. 5, of Site 4242. Both of these probable agricultural features are within the projects limits of grading, as indicated on the preliminary construction drawings, so will be destroyed by the planned construction.

Another 25 meter long wall segment is indicated on the preliminary drawings (at Sta. 23+32 /23m left cl./ ca. 108ft., See Map 10, page 37). This 'feature' was noted during the field monitoring. It is however, only the up-hill portion of the debris berm produced by the extensive bulldozing done in the middle path of the major paths mentioned above (on page 28). No state site number will be assigned. These lower older paths are of an unknown date, but perhaps of the period sometime after 1940 (per our informant Terry Shintaku). In any event, it is completely in the neighboring property, and outside the indicated grading limits, and therefore is not expected to be impacted by construction.

The wall segment that was identified originally as the first Site 4242, that is discussed in detail by Bordner (ibid, p 13-15), and found to be an historic (or possibly late prehistoric) boundary wall, is located at Sta. 24+85. It is 6 meters left of the planned centerline, at an elevation of 122 feet. The wall, now designated Feature No. 6, runs from there down slope to the east, and also up slope, across the new access trail (at Sta. 24+93 / rt. cl. / 142ft.), to the west, up to about the 180 foot elevation. This newly identified up slope continuation of Feature No. 6 extends 14 meters to a small vertical ledge about 2 meters high. The wall then restarts above that ledge, and goes for another 5 meters before apparently ending as a 2 meter long simple alignment of stones (refer to Map 10, page 37, and

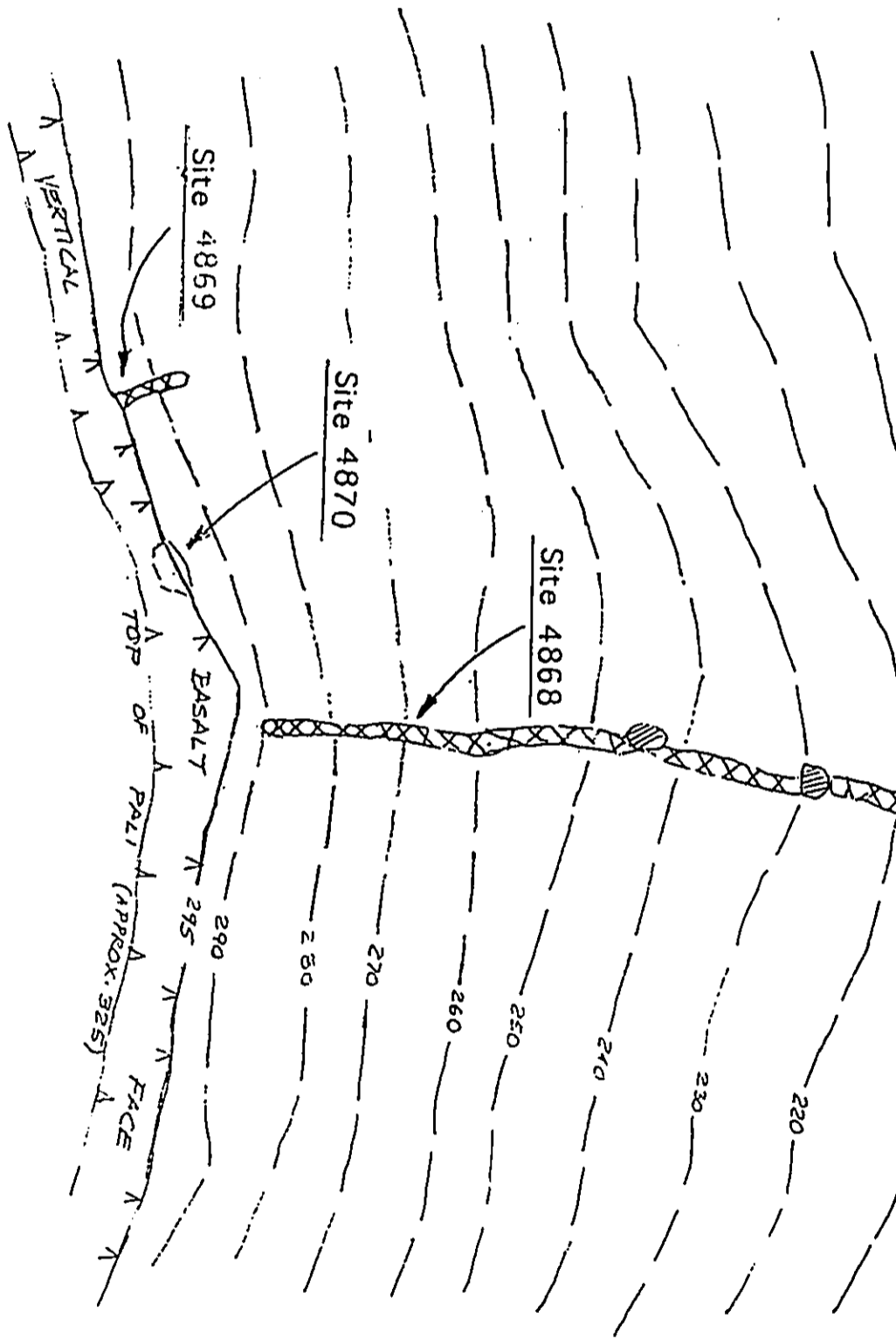


Map 10
Middle Section of Site 4242

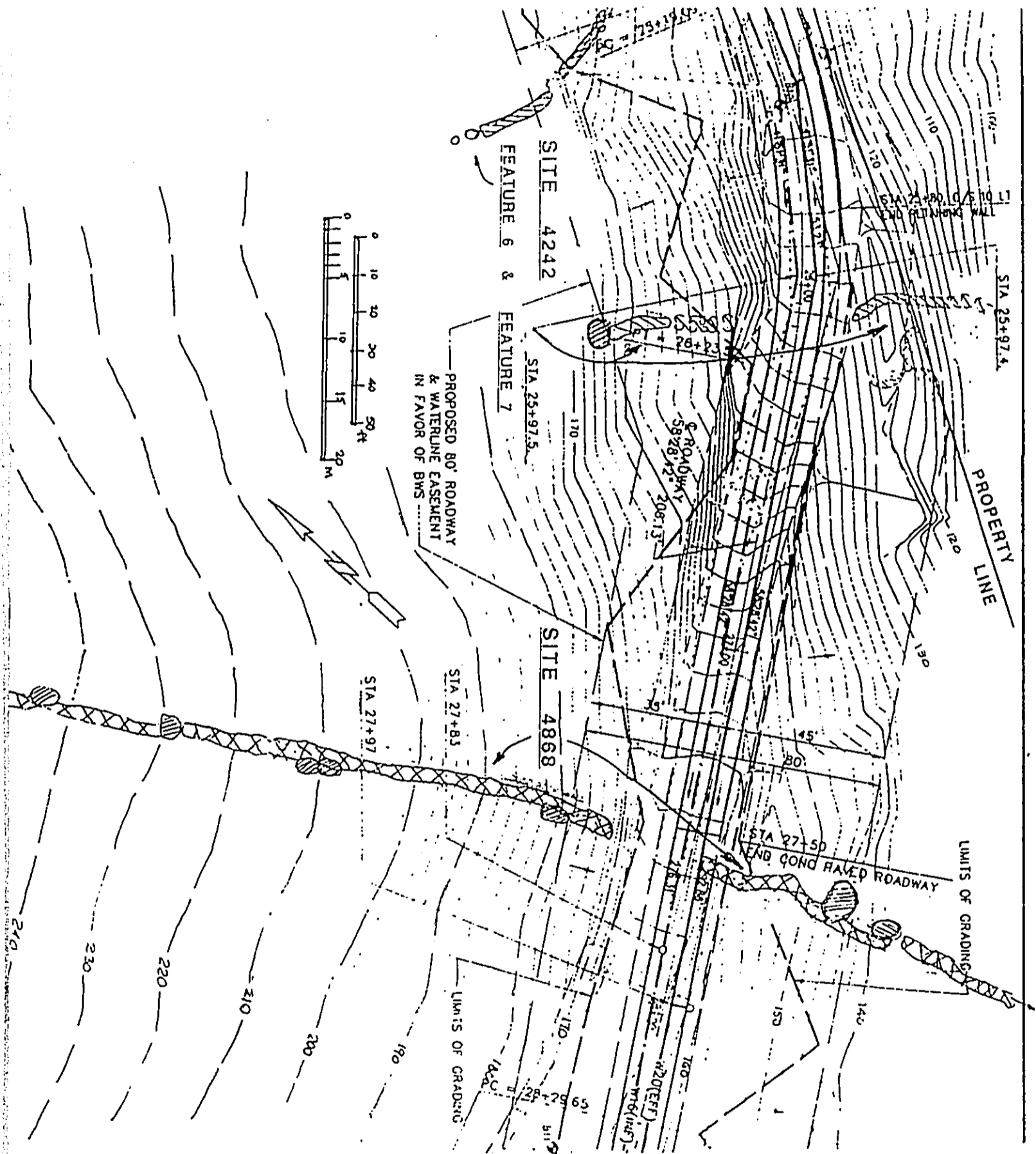
Map 11, page 40). That wall is now redesignated as Feature No. 6 of Site 4242. The lower portion of this feature is in good condition and is located in the neighboring property and therefor technically outside the indicated grading limits, so it is not supposed to be impacted by construction. As it is only slightly over one meter from the property line and down slope in a fairly steep area, a portion of this wall may in fact be adversely affected during construction. The whole up slope segment of Feature No. 6 is in poor, to very poor condition, with a couple of broken sections. Part of this segment is within the planned construction area, so will probably be destroyed.

The last, and most south-westerly, or in-valley component of Site 4242, now given the designation of Feature No. 7 (see Map 11, page 39). This feature (at 26+05 / left cl. / 132ft.), is another newly identified vertical wall that was cut by grading the access trail. This wall was not previously identified because it was completely covered by dense christmas berry trees until crossed by the CAT 977. This lower section was a double faced (but not corefilled) stacked wall approximately 7 meters long, and was in fair condition. This lower section is now covered by the material needed to bring the access trail up to its present grade at the bottom of this low spot. At the right (at Sta. 26+12 / rt. cl. / 146ft.), the wall is in poor shape for the first 3 meters, then continues as a 80cm high stacked double face wall for 4 meters more, where it ends at the base of a large boulder. Most of the up slope section is outside the limits of grading indicated on the construction plans.

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99



Upper



Map 11
Upper Section of Site 4242, and Sites 4868, 4869 and 4870
39

Further on into the valley proper the new access trail cuts through a well constructed large wall running directly up the slope from near the old valley trail. The wall is located at either side of the new access trail (at Sta. 27+52 / 7m rt. cl. / 174 ft, and 27+55 / 0.5m left cl. / 163ft, Refer to Map 11, page 39). This is a double-faced stacked wall, and is in generally good to excellent condition. When followed out down the steep slope through the thick *hau* bush it reaches to within 10 meters of the main trail, Site 4867, near the bottom of the valley, at an elevation of approximately 85 feet.

Above the new access trail, to the right, the wall continues on up without a break some 50 or 60+ meters, to end in a grove of Formosan koa trees within 2.5 meters from the in-valley end of the base of a 6 to 10+ meter high vertical faced blue-stone outcrop, or small *pali* that wraps around the steep hill to the north at about the 300 foot elevation line. This bare stone out crop is almost half way up Kaipapau Peak, which has a standard USGS Triangulation Station Target on its top at an elevation of 665 feet.

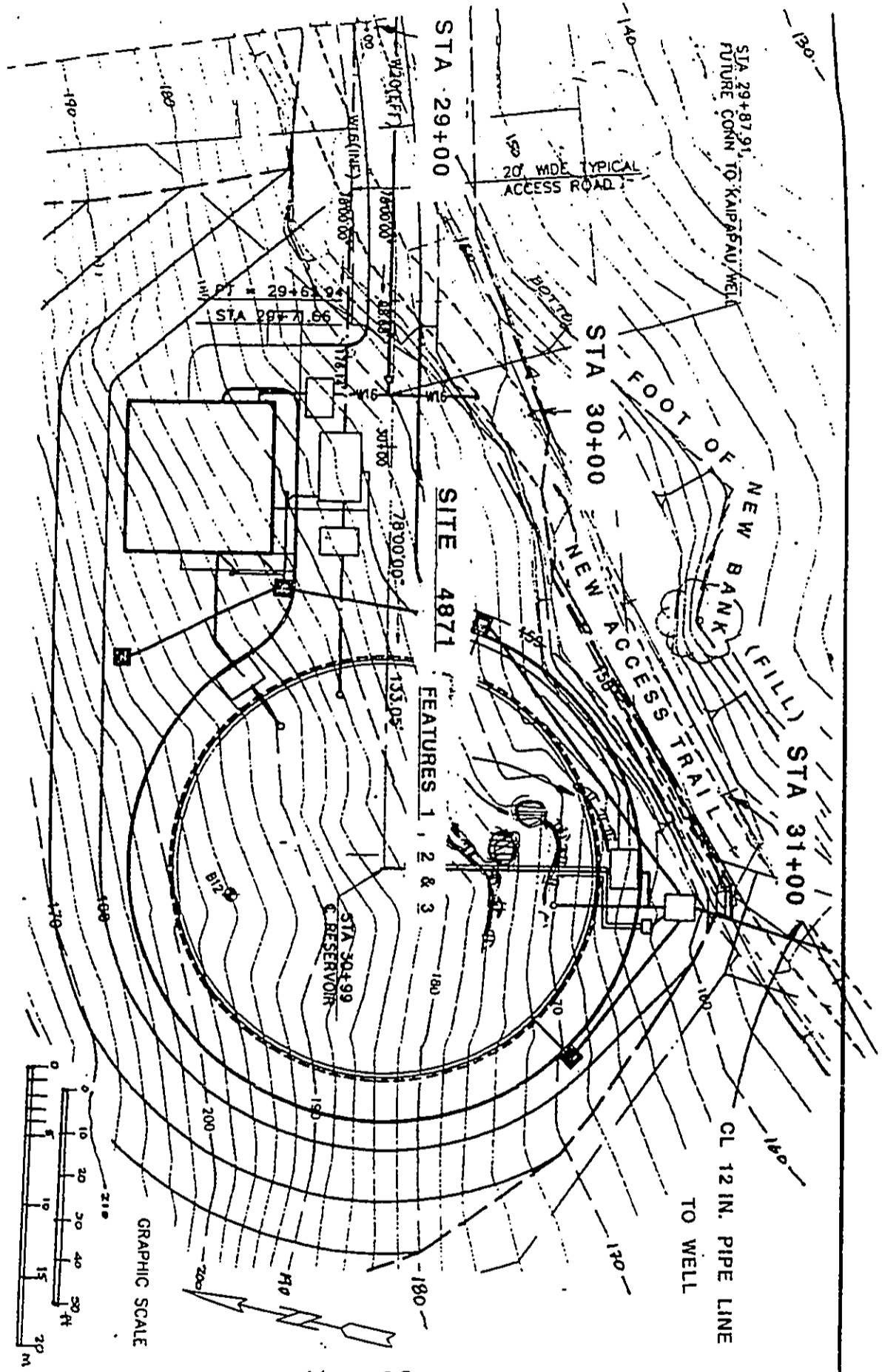
The substantially built wall averages one meter in height through out its up slope run, and is nowhere less than 85cm through at its base, and in places as wide as 1.2 meter. It is built of small boulders and large cobbles of angular and sub-angular basalt, in one to three courses, and uses the naturally occurring larger boulders where possible. This wall is assigned Site 4868.

When investigating the upper extent of Site 4868, and checking the area along the base of the small *pali*, two more features were identified. One is a short vertical section of wall located out-valley,

approximately 20 meters to the north-east of the longer wall. This short wall is constructed of similar material but is not as high. It has its upper end anchored at the base of the basalt outcrop, but only extends down the 25 to 30% slope for 6 meters. Judging by its alignment, it is possible this might represent the up hill end of Feature 7 of Site 4242. Because there was no obvious down hill extension beyond the 6 meter length however, this wall is assigned Site 4869.

At about midway between these two walls (Site 4868 and Site 4869), is a shallow cave in the base of the partial overhang of the small *pali*. The small shelter has a shallow, clean, level, trapezoidal shaped floor, of dry fine soil, measuring 1.5 meter front to back, by about 2.5 meters across the face, with comfortable sitting head room. There was no indication of any surface cultural remains here. The small shelter is assigned Site 4870.

In the area where the Hauula 180 Reservoir is to be built, to the right and up slope of the new access trail, we located a group of three short, roughly parallel walls (refer to Map 12, page 42). These are simple, low (not over 60cm high) single-stacked, horizontal walls of one to two courses, and retain small areas of soil on their up slope sides. They are therefore assumed to be agricultural in function. The lowest retaining wall (at Sta. 30+83 / 9.5 rt. cl. / 169ft.), is 5 meters long, and roughly perpendicular to the north-west direction of slope in this tipped bowl like area. This wall is assigned Feature 1 of Site 4871. Feature 2 is 3 meters further up slope (at Sta. 30+85 / 12.5m rt. cl. / 172ft.). This retaining wall is anchored at the north-east

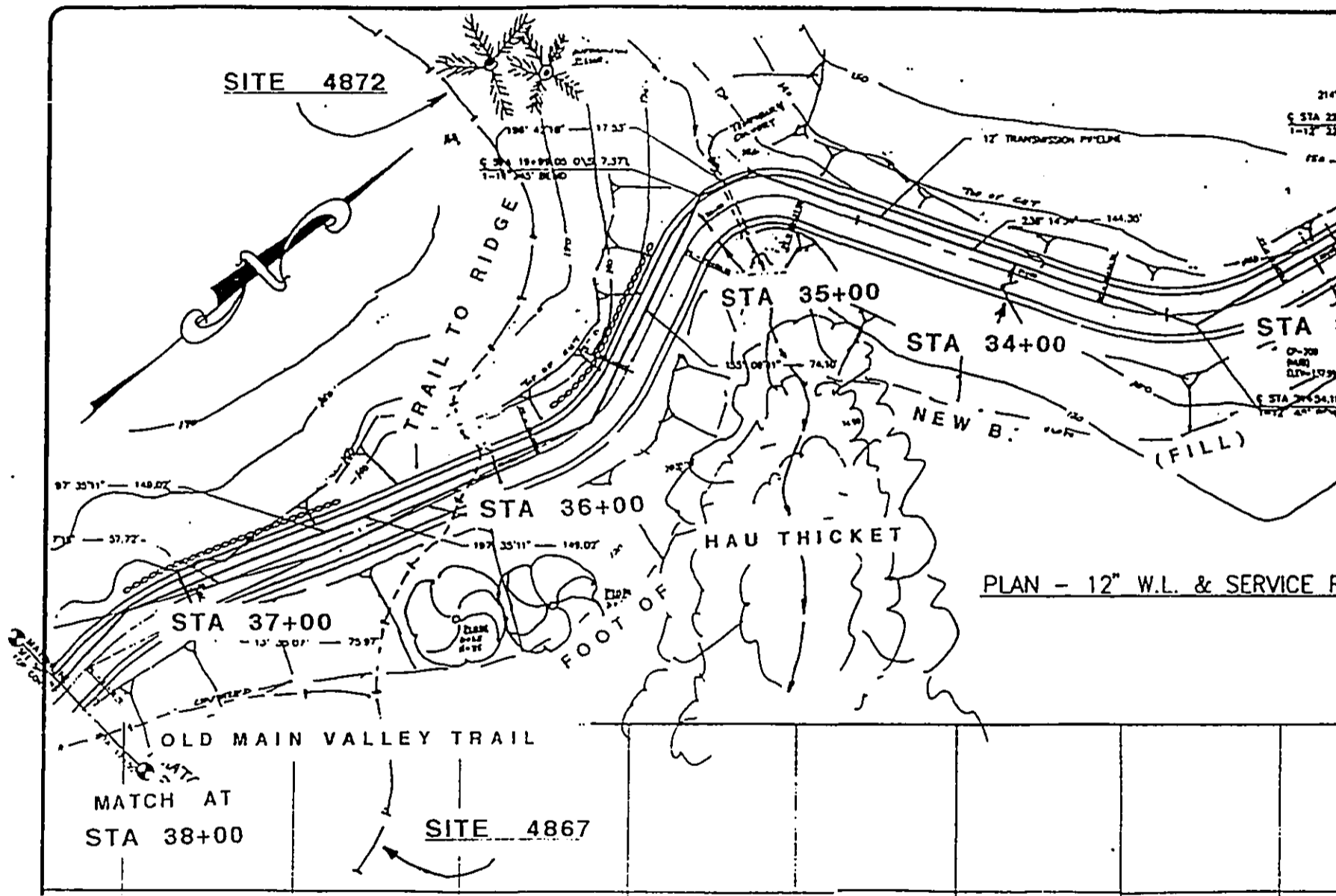


Map 12
Site 4871, and the 180 Reservoir

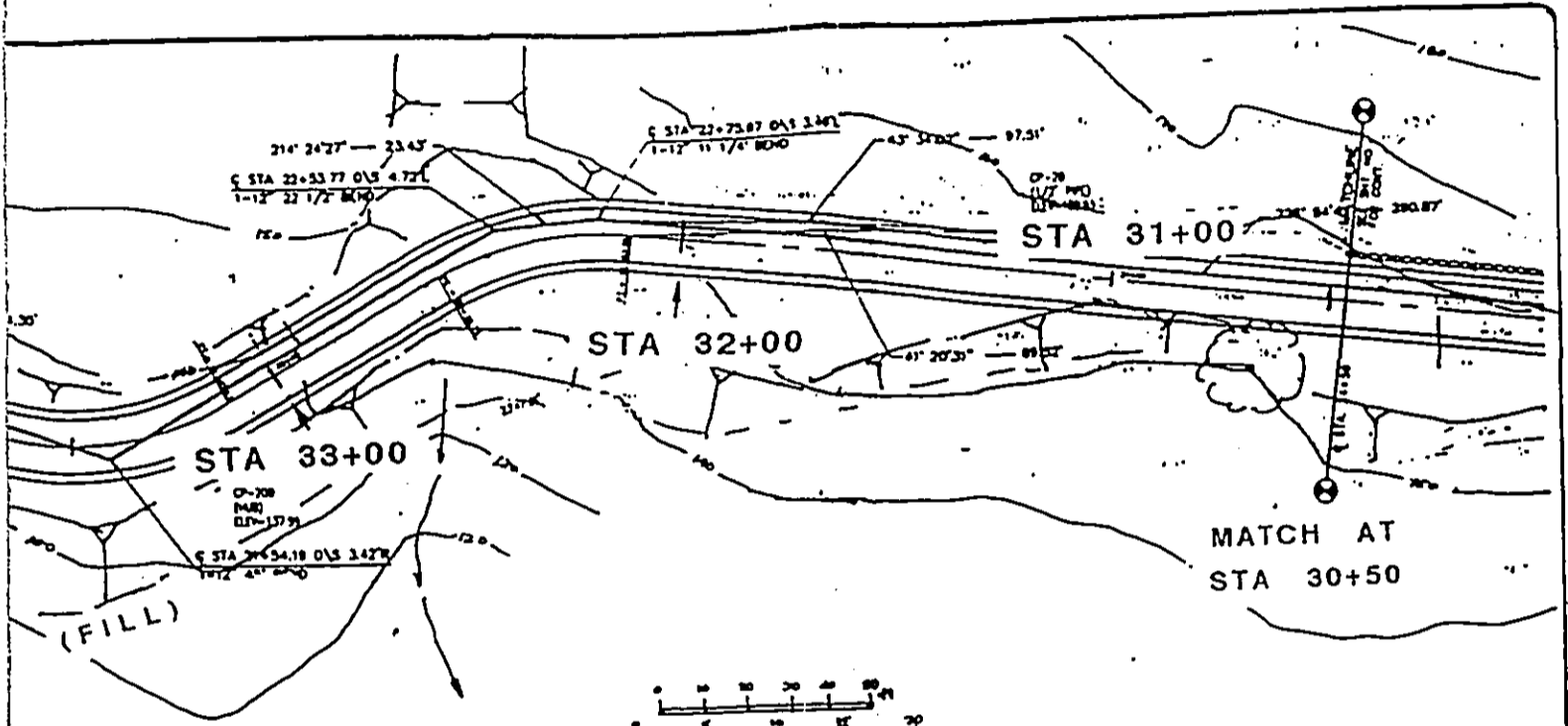
end by a large boulder, and extends to the southwest some 6.5 meters. The third wall is the longest at 9 meters length (at 30+80 / 19.5m rt. cl. / 177ft.), and becomes Feature 3 of Site 4871.

There is a prominent spur ridge immediately past the first side stream crossing, or steep gulch, at Sta. 34+90. The gulch is dry most of the time, but a new culvert was needed following a period of heavy rains. Around the steep section beyond, the new access route cut through and over the main trail, Site 4867, where it has to come up from the valley bottom to avoid a high ledge that drops straight to the stream bed. This was also the area of the junction with the trail on up to the main ridge to the north, and on out to Kaipapau Peak. This side trail, although widened and somewhat modified in places in the recent past, is part of the old system, so now is designated Site 4872. It was cut and partially covered when crossed by the new access trail (at Sta. 36+05 / ca.138ft., refer to Map 13, page 44). The ridge trail is now reached by a new steep trail cut into the ironwood grove from the area of the side stream crossing, near the temporary culvert.

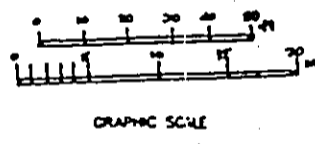
The main valley trail, Site 4867, is forced up the spur from near the stream side to an elevation of about 140 feet here. It then leveled out at about where the ridge trail branched off to the right and continues up into the ironwood grove above Sta. 35+50. The main valley trail then swings to the left, paralleling just a meter or two below the level of the new access route (and getting completely covered up in this section as a result of the grading). The main trail,



Map 13
 Trails, Sites 4867 and 4872



W.L. & SERVICE ROAD



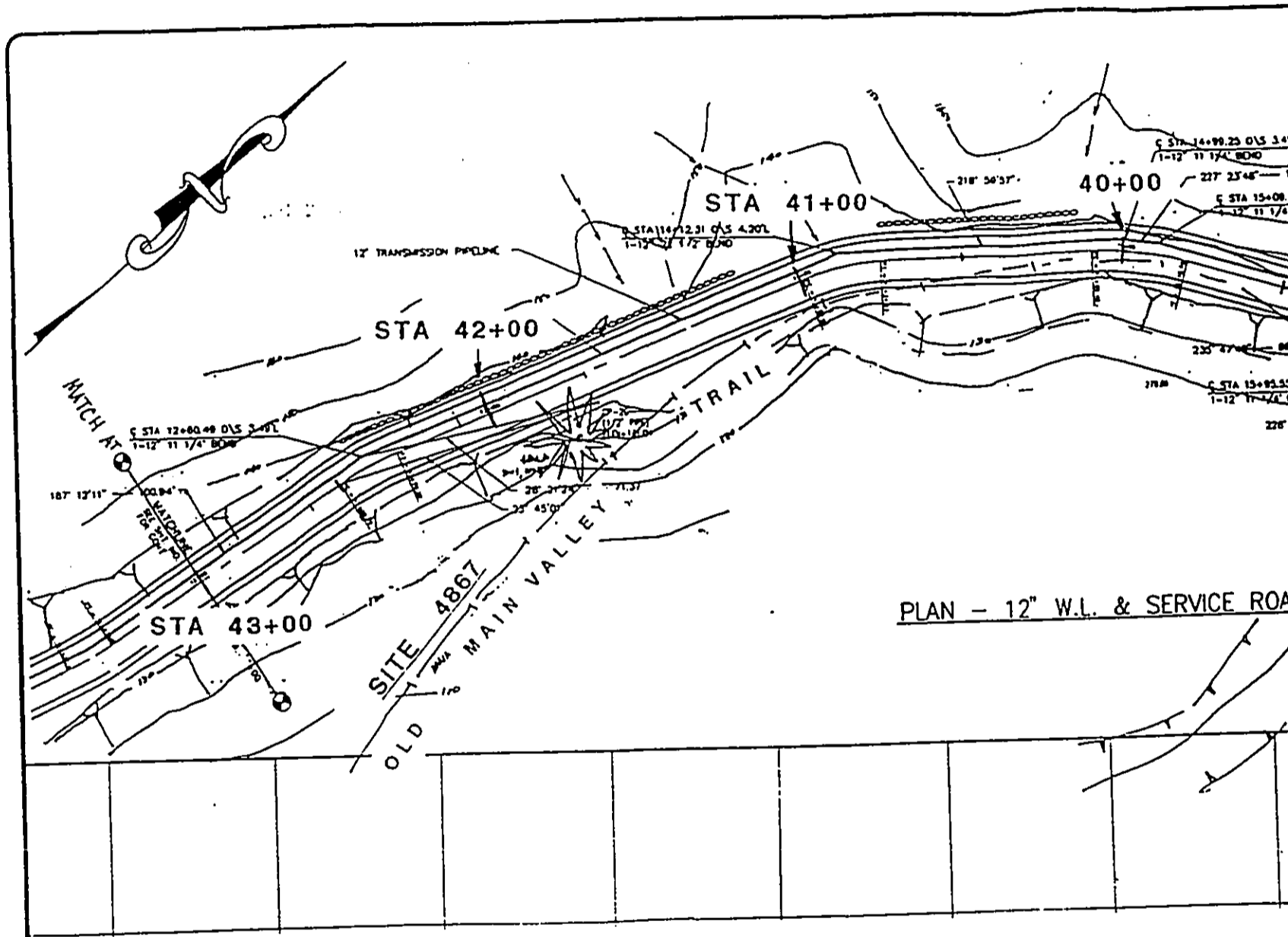
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Site 4867 reappears now as it starts dropping back toward the level of the stream again near a large *Hala* tree (at Sta. 41+70 / 3.5m left cl. / 127ft., refer to Map 14, page 46). Further on, it reappears for a short section again near the stream, below another large spur ridge from about Sta. 44+00, up to Sta. 48+50, where it then drops into the christmas berry thicket, and is lost for the last time (refer to Map 15, page 47).

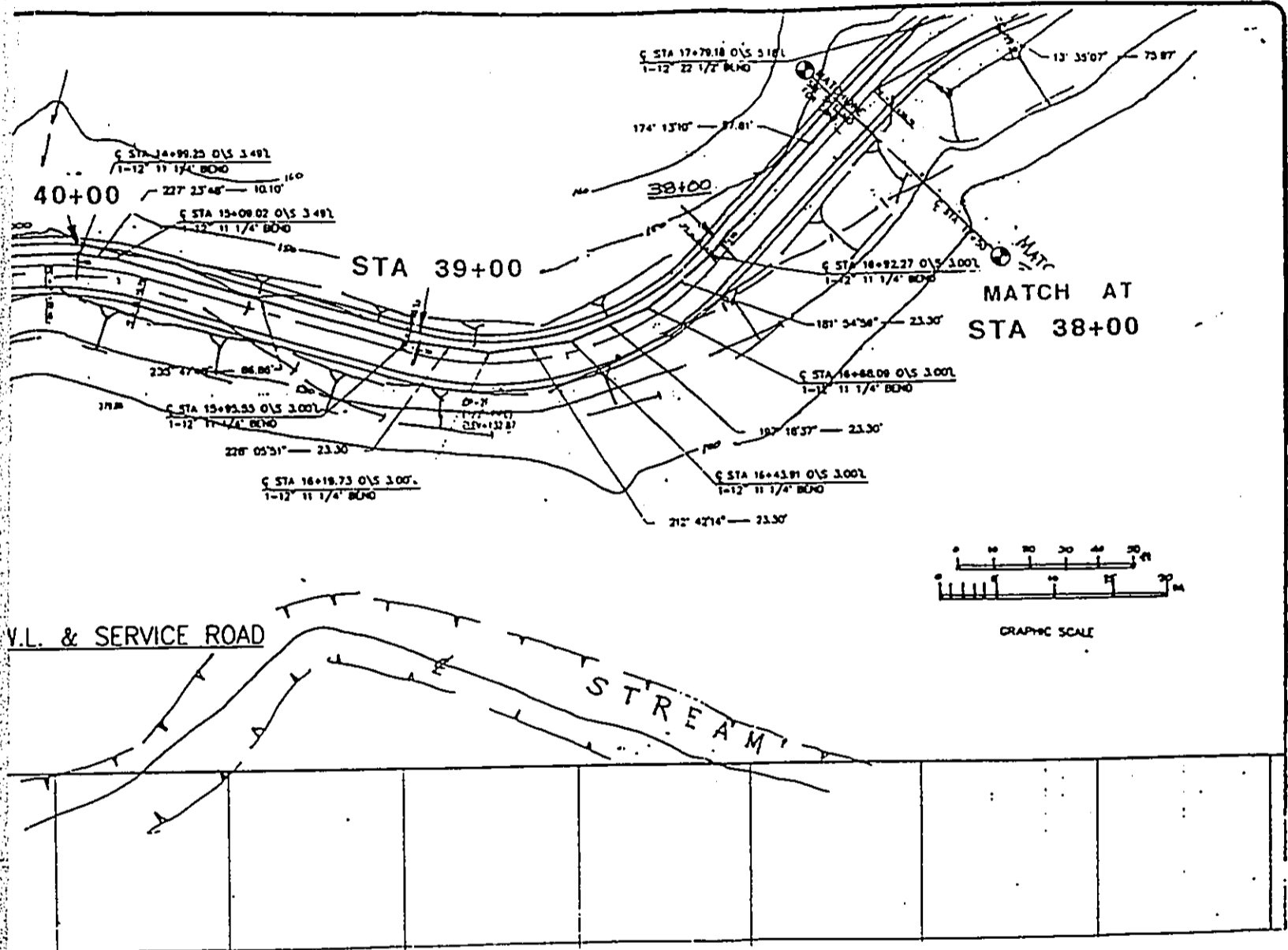
The new access dozer trail passes through a large low area that is nearly level, extending from Sta. 49+00 to Sta. 51+50, or a distance of about 75 meters. The whole roughly rectangular area here was choked by a dense thicket of christmas berry trees. This area is the first sizable flat section encountered along the valley floor. It extends from the stream edge which is at the far left edge of the valley floor, to the new access trail that keeps to the extreme right of the valley floor, along the base of the very steep north valley wall, a distance across that varies from 35 to 50 meters.

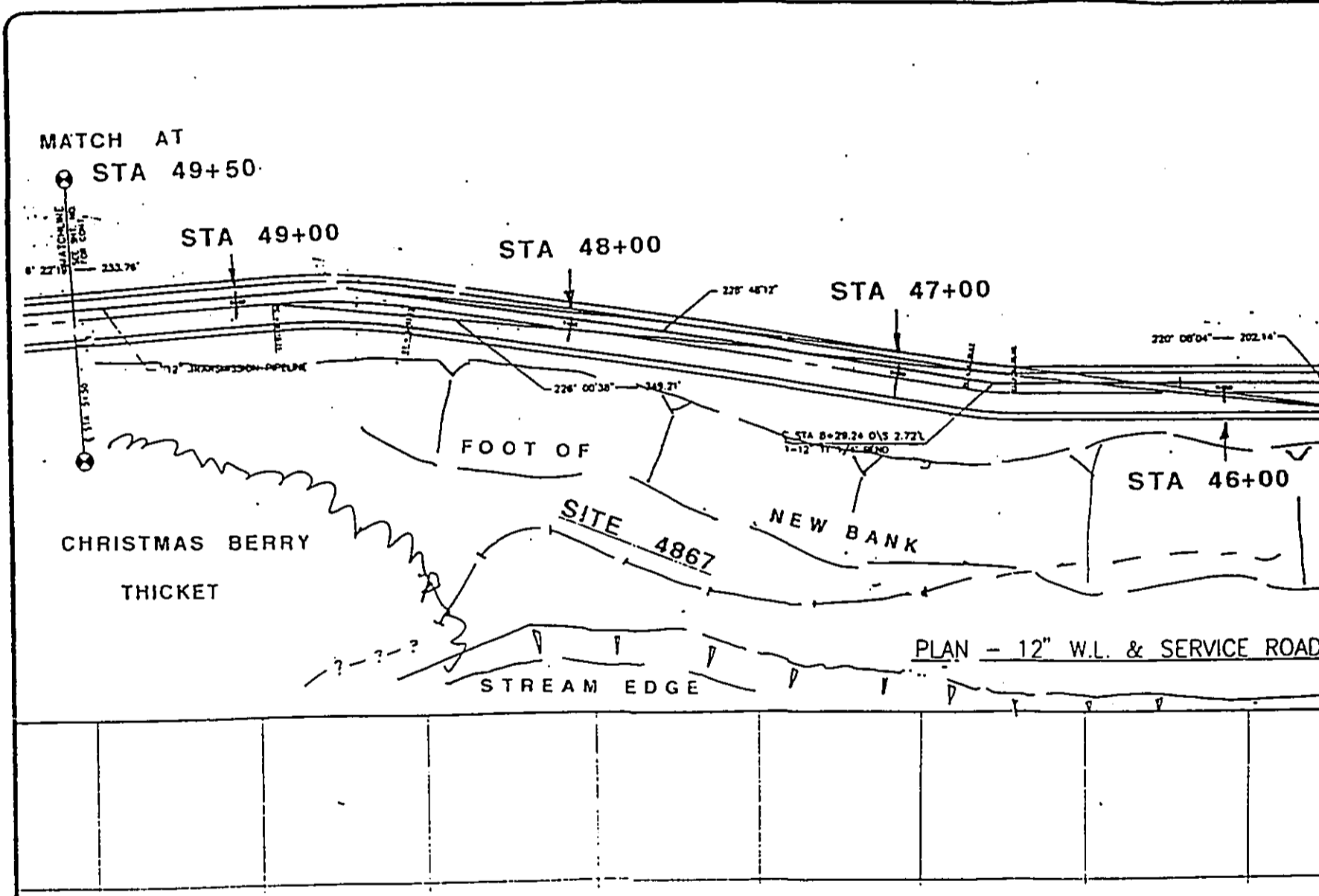
A cluster of a variety of newly identified features were discovered centered in this stream side flat in the process of the clearing and grubbing operations. The area is designated Site 4873 (see Map 16, page 50). The site is composed of the following features:

Feature 1 - this is a small rectangular platform (at Sta. 49+67 / 15m left cl. / 127ft). The platform measures 2.5 meters by 4.0 meters, and has a single stack 20cm high L-shaped wall on the south and east sides, and is associated directly with;

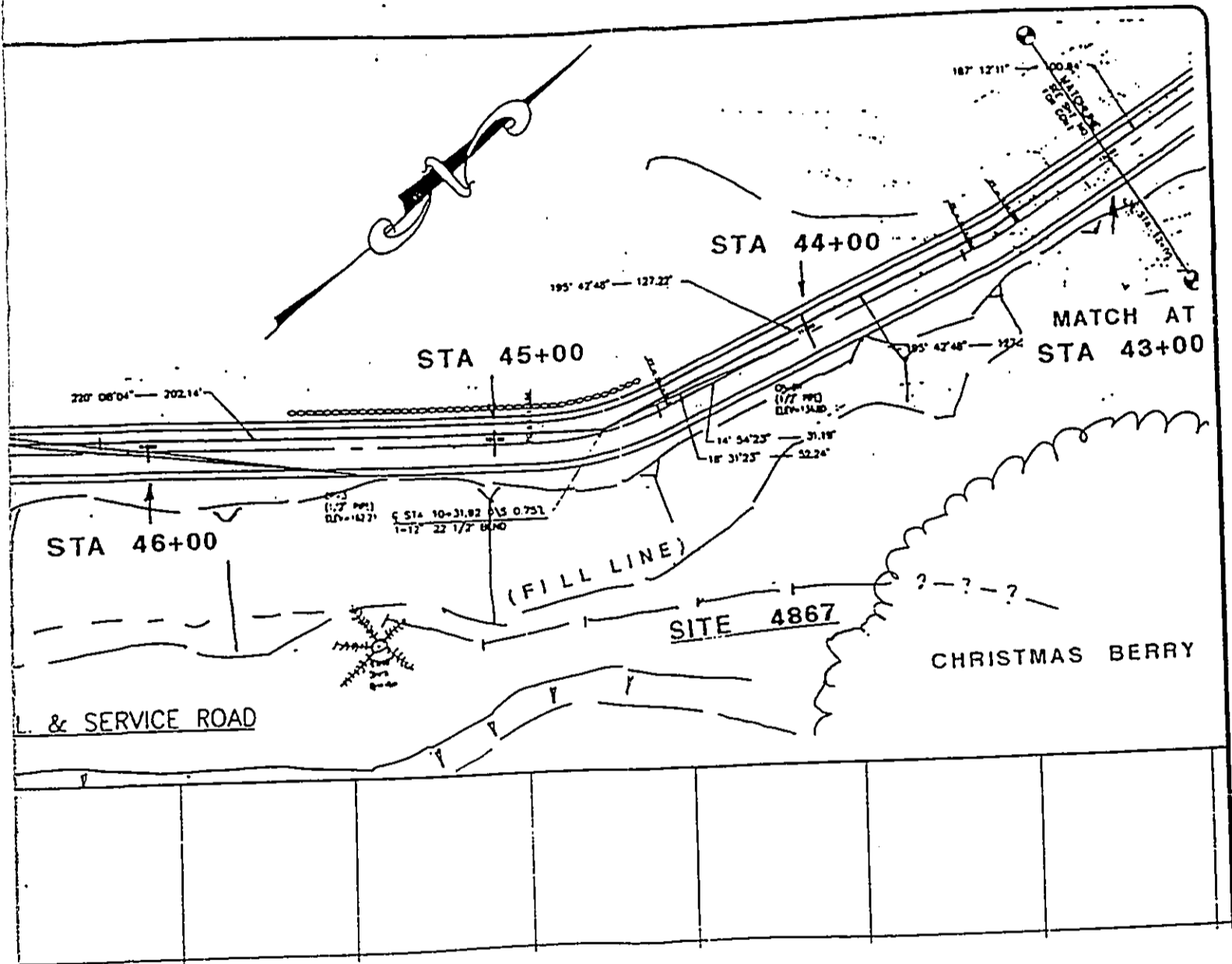


Map 14
 Middle Section of Main Trail, Site 4867
 46





Map 15
 Upper Section of Trail, Site 4867
 47



Feature 2 - a terrace, with a 5 meter long low (20cm high), nearly straight, single stack 20cm high L shaped retaining wall, parallel to Feature 1 on two sides, and 1m further left or stream side of Feature 1 (at Sta. 49+68 / 17.5m left cl. / 126.5ft.);

Feature 3 - is a massive wall, running perpendicular to both the stream and the new access trail (at Sta. 49+91 / 6m left cl. / 127ft). The rough, double-faced wall is built of small to large water-worn basalt boulders, some 1.2+ meters in diameter. The wall measures from 1.2 meter to 1.6 meters across its base, varies from 1.5 meter high at the end nearest the new roadway, to 1.75 meter high at mid length, and is 18 meters long;

Feature 4 - is a probable *auwai*, or water control ditch. The middle of this approximately 22 meters long, shallow, 1 meter wide (average) *auwai* is located halfway between the stream and Feature 1 and Feature 2, or 5 meters off the end of Feature 3 (at Sta. 49+85 / 23.5m left cl. / ca. 124ft);

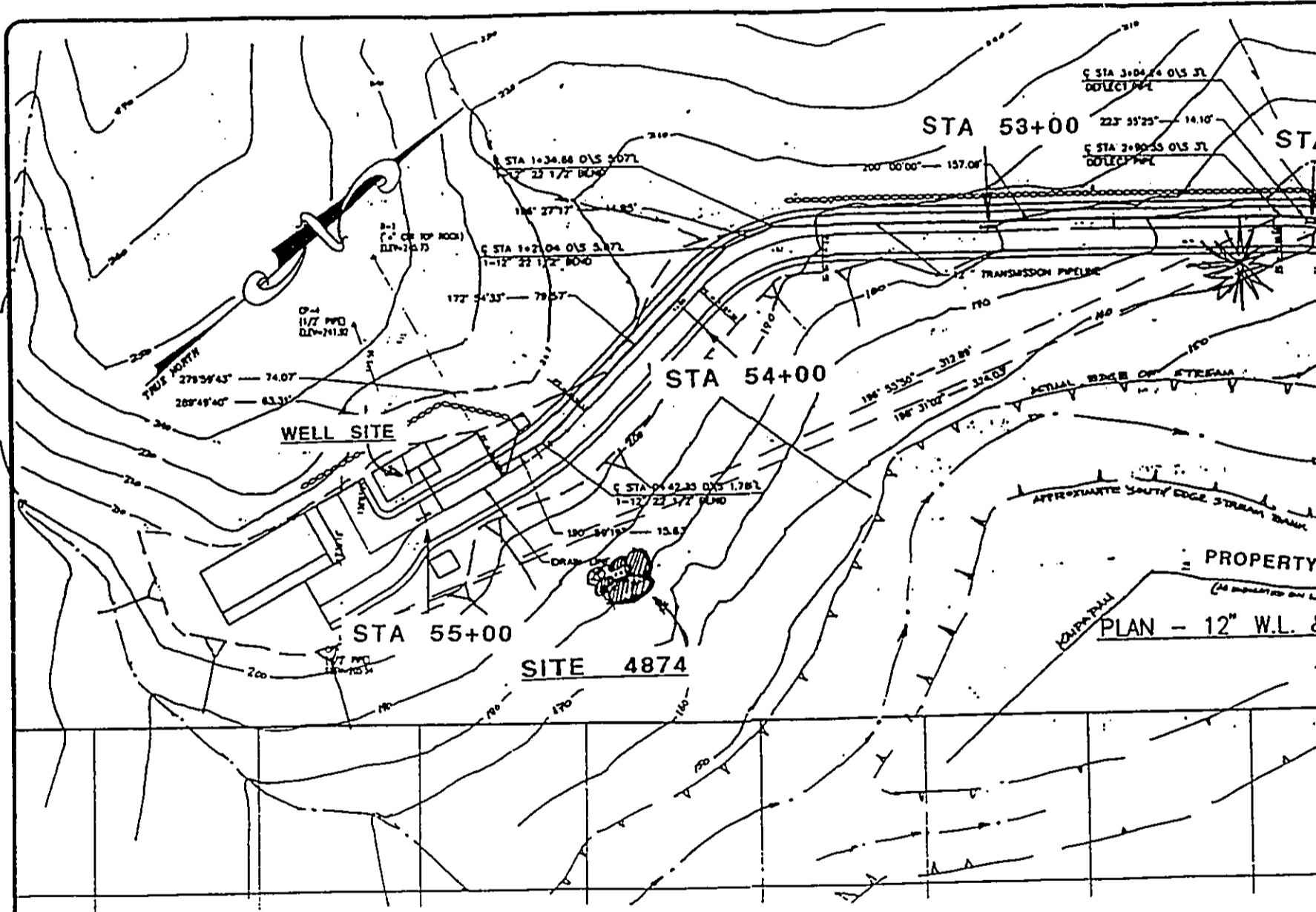
Feature 5 - a water source, in the form of a 2+ meter deep, almost permanent (and possibly modified) pool in the main stream, at the base of a large rock outcrop. The outcrop is on the far or left side of Kaipapa'u Stream;

Feature 6 - a slow flowing *puna* or spring is located across the stream on the in-valley side of the prominent rock outcrop, some 5 meters beyond, or up stream of the pool.

These features are assumed to be the remains of a habitation and use site, that was directly associated with a fair sized wet-land agricultural system in the beginning of the middle valley area. The small habitation, Features 1 and 2, appears to have needed protection from flash flooding at some time, as evidenced by the large wall, Feature 3. This can be surmised by the apparent rough, or even hasty construction of the massive wall. The huge boulders used to build the base of the wall are perched on the surface, rather than carefully set (with the top of the first course leveled) as seen in the near by smaller walls of Features 1 and 2.

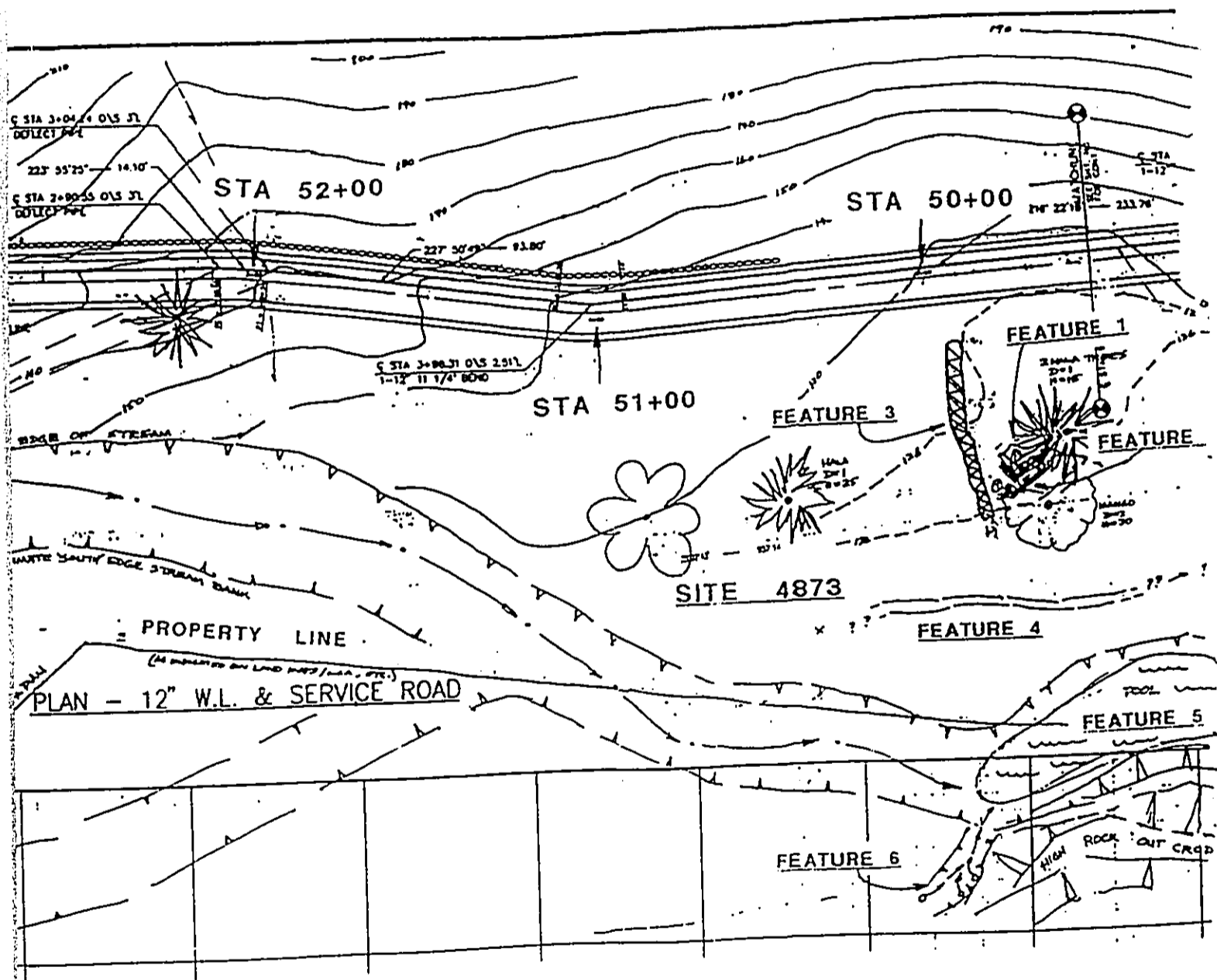
Presently, the only plants of economic value found in the vicinity of Site 4873 are the cluster of hala, and two large but low common mango trees in the immediate area of the platform and terrace, another hala 15 meters further in valley, beyond the big wall, and some scattered kukui trees on the 'north' slope of the valley.

The final feature noted during monitoring was the tightly packed cluster of large boulders in the spur ridge at the stream side of the new well site. This natural outcrop of large, well rounded basalt boulders is prominently located in the spur that is made up of decomposed ash and cinder, and soil. This cluster of rocks high above the stream was pointed out by informants as having some *mana*. The possibly modified out-crop has a commanding view out of the valley, and looks directly down on a large S-bend in the stream, as well as on down to the whole flat area down-stream that is designated Site 4873 (see Map 16, page 50).



Map 16
Sites 4873 and 4874

DOCUMENT CAPTURED AS RECEIVED



At the center of the cluster is a level area of soil, or small 'terrace' measuring 1 by 1.2 meters, that is now partially covered by a small wind-carved java plum tree. There were a number of clumps of *ti* at the in-valley side of the boulders and below, before the grading operations covered them. The cluster of large boulders with small central 'terrace' is designated Site 4874 , a possible site of a sacred nature.

Conclusion and Recommendations

During the course of monitoring the construction of the rough exploratory well access trail, we were able to add considerably to the inventory of cultural features that had been known to exist in the lower reaches of Kaipapa'u Valley. With the total man hours that have now been spent in the project area during this phase of the Board's project in Kaipapa'u Valley, it is unlikely that any cultural features in the area of planned construction escaped detection, that is within the area of the slopes of the lower third of the north side of this valley, up to the actual well site.

We were able to get a much clearer picture of what does remain in the affected project areas at the outer edge of Kaipapa'u Peak, or the area of Site 4242. The previous field work in this general area had resulted in a very incomplete understanding of what may once have been going on here. The identification of the small terraces, and the 'open' areas near what is left of a series of short meandering, but disconnected wall features seem now to rule out use patterns of either habitation or formal religious structures in this

area. The rather random and apparently opportunistically constructed walls and associated small terraces in this area are often found in spots where naturally existing boulders made almost adequate, or at least partial retaining walls on moderately sloping hillsides such as this. It seems that an interpretation of limited use, or perhaps even only intermittent activity for agricultural purposes best fits the pattern of the data recovered to date from this rather 'damaged' hillside area. It should be noted that while the site shows no indication of significant past use, the area in which the site is located has become identified by some of the nearby residents as an area of prior sacred or religious use (i.e., as a *heiau*). On page 23 and again on 24-25, of this report we mentioned the extensive bulldozing done over a period of time in this section of the property, and in our letter to the Board, dated 30 May 1992. To further quote from paragraph two of that letter:

"More information has come to light concerning the area indicated on our copy of the Edgar Lee Engineering Design Group, Inc's. topographic plan as 'Heiau', in the lower section of the project. When Tracy Runnells, of Rosco Moss, asked the adjoining property owner about the old bulldozer paths, the (senior) Shintaku explained that the trails had been cut right after the present property lines had been established with the subdividing of the Glover lands in the early 1960's. When the 'upper' trail was being done the operator had equipment trouble that resulted in his losing the blade off the dozer. In disgust he had returned to the end of Kawaipuna Road, and as he packed up told them (the Shintakus) 'it must be a heiau up there, because only that would explain what happened' - to his machine.

When Matt Williams and Phillip Kam accompanied us up to the end of that existing trail, the morning of Tuesday, 19 May, Tony Toorijian, Rosco Moss's operator immediately recognized a large flat piece of metal with a double row of holes, as the cutting blade from a D-8 Cat, effectively confirming the possible source of the designation of the walls as *heiau*." (SRSC letter to BWS, 30 May, 1992)

Neither the archaeological or historic evidence uncovered to date support an interpretation of religious use for this area, yet it is of interest that such a perception seems to have become part of some segment of the contemporary Kaipapau communities view of older remnant features in an area that does not see much use or traffic.

As a result of discussions with archaeologists at the State Historic Sites Division, further interviews were conducted in August 1995 to attempt to clarify the accuracy of the *heiau* designation for Site 4242. The initial interview was with the Shintaku family (who have lived in the area since the 1950's). They reiterated the information collected earlier about former bulldozing, and again noted that they had never heard any other stories to indicate that a religious site was located in the area adjacent to their property. They suggested further individuals to contact whom they felt would be most likely able to clarify the situation. They assured us that the majority of the present residents living in the subdivision near the project area relatively recent arrivals and would not likely be at all knowledgeable about the oral traditions of the area.

A further interview with Stu Medeiros (who has lived in the area for over 20 years) elicited the same response - - no knowledge

of any ritual site(s) in the immediate area beyond the end of Kawaipuna Street. He also indicated additional individuals we might contact who could possibly provide more substantial information about traditional sites in the area. It should be noted that during both of these interviews mentioned above, that the *heiau* in Ma'akua were brought up by the interviewees, so these parties can be seen as having some knowledge of the ritual sites in the local area.

The third interview was with Ahi Logan, who was recommended by Stu Medeiros as a good source for traditional information of the region. As in the earlier cases, he was not aware of any ritual sites at this location, though he also qualified his remarks by noting that Kaipapa'u was not a valley he had a substantial amount of knowledge on. He indicated that he would pursue the matter, with inquiries to others about the question.

The last interview was with Herbert 'Mahi' Kamekee'aina, who the Shintakus had recommended, as he has hunted in the area for years. In discussion with Mahi he noted that his father had also hunted pig in this valley, long before Mahi started going with him as a boy. He said that any time they came upon a religious site in other areas they always stopped and his father related what he knew about it, yet in all their treks into Kaipapa'u, his father had never mentioned the existence of a ritual site in the Site 4242 area (the elder Kamehee'aina passed away in 1983). When asked if he knew about any features in the area just above the Sintakus barn, Mahi said there were some small walls in among the trees there, and agreed we

were talking about the same thing. He also remarked that there are more walls up near the new well, and noted that the boulders on the slope right below the well (Site 4874) may be a possible ritual site.

In this discussion he also noted that he was unfamiliar with any big walls or planting terraces further up the valley (*mauka* of the study area), there being a few small walls only. This brings into question the designation of the Upper Kaipapa'u Stream Complex, Site 1056, as an agricultural complex.

The interviews were conducted in each case with individuals who both exhibited knowledge of Koolauloa in general and the Hauula area in particular, and in addition know about the ritual sites that do exist in this area. The information collected from them serves to conclusively confirm the results of archaeological and historical research conducted earlier. While Site 4242 may be viewed as being a ritual site by some individual(s), there is no extant evidence from the archaeological, historical, or oral traditions that support the allegation that we were able to locate. This validates our earlier assessment that the site represents the remnants of a small dryland agricultural complex rather than a site of ritual construction.

Further on, and into the valley itself we see a couple of well built walls. These larger walls are substantially different in nature from any of those noted in the Site 4242 area. The main difference noted is that Site 4868 is essentially a more massive and continuous long wall that runs directly up and down slope, from near the valley floor, to a point at the base of a sheer rock face outcrop

where it would be impossible to continue. As such this wall is most likely associated with land boundaries, or even *ahupuaa* subdivisions, perhaps even of the early historic period. Unfortunately this particular wall does not coincide with any known land boundaries that we have been able to uncover in our research to date.

Site 4869 (the short wall section) and 4870 (the small shelter cave) are both at the elevation of the top end of Site 4868, at about 300 feet, where the access road below is at 165 feet. This puts these sites well outside the scope of any possible impact from the planned construction activity.

Site 4871, which consists of three small agricultural features, is a good example of one kind of simple upland agricultural modification that may provide physical evidence to support the specific land use records discussed in the cases of *Hikiau* (L.C.A. 8167) and *Hoopalahee* (L.C.A. 8171). On page five above *Hikiau* states, ". . . I have a claim for cultivation in the upland, and in the forest, . . ." Similarly, *Hoopalahee's* testimony indicates he too used inland areas in Kaipapa'u.

There is no indication of just how far inland this use actually was. *Hoopalahee* listed his use of even more named plots, and plots 'owned' by others than he actually claimed for himself in his testimony ,

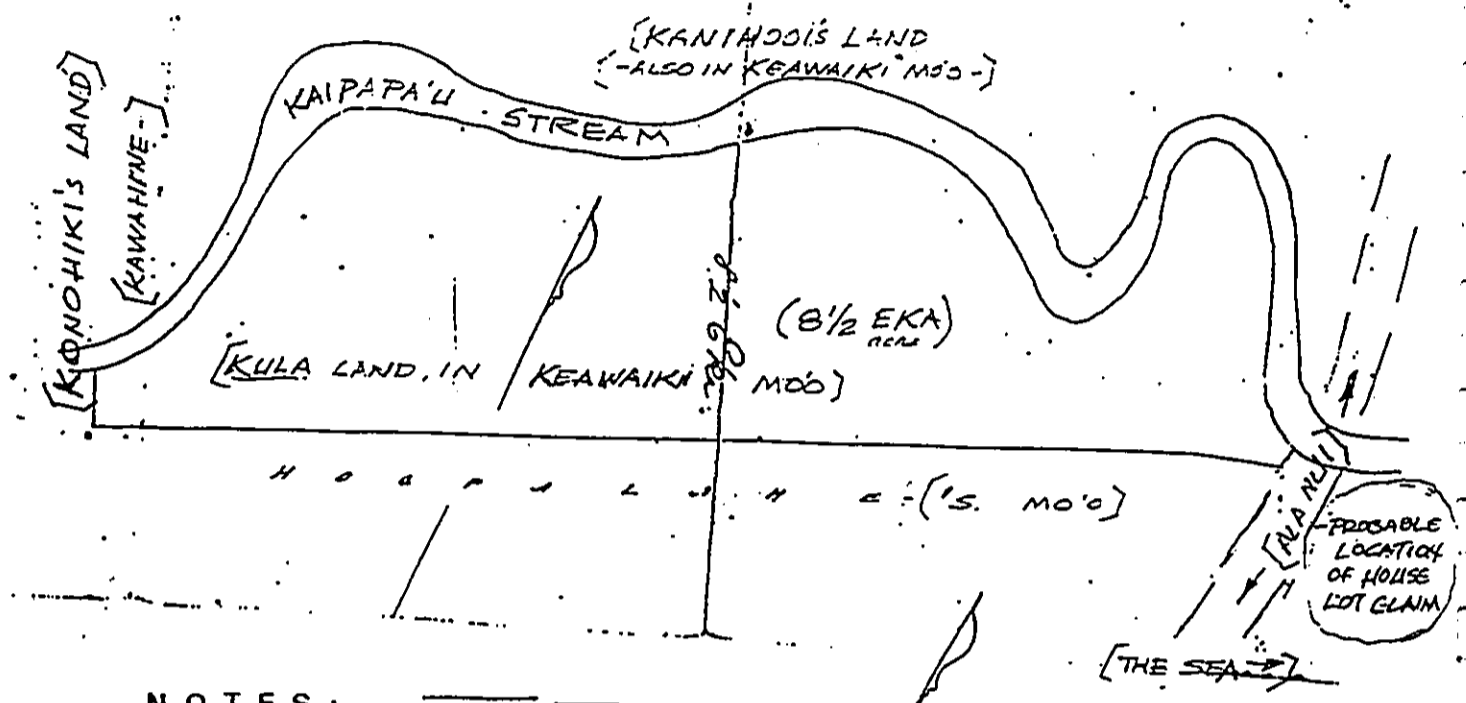
" . . . I cultivate in the *kula* of Kanihooi, and in the *kula* of

Kawahine [from additional testimony we find this was the Konohiki for all of Kaipapa'u Ahupua'a], and in the *kula* of Miihe. I have a claim of cultivation in the upland and in the forest. I farm in the *Ahupua'a* of Hauula. The *mo'o* is Kalaipahoa, . . ."

Unfortunately, the specific parcel or location of these lands, for most of the individuals named listed here are now lost. Some of these cultivated lands may have been on parcels in inland portions of the Boards project area, or even further, into upper valley sections of Kaipapa'u *ahupua'a*, perhaps even beyond the Boards' project area, such as the Upper Kaipapa'u agricultural site complex, State Site No. 1056.

In an attempt to better understand the extent of the data that was presented in support of their 1851 claims, we have graphically analysed, that is added and consolidated annotations to the copies of their respective plot plans (see Maps 17 and 18, pages 58 and 59). The items added and indicated in parentheses are directly from the plot plans, and that in brackets is derived from the translated testimony. At least for these respective actual Land Court Awards, and some of the immediately surrounding parcels, we can now 'recover' a few of the traditional *Moo* names for this area.

Sites 4867 and 4872, the trail systems, are reflective both of past use patterns in the valley, as they provide the main means of access to the inner sections of the valley, and contemporary demands for recreational and nature-based opportunities. While the trails have persisted in the same location for much of at least the last hundred years, they have been heavily modified by modern



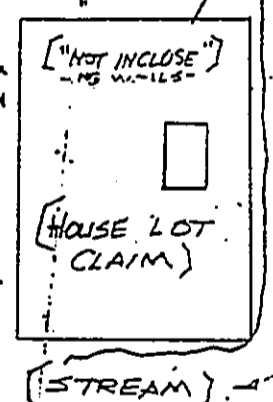
NOTES:

- IN BRACKETS = [FROM TESTIMONY]
- IN PARENTHESSES = (FROM PLOT PLAN)
- ALSO COMPARE THIS WITH MAP 3, P. 8 -

[LAND OF HOOPALHEE]

(GREAT WAY) GOV. RD

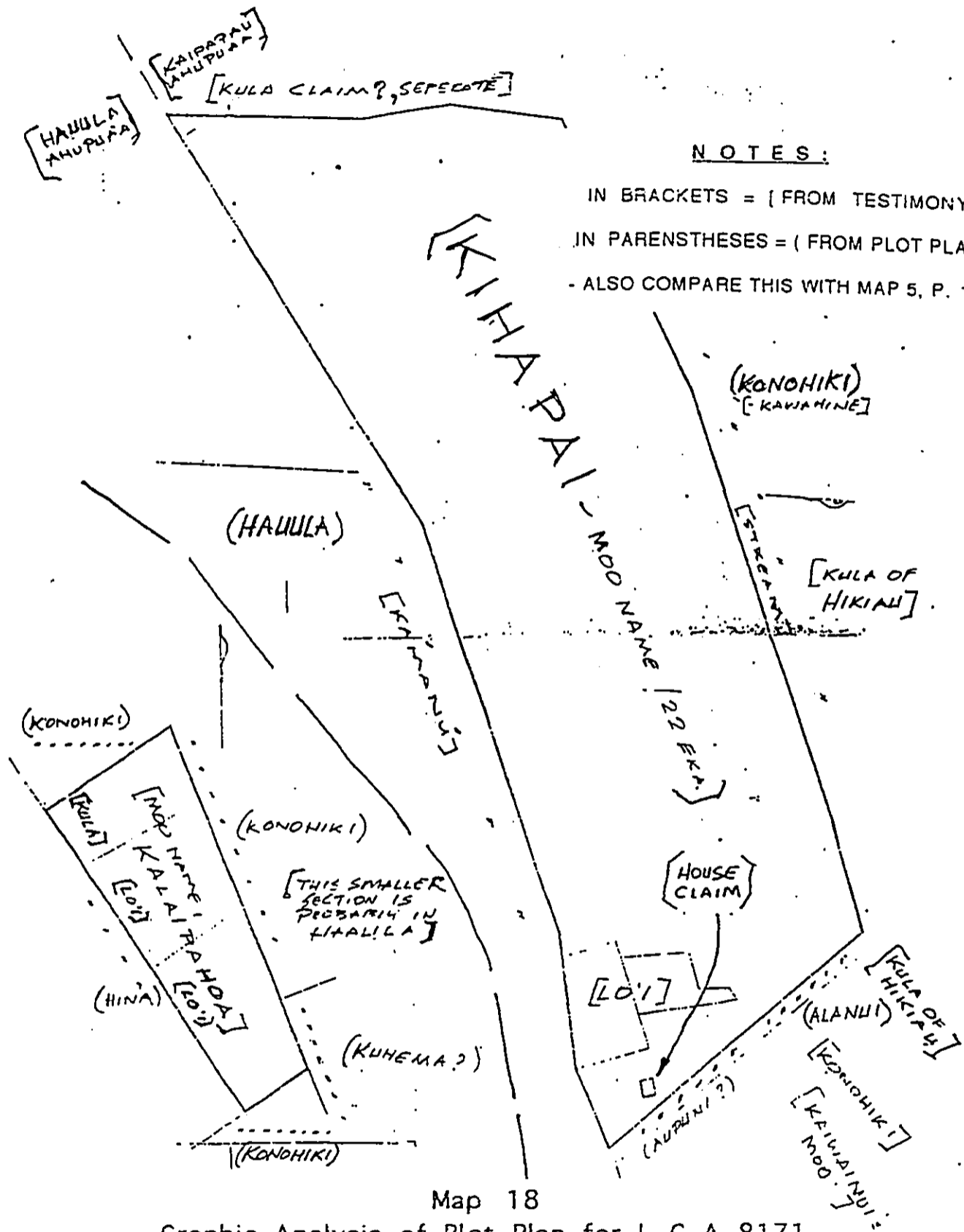
NOT PART OF LCA 8167



- DRAWN TO LARGER SCALE

- OR REVERSED, CONFLICTING TESTIMONY -

Map 17
Graphic Analysis of Plot Plan for L C A 8167



Map 18
Graphic Analysis of Plot Plan for L C A 8171

demands for safe and accesible trail opportunities for recreational hiking, and subsistence hunting use. The integrity of the original foot trail systems has disappeared, to be replaced by the impact of hiking boots, horses, and mountain and motor bikes, with the occasional hunters venturing further up-valley. Given the limited evidence visible in the valley, it is impossible to determine the exact nature, purpose and density of traffic on the trail system, though its persistence to the present argues that upper sections of the valley may have served both in the past and present more for the more casual collection of resources rather than agricultural production. If the trails had been used only for access for traditional dry and or wetland agricultural production, the collapse of this system by the late 19th century would have seen traffic on the trails disappear, with any trails becoming increasingly overgrown and lost to common knowledge, as has happened in most other locations in Hawaii. The continued use of this trail system (or at least major portions of it) argues that trail use has not significantly changed in the intervening period, which also tends to support our observations on the limited number and nature of agricultural-related features in the valley.

This is supported by the nature and function of the features that make up Site 4873, a combination of both agricultural and habitation uses. As Handy quoted his informants:

" . . . In Kaipapau (Shallow Sea) the ahupua'a adjacent to Hauula, the upper stream valley is steep and narrow, yet natives of the district say that, making the most of a small opportunity, a few lo'i used to be worked there. " (emphasis, ours).

This comment still very aptly describes the physical situation,

and supports the argument made throughout this report that use of Kaipapa'u was limited both in scope and location. Site 4873, the small agricultural system discovered here is an example of the type of feature cluster(s) that might be expected to make up State Site No. 1056, (The Upper Kaipapa'u Stream Complex), found further into the valley. This later site complex has never been mapped or inventoried, and its actual extent and the nature of its sites is unknown, especially given the contradictory information on the very existence of that complex (Mahi Kamakeeaina interview). Given that recreational traffic in the valley will undoubtedly grow with the improvements provided by the Boards' well construction project and its paved roadway, the questions about the Site 1056 complex should be answered by identifying and inventorying its features to provide an interpretative context for the lower portions of Kaipapa'u Valley.

It is expected that as long as the Boards' contractor(s) for this project follows the requirements set forth in the Boards' preservation and mitigation plan, as developed from the following assessments and recommendations, the potential for construction impacts to the cultural resources of this valley can be minimized.

Assessment of Site Significance

The determination of significance for archaeological materials (sites, features etc.) is based on criteria as defined in the nomination process to the State Register of Historic Sites, and consists of five specific related criterion. They are:

- 1) Significance criteria 'a', are those locations associated with historic events which made an important contribution to general trends in history;
- 2) Criteria 'b' are those locations associated with individuals who were important in history;
- 3) Criteria 'c' are those locations which embody the distinctive characteristics of a particular type, period, or form of construction;
- 4) Criteria 'd' are those locations which have yielded, or show a potential to yield important data to further research in prehistory or history; and
- 5) Criteria 'e', being those locations which have important value to social/ethnic groups within Hawaii.

While some nearby sites such as State Site Number 3394, a *heiau* in Ma'akua; or Kaunihokahi *heiau* in Hau'ula ahupua'a; or Huihua fishpond in Kahana, or those in La'ie; or *koa* such as seen at Kalanai in Laie, that do clearly fulfill more than one of the above criterion, the sites identified during this project in Kaipapa'u are not such obvious candidates for significance in categories 'a' - 'c'. None are major symbols of political or religious power, or examples of formal public architecture, nor are they sites with compelling oral or historic links. They are simply the surviving remnants of a dryland *maka'ainana* agricultural system in this particular section of

Ko'olauloa. As a result the determination of significance for these sites, with exception of Site 4874, rests primarily on criteria 'd' - on the need for preservation of the archaeological record.

The assesment of significance is based in large part upon the application of the settlement pattern approach as an evaluative tool to each site under criteria 'd' examination. Sites which individually may be of limited architectural, historical or even archaeological significance alone, are seen as part of the larger pattern of changing land use and modification. Within this context, site significance is established on the ability of the site to contribute to the larger general questions facing Pacific archaeology rather than the site being a unique, singular unit. The Makaha Valley project of the 1960's and recent research in Anahulu (Kirch 1992) are examples of how relatively mundane sites contribute substantially to analysis of changing patterns of land use and modification in Hawai'i.

In the instance of this project we were unable to locate any clear and direct links between the archaeological features (such as the walls of Site 4868) and the unfortunately limited historical record, despite an exhaustive review of the available documentation and sources. However the sites do reflect human modification of the landscape for specific purposes, and as a result, the sites in the study area, in many cases can still contribute data to the archaeological record and help to resolve current questions about the level of intensity of dryland agricultural production in relatively marginal areas such as this section of Ko'olauloa. It is within the specific context of criteria 'd' that the significance of these sites

will be developed.

Site 4868 Site 4868 consists now of two segments of what was once a large continuous wall that was cut by the construction of the rough well access road at Sta. 27+60 (at the elevation of about 164 feet, see Map 11, page 38). The wall extends from near the bottom of the steep slope, perpendicular to that slope, and on up past the new well access trail, ending at the base of a high vertical basalt outcrop face at approximately the 300 foot elevation. The slope here is much too steep for any kind of agricultural use. As such the wall appears to have functioned primarily as a boundary marker, perhaps as a property boundary indicator, or to delineate the area of the limited dry field agriculture system we identified in-valley of this location at Site 4871, above Sta. 30+80. It should be noted here that Feature 7 of Site 4242 (the closest of that site) is more than 50 meters out-valley, and this feature itself would have served well as a boundary wall for that agricultural site. That feature (7), and Feature 6 of (Site 4242) are both short, smaller walls, that are constructed in much the same style as all the other features of that site, and as such are not at all like Site 4868 . The lack of any similarity to the Site 4242 features here leaves substantial doubt as to any formal relationship between these two sites.

The historical research undertaken was unable to identify any records directly linking the Site 4868 wall to specific land awards or other existing documents as they discuss this part of the valley.

That is to say - this alignment does not coincide with or match any of the known land subdivision/boundary lines on record. The only known land divisions in the valley are either further into the valley, or well outside this walls location. This then tends to support the view of their agricultural boundary function.

The Site 4868 wall segments have been identified, mapped and described. Collecting additional data in the form of specific details on wall construction and possibly the date or period of its construction would require dismantling portions of the wall and limited excavation. The wall segments do not have any direct verification in the historical record, nor any formal structural links to Site 4242. The isolated nature of this wall, and the anomalous position of the site to Site 4242 argue against any compelling rationale to pursue further data collection at Site 4868. Such collection would result in damage to a site that will otherwise remain undisturbed, and the probability of locating and recovering a datable (radiocarbon) sample here is low enough to discourage further adverse effect on the site, at this time.

The planned pipeline and well access road will follow the existing roadway through the area of Site 4846, but the site proper will not be effected by that construction, if the simple mitigative steps listed below are undertaken. Given the desire to preserve the site as a unique part of the archaeological record in its present condition and protect it from any possible direct impact by construction during this project, we recommend that:

- a) the site boundaries be flagged off to continually warn the construction crew away from the sites' features and thus protect it in place;
- b) the final construction plans will be marked with the appropriate exclusion zones to make it clear that the site is out of bounds to all construction activities; and
- c) both the construction crew foremen and the Board of Water Supply project inspector will be walked over the site area prior to the start of construction.

These three steps outlined above will be considered the minimum mitigation measures to be undertaken for other significant sites in the study area where such sites will not be directly effected by construction activities. However such sites are in close enough proximity to construction activities to suffer inadvertant damage from indirect effects, especially from earth moving and clearing and grubbing, and as such should be protected by the measures described above.

Site 4870 This is a possible shelter cave located ten meters east of the top end of the Site 4868 wail (see page 41). This small cave in the basalt rock cliff face is a considerable distance up slope from the access roadway, at an elevation of 300 feet (as taken from the preliminary topo. plan provided by E. Lee Engineering Design, May

1992). This shallow cave had no visible cultural material on the surface, but does contain a clear level soil deposit, of unknown depth. The lack of any obvious human modification to the front of the cave make determination of past human occupation at the site ambiguous. The possibility of intact subsurface deposits here, reflecting past use both of the site and this section of the valley, both in terms of period of occupance (radiocarbon dates) and kind of use, or activities, undertaken in the past (artifacts and pollen analysis) indicate that the site should be considered significant under criteria 'd'.

The lack of visible (surface) evidence of human occupation at the shelter cave, combined with the lack of any possible effect that the planned project will have on the site leads us to recommend that Site 4870 be protected in place from indirect effects of this project and be preserved intact for the archaeological record. The site has been identified, located and mapped, and described. Further data collection would require excavation, which does not appear warranted in this instance, given the nature of the site and its location in relationship to the project.

Site 4869 This short wall segment is located 20 meters east of the upper end of the Site 4868 wall (see page 40-41). The wall segment extends directly down slope from the same basalt cliff face a distance of six meters. As with the Site 4870 cave, this wall is located a substantial distance away from the planned project area, and at a much higher elevation. Its alignment suggests it may

represent an extreme up hill remnant of Feature 7, of Site 4242, but there are no intervening wall segments or other features between the two to confirm this, and thus because of the distance between the two, the wall must be viewed in isolation.

This site has been identified, mapped and described. Further data retrieval would require dismantling the wall and doing localized test excavations, with the same goal as for the Site 4868 wall, that of clarifying the relationship of Site 4869 with other human activities in this section of Kaipapa'u by detailing the establishment of date and method of construction.

Site 4869 qualifies for significance under criteria 'd' as it may offer limited further possibilities for data recovery.

As was seen in the case of Site 4868 and Site 4870, the lack of any link to the available historic documentation on past land use for the area means that the probability of the retrieval of additional useful data here at this time is low. This, combined with the considerable distance up-slope from the construction project area (which means the site will not be effected in any way by this project), indicates therefore that the need and interest in further data collection here would result in unnecessary damage to the site, and is not warranted. Appropriate mitigation for this site would be to protect it in place from indirect effects of the project by including it in the exclusion area that will be established for Site 4868 (upper half) and Site 4870.

Site 4871 Site 4871 is a cluster of three short retaining walls that define a small dryland planting area (see pages 41 and 43, and Map 12). There is no historic documentation for claimants, or clarifying past use of this site. The site is typical of opportunistic dryland planting areas in marginal regions like this hill side section of Kaipapa'u, with thin natural soil and almost no level land suitable for agriculture. However, as the Makaha Valley Project (1960's) and the Anahulu study (Kirch 1992) have shown, even areas that appear outwardly unimpressive have the potential to contribute information to the archaeological record, to clarifying patterns of land use and exploitation of the region. For this reason Site 4871 fulfills the requirements for a determination of significance under criteria 'd'.

The Site 4871 features have been identified, mapped and described. Further investigation would require excavation at the terraces to collect data that could clarify actual construction and use patterns here. Pollen sample analysis, or even collection of actual cultigen remains would indicate the pattern of activity here, and possibly information on period(s) of use, through recovery of datable radiocarbon samples. Given the limited and contradictory nature of the Upper Kaipapa'u Stream Complex, Site 1056 (as yet unstudied or mapped, See page 55), and the lack of direct supporting historical documentation to clarify these situations, excavation of Site 4871 is warranted to recover what ever additional data and information may be present.

It can be seen from Map 12, page 42, that Site 4871 falls

completely within the construction boundaries of the 180 Reservoir, and is slated to be destroyed in its entirety by the planned construction activities there. All available surface data from this site has been recorded. Subsurface investigations provide the last opportunity for the site to contribute data to resolve questions about agricultural use and occupation of Kaipapa'u, questions which can not be resolved through nonintrusive means such as use of historical documentation.

We recommend the following sequence of mitigative actions be undertaken for the retrieval of the subsurface data from Site 4871:

- a) An archaeologist will monitor the clearing and grubbing activities in the area of the 180 Reservoir, above the present well access road from Sta. 28+00, to Sta. 30+50;
- b) The archaeologist be allowed a short 'loan' of one the contractors Hop-tos for test trenching the features of this site, when they are working in the vicinity; and
- c) Monitor any subsequent construction excavation in the area of Site 4871 to recover any additional data.

With completion of these steps the ability of Site 4871 to contribute to the larger archaeological record will be exhausted.

Sites 4867 and 4872 By virtue of their past role in Hawaiian society, and the continuing importance to a number of contemporary interest groups, trails which reflect continuity between the past and present in Hawai'i are usually seen as significant under both criterion 'd' and 'e'.

The Site 4867 and Site 4872 portions of the valley trail system (discussed in detail on pages 29-31 and 43-5) have seen a variety of extensive modifications over time prior to this study, such as major modern improvements in terms of routing changes, clearing and widening (including sections that had been bulldozed). This includes widening upper sections of the ridge trail, Site 4872 during World War II, to provide access to the top of Kaipapa'u Peak for the construction of the concrete bunker/observation post sited there.

There are no visible archaeological features that define the trails such as stepping stones, *ahu*, retaining walls or curbing, the trails now being simply defined by the persistent use of this route for access into into the *mauka* or interior portions of Kaipapa'u Valley. The precontact trail has been obscured by the sporadic, but continual use and obvious modifications, most of which are historic.

The location of the trail and the demand for continued access, combined with the persistence of the precontact trail along roughly the same alignment, clarify that the Site 4867 and Site 4872 trails do in fact fulfill significance criterion 'd' and 'e'.

At this point in time the trail has been identified, described and mapped, and as such the ability of these sites to contribute

further to the archaeological database has been exhausted.

It has to be noted that the trails continue to serve a multiplicity of social functions, both as a continuation of traditional uses (such as collection of plants and plant products, and hunting in up valley areas) and those of a more contemporary nature (like recreational hiking, horse back riding, and motor biking). Consequently the sections of the existing trail into the valley that will be destroyed or bypassed by construction of this project must be compensated for by allowing for continued access along the new roadway to the *mauka* areas of this valley.

We therefore recommend that the present trail system be integrated into the Boards access road to the well site. This will allow for continued access up-valley by replacing the now heavily modified present trail, and avoid the disruption incurred by the destruction of portions of Site 4867 and Site 4872 that will otherwise occur.

Site 4873 Site 4873 appears to have served as both a habitation area and for agricultural production (as discussed in detail on pages 45-9, and Map 16, page 50). The site, which consists of a small platform and a series of agricultural features in an alluvial flat along Kaipapa'u Stream, is relatively undisturbed.

Given the limitations of the documentation on past land use in the historic record for Kaipapa'u, and the fact that the few remaining wetfield agricultural systems in other sections of the valley have been destroyed by residential subdivision development in the last 40

years, Site 4873 is seen as the last remnant of wetfield production in the entire lower valley. As such it offers substantial possibilities to add information on patterns and periods of agricultural use in this valley, especially as the majority of the other sites located during the project were related to upslope dryland crop production.

Site 4873 fulfills criteria 'd', as it offers substantial opportunities to contribute further data and information to research questions raised during this project.

The site has been located, mapped and described. At this point further data recovery would require subsurface investigations, either in the form of a program of limited testing throughout the site, and or by monitoring the future construction excavations for the pipe line along the north side of Site 4873 (see Map 16, page 50). While this part of the flat did not contain any visible surface features, the location of visible features suggests that this whole level section would have been a logical location for planting areas. As such it should contain data that could reflect details of the patterns of planting and use, and period(s) of that use of the site proper (as defined by the surface features).

The formal boundaries of Site 4873's features fall outside the construction limits for this project, and the site thus defined should not be directly effected by the project. Indirect effects will be limited to nearby additional clearing and grubbing, excavations for the pipe line, and a possible turnaround - equipment parking area at the bottom of the roadway coming down from the well site. These

can be mitigated against by flagging the site perimeter and establishing an exclusion zone that will be out-of-bounds to any construction activities.

Given that agricultural activity may well have extended into the flat areas below Sta. 45+00 and beyond Sta. 51+00, we feel that sufficient possibility exists for additional data recovery clarifying the nature and extent of that agricultural use of nearby parts of Site 4873. However as these parts of the large flat section fall outside the formal site boundaries, we feel that archaeological monitoring during construction excavation and trenching in the area of the flats here would be more appropriate than subsurface testing. Given the nature of alluvial deposition action on this intermittent stream, it is possible that whatever cultural layer is present may be either partially destroyed or buried under substantial overburden. This being the case, controlled testing here would likely be inefficient at best, and possibly unsuccessful. Monitoring during the deep trenching for the pipe line on the other hand will allow for a more complete and efficient examination of the subsurface indications of past activity in the flat along the whole north side of the valley floor. Monitoring should include examination and recording of the stratigraphic profiles, collection of any cultural remains, soil (and possible pollen) samples, and possible radiocarbon samples for dating purposes. The goal would be to clarify the presence and extent of the wet-field agricultural production in this lower-middle section of Kaipapa'u Valley, and look at the relationship of such production to

the dryland systems in areas such as Sites 4242 and 4871, in terms of periods of use and types of crop production and their relative importance to the *ahupua'a* and the larger community.

Site 4242 Site 4242 consists of a series of simple stacked, discontinuous walls and associated small terraces in an area of very degraded context (see Maps 9 -11). This latter situation is the result of heavy impact by recent (post 1940's) bulldozing activity (as discussed on pages 32 - 39, and 52). The remnant walls and terraces are now in such poor condition from the bulldozing that site integrity is poor -- the relationships between the remaining features is problematical at best, both as a result of destruction of some features and gross (bulldozer) modification of the land surfaces here.

Our detailed examination of the historic records for Kaipapa'u was unable to find any references that could explain the use of the Site 4242 walls and terraces. Despite the label that was attached to the site by the surveyors (in 1992), we were unable to locate any reference to a ritual site in the vicinity (see pages 1 - 3, 52 - 55 above, and Bordner 1992), either in the historic documentation or in oral interviews with a number of knowledgeable area residents. This view is reinforced by the lack of contemporary ritual use or interest in the site. As a result of our research we feel that it is clear beyond a reasonable doubt that Site 4242 is the remnant of a dryland agricultural system with simple terracing and boundary walls. As mentioned above the present site integrity is poor due to past heavy

bulldozing. As a consequence the features that do remain are in poor condition, but represent portions of the largest dryland agricultural system we located in the valley. For this reason Site 4242 is considered to be significant under criteria 'd', as the features still offer the possibility of further data collection.

The site has been identified, mapped and described. All means of surface investigation have been exhausted. While the site integrity is deemed poor, subsurface investigations of the various features, especially the terraced areas, should elicit further details and data that would clarify both site use (dryland agriculture planting) and period of use through location of cultural activity layer(s), pollen samples (crop production) and other samples for radiocarbon dating. The retaining and other short walls are more problematical, as their integrity has been more heavily compromised and their function thus obscured. We feel that the wall remnants, by virtue of their having been mapped and recorded, have exhausted their ability to contribute further information to the larger questions raised earlier and thus they do not require subsurface investigation.

Under the presently available version of the Board's construction plans for the area, Site 4242 will be bisected and largely destroyed by the construction of the 180 Reservoir access road and pipeline.

We recommend that appropriate mitigation for Site 4242 consist of the following:

- a) All features outside the immediate construction zone

should be flagged (and these areas are to be marked on the final construction plans) to mark off exclusion areas. This will preserve a significant proportion of the site from both direct and indirect effects of construction. Once thus protected we recommend that these portions of the site be preserved (for possible future research if a suitable research design is developed that would require subsurface testing of the remaining features);

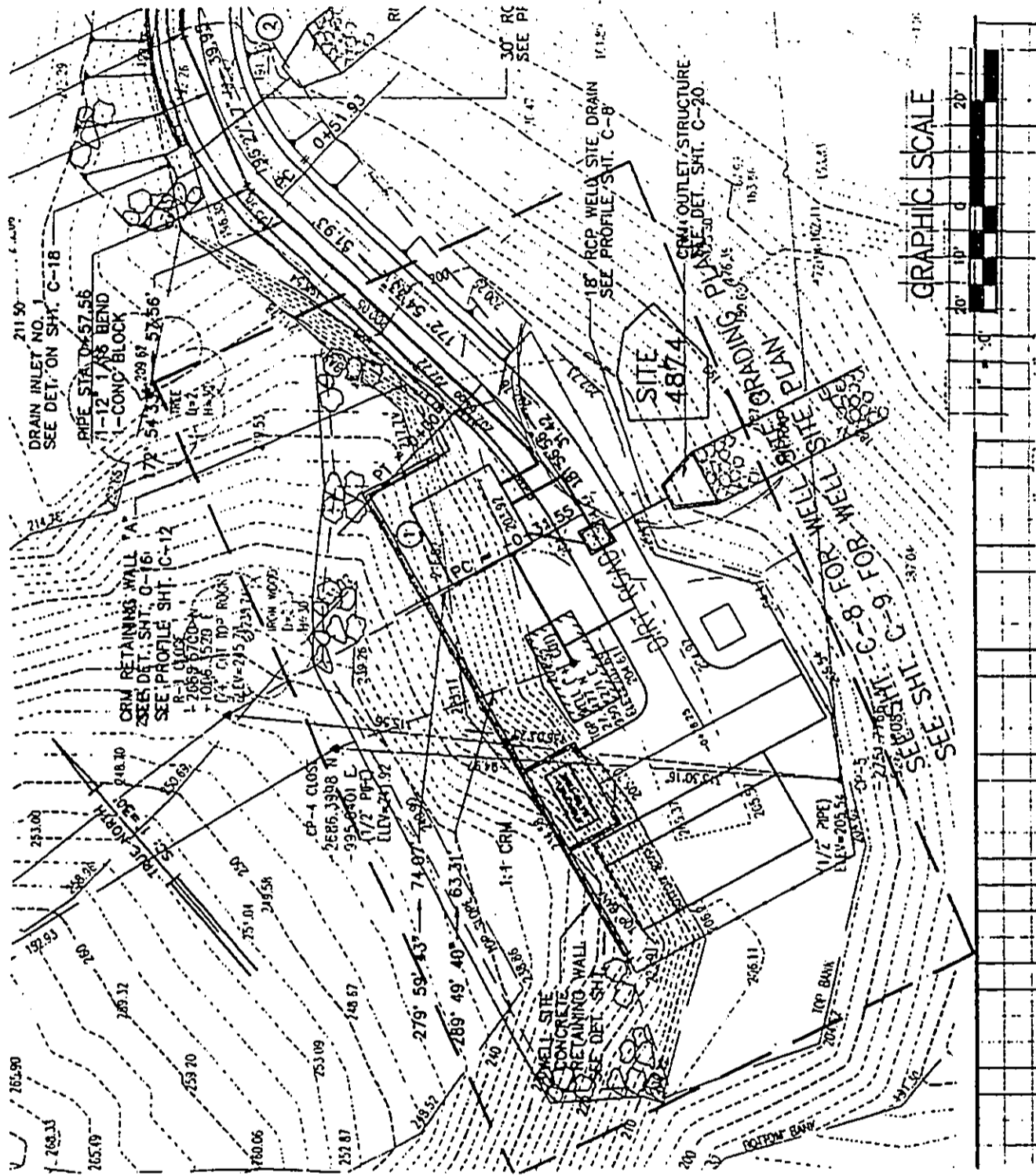
b) The portion(s) of the site within the project construction zone could be subjected to archaeological subsurface testing. However the lack of integrity of the site remnants, general surface disturbance, and the lack of supporting historic documentation mean that the probability of recovery of useful additional data would be small. A more efficient use of data recovery would be in the form of monitoring during subsurface construction activity in the vicinity of the site. This would allow for the collection of stratigraphic profiles that could provide evidence of subsurface activity over a substantial area, providing in the process continuous profiles through the area. This would also likely include isolated locations that had not been subjected to the prior series of destructive modifications. In such locations soil samples should be collected, and if present radiocarbon samples collected, as it may still be possible to gather enough data from the subsurface portions of the site to develop greater understanding of past land use and

periods of use for this section of Kaipápa'u. This subsurface collection of data will exhaust the possibilities that the effected features of Site 4242 have to contribute to the information for Kaipapa'u archaeologically, and those features will no longer be considered significant.

Site 4874 Site 4874 is a natural cluster of large boulders and a small terrace on the slope just two meters below the graded well site (see pages 49-51, and Map 16, page 50). While the site was not named or described in the historical records, nor does it exhibit any visible surface evidence of human modification, some area residents consider the site to be imbued with *mana* and to be a site that might have at one time been sacred, or even have functioned at least at some level as a ritual site. Site 4874 therefore becomes eligible for significance under criteria 'e', as it functions as a place of ritual importance, and according to at least one informant, has been so for a long period of time (pages 52-55).

Site 4874 is shown as being at the edge of the construction area for the well head facilities as presently planned, according to the newest available construction plans done by Okahara & Associates, sheet C-3, no dates (copy of a portion attached, Map 19, page 79).

At this juncture the possibility of direct effects of construction activities on this Site 4874 cannot be ruled out, primarily because of the proximity of the indicated 18" Well Site Drain, which is only five feet away. Other indirect effects may also

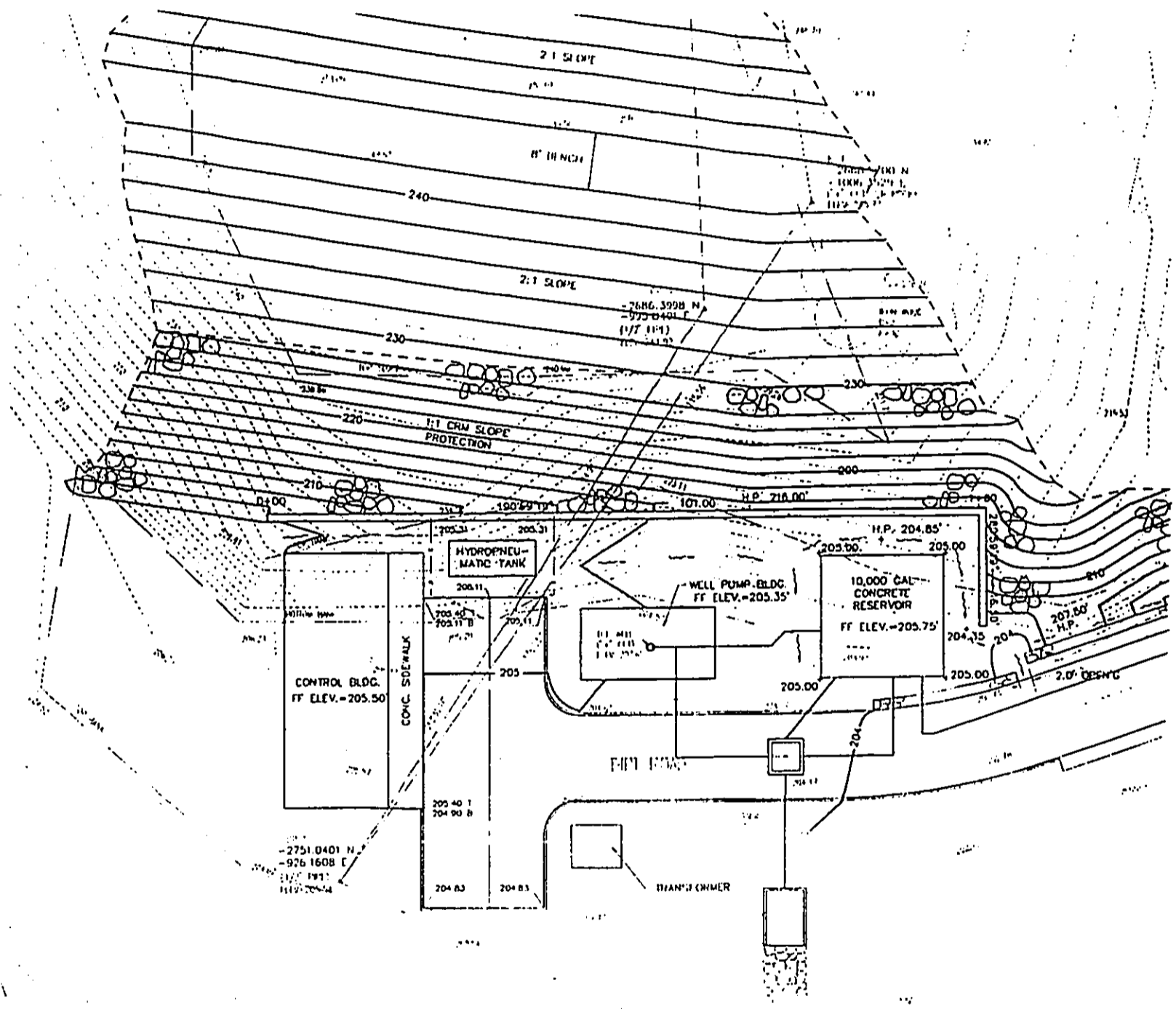


Map 19
A Portion of the Well Site Plan - Sheet C-3

occur, for instance as a result of the extensive earth moving required behind the well, and for the wellsite structures and facilities (including a 10,000 gallon reservoir), as indicated on the Grading Plan - Sheet C-8 (copy of a portion attached, Map 20, page 81).

To mitigate against disturbance(s) to Site 4874, we recommend the following measures:

- a) That the wellsite structures and related construction (including drainage systems and upperslope cutting and grading be moved further South, away from Site 4874, with the new North edge of the wellsite facilities being in line with the wellhead proper;
- b) A buffer zone must be marked off with flagging on site, and shown on revised final construction plans, establishing an exclusion area for all construction activities and possible effects, and a temporary barrier be put up to keep loose debris from the well site area from being pushed down into the area of Site 4874 ; and
- c) The Board, in consultation with the contractor, the archaeologists, and the State Historic Preservation Division archaeologists, must ensure that the integrity of Site 4874.



WELL SITE GRADING PLAN

SCALE 1" = 20'

Map 20

A Portion of the Grading Plan - Sheet C-8

will not be compromised by lasting direct or indirect effects of the well construction. Visual view planes and audible levels (post-construction) must remain within limits that are present at the site prior to construction. Access to Site 4874 after construction should be neither restricted or improved. These requirements may be accomplished through a combination of careful plantings, and perhaps low retaining wall construction, to be completed during the well facility construction project.

SITE NO.	TYPE	FUNCTIONAL DESCRIPTION	DESCRIPTION	REFERENCE	PRESENT CONDITION	EXPECTED EFFECT OF CONSTRUCTION	SIGNIFICANCE INITIAL LEVEL	IMPACT
4B67	TRAIL	TRAIL UP TO NORTH RIDGE	TRAIL TO NORTH RIDGE, THROUGH OPEN AREA ABOVE RD	PAGE 43, 44, 45, MAPS 9, 10, 11	GOOD TO POOR	VARIES - NONE TO COMPLETE DESTRUCTION	CRITERIA D & CRITERIA E	IMPACT
4B68	WALL & TERRACES	STAIRED WALL & SMALL AG. TERRACES	SIMPLE STAIRED WALL, DOUBLE FACED WALLS, & TERRACES	PAGES 39 & 40, MAPS 9 & 10, & Gardner, p 10	FAIR TO BAD	VARIES - FROM COMPLETE DESTRUCTION TO NO IMPACT	CRITERIA D	IMPACT
4B69	WALL	BOUNDARY WALL	DOUBLE FACED WALL, Vertical, L = 80+ m, to 1.5 m wide & 1.2 m h	PAGES 39 & 40, MAP 11	GOOD TO EXCELLENT	VARIES - NONE TO PARTIAL DESTRUCTION (NEAR PLANNED CONSTRUCTION)	CRITERIA D	IMPACT
4B70	WALL	BOUNDARY WALL	DOUBLE FACED WALL, Vertical, L = 60+ m, to 1.2 m wide & 1 m h	PAGE 40, MAP 11	GOOD TO EXCELLENT	NO IMPACT	CRITERIA D	IMPACT
4B71	WALL	BOUNDARY WALL	DOUBLE FACED WALL, Vertical, L = 8 m, to 1 m wide & 75 cm h	PAGE 40	GOOD	NO IMPACT	CRITERIA D	IMPACT
4B72	CAVE	SHELTER CAVE	SHALLOW CAVE IN ROCK CLIFF FACE, 2.5 m across front, & 1.5 m deep	PAGE 41	GOOD	NO IMPACT	CRITERIA D	IMPACT
4B73	WALL	SMALL AGRIC TERRACES	THREE SIMPLE STAIRED RETAINING WALLS & TERRACES, Horizontal walls, L = 5 to 9m, to 60 cm h	PAGES 41 & 42, MAP 12	GOOD	COMPLETE DESTRUCTION	CRITERIA D	IMPACT
4B74	TRAIL	TRAIL UP TO NORTH RIDGE & VALLEY	TRAIL TO NORTH RIDGE, & ON TO KAIAPAPA PLAY	PAGE 43, MAP 13	GOOD	VARIES - NONE ABOVE PLANNED ROUTE TO PARTIAL DESTRUCTION BELOW	CRITERIA D & CRITERIA E	IMPACT
4B75	HABITATION	POSSIBLE HOUSE PLATFORM, 'L' SHAPED WALL, DOUBLE FACED WALL, SHALLOW DITCH, & WATER SOURCES	RECTANGULAR PLATFORM, 'L' SHAPED WALL, MASSIVE WALL, SHALLOW DITCH, INTERPRETATION FROM STREAM COURSE, & PHOTOGRAPHING	PAGES 45 & 46, MAP 16	GOOD	NO IMPACT	CRITERIA D	IMPACT
4B76	LARGE Boulders & Small Terrace	POSSIBLE SACRED SITE	LARGE BOULDERS SURROUNDING SMALL TERRACE ON VALLEY FLOOR	PAGES 49 & 51, MAP 16	GOOD TO FAIR	POSSIBLE PARTIAL DESTRUCTION	CRITERIA D & CRITERIA E	IMPACT

Table 1
Summary of Sites
83

INITIAL LEVEL	JUSTIFICATION & COMMENT	TRIAL CHANGES &	SIGNIFICANT BASIS OF NEW DETERMINATION	SUGGESTED MITIGATION
CRITERIA D & CRITERIA E	INFORMATION VALUE (DEPOSIT ORIENTED)	NO LONGER SIGNIFICANT	IMPROVED ACCESS WILL BE PROVIDED BY PLANNED PROJECT	PRESERVE IN PLACE WHERE POSSIBLE
CRITERIA D	INFORMATION VALUE	NO LONGER SIGNIFICANT	- IF SURFACE DATA IS COVERED	MONITOR DURING CONSTRUCTION
CRITERIA D	INFORMATION VALUE	NO CHANGE		PRESERVE IN PLACE WHERE POSSIBLE
CRITERIA D	INFORMATION VALUE	NO CHANGE		FLAG & PRESERVE IN PLACE
CRITERIA D	INFORMATION VALUE	NO CHANGE		PRESERVE IN PLACE
CRITERIA D	INFORMATION VALUE (DEPOSIT ORIENTED)	NO CHANGE		PRESERVE IN PLACE
CRITERIA D	INFORMATION VALUE (DEPOSIT ORIENTED)	NO LONGER SIGNIFICANT	- IF SURFACE DATA IS COVERED	SURFACE DATA ALREADY COLLECTED, MONITOR DURING CONSTRUCTION
CRITERIA D & CRITERIA E	INFORMATION VALUE - CULTURAL USE TO PRESENT DATE	NO LONGER SIGNIFICANT - CRITERIA E REMAINS	- INFORMATION COLLECTION COMPLETED - IMPROVED ACCESS WILL BE PROVIDED BY PLANNED PROJECT	PRESERVE IN PLACE WHERE POSSIBLE
CRITERIA D	INFORMATION VALUE (DEPOSIT ORIENTED)	NO CHANGE		FLAG & PRESERVE IN PLACE, MONITOR DURING CONSTRUCTION
CRITERIA D & CRITERIA E	INFORMATION VALUE (DEPOSIT ORIENTED)	NO CHANGE		FLAG & PRESERVE IN PLACE, MONITOR DURING CONSTRUCTION

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













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



























APPENDIX I

LEGEND

NATURAL FEATURES

-  Outcrop
-  Crack
-  Cliff/Pafl
-  Slope
-  Depression
-  Drainage Swale (DRY)
-  Stream *BY DIRECT OF FLOW*
-  Puna / Spring
-  Large Boulder
-  Stones/Boulders
-  Bushes
-  Ridge line
-  Large Tree
- 

CULTURAL FEATURES

-  Trail
-  Stepping-Stone Trail
-  Curb-Lined Trail
-  Stone Alignment
-  Hearth
-  Cave Shelter
-  Petroglyph
-  Unexcavated Grave
-  Excavated Grave
-  Stone Mound (low)
-  Ahu/Calm
-  Ala Stone
-  Up-right Stone
- 
-  Wall/Stacked Stone
-  Wall/Core-Filled
-  Retaining Wall
-  Broken Wall
-  Papamu
-  Terrace
-  Modified Depression
-  Rubble
-  Platform
-  Pavement
-  Rubble Alignment
-  Fence line
-  Pipe Line
- 

APPENDIX II

ARCHAEOLOGICAL INVENTORY SURVEY
FOR
KAIPAPA'U EXPLORATORY WELL, HAU'ULA '180' RESERVOIR
AND ACCESS ROAD

Conducted for
City and County of Honolulu Board of Water Supply

by
Social Research Systems Co-op.
Richard Bordner

October 1992

ARCHAEOLOGICAL INVENTORY SURVEY FOR
KAIPAPA'U EXPLORATORY WELL, HAU'ULA '180' RESERVOIR
AND ACCESS ROAD

AHUPUA'A OF KAIPAPA'U, O'AHU

Abstract

On September 4, 1989 an archaeological inventory survey was conducted of the area proposed for the Hau'ula '180' Reservoir and Pump Station. A second survey was conducted on January 20, 1992 of the proposed road alignment and wellsite for the Kaipapau Well. No major sites of archaeological or historical interest were noted, though several boundary walls of apparently historical nature were noted. In addition, there are a number of small areas that appear to have been cleared for agricultural use. No other sites were noted during the surveys.

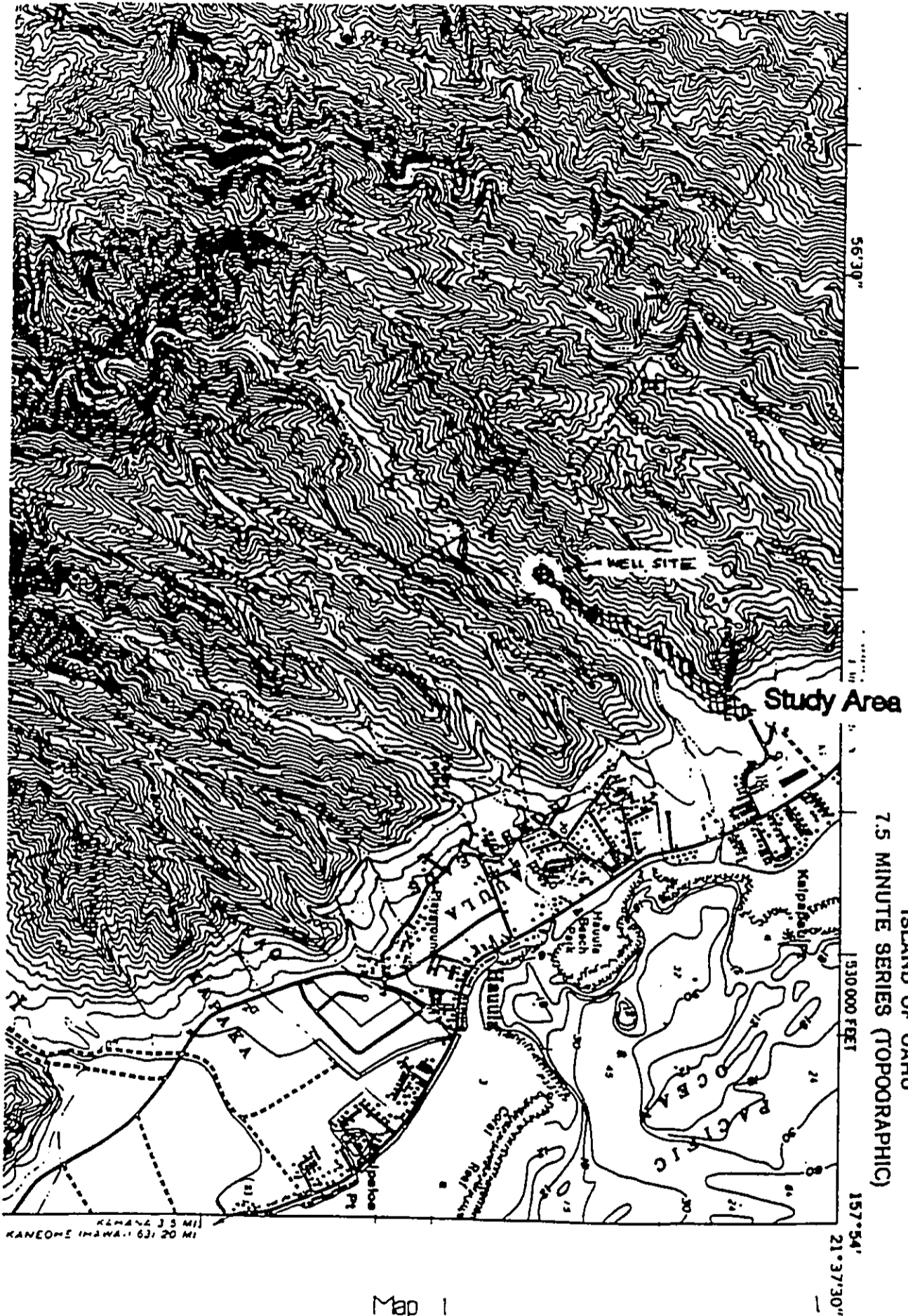
Introduction

The proposed Kaipapa'u well and associated Hau'ula '180' Reservoir and Pump Station is located on the slopes of Kaipapa'u Hill near Hau'ula in the ahupua'a of Kaipapa'u. According to Pukui et al the term, which is seen not only in the ahupua'a, hill and stream but also on the point means 'shallow sea'.

Historical Background

In planning and conducting research of specific parcels of land, it is common to search literature for references to the broad district in which the parcel is located and then to seek specific information on the parcel itself. By this process, a cultural and historical context is established; details relative to a particular parcel can then be more fully comprehended and appreciated when viewed in terms of the broader surrounding environment.

After a thorough examination of readily-available published and unpublished literature pertaining to Hawaiian culture, mythology, land use and history, it became evident that little information exists relative to the district of Kaipapa'u and virtually nothing could be



Map 1
Study Area Location Map (a portion of U.S.G.S. Hauula Quad.)

found relative to the specific project site. As a result of this dearth, it has become the primary intent of this narrative to assemble available literary references to the broader project area (Kaipapa'u district) and to offer reasonable analyses and interpretations of the data presented.

Native Traditions

Naming of the District

It is suggested that Kaipapa'u (literally "ocean of shoals") is so called because this name provides an accurate description of one of the area's distinctive physical attributes.

John Clark explains further:

To Hawaiian fishermen, a *papa* is a flat section of ocean bottom that is somewhat smooth, such as a shelf or reef. A *papau* is just the opposite, being a rough, uneven reef area with many pockets and a rocky bottom. The land division of Kaipapau, meaning "ocean of shoals," was named for its shallow, rocky offshore bottom. There is very little sand beach along the Kaipapau shoreline, which stretches from the Sacred Hearts Seminary to Waipilopilo Stream.... (Clark 1977:146)

He adds the following note on the seaward portion of the district:

The *makai* region of Kaipapau, the area surrounding the Hauula Kai Shopping Center, formerly was known as Kakaihala. Papapiapia, Papaakea, and Kao were the popular fishing grounds fronting Kakaihala.... (Clark 1977:146)

The Hawaiians of old saw great opportunity in the above name and would jest about Kaipapa'u in reference to a slow-witted individuals by uttering "No Kaipapau, paha? From Kaipapau, perhaps?"

Pukui explains the above:

A play on the name Kaipapau (Shallow-sea). He must be from Kaipapau, for he appears to be shallow-minded. (Pukui 1983:254)

Legendary References

There are definite associations between this land area, a number of seemingly unrelated priests who chose to dwell in this vicinity and certain kinds of fish frequenting these waters.

Summers cites Westervelt in relating the following tale relative to an unnamed priest and the *ulua* fish:

There is a valley near Hauula called Kaipapau. Here lived an old kahuna who always worshipped the two great gods Kane and Kanaloa. These gods had their home in the place where the old man continually worshipped them. Once the gods came to their sister's home and received from her dried fish for food. This they carried to the sea and threw into the waters, where it became alive again and swam along the coast while the gods journeyed inland. By and by they came to the little river on which the old man had his home. The gods went inland along the bank of the river, and the fish turned also, forcing their way over the sand bank which marked the mouth of the little stream. Then they went up the river to a pool before the place where the gods had stopped. Ever since, when high water has made the river accessible, these fish, named *ulua*, have come to the place where the gods were worshipped by the kahuna and where they rested and drank *awa* with him. (Summers 1978:160)

Though somewhat strange in parts, it is possible that the above tale explains a natural phenomena observed by the ancients and understood by them in terms of the gods to whom they owed their existence.

In her compilation of cultural references as they relate to various sites on Oahu, Summers includes the following brief mention to another priest who resided in Kaipapa'u:

Kapukaihaoa was the famous priest of Oahu. He could discern mysteries and secret and forthcoming events. He lived in Kaipapau, Koolauloa. (Fornander as cited in Summers 1978:160)

Efforts were made to locate additional details concerning this priest; no further information was found in any of the sources consulted.

One other priest is encountered in traditional literature who has definite ties with the area. Two separate references describe the priest Makuakaumana as traveling to and from Hawaii to his homeland Kahiki in company with the 12th-century priest Paa. His departure from Kahiki is commemorated in the saying "Eia no kahi koe o ka moamo. Here is the only space left, the *moamo*."

Pukui explains the above, thus:

Said when offering a small space or seat to a friend when every other place is occupied. As Paa was leaving from Kahiki with a canoe filled to capacity, a priest, Makuakaumana, called out, asking to come along. He was offered the only available space-the sharp point at the stern of the canoe, the *moamo*. (Pukui 1983:38)

On his return to Kahiki, Makuakaumana again faces the same problematic situation. Handy writes the following and ends with a direct reference to a spring situated in Kaipapa'u which memorializes Makuakaumana's residence in this district.

...Is is from here [Hauuia] that, according to legend, the *kahuna* Makuakaumana was taken back to Kahiki by a whale when his chief, Paa, had no room for him in his canoe. There is still a spring in the uplands of Kaipapau, the adjacent district, named for the famous seer who dwelt in the vicinity, Puna-a-Makuakaumana. (Handy 1972:460)

A final entry under the heading of Legendary References describes another natural phenomena of which the Hawaiians of old were aware--the travel and spawning habits of the *anaeholo* fish. These observations were simply summarized in the saying "Ka ia hali a ka makani. The fish fetched by the wind."

Pertaining to the above, Pukui writes:

The *anaeholo*, a fish that travels from Honouliuli, where it breeds, to Kaipapau on the windward side of Oahu. It then turns about and returns to its original home. It is driven closer to shore when the wind is strong. (Pukui 1983:145)

Land Records

The Land Commission Awards of the late 1840's

It appears from official published documentation that during the Great Mahele when fee-simple title was first instituted in the Islands, there was minimal interest in claiming lands in the district of Kaipapa'u. Only two natives registered their claims for lands which they resided upon and actively cultivated in this district: Hikiau (LCA 8167) was awarded two parcels of land totaling 8.75 acres and Hoopalahee (LCA 8171) received a single 22-acre parcel.

Both of these properties are located makai of the study area, in the flats that now form the major portion of the residential subdivision mauka of Kamehameha Highway.

Land Commission Award 8167 (Hikiau) [Native Register]:

Be it known to you, the Land Commissioners, that my claim for land is in the *Ahupua'a* of Kaipapau. Keaweiki has the *mo'o*, I only have a *kula*. It is bounded on the north by Kanihooi's *mo'o*, on the east, Hoopalahe's *mo'o*. I have a claim for cultivation in the upland, and in the forest, and a fishing claim, and a house lot claim. *Hikiau*. (N. Register: v. 5 pp. 496)

[Foreign Testimony]: Maiiahi, sworn, says he knows the *kula* land claimed by Hikiau in Kaipapau (a Gov't land). There is but one [?] which is cultivated in potatoes, melons, etc. It is bounded on the north by the land of Kanihooi, - east by the seaside, - south by the land of Hoopalahe, - west by the konohiki. Claimant has occupied the land since before there was any law. Keaweiki is the name of the *mo'o aina*.

Witness knows the House Lot of the 6th[?]. It is not enclosed. It is bounded on the Waialua side by a stream - makai by a hill - Hauula side the same - Mauka by the land of Hoopalahe.

Kawahine, the konohiki, had no objections to make to this claim. (For. Testimony: v. 8 pp. 10)

Land Commission Award 8171 (Hoopalahee) [Native Register]:

Be it known by the Land Commissioners that my land claim in the *Ahupua'a* of Kaipapau. The *mo'o* is Kihapai, in this *mo'o* I have 4 *lo'i*, bounded on the north by a house claim, on the east by Kawainui's *mo'o*. I have a *kula* claim in this *mo'o* adjoining on the east [or south?] of Hikiau's *mo'o kula*. I cultivate in the *kula* of Kanihooi, and in the *kula* of Kawahine, and in the *kula* of Maiahe.

I have a claim of cultivation in the upland and in the forest. I farm in the *Ahupua'a* of Hauula. The *mo'o* is Kalaipahoa, I have 2 *lo'i* in it and a small *kula* also adjoining on the north of the *lo'i*s in this *mo'o*. The boundaries are: on the north, the *kula*, on the east, the *mo'o* of the Konohikis. Those are my claims, from the Konohikis. I also have a house claim. *Hoopalahe* (Nat. Reg: v. 5 pp. 497)

[Foreign Testimony]:

Hoopalahe: Maiiahi, sworn, says he knows the *kalo* land claimed by Hoopalahe in Kaipapau. There are 4 patches, forming 1 piece. Bounded on the Waialua side by the *kula* land of Hikiau, - makai the same, - Hauula side by the boundary of Hauula, - mauka the same. Claimant has a piece of *kula* land planted. It is enclosed with a fence, and Bounded on Waialua side by Hikiau's land, - makai by the Konohiki, - Hauula side by Hauula boundary, - mauka by the hills.

Koekoe, sworn, says he knows the *kalo* land claimed by Hoopalahe in Hauula. There are 2 patches forming 1 piece. Bounded on the north by a stream, - east by the Konohiki, - south by Kamanu's land, - west by Hinamo'o's lands.

Witness knows the house lot claimed by Hoopalahe in Kaipapau, the stones are prepared for building a wall round it. It is bounded on the north by a stream, - east by the seaside, - south by Hauula boundary, - west by claimant's *kalo* land.

Kawahine, the konohiki of Kaipapau, made no objection to the claim in that land. Claimant [?] has occupied since long before witness came there.

The King's Land Agent made no objection to the claim in Hauula. (For. Test.: v. 10 pp. 9)

Land Grants: 1850-1915

Even the number of Land Grants purchased from the Government after the Mahele were insignificant. It is of some interest to note that of the four Grants listed in the Indices, all were fairly sizeable in acreage:

<u>No.</u>	<u>Grantee</u>	<u>Acreage</u>	<u>Date of Purchase</u>
1802	Kaupea & Kauai	133.30	1855
2110	Naliili	66.66	1856
2351	Hoopalahee	123.00	1857
4855	Jas. B. Castle	282.00	1904

Land Use Through Historic Time

E.S. Craighill Handy conducted a comprehensive survey of land use in the 1930's for districts of all islands. Of Kaipapa'u, he wrote:

Kaipapau was a large stream giving this *ahupuaa* its name. The level land opening out below the valley, now in cane, presumably all in terraces. Hauula natives say that there are old taro flats along the stream up the valley, which is very narrow and steep. (Handy 1971:91)

He later updated his account through the early 1950's:

...In Kaipapau (Shallow Sea) the *ahupuaa* adjacent to Hauula, the upper stream valley is steep and narrow, yet natives of the district say that, making the most of small opportunity, a few *loi* used to be worked there. The level land to seaward may once have supported a moderate amount of terracing, but as this was all under cane when the area was studied in 1953, the extent could not be determined. (Handy et al. 1972:460)

Summary

The ancient traditions, though fragmented and possibly of an early era, bear out the theme of Kaipapa'u as a residence of priests--some of which were known and well-respected. With this in mind, it would be natural to expect the survival of some of the structures connected with the priesthood. This, however, does not appear to be the case; literature and even transcribed oral tradition have not preserved the names or locations of

any sacred sites or structures within the area. Whether these existed at all or whether it was lost to memory is difficult to ascertain from the meager information available.

Taro cultivation and fishing as occupations sustained a small resident population through the 1850's as indicated by the available land records. It should be noted that the Land Commission Awards indicate that land was carried in cultivation for cash-cropping in the 1850's, though a number of the individuals cited in the boundary testimony do not show up in the Land Commission Awards. Other than vague assertions of "cultivation in the uplands" (Hikiau's 8167 Register claim) at a non-specified location, the historic records give no clear indication of land use specifically within the study area, though the area makai of the study area that is now in subdivision appears to have been the major agricultural area for the immediate region.

The boundary walls encountered in the study area may reflect the Hikiau (L.C.A. 8167) uplands claim, though this claim could apply to any mauka section of the valley, and in fact may be linked to the reported terracing noted much further back in the valley where the valley widens back out. Given the very steep nature of the valley floor in the study area, combined with the large amount of both water-transport and landslide boulder, it is highly unlikely that any agriculture was conducted in the majority of the valley floor within the study area boundaries. This is supported by the lack of clear land testimony for the area, which was likely peripherally exploited in conjunction with the more intensive use makai near the shore.

Summary of Land Use at Contact:

This section of Kaipapa'u appears to have been focused around marine exploitation as suggested in the oral tradition relating to fish migrations linked to the stream. The alluvial flats at the mouth of the valley were used for wet-field agricultural production in all areas which could be fed by diverted flow from Kaipapa'u stream. As the valley narrows dramatically just mauka of the stream mouth, this area of steep slope and spectacular stream flooding was likely used for forest products and occasional dry-land planting,

though the soil in most areas is very poor (consisting of decomposed ash). Considerably further up the valley may have been an area of secondary wet-field or intensive dry-field agriculture, as the valley floor appears to flatten out and allow more intensive land use. The study area proper appears to have been a portion of the lightly-exploited upland slope.

Prior Archaeological Work

The study area has been surveyed by archaeologists on two occasions, the first in 1983-1984 by Chiniago Inc. (for VTN Pacific), the second in 1988 by Paul H. Rosendahl, Ph.D., Inc. (for Belt, Collins & Associates). The first was in reaction to the Statewide Inventory of Historic Places, which had located a Site 1056 Upper Kaipapau Stream location which included the upper section of the study area. Site 1056 was said to contain a large wall, terracing and 'wahine slit' rock on a platform. The sites were not located due to thick vegetation, and had only been viewed by farmers. The site boundary was thus entirely speculative.

The 1983-84 survey by Chiniago Inc. consisted entirely of a visual reconnaissance from a nearby ridge as access to the study area could not be obtained. No sites were located during the visual reconnaissance, but due to the cursory nature of the study a physical reconnaissance was recommended.

The 1988 reconnaissance survey by Paul H. Rosendahl, Ph.D., Inc. was conducted on September 28, 1988:

"by Supervisory Archaeologists Alan T. Walker and Bert Rader, assisted by PHRI Field Archaeologist Jack Harris. The survey was accomplished by means of a series of pedestrian transects oriented both parallel and perpendicular to the major axis of the Access Road. The parallel transects consisted of walking along the 2,800 foot long narrow foot trail traversing the southeast side of the project area and examining the area immediately adjacent to the trail. The perpendicular transects were conducted over the area extending 30 m northwest of the trail and over the area of the proposed well sites. The perpendicular transects overall progressed in a southwesterly to northeasterly direction. During the perpendicular transects, intervals between sweeping crew members were 15.0-20.0 m."(Rosendahl 1988:5)

This reconnaissance survey located two possible archaeological sites, a wall and ditch.

The wall, designated Feature 418-1, was a:

...somewhat L-shaped wall situated on the northwest slope of Kaipapau Gulch... The wall is in poor to fair condition and appears to be an original, unmodified construction. The wall measures c. 15.0 m long (measured from tip to tip of L-shape) by 0.50-0.75 m wide by 1.0 m high. It consists of subangular basalt boulders crudely stacked three to four courses high. The wall is free-standing and is crudely faced on both sides. Several soil pockets are present in the vicinity of the wall. Because the wall may have served to delineate these pockets, the wall is tentatively assigned an agricultural function. The structural form of the feature and its location and condition indicate it is prehistoric. (Rosendahl 1988:6)

Feature 418-2, the ditch, was located in the proximity of Feature 418-1 and consisted of:

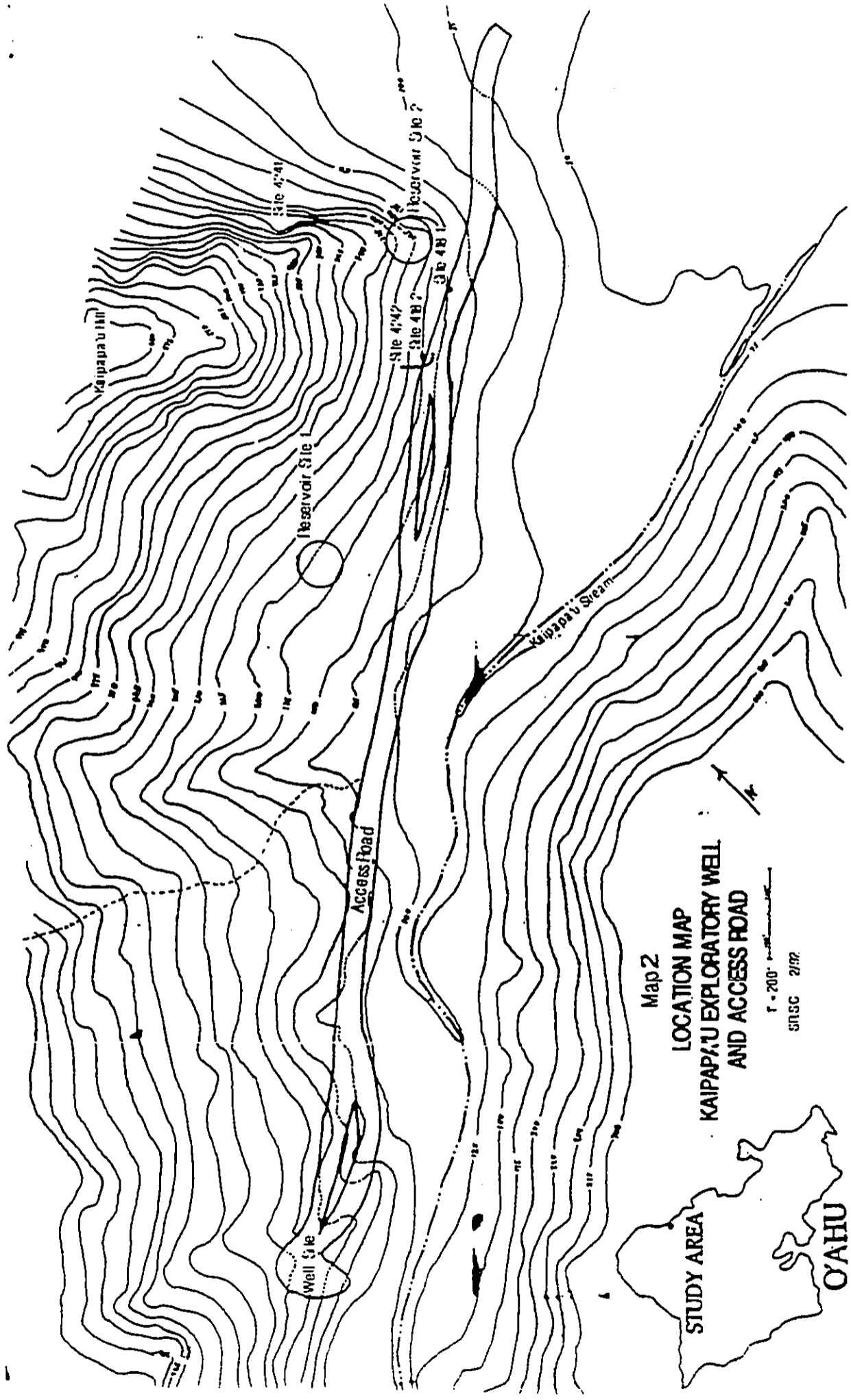
...very eroded and is in poor to fair condition, and it appears to be unmodified. The ditch measures c. 30.0+ m long by 1.75m wide by 0.40m deep. It is constructed perpendicular to the slope of the mountain. The upslope side of the ditch is cut slightly into the soil and the downslope side consists of a rounded soil embankment. The ditch in cross-section profile appears as a shallow U-shape. The ditch is not boulder-faced, and it does not contain kerbstones; it is tentatively interpreted to function as an 'auwai or agricultural irrigation channel. The structural form of the feature and its location and condition indicate it may be prehistoric. (Rosendahl 1988:6)

The report concluded that the features indicated a possibility that both dryland and wetland agricultural systems were present in Kaipapa'u Gulch, though primary association would be with coastal settlement as per other sections of windward O'ahu. Based on this conclusion they recommended that:

Although Features 418-1 and -2 are not good examples of site/feature types and are of limited cultural value, they still contain potentially significant information content--specifically, the features have not yet been dated, and dating may provide valuable information on the nature and function of inland agricultural features associated with coastal settlements. Therefore, it is recommended that a program of limited data recovery be conducted in the project area. This program would include test excavations and detailed recording of all features, and would focus on recovering dating samples. It is also recommended that additional historical documentary research on the project area be conducted.

If the above recommendations are not compatible with development plans, it is recommended that Features 418-1 and -2 be preserved "as is" and limited data recovery work at the features be conducted at a later date...it is recommended that the features be flagged prior to any development work, and that all grubbing or other development work in the immediate vicinity of the features be monitored by a qualified archaeologist. (Rosendahl 1988:11)

As will be noted later, informants located during the 1992 survey indicated that the Site 1056 features are in fact located significantly further up the valley beyond the study area



where Kaipapa'u stream bears due south.

Field Survey

A inventory survey of the area of the road alignment inclusive of the proposed Hau'ula 180 Reservoir was conducted on September 4, 1989 by Richard Bordner and David Cox of Social Research Systems Co-op. The survey was conducted on foot, and concentrated in the areas noted as the probable access road and reservoir sites on the maps provided by the client. The survey was done on foot in sweeps with individuals 15m apart due to the poor visibility in order to adequately cover the survey area. It was a primary concern of this survey to both relocate the sites tagged during the Paul Rosendahl Inc. survey (Features 418-1 and -2) and also conduct sweeps in those areas noted during the earlier research as consisting of extremely thick vegetation, as any sites missed during the earlier work would be likely located in these areas.

A second inventory survey was conducted on January 20, 1992, this time extending the survey to include the road alignment up to and inclusive of the proposed Kaipapa'u well. The survey was conducted by Richard Bordner, David Cox and Bill Kelly of S.R.S.C. The field survey techniques were the same as utilized on the first survey, with 15m gaps wherever feasible (except in areas of extreme slope). Due to the heavy vegetation the area of the initial (1989) survey was resurveyed to ensure complete coverage of all sections of the study area.

The lower makai slopes of Kaipapa'u Hill have been heavily modified by clearing and grubbing. At present the makai slopes down to the stream are in agricultural use, with bulldozed trails meandering through the lower slopes. The slopes facing directly makai are now overgrown but have been cleared in the past for pasture. Wooden corrals and boundary fences were present in this area. A historic well and reservoir (private) is located on the upper makai slope of Kaipapa'u Hill, designated by the State Historic Site Number

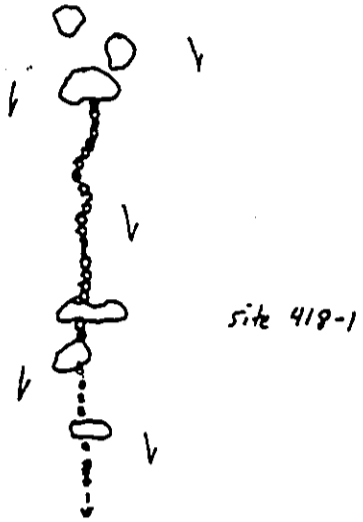
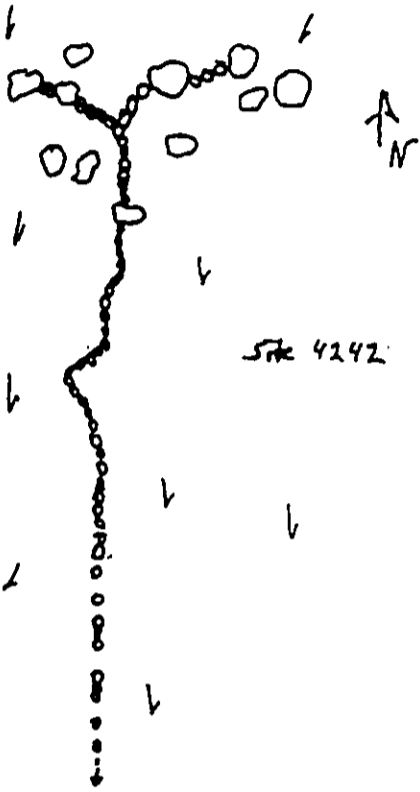
Site 4241, and appears to have some relation to a series of bulldozed trails running between the 100-150 foot contour of the hill to the vicinity of proposed Reservoir Site 2. The existing well, which is not in use, appears to be slightly higher than the proposed reservoir (elevation 180 feet).

Once out of the makai slopes, the vegetation was very dense, consisting mainly of christmas berry, lantana, koa haole and guava. The terrain was extremely broken, the ground being covered in boulder talus from the upper slopes of the hill. This talus has stabilized into what often appears on initial examination to be human constructed stacking but upon close examination it becomes evident are natural erosion terraces. The slope is steep in the lower sections, becoming very steep in the upper reaches. This combined with the large boulders and the thick vegetation made for poor visibility and difficult conditions. That similar conditions are the norm may explain the apparent misinterpretation of 'features' during earlier surveys as noted below, especially combined with the apparently random bulldozer activity in the area.

Within the proposed access road and near to the proposed Reservoir Site 2 there are several apparent boundary/cattle walls which run downslope which have been designated State Historic Site 4242. These consisted of stacked rock up to .4m high and .4m wide. In the lower slopes, where the walls were in somewhat better condition they were still of stacked construction, up to .7m high and .5m wide. Near these wall sections was an area that contained a large number of noni and ti. However there were no visible features in the area.

We were unable to locate the flags or marker from the Walker /Rosendahl reconnaissance during our 1989 survey, but did locate several flags with partial notation during the 1992 survey. A flag was noted which seemed to mark a short possible boundary wall section similar to those noted in Site 4242. It is assumed that this indicates the Walker/Rosendahl Site 418-1. Given the right-angle orientation of the walls to the slope we agree with the earlier assessment that the feature served as a designator for

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Map 3 : Site Maps
1"=30'

slope exploitation, likely for dry-land planting. However the casual nature of the wall construction and its orientation are more in keeping with boundary walls constructed during the early historic period, when cash-cropping made concern about land boundaries more intense, with a number of disputes arising.

A good example can be found just to the south in Hau'ula, where Land Commission Awards records note a series of complaints about an individual claiming land that he had recently enclosed by boundary walls though the land had been used traditionally by others. The L.C.A. testimony for Kaipapa'u suggests casual exploitation of slope areas throughout the valley for opportunistic, low-intensity dryland planting. Thus the walls most likely delineate areas exploited by certain individuals during the historic period.

Several heavily overgrown bulldozed trails run along the slope in the area below and to the southwest of proposed Reservoir Site 2, and on one of the trails we noted a flag: "PHRI 88-418 Site 418-2 9/28/88". It appears that this flag denotes Archaeological Site 418-2 located by Alan Walker et al of Paul Rosendahl, Inc. for R.M. Towill and the Proposed Kaipapau Exploratory Well in Nov. 1988 (see Walker and Rosendahl 1988). This location was 3m from Site 4242 and close to a large piece of forged iron that has been identified as the blade to a Cat-7 bulldozer. At the marker and flag the only feature noted was the edge of a bulldozed trail, which could have easily been interpreted as a ditch in the very heavy vegetation, especially given that the system of field sweeps conducted by Walker et al would have arrived at this location from downslope, thus minimizing the possibility that they would have correlated the surface disturbance to the bulldozer trail which runs from west to east.

Other than the boundary walls within the proposed access road corridor (Site 4242/Feature 418-1) we were unable to locate any other features of archaeological or historical interest during either the 1989 or 1992 surveys. In the lower slope sections we noted areas that were flat enough and free from large stone and would have served as agricultural areas, but there were no visible signs of clearing or of terracing. This was

especially true of the area between Reservoir Site 1 and the well site. The vegetation in this area is, if possible, even worse than that near Reservoir Site 2--a combination of extremely high sword grass, lantana and hau in the lower stretches changing to lantana, christmas berry and guava in the higher elevations. The flats are located outside the study area proper, but the vegetation and lack of archaeological features that could be expected (especially given the L.C.A. testimony for the makai sections) is likely due to the fact that this area was placed into sugar production in the last part of the 19th century, and thus had been extensively cleared.

The study area from this area on up to the well site had very poor visibility, but it was noted that as with the Reservoir Site 2 the slope is very steep and littered with talus material. In this area the slope material consists of very friable and unstable decomposed ash, and contains a number of recent landslides. This section is much narrower than the area beyond the proposed reservoir and is significantly steeper. We did not locate any features of past human exploitation of this area. In the area of Kaipapa'u stream, the quantity and large size talus material, combined with the lack of visible human modification and the striking indicators of significant flash-flooding due to the narrow aspect of the valley indicate that sub-surface testing would be fruitless.

Despite the heavy vegetation throughout the study area, we are confident that all visible sites were located during the survey. The multiple surveys conducted of this area by two different firms, at three different times, will have provided adequate coverage to the area, especially given the poor potential of a goodly portion of the study area.

In an attempt to locate the Site 1056 agricultural system, we extended the 1992 survey to the opposite stream bank in an attempt to locate any possible agricultural areas, but were unable to locate any features of interest. Thus while this section of the study area is marked as being within the State Site 1056 agricultural valley system, we fail to see any indication that the site boundaries should include this section. Conversations with hunters while conducting the survey indicated that the sites noted as defining Site 1056 are in fact

located a considerable distance up Kaipapa'u stream at the the point where the stream bends to the south and the valley opens up with a more gentle slope. This would indicate that the State should re-evaluate the site boundaries for Site 1056, as at present the boundaries indicated in the State Historic Office files do not accurately reflect the likely site boundaries, at least within the study area.

Conclusion

We were able to locate and identify the archaeological features noted by the PHRI archaeologists (Sites 418-1 and 418-2) but have noted that Site 418-2 appears to be the result of recent bulldozing, while Site 418-1 is historic. The Sites 4241 (the historic well) and 4242 (historic walls) also reflect recent activity in the valley rather than precontact use.

This may explain the relative dearth of traditional accounts related to the study area. The major paradox remaining is the apparent strong religious connotations of Kaipapa'u as a priestly residence, especially given the lack of large named religious structures. We suggest that this function (residence) is tied to Kaipapa'u Hill as a natural manifestation of mana rather than man-made objects. The only way to resolve this issue would be to examine the peak for coral or other indicators of past use. However this area is outside the scope of this project and will not be impacted by the Kaipapa'u Well project.

Only three features of archaeological or historical interest were noted in these surveys:

- 1) The historic well and reservoir (Site 4241) now abandoned on the upper slope of Kaipapa'u Hill. This site does not appear to offer any particular research or informational opportunities, nor does it fall under the criteria a-d of evaluation of significance for the National Register of Historic Places.

- 2) The historic boundary wall (Site 418-1) originally noted during the Walker/Rosendahl Study as an precontact boundary wall delineating planting areas. This wall has been reinterpreted as a historic period boundary wall. It does not appear to offer

any particular research or informational opportunities, nor does it fall under the criteria a-d of evaluation of significance for the National Register of Historic Places. However, we concur with the Rosendahl recommendation that the wall be preserved in its entirety if at all possible, as it may at some time in the future be useful in analysis of historic change in land use patterns as per work done in Anahulu Valley. If not, then the site should be flagged, and monitoring be conducted while any construction is being conducted in the vicinity to recover any possible cultural material that may be exposed.

3) The historic boundary walls (Site 4242/418-2). These walls do not offer any visible research opportunities other than those noted for Feature 418-1, nor do they qualify under the criteria a-d of evaluation of significance for the National Register of Historic Places. As per Feature 418-1, we recommend that the site be left intact if at all possible, but if some damage must take place, that monitoring be conducted during all construction in the vicinity of the site to recover any cultural material that may be exposed.

The existing well/reservoir (Site 4241) is outside of the area of impact of the proposed Reservoir Site 2, but both the 418-1 wall and Site 4242 boundary walls will be impacted directly by the access road construction.

The lack of any clear indication of precontact or early historic use of the study area, combined with the poor soil, heavy talus and steep slopes, especially in the area beyond the proposed reservoir, all indicate that this area has a very low possibility of recovering of subsurface cultural materials.

Recommendations

As excavation will be taking place during construction we recommend that an archaeologist monitor construction excavation during the phases leading from the project start line at the end of the existing road for the first 1200 feet of the access road to record both any subsurface information exposed and also note any information uncovered during

removal of Sites 418-1 and 4242, as this area has the only locations that may have been suitable for agricultural use.

We do not see that any archaeological monitoring is necessary in either the road section beyond the initial 1200 feet nor at the well proper given the steep slope and talus material. However we would recommend that an archaeologist be on stand-by during all subsurface phases of the project in case material of archaeological or historical interest is exposed by construction activity.

As noted originally by Handy, Kaipapa'u is not a terribly attractive location for large-scale agriculture in the mauka portions due to the steep nature of the terrain. In fact the only useful area presently in either habitation or agriculture is at the mouth of the valley in the floodplain. Unlike many other valleys we noted a general lack of erosional terraces on the slopes of Kaipapa'u Hill, which in other valleys provide a source for much of the usable agricultural land. This appears due to the narrow width of the valley, with extremely steep slopes, which keep slopes from developing an angle of repose that is stable.

The prominent nature of Kaipapa'u Hill, with its distinctive saddle, would be a prime candidate for religious features, especially given its overlook position over the stream entrance which is key in the limited legendary record, but there is no indication of a structure on the hill, though it is possible the hill was a non-structural heiau (or possibly just the peak). The general lack of strong information relating to religious features in the valley, especially given the prestigious kahuna which inhabited (and logically worshiped) in the valley is puzzling and without further historical research will remain an anomaly.

Final Environmental Assessment

Kaipapa`u Well and Associated Facilities

APPENDIX 4b

**SCS SUPPLEMENTAL ARCHAEOLOGICAL SURVEY AND
CULTURAL IMPACT ASSESSMENT, 2003**

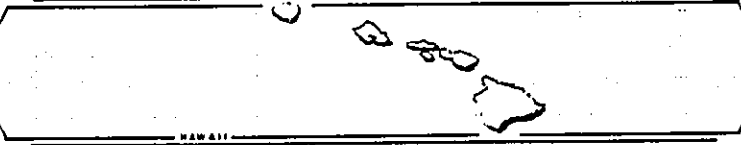
SCS Project 302-1

**A SUPPLEMENTAL ARCHAEOLOGICAL INVENTORY SURVEY AND
CULTURAL IMPACT ASSESSMENT OF KAIPAPA`U WELL AND
ASSOCIATED FACILITIES
LOCATED IN HAU`ULA AHUPUA`A, KO`OLAULOA DISTRICT,
O`AHU ISLAND HAWAII
[TMK: 5-4-004:004].**

Prepared by:
Leann McGerty, B.A.
and
Robert L. Spear, Ph.D.
August 2003

Prepared for:
Ron Terry, Ph.D.
Geometrician Associates
and the
Honolulu Board of Water Supply

SCIENTIFIC CONSULTANT SERVICES Inc.

A stylized map of the Hawaiian Islands is centered within a decorative horizontal bar. The word "HAWAII" is printed in small letters below the map.

711 Kapiolani Blvd. Suite 975 Honolulu, Hawaii 96813

ABSTRACT

At the request of the Geometrician Associates and the Honolulu Board of Water Supply, Scientific Consultant Services, Inc. (SCS) conducted a supplemental Archaeological Inventory Survey and Cultural Impact Assessment of Kaipapa`u Well and associated facilities located in Hau`ula Ahupua`a, Ko`olauloa District, O`ahu Island (TMK: 5-4-004:004). A previous inventory survey identified nine sites composed of twenty-two features in the valley. In 1995, Site 4874 had been identified as a "possible ritual site" by a resident of Hau`ula. The present Inventory Survey conducted in July of 2003 did not identify any additional sites in the road corridor or at the reservoir and well sites. SCS consulted with community members and the Ko`olauloa Hawaiian Civic Club concerning any information pertaining to Kaipapa`u Valley and Site 4874. No information was forthcoming. Based on community response and archival research, Site 4874 is not a sacred/ritual site. It has also been determined that, pursuant to Act 50, the exercise of native Hawaiian rights related to gathering, access, or other customary activities in the valley will not be affected and there will be no adverse effect upon any cultural practices or beliefs due to the construction on the proposed Board of Water Supply project at Kaipapa`u.

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INTRODUCTION

At the request of the Geometrician Associates and the Honolulu Board of Water Supply, Scientific Consultant Services, Inc. (SCS) conducted a supplemental Archaeological Inventory Survey and Cultural Assessment on Kaipapa`u Well and associated facilities located in Hau`ula Ahupua`a, Ko`olauloa District, O`ahu Island [TMK: 5-4-004:004] (Figure 1 and 2).

Several archaeological surveys have been conducted in Kaipapa`u Valley beginning with the Statewide Inventory of Historic places (1983-84) at which time a site was identified in the upper part of Kaipapa`u Valley, outside of the present project area. A 1988 reconnaissance identified two features located significantly further up the valley, also beyond the study area (Walker and Rosendahl 1988). In 1992 an Inventory Survey was conducted for Kaipapa`u exploratory well, reservoir and access road at which time "no major sites of archaeological or historical interest were noted though several boundary walls of apparently historical nature were noted" (Bordner 1992). Archaeological Inventory Survey and monitoring were conducted in 1995 (Cox 1995). A total of nine sites composed of twenty-two features were identified in or near the construction corridor for the planned well and transmission pipeline and the associated reservoir. In addition, archival research suggested a religious connotation for Kaipapa`u Valley as a priestly residence, although no archaeological remains were identified as religious structures (Sterling and Summers 1978:160). It was suggested by a resident that possibly Site 4874 was a ritual site (Figure 3; Cox 1995).

METHODOLOGY

Field work was conducted by Leann McGerty (Project Director) and Mary Sullivan (Field Assistant) in July of 2003 under the overall direction of Robert L. Spear, Ph.D. The fieldwork consisted of a pedestrian survey to relocate previously identified sites, as well as identifying any unrecorded archaeological sites along the same route. The survey extended the entire length of the access road, to the reservoir and well sites on the north side of Kaipapa`u Valley (Figure 4). The access road is presently a bulldozed dirt track that is elevated above the valley floor.

The Cultural Impact Assessment involved evaluating the probability of negative impact on cultural values and rights within the project area and its vicinity. Impact to Kaipapa`u Valley and stream due to the new access road and Honolulu Board of Water Supply facility was a concern. Site 4874, identified in 1995, had been described as a "tightly packed cluster of large boulders in the spur ridge at the stream side of the new well site...This cluster of rocks high above the stream was pointed out by informants as having some *mana*" (Cox 1995:49).

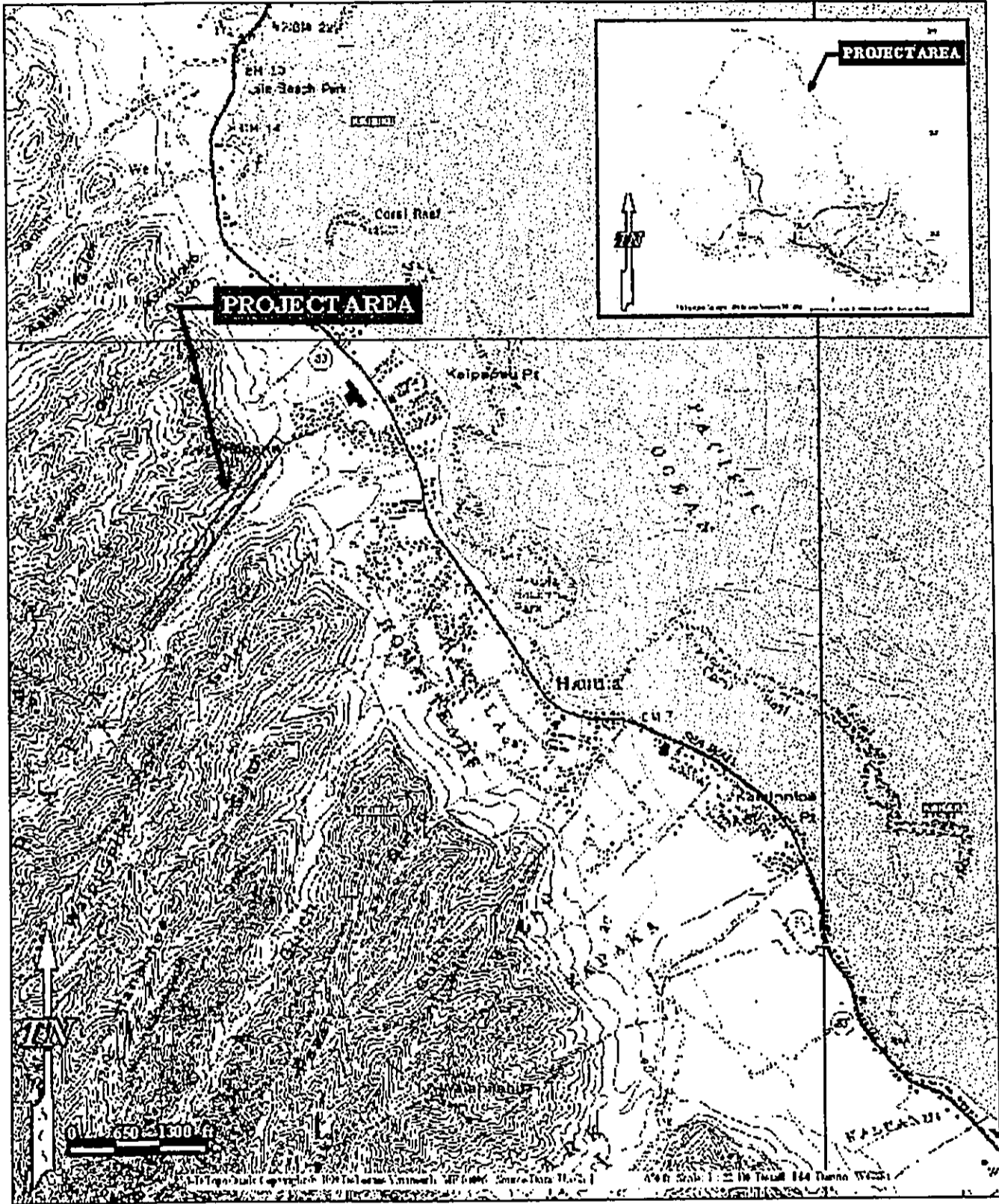


Figure 1: USGS Hauula Quadrangle Showing Project Area.

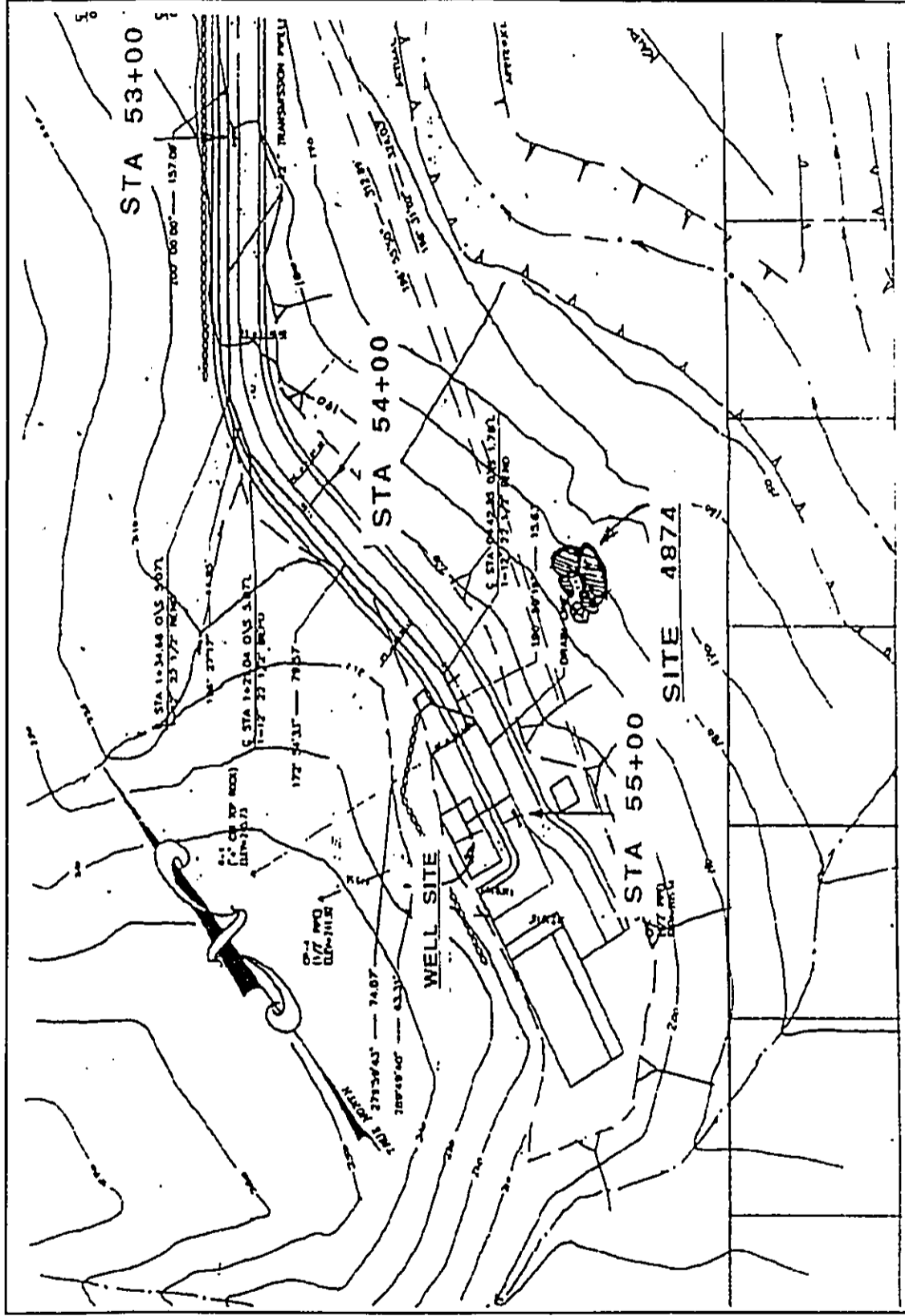


Figure 3: Plan View Map of the Location of Site 4874.

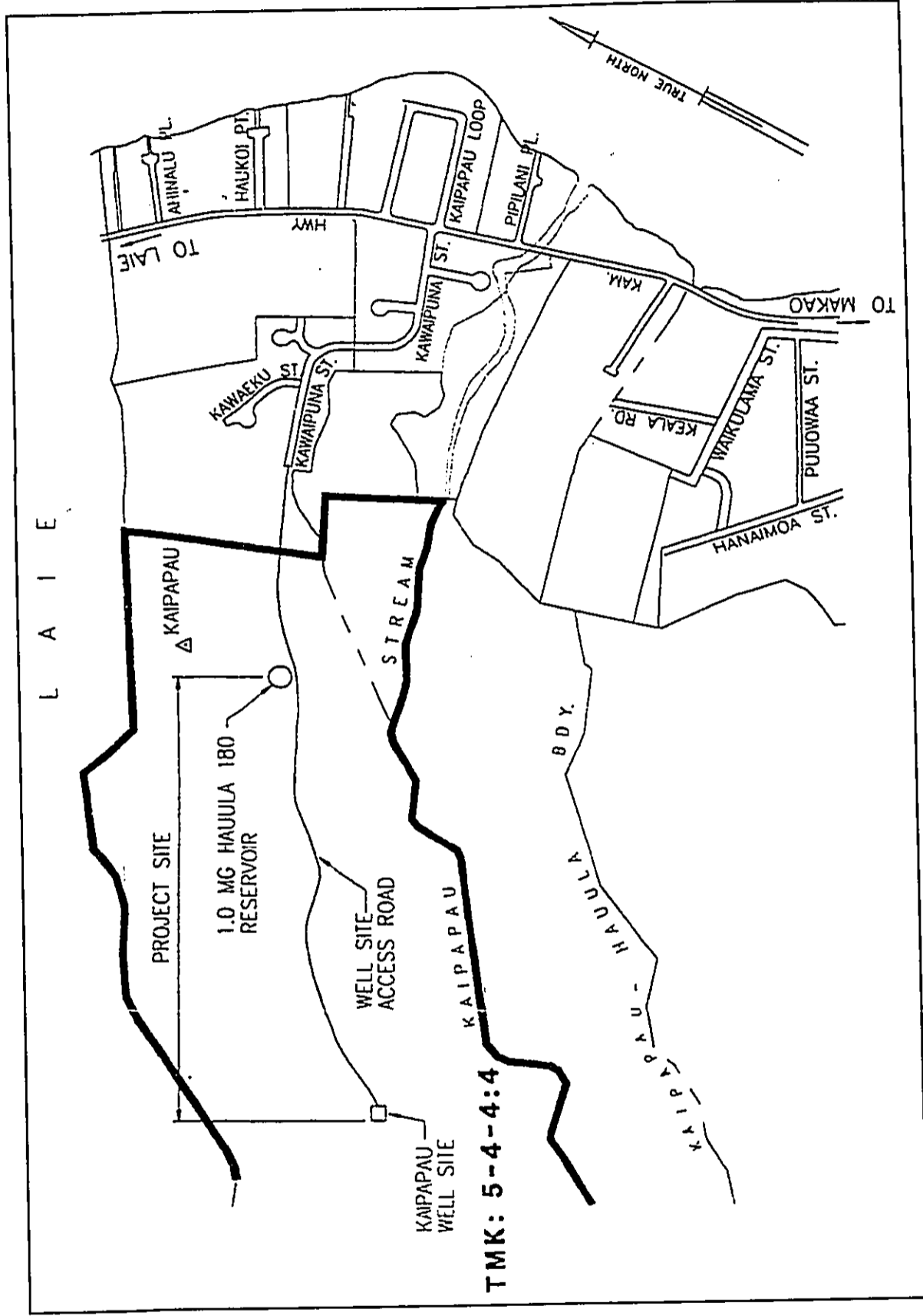


Figure 4: Plan View Map of Access Road and Survey Route.

According to the *Guidelines for Assessing Cultural Impacts* established by the Hawaii State Office of Environmental Quality Control (OEQC, 1997):

The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religions and spiritual customs...The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man-made and natural which support such cultural beliefs.

Act 50, enacted by the Legislature of the State of Hawaii (2000) with House Bill 2895, relating to Environmental Impact Statements, proposes that:

...there is a need to clarify that the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawaii's culture, and traditional and customary rights...[H.B. NO. 2895]

Act 50 requires an assessment of any impact on the cultural practices of the community and state as defined below:

- (1) A traditional cultural practice that is being conducted [at present]...and
- (2) Traditional, beliefs, practices, life-ways, societal, history of a community and its traditions, arts, crafts, music, and related social institutions [Act 50, Cultural Impact Assessment 2001].

It was also concluded that a proposed action that may not physically alter gathering practices, but affect access to gathering areas would be included in the investigation (State of Hawaii 1997).

This Cultural Impact Assessment was prepared in accordance with the methodology and content protocol provided in the *Guidelines for Assessing Cultural Impacts* (OEQC 1997). Extensive archival and documentary research has been presented in two previous reports and is not repeated here (Bordner 1992; Cox 1995).

SETTLEMENT MODEL FOR KAIPAPA'U AHUPUA'A

The Hawaiian economy was based on agricultural production and marine exploitation, as well as raising livestock and collecting wild plants and birds. Extended household groups settled in various *ahupua`a*. Within this land unit, residents were able to harvest from both the land and the sea. Ideally, this situation allowed each *ahupua`a* to be self-sufficient by supplying needed resources from different environmental zones (Lyons 1875:111).

During the pre-Contact time period there were primarily two types of agriculture, wetland and dry land, both of which were dependent upon geography and physiography. River valleys, such as Kaipapa`u, provided ideal conditions for wetland *kalo* (*Colocasia esculenta*) agriculture that incorporated pond fields and irrigation canals. Many stream gulches and river valleys similar to Kaipapa`u, were defined by cultivation occurring in the lower valley and on bends in the stream where alluvial terraces could be modified to take advantage of the water flow (Kirch and Sahlins Vol. 2 1992:59; Earle 1978). In *ahupua`a* with narrow gulches and adjacent tablelands or slopes, the upper regions often contained small stream flats where farming occurred. Most farming, however, took place in the lower portions of the stream valley where there were broader alluvial flat lands. Sometimes habitation occurred on the dry colluvial areas at the base of the gulch walls or above on the flat slopes. Other cultigens, such as *kō* (sugar cane, *Saccharum officinarum*) and *mai`a* (banana, *Musa sp.*), were grown in the valleys and such crops as *uala* (sweet potato, *Ipomoea batatas*) were often cultivated on the tablelands. This was the typical agricultural pattern seen during traditional times in all of the Hawaiian Islands (Kirch and Sahlins 1992, Vol. 1; Kirch 1985).

Archival research establishes taro cultivation and fishing as the subsistence strategy sustaining the small resident population in Kaipapa`u through the 1850s (Bordner 1992; Cox 1995). The alluvial flats at the mouth of the valley were used for taro *lo`i* (irrigated pond fields) and were watered by Kaipapa`u Stream. The steepness of the upland section of the valley provided excellent conditions for individual dry-land gardens called *okipū* and the harvesting of forest products. Five land claims were registered for Kaipapa`u, and four Land Commission Awards were granted during the Māhele (Waihona Aina Corporation, 2003, Māhele Database, Honolulu, Hi.). Testimony concerning these claims refer to "traditional rights for activities and uses on other parcels in the uplands of this *ahupua`a*" (Cox 1955:11). From 1855 through 1905, four Land Grants were purchased in Kaipapa`u encompassing the un-awarded land in the *ahupua`a* and a continuing shift to cash crops became the primary focus.

SUPPLEMENTARY INVENTORY SURVEY

No new archaeological sites were identified along the access road or at the reservoir and well sites. A properly engineered and maintained access road precludes impact to the stream at the bottom of the valley and do not affect access to the valley.

CONSULTATION

Individuals and/or groups having knowledge of traditional practices and beliefs associated with a project area or knowing of historical properties within a project area were sought for consultation. Those people who had particular knowledge of traditions passed down from preceding generations and/or personal familiarity with the project area were invited to share

their relevant information. Initial contact was made with the Ko'olauloa Hawaiian Civic Club, Cultural Historian Dawn Wasson, and several individuals who had been interviewed in 1995 concerning Site 4874. Dawn Wasson contacted residents of the *ahupua`a* and researched archival records with negative results. Mr. John Santiago Jr., a long-time resident of Hau'ula, had been told there were supposed to be sacred places in the valley but did not know where they were located. Terry Shintaku, a farmer whose family has lived at the end of Kawaipuna Street (where the access road begins) for over fifty years and was raised in Hau'ula reported no cultural activities occurring in the valley.

IMPACT ANALYSIS

Consultation was conducted with individuals and/or organizations with knowledge of the project area, its cultural resources, its traditional practices and beliefs. Based on the results of this research, as well as the results of the re-survey of the access route, reservoir and well sites recommendations for mitigation of any effects can be suggested.

Well projects sometimes have the potential to impact stream flow or other culturally important characteristics of the water. However, hydrologists have stated that the aquifer tapped by the proposed well is below and separated from the water that enters into, or flows into, Kaipapa'u Stream, and there does not appear to be any adverse effects of stream flow as a result of the proposed project (Honolulu Board of Water Supply, 1995). Therefore, there would be no effects on cultural values encompassed in Kaipapa'u Stream or its vicinity.

Knowledgeable individuals and groups were contacted for information concerning Site 4874 and cultural activities occurring in the Kaipapa'u Valley. No new information concerning sites in the valley or traditional activities was forthcoming.

SCS conducted a re-survey of the access road, reservoir and well sites in order to ensure that the previous inventory survey adequately covered the project area and had identified all historic sites. No new sites were identified. Because the access road ascends above the valley floor, there is no potential impact to the stream system or valley bottom.

In accordance with 36 CFR Part 800, SCS has assessed the effects of the access road, reservoir and well sites on Site 4874 and the surrounding valley and stream system. The results of our assessment indicate that no historic properties are affected by the presence of the new Board of Water Supply facility. Pursuant to Act 50, SCS has determined that no traditional or customary activities will be obstructed due to the construction of this facility.

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Final Environmental Assessment

Kaipapa`u Well and Associated Facilities

APPENDIX 4c

**ARCHAEOLOGICAL INVENTORY SURVEY
CORRESPONDENCE**

DOCUMENT CAPTURED AS RECEIVED

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

MICHAEL U. WILSON
BOARD OF LAND AND NATURAL RESOURCES

-456/95 DEPUTY
GILBERT COLOMA-AGARAN

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES CONSERVATION AND ENVIRONMENTAL AFFAIRS CONSERVATION AND RESOURCES ENFORCEMENT CONVEYANCES
FORESTRY AND WILDLIFE HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT STATE PARKS WATER AND LAND DEVELOPMENT

August 7, 1995

Raymond H. Sato
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

LOG NO: 14917 ✓
DOC NO: 9508TD09

AUG 11 10 02 AM '95

Dear Mr. Sato:

**SUBJECT: Draft Environmental Assessment (DEA) for the Proposed Kaipapa`u Well, Breaker Reservoir, Control Station, Pipeline and Access Road Development
Kaipapa`u, Ko`olauloa, O`ahu
TMK: 5-4-4: 4**

Thank you for the opportunity to review this DEA, which includes as Appendix II an unacceptable inventory survey report (Bordner 1992). Our concerns with this report are detailed in my April 1995 letter to you (LOG NO: 14269). The meetings among our staff and with the archaeological contractors suggested in that letter are taking place. Most recently, Tom Dye of my staff met with Richard Bordner and Dave Cox at our office on August 2nd. Several of the issues noted in my letter are still outstanding. As correctly noted in the DEA at page 36, we must accept the inventory survey report and concur with significance determinations before construction begins.

If you have any questions please call Tom Dye at 587-0014.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

TD:jk

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



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August 31, 1995

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SEP 8 1995

OKAHARA, & ASSOC., INC.

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ORIGINAL FILED - HILO
IN 92034

Mr. Don Hibbard, Administrator
State Historic Preservation Division
Department of Land and Natural Resources
State of Hawaii
33 South King Street, 6th Floor
Honolulu, Hawaii 96813

Dear Mr. Hibbard:

Subject: Your Letter of August 7, 1995 Regarding the Draft Environmental Assessment (EA) for the Proposed Kaipapa'u Well, Breaker Reservoir, Control Station, Pipeline, and Access Road Development at Kaipapa'u, Oahu, Hawaii, TMK: 5-4-4: 04

Thank you for reviewing the Draft EA for our proposed Kaipapa'u Well, breaker reservoir, control station, pipeline and access road development.

We acknowledge that the archaeological inventory survey report should be revised and accepted by your agency before construction begins. The inventory survey report is presently being revised for your acceptance.

If you have any questions, please contact Barry Usagawa at 527-5235.

Very truly yours,

A handwritten signature in black ink, appearing to read "Raymond H. Sato".

RAYMOND H. SATO
Manager and Chief Engineer

cc: Okahara and Associates, Inc.

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953158

JAMES J. CAYETANO
GOVERNOR OF HAWAII

RECEIVED
BD OF WATER SUPPLY

OCT 13 1 24 PM '95



OCT 13 1995

PE
CC: MGY

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT COLOMA-AGARAN

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES CONSERVATION AND ENVIRONMENTAL AFFAIRS CONSERVATION AND RESOURCES ENFORCEMENT CONVEYANCES
FORESTRY AND WILDLIFE HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT STATE PARKS WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

October 9, 1995

Raymond H. Sato
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
530 South Beretania Street
Honolulu, Hawaii 96843

LOG NO: 15663
DOC NO: 9510TD08

Dear Mr. Sato:

SUBJECT: Proposed Kaipapa`u Well, Breaker Reservoir, Control Station, Pipeline and Access Road Development
Kaipapa`u, Ko`olauloa, O`ahu
TMK: 5-4-4: 4

We would like to thank Scot Muraoka and Francis Fung of your staff for accompanying Holly McEldowney and Tom Dye of my staff on a field inspection of historic sites along the route of this project, and for their understanding regarding difficulties which have arisen with this project. This field inspection was carried out on September 22nd with your archaeological consultants, Richard Bordner and David Cox.

As you know from previous correspondence (most recently DOC NO: 9508TD09) we have not received an acceptable inventory survey report. We have been working with your consultants for several months to bring this report up to current standards. But, they have had difficulties doing so, and an acceptable report is not yet available. We do believe, however, that the review of this project can proceed, with the understanding that an acceptable report will be forthcoming.

Three historic sites in the project area might be impacted by the project. One (4874) is a site that may have some traditional cultural significance. We have been unable to contact Mahi Kamake`eaina to discuss this matter, but will continue to try. Thus, we cannot yet complete an evaluation of this site. This site is in the well area. The other two sites are in the access road and reservoir portions of your project. They are a small terrace site (4871) and a site with walls and terraces (4242). As your staff knows, we believe that the sites contained some minimal information on the past (criterion D of the Hawaii Register of Historic Places). Reasonable amounts of this information have been recovered/recorded at site 4871 during the survey, making this site "no longer significant" in our opinion. Site 4242 is still significant for criterion D, but your proposed work in the vicinity of this site is minimal and we believe that it will have "no effect" on the information contained in the site. Thus, we disagree with your consultant's claim that these two sites need to undergo archaeological data recovery.

XC: Engineering

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Raymond Sato
Page 2

We believe that your archaeological consultant's claim for more work does not have merit. For site -4871, your consultant is claiming that information on "construction and use patterns" can be derived from study of these small terraces, and that this is best collected using a combination of monitoring and excavation with a backhoe. Your consultants believe that pollen, preserved cultigens (such as sweet potato, perhaps), and material for radiocarbon dating can be recovered from these terraces. In our experience it is unlikely that useful pollen will be found in colluvial soils such as those at site 4871; it is extremely unlikely that cultigens will be recovered in excavations; and the archaeological evidence needed to associate organic material with the construction of these "opportunistic dryland planting areas" would be next to impossible to recover under the best of conditions. The proposed monitoring and backhoe excavation procedures decrease the likelihood that these types of information, in the unlikely event that they are present, can be collected. For site 4242, your consulting archaeologist also recommends that archaeological monitoring take place. This site is a series of simple stacked, discontinuous walls and small terraces in a bulldozed area. The monitoring proposed would collect soil, samples for dating, and a profile along the length of the access road. Once again, we are not convinced that the information that the consultants propose to collect will be important for Hawaiian history. We understand from Scot Muraoka that the only construction in this area will improve the existing access road, so this site will largely be avoided anyway.

Given our opinions on the significance of site -4871 and -4242, and your staff's agreement with these opinions, we believe that our two agencies are in consensus on the significance determinations for these sites and potential effects that the project might have upon them. Thus, we believe that construction of the access road to the reservoir portions of your project will have "no effect" on significant historic sites.

★ We do request that construction at the well site wait until we have cleared up the confusion surrounding the traditional cultural significance of site -4874.

Since we have resolved significance and mitigation measures for these sites, we also recommend that the final revision of the report by your consultant need only include the site inventory portion of an archaeological inventory survey. There is no longer a need for that report to include significance evaluations or mitigation recommendations. Perhaps that will make it easier for your consultant to bring the report to acceptable standards.

We appreciate your patience in this frustrating matter and your realization that truly significant historic sites do need consideration and proper mitigation.

Aloha,

Don Hibbard
for DON HIBBARD, Administrator
State Historic Preservation Division

TD:jk

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geometrician

ASSOCIATES, LLC

integrating geographic science and planning

November 15, 2002

Sara Collins, O'ahu Island Archaeologist
State Historic Preservation Division
601 Kamokila Blvd., Rm. 555
Kapolei HI 96707
VIA FAX (808) 692-8020

Dear Dr. Collins:

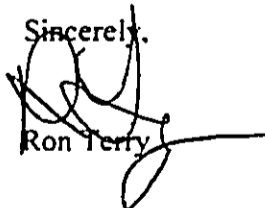
**Subject: Proposed Kaipapa'u Well, Breaker Reservoir, Control Station,
Pipeline and Access Road at Kaipapa'u, O'ahu, Hawai'i, TMK: 5-4-4:04**

I am part of a consulting team that has been contracted by the Honolulu Board of Water Supply (BWS) to perform engineering design and environmental assessment for this project. Our correspondence file (in particular, your office's letter to Raymond Sato of BWS dated October 9, 1995) indicates that the survey was near acceptance, but required additional work, seven years ago. This letter is to confirm the Scope of Work that would conclude the requirements for archaeological inventory survey for the project.

The following is our understanding of what our contracting archaeologists must accomplish to successfully conclude the process. The archaeologists should first consult with appropriate persons to attempt to determine whether Site 4874 has traditional cultural significance. After this, assessment of effects and mitigation (as necessary) for the site must be determined in consultation with your office and other consulted groups, as appropriate. Second, based on our conversations, we understand that a recheck of the reservoir site, access road, and well site should be done in order to ensure that the existing draft archaeological inventory survey found all sites. If additional sites are located, then all necessary steps of significance evaluation, determination of effects, etc., must be accomplished. Finally, the archaeologist should submit a report detailing this work in accordance with SHPD standards, that would be meant to supplement (not replace) the original survey.

We would appreciate it if you would confirm that this scope is adequate, indicating any revisions that may be necessary. Thank you very much for your attention to this matter. We look forward to completing the process in the near future.

Sincerely,



Ron Terry

cc: Glenn Suzuki, Okahara & Associates

phone: (808) 982-5831 · fax: (808) 966-7593 · HC 2 Box 9575 Kea'au Hawai'i 96749 ·
rterry@interpac.net

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII



STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING, ROOM 555
801 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707

GILBERT S. COLOMA-AGARAN, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCES MANAGEMENT

DEPUTIES
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LINNELL NISHIOKA

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MANAGEMENT
CONSERVATION AND RESOURCES
ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS

November 19, 2002

Mr. Rob Terry
Geometrician Associates, LLC
HC2 Box 9575
Kea`au Hawai`i 96749

LOG NO: 31148 ✓
DOC NO: 0211SC07

Dear Mr. Terry:

**SUBJECT: Chapter 6E-8 Historic Preservation Review of a Scope of Work for a Supplemental Archaeological Inventory Survey at the Proposed Kaipapa`u Well
Kaipapa`u, Ko`olauloa, O`ahu
TMK: (1)-5-4-004: 004**

Thank you for your facsimile of November 15, 2002, in which you outline a scope of work for the completion of supplemental archaeological inventory survey work in connection with the proposed Kaipapa`u Well to be built by the City and County of Honolulu Board of Water Supply (BWS) in Hau`ula, O`ahu.

Based on previous comments provided by our office to BWS (letter of October 9, 1995, Hibbard to Sato, DOC NO: 9510TD08), you have proposed that the following tasks be included in the scope of work:

Consultation with knowledgeable community members regarding the potential traditional cultural significance of Site 50-80-05-4874;

If Site 4874 is deemed significant, assessment of effect and mitigation (as needed) will be proposed, in consultation with SHPD;

Re-survey of the reservoir site, access road, and well site in order to ensure that the previous inventory survey adequately covered the project area and found all historic sites.

If additional historic sites are found during the re-survey of the project area, determination of significance and effect, and proposals for mitigation (if any) will be carried out.

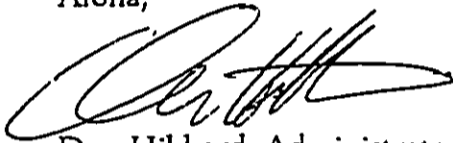
Mr. Rob Terry
Page Two

A supplemental survey report, documenting these findings, will be submitted to the State Historic Preservation Division for review and approval, prior to beginning construction work on the well.

We have reviewed the scope in conjunction with the prior correspondence, and we concur with the scope of work for the supplemental archaeological inventory survey. We look forward to receiving the report for review.

Should you have any questions about archaeology, please feel free to contact Sara Collins at 692-8026. Should you have any questions about cultural matters, please feel free to contact Holly McEldowney at 692-8028.

Aloha,



Don Hibbard, Administrator
State Historic Preservation Division

SC:jk

c: Holly McEldowney, Acting Branch Chief, History and Culture

LINDA LINGLE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING, ROOM 555
601 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707

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CHAIRPERSON
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DEPUTY DIRECTOR - WATER

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KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

December 31, 2003

Ron Terry, Ph.D.
Geometrician Associates
HC 2 Box 9575
Keaau, Hawaii 96749

LOG NO: 2003.2703
DOC NO: 0312SC18

Dear Dr. Terry:

**SUBJECT: Chapter 6E-8 Historic Preservation Review of a Supplemental
Archaeological Inventory Survey Report for the proposed Kaipapa`u Well
and Associated Facilities [County/BWS]
Hau`ula, Ko`olauloa, O`ahu
TMK: (1)-5-4-004:004**

Thank you for the submission of a report documenting the results of a supplemental archaeological inventory survey in support of the proposed Kaipapau Well and associated improvements (McGerty & Spear, 2003. *A Supplemental Archaeological Inventory Survey and Cultural Impact Assessment of Kaipapap`u Well and Associated Facilities Located in Hau`ula Ahupua`a, Ko`olauloa District, O`ahu Island, Hawai`i [TMK: 5-4-004:004]*). We received the subject report via electronic mail on September 15, 2003 and provide the following comments. Our review is late and we apologize for any inconvenience this may cause you or your client.

The project area was previously surveyed in 1995, with a total of nine historic sites comprising 25 features recorded. Among the historic sites identified in 1995 was Site 50-80-05-4874, a cluster of large boulders with a small central terrace that some individuals considered to be sacred.

The supplemental survey action included re-location of the previously identified sites, and a field inspection of the existing access road, which leads to the reservoir and well sites on the north side of Kaipapa`u valley. In addition, the Ko`olauloa Hawaiian Civic Club, Ms. Dawn Wasson, and other longtime residents of the Hau`ula area were consulted with regard to Site -4874. Additional archival research was also carried out. No new historic sites were found nor was any further evidence pertaining to the history or allegedly sacred nature of Site -4874. Your consultant states that all historic sites were found, and that they expect "no historic properties will be affected" since the known sites lie outside the project area.

Ron Terry, Ph.D.
Page 2

Before we can accept the report as final, we ask that several minor items be addressed. First, please include a full citation for the SIHP number for Site -4874. Secondly, what was the total acreage covered by the supplemental survey? Once we receive these corrected items – and they may be submitted on separate pages for inclusion with the report on file at our office – we anticipate accepting the report as final.

Should you have any questions, please feel free to contact Sara Collins at (808) 692-8026.

Aloha,

P. Holly McEldowney

P. Holly McEldowney, Administrator
State Historic Preservation Division

c. Leann McGerty, B.A., & Robert Spear, Ph.D., Scientific Consultant Services

SC:ak

Oct. 15. 2004 11:37AM

SCIENTIFIC CONSULTANT SVCS INC

No. 8504 P. 4

LINDA LINGLE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING, ROOM 555
801 KAMOKILA BOULEVARD
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January 21, 2004

Ms. Leann McGerty, Senior Archaeologist
Scientific Consultant Services
711 Kapiolani Blvd., Suite 975
Honolulu, Hawaii 96813.

LOG NO: 2004.0101
DOC NO: 0401EJ12

Dear Ms. McGerty:

SUBJECT: Chapter 6E-8 Historic Preservation Review of REVISIONS to a Supplemental Archaeological Inventory Survey Report to the Proposed Kaipapa'u Well and Associated Facilities [County BWS] TMK: (1) 5-4-004:004

Thank you for the submission of the revised pages for the report (McGerty & Spear, 2003). A supplemental Archaeological Inventory Survey and Cultural Impact Assessment of Kaipapa'u Well and Associated Facilities Located in Hau'ula Ahupua'a, Ko'olaupua District, O'ahu Island, Hawai'i [TMK: 5-4-004:004]. The revisions were made to address our comments on the draft version of the report (SHPD Log 2003.2703, McEldowney to Terry, December 31, 2003).

We believe that the revisions have been acceptably made and will place the report in our library where it will be available for public use.

Should you have any questions, please feel free to call Sara Collins at (808) 692-8026 or Elaine Jourdan at (808) 692-8027.

Aloha,

P. Holly McEldowney

P. Holly McEldowney, Administrator
State Historic Preservation Division

EJ:ak

CORRECTION

THE PRECEDING DOCUMENT(S) HAS
BEEN REPHOTOGRAPHED TO ASSURE
LEGIBILITY
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IMMEDIATELY FOLLOWING

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January 21, 2004

Ms. Leann McGerty, Senior Archaeologist
Scientific Consultant Services
711 Kapiolani Blvd., Suite 975
Honolulu, Hawaii 96813.

LOG NO: 2004.0101
DOC NO: 0401EJ12

Dear Ms. McGerty:

SUBJECT: Chapter 6E-8 Historic Preservation Review of REVISIONS to a Supplemental Archaeological Inventory Survey Report to the Proposed Kaipapa'u Well and Associated Facilities [County BWS] TMK: (1) 5-4-004:004

Thank you for the submission of the revised pages for the report (McGerty & Spear, 2003). A supplemental Archaeological Inventory Survey and Cultural Impact Assessment of Kaipapa'u Well and Associated Facilities Located in Hau'ula Ahupua'a, Ko'olaupua District, O'ahu Island, Hawai'i [TMK: 5-4-004:004]. The revisions were made to address our comments on the draft version of the report (SHPD Log 2003.2703, McEldowney to Terry, December 31, 2003).

We believe that the revisions have been acceptably made and will place the report in our library where it will be available for public use.

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Aloha,

P. Holly McEldowney

P. Holly McEldowney, Administrator
State Historic Preservation Division

EJ:ak

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