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GOVERNOR OF HAWAII



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DEPARTMENT OF LAND AND NATURAL RESOURCES
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STATE PARKS
WATER AND LAND DEVELOPMENT

FILE NO.: OA-10/22/92-2603
DOC. NO.: 1756

FEB 9 1993

MEMORANDUM

TO: The Honorable Brian J. J. Choy, Director
Office of Environmental Quality Control

FROM: John P. Keppeler, II, Acting Chairperson
Board of Land and Natural Resources

SUBJECT: Document for Publication in the OEQC Bulletin - Final
Environmental Assessment for Conservation District Use
Application No. OA-10/22/92-2603 for an Exploratory Well
at Manoa Valley, Honolulu, Oahu TMK: 2-9-55: 04

The above mentioned Chapter 343 document was reviewed and a negative declaration was declared based upon the final environmental assessment provided with the CDUA.

Please feel free to call Roy Schaefer of our Office of Conservation and Environmental Affairs, at 587-0377, if you have any questions.

cc: CH2M Hill

1993-02-23-0A-*FEA-Manoa Alluvial Exploratory Well* FEB 23 1993

Manoa Alluvial Exploratory Well
Manoa, Oahu, Hawaii

CDWA # OA-2603

FINAL

**Environmental Assessment
for
Manoa Alluvial Exploratory Well**

Applicant:

Kamehameha Schools/Bernice Pauahi Bishop Estate

For submittal to:

Department of Land and Natural Resources
State of Hawaii

Prepared by:
CH2M HILL
January 1993

**Manoa Alluvial Aquifer Exploratory Well
at the End of Kumulani Street**

**Manoa, Oahu, Hawaii
Tax Map Key: 2-9-55:4**

Proposed by:

**Kamehameha Schools/
Bernice Pauahi Bishop Estate**
P.O. Box 3466
Honolulu, Hawaii 96801-3466
Contact: Paul Cathcart
Telephone: 523-6248

Prepared by:

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January 1993

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Section 1

Introduction and Project Summary

1.1 Introduction

This Conservation District Use Application and Environmental Assessment is for the proposed installation of an alluvial aquifer exploratory well on Kamehameha Schools/Bernice Pauahi Bishop Estate (Bishop Estate) property in Manoa Valley on the island of Oahu, and the subsequent conversion of the well to a permanent facility should the existence of water of sufficient quality and quantity be determined.

The purpose of the alluvial aquifer exploratory well is to determine if the proposed well location has water of sufficient quality and quantity to develop a permanent well. If sufficient quality and quantity of water are identified at the proposed alluvial aquifer exploratory well, the necessary pump, controls, and related facilities will be constructed to convert the exploratory well to a permanent one. If a permanent well is developed, it will be dedicated to the Honolulu Board of Water Supply (BWS) upon completion. The ultimate purpose of the project is to develop more potable water for the Honolulu water system. The permanent well will be built to BWS specifications, and the well and well site will be wholly owned and operated by the BWS. Water from the well, anticipated to be approximately 0.5 to 1.0 million gallons per day, will become a part of the Board of Water Supply public water system.

1.2 Project Summary

Applicant and Landowner: Kamehameha Schools/Bernice Pauahi Bishop Estate
P. O. Box 346
Honolulu, Hawaii 96801-3466

Location: At the Ewa end of Kumulani Street, approximately 65 feet east of the intersection of Kumulani Street and Kumulani Place

Tax Map Key: 2-9-55:4

Size: 182.213 acres (project site encompasses approximately 15,000 square feet)

**Existing
Land Use
Regulations:**

State Land Use Classification: Conservation District, Limited
Subzone
City and County of Honolulu Development Plan: Preservation
City and County of Honolulu Development Plan Public Facilities
Map: Not designated
City and County of Honolulu Zoning: Preservation (P-1)
Flood Insurance Rate Map (FIRM) Flood Zone: Zone X

**Existing Land
Use:**

Undeveloped

**Approving
Agency:**

Board of Land and Natural Resources

Request:

Conservation District Use Permit

**Other
Approval:**

Commission on Water Resource Management

1.3 Alternatives Considered

The alternative considered was the "no action" alternative. If this alternative were implemented, Bishop Estate would not be able to gather the information necessary to determine if the development of a permanent well at the Manoa Valley site is feasible. The development of a permanent well would provide more potable water for the Honolulu water system. Selection of the no action alternative would therefore preclude Bishop Estate from developing the alluvial aquifer exploratory well, and subsequently, the permanent well for the Honolulu Board of Water Supply. It was therefore not considered further.

1.4 Agencies Consulted

Agencies consulted in preparing the EA include the following:

- Hawaii Department of Land and Natural Resources (DLNR), Office of Conservation and Environmental Affairs
- Hawaii DLNR, Land Management Division
- Hawaii DLNR, Division of Water and Land Development
- City and County of Honolulu, Board of Water Supply

- City and County of Honolulu, Planning Department
- Commission on Water Resource Management

1.5 Determination

In accordance with Chapter 343, Hawaii Revised Statutes (HRS) and Chapter 200 of Title 11, Department of Health, and based on the information and analysis in this *Environmental Assessment*, the proposed action was determined not to have a significant adverse effect on the environment.

The following determinations have been made for the proposed action:

1. It does not involve an irrevocable commitment to loss or destruction of any natural or cultural resource.
2. It does not curtail the range of beneficial uses of the environment.
3. It does not conflict with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, Hawaii Revised Statutes, and any revisions thereof and amendments thereto, and any court decisions or executive orders.
4. It does not substantially affect the economic or social welfare of the community or State.
5. It does not substantially affect public health.
6. It does not involve substantial secondary impacts, such as population changes or effects on public facilities.
7. It does not involve a substantial degradation of environmental quality.
8. It does not have a cumulative effect upon the environment, and it does not involve a commitment for larger actions.
9. It does not substantially affect a rare, threatened, or endangered species, or its habitat.
10. It does not detrimentally affect air or water quality, or ambient noise levels.
11. It does not affect an environmentally sensitive area, such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

Section 2 Project Description

2.1 Background

In 1991, an assessment was made of all of Bishop Estate's land on the Island of Oahu to determine water supply potential. One of the parcels identified as a potential alluvial aquifer well site was the Manoa Valley parcel. It was identified as having the potential for providing 0.5 to 1.0 million gallons per day at a depth of approximately 900 feet.

2.2 Project Location

The site for the proposed alluvial aquifer exploratory well is in Manoa Valley, at the Ewa end of Kumulani Street, in Honolulu, Oahu. Site conditions at the end of Kumulani Street are shown in Figure 1. The project site is owned in fee by Bishop Estate.

2.3 Proposed Project

The purpose of the proposed project is to develop a new potable water source in the Manoa alluvial aquifer. The proposed project consists of the development of an exploratory well, and the subsequent conversion to a permanent well should water of sufficient quality and quantity be determined. Groundwater data from the proposed well will be collected. The well site will cover an area of approximately 15,000 square feet, and the site dimensions are expected to be approximately 135 feet by 110 feet.

The access road to the project site will be an extension of Kumulani Street, as shown in Figure 2, and will be approximately 20 feet in width and 100 feet in length.

The project site is gently sloping and is at an elevation of approximately 500 feet. The site map is presented in Figure 3, and the tax map showing the proposed project location is shown in Figure 4.

Project Activities

Implementation of the proposed project will involve the following activities. An area approximately 30 feet by 30 feet will be cleared and rough graded where the drill rig will be located during drilling. This minor clearing and grading is not anticipated to increase the amount of stormwater discharge over existing conditions. The well will have a 12-inch-diameter casing, and will be drilled approximately 900 feet down to the alluvial aquifer. Drilling methods will include either cable tool drilling or rotary drilling. After the well is drilled, a test pump will be installed. A cross section of the well is shown in Figure 5.



Figure 1: Looking Ewa toward the end of Kumulani Street. The well is proposed to be set back approximately 30 feet.

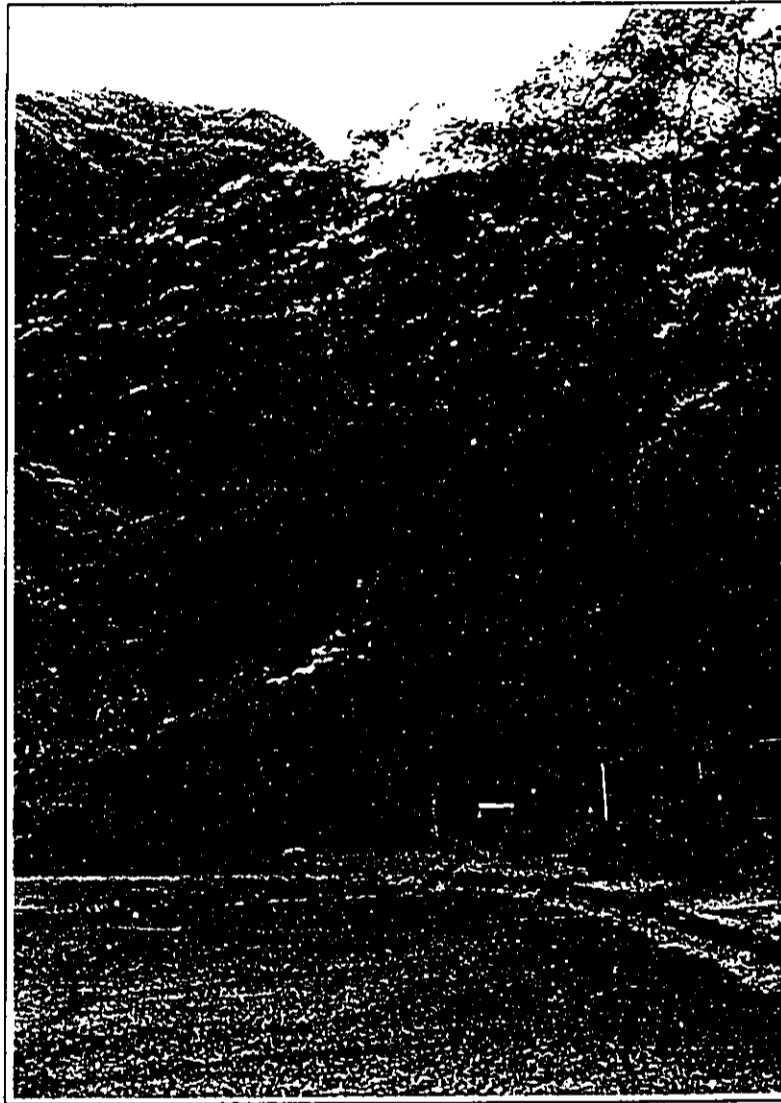
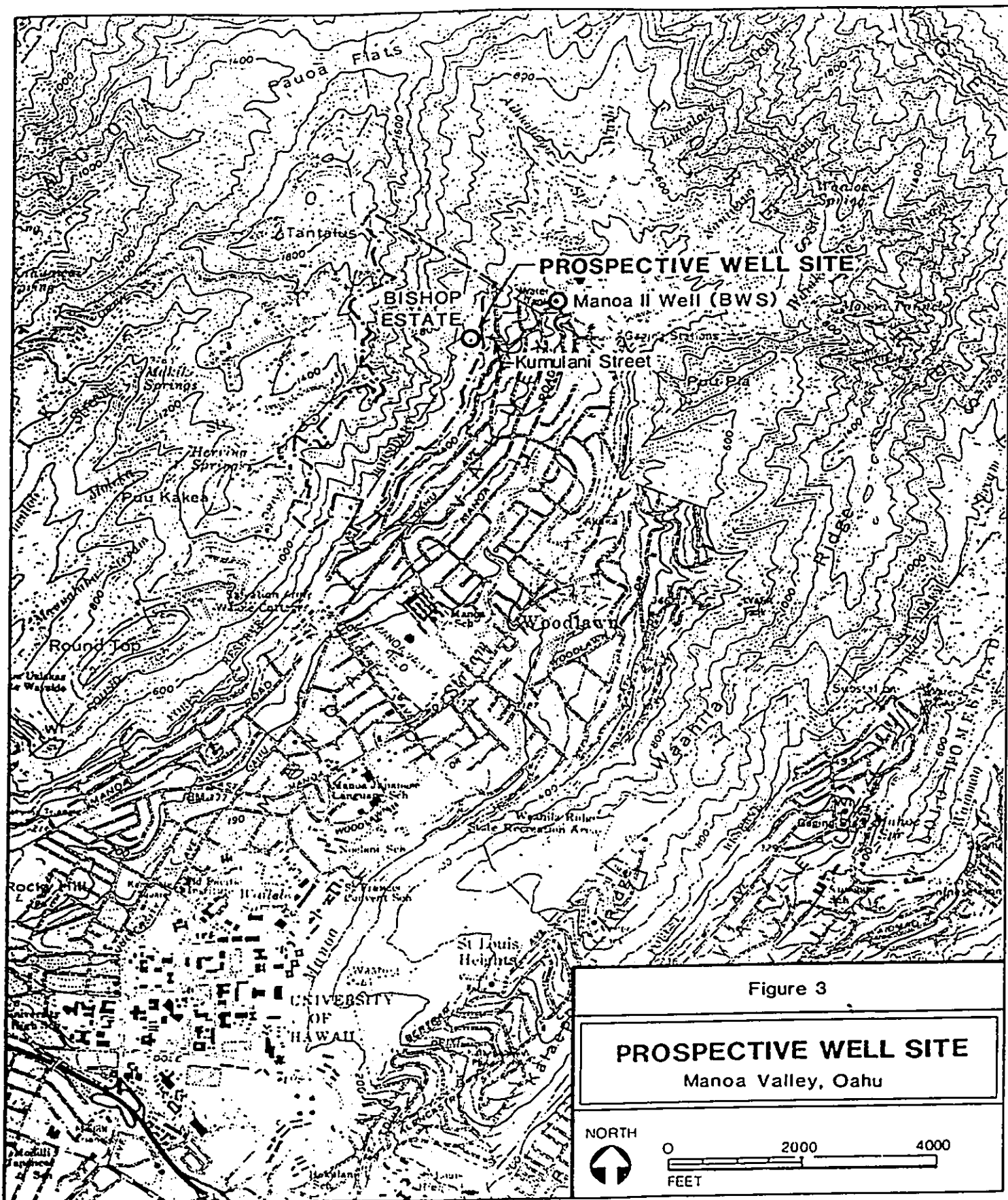
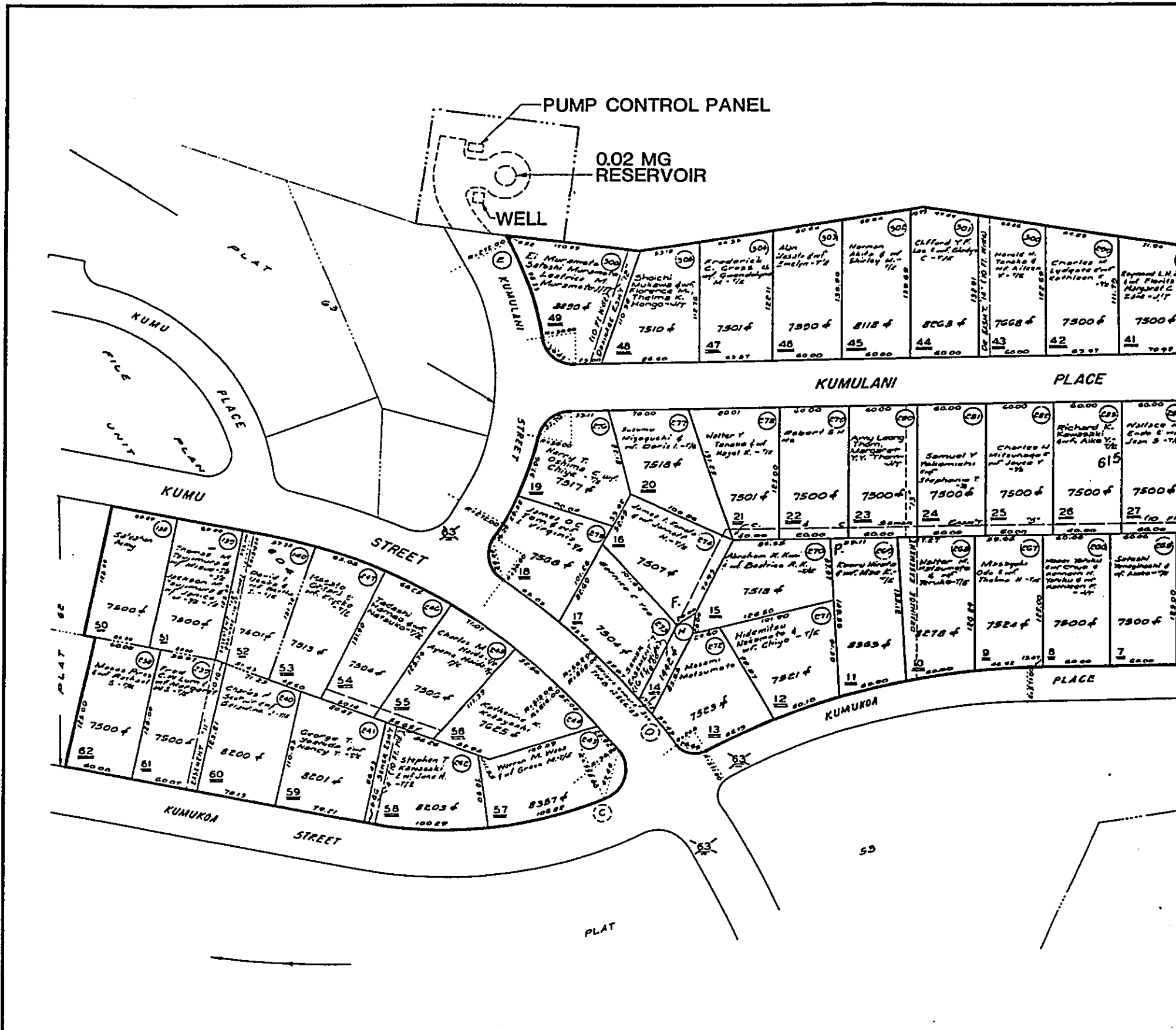


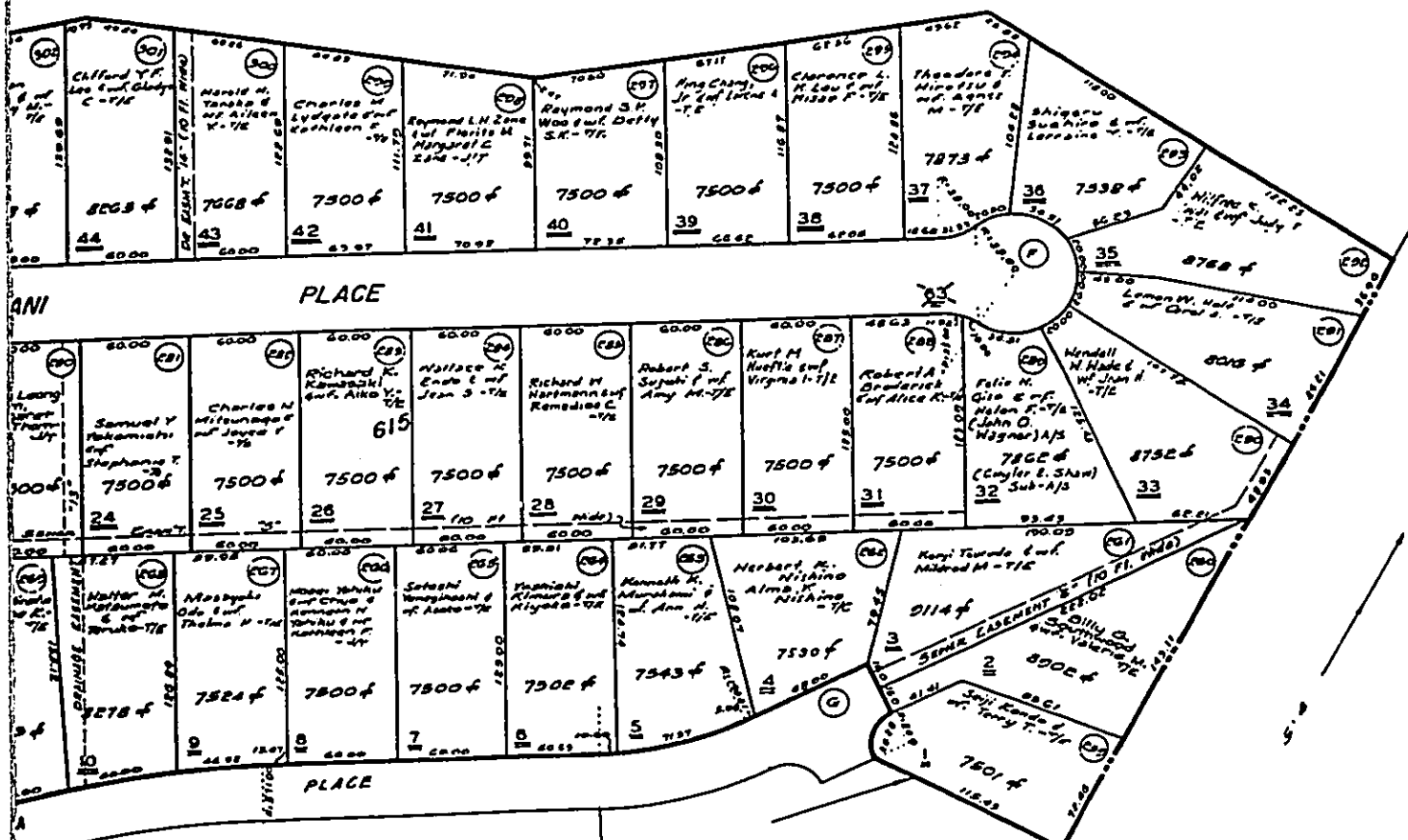
Figure 2: Looking in the Ewa direction at the end of Kumulani Street. The proposed access road would be connected to the end of Kumulani Street.





por. BISHOP MANOA TRACT - UNIT II & por. UNIT I. PUKAOMAOMAO, MANOA VALLEY, OAHU. F. P. 615

TRUE NORTH
SCALE: 1 in. = 50 ft.



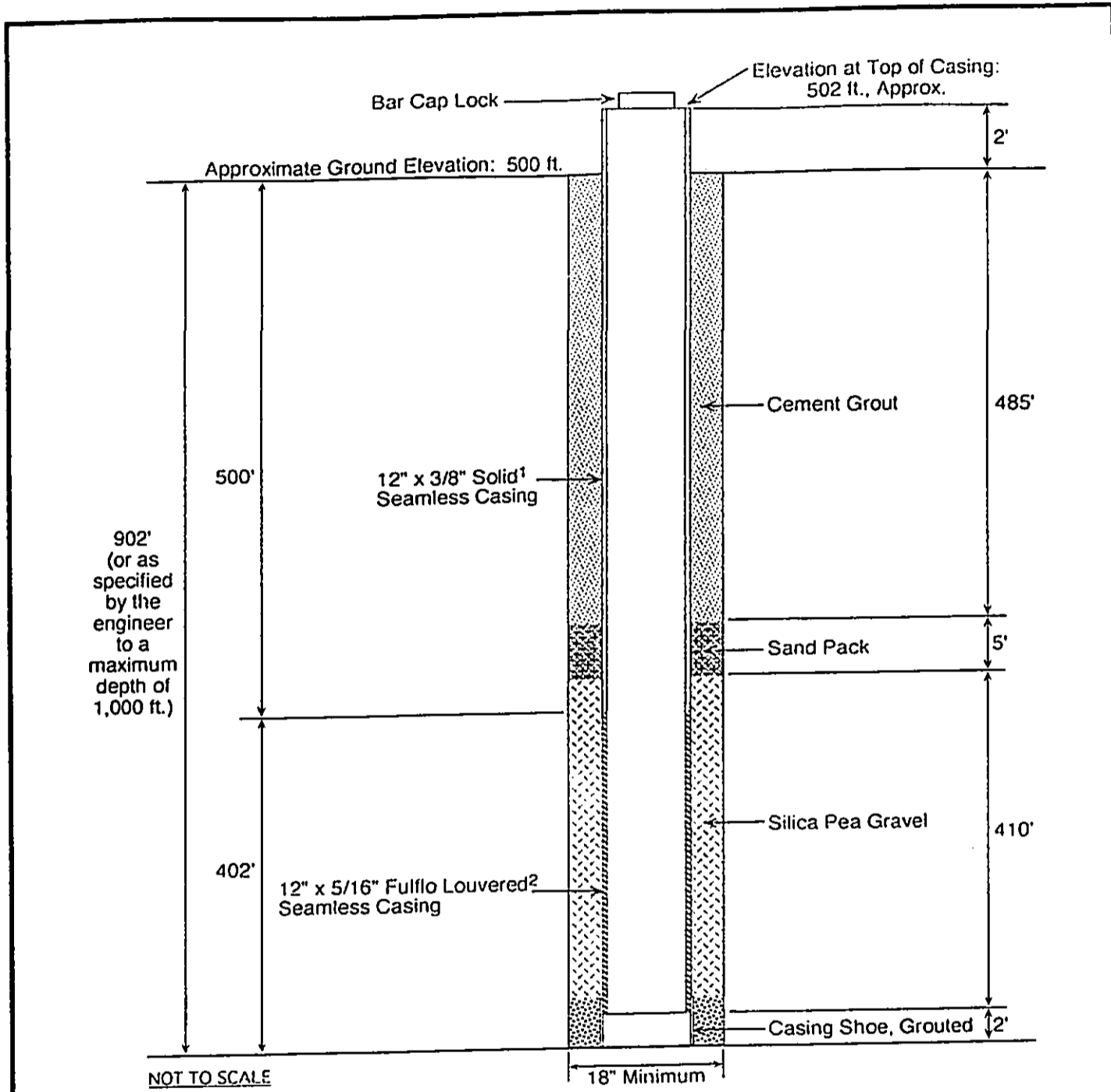
NOTE: All lots owned by Theodore C. H. Chee & Chuck O. Shima - JX unless otherwise noted.

DEPARTMENT OF THE TAX COMMISSIONER
TAXATION MAPS BUREAU
STATE OF HAWAII
TAX MAP

FIRST		DIVISION	
ZONE	SEC.	PLAT	
2	9	64	
CONTAINING		PARCELS	

SUBJECT TO CHANGE

Figure 4



NOTES:

¹Solid Casing:
 Material: Steel
 Length: 500 ft.
 Diameter: 12 in.
 Wall thickness: 3/8 in.

²Louvered Casing:
 Material: Steel
 Length: 400 ft.
 Diameter: 12 in.
 Wall thickness: 5/16 in.
 Openings: 85 sq. in./L.F.
 (Min. 80 sq. in./L.F.)

Figure 5

CROSS-SECTION OF EXPLORATORY WELL

CHM HILL

All excavated material will be disposed of at a suitable location. Access to the well site will be cleared and rough graded by a bulldozer.

A pump test of the well will be performed to determine the sustained well capacity and water quality of the alluvial aquifer. The well will be pump tested for a 7 day period, with a proposed amount of withdrawal of 1 million gallons per day. The water that is pumped from the ground during the test will be disposed of in a natural swale, which feeds into a stormwater drain in Kumulani Street. Care will be taken in disposing of the test water to preclude the possibility of flushing debris into or re-suspending sediments and other pollutants through the City's stormwater drainage system. Specifically, it is fully anticipated that the water discharged as a result of the well testing will be pure, and therefore will not introduce any pollutants into the stormwater system. Furthermore, this water will be discharged into a heavily vegetated swale, which will eliminate the possibility of delivering suspended sediment into the City system. Additionally, in accordance with all established requirements and procedures for such, the City and County of Honolulu Department of Public Works' *Permit to Discharge Effluent into the Municipal Storm Sewer System* and *Construction Dewatering into Municipal Separate Storm Sewer System* permit, and the State of Hawaii Department of Health's *NPDES General Permit*, will be acquired.

If the test results indicate that development of a well in this location is feasible, the exploratory well will be converted to a permanent facility. The permanent well will be developed to City and County of Honolulu Board of Water Supply specifications, and will be dedicated to the Board of Water Supply to provide potable water to Honolulu residents as part of the public system. The permanent well site will include a well, outdoor control panels, a small holding tank, and a paved turn-around area. Additionally, the access road from the end of Kumulani Street will be paved and improved, in accordance with all applicable standards.

If the test results indicate that well development at the proposed site is not feasible, Bishop Estate will pursue exploratory well drilling at an alternate location, and will remove the pump, seal the well by grout injection to prevent contamination of the aquifer, and clean and return the well site to its original condition. Additionally, the area from the end of Kumulani Street to the exploratory well site, the preliminary access way, will also be returned to its original condition.

2.4 Project Schedule

Work on the alluvial aquifer exploratory well will commence when Bishop Estate receives approval from the Department of Land and Natural Resources and the Commission on Water Resource Management. Well drilling is expected to last approximately 10 to 12 months. If it is determined that a permanent well is feasible, conversion of the exploratory well to a permanent facility is anticipated to last approximately 18 months.

Project construction activities will occur Monday through Friday. No construction will occur

on weekends or holidays. Clearing and grading activities will be limited to the hours between 7:30 a.m. and 4:30 p.m. Drilling activities will generally occur from 7:30 a.m. to 4:30 p.m. A Department of Health noise permit will be obtained, and conditions specified in the permit will be adhered to.

Section 3 Affected Environment

3.1 Climate

3.1.1 Existing Environment

The average annual temperature for Honolulu is approximately 78°F. The temperature ranges from a low of approximately 65°F in the winter months to a high of approximately 88°F in the summer months. The mean annual rainfall in the project vicinity in Manoa Valley is approximately 150 inches per year.

3.1.2 Project Impacts

Installation of an alluvial aquifer exploratory well will not have an effect on the climate of the area.

3.1.3 Mitigation Measures

No mitigation measures are proposed or required.

3.2 Natural Hazards

3.2.1 Existing Environment

The proposed alluvial aquifer exploratory well site is within Zone X on the National Flood Insurance Program Flood Insurance Rate Map. Zone X is an area that is outside of the 500-year flood plain.

Waianae and Koolau volcanoes are still considered active volcanoes, although neither have erupted in recent history.

3.2.2 Project Impacts

Because the proposed project is outside the 500-year flood plain, it is not expected to increase the flood hazard, nor should a flood affect the proposed well. In addition, because Waianae and Koolau volcanoes have not erupted in recent history, the relative location of the two volcanoes to the proposed exploratory well is not considered a major siting constraint.

3.2.3 Mitigation Measures

No mitigation measures are proposed or required.

3.3 Soils and Geology

3.3.1 Existing Environment

Soils

The soil classification for the project area is Lolekaa silty clay with 40 to 70 percent slopes. The Lolekaa series consists of well-drained soils on fans and terraces. These soils developed in old, gravelly colluvium and alluvium. They are gently sloping to very steep, and elevations range from nearly sea level to 500 feet. Runoff occurring on the Lolekaa series is rapid, and the erosion hazard is severe.

Geology

The Hawaiian Islands are almost completely volcanic. The vast majority of the volcanic rocks are lava flows. The volcanoes were formed by eruptions of fluid lava from the sea. As the eruptions gradually died, the volcanic mountains were eroded. The ocean waves cut cliffs, and inland streams cut deep valleys, gradually transforming the rounded shield volcanoes into a jagged range of mountains.

The island of Oahu is made up of two eroded shield volcanoes, the Waianae and the Koolau mountains, which are connected by the Schofield plateau. The Koolau is the younger of the two volcanoes and receives more rainfall than Waianae. Manoa Valley, which is on the leeward side of the Koolau shield volcano, was formed by erosion from extensive rainfall. Manoa Stream runs through the floor of the valley. The valley walls are composed of Koolau basalt, and the valley floors are generally composed of aa and pahoehoe flows of basalt.

3.3.2 Project Impacts

Clearing and grading activities at the project site will result in a temporary increase in dust, runoff, and erosion that can be mitigated to a non-significant level.

3.3.3 Mitigation Measures

To minimize project-induced dust, runoff, and erosion, the following mitigation measures should be implemented:

- To reduce dust, the cleared and graded areas and access road should be

watered as needed so the top layer forms a crust.

- Kumulani Street and Kumulani Place should be kept clear of any construction debris.
- The contractor will clean roads on a regular basis.
- Excavated material should be stockpiled in a suitable location on the project site and should be covered to minimize erosion by wind and water.
- To reduce erosion, vegetation on the site should be left in place as much as possible.

3.4 Water Resources

3.4.1 Existing Environment

The project site is within the Honolulu Water Management Area controlled by the State's Commission on Water Resource Management. The Honolulu area extending from Moanalua to Kaimuki has been designated by the State as the Moanalua-Kaimuki Subarea. There are four aquifer systems in the Moanalua-Kaimuki Subarea: Moanalua, Kalihi, Nuuanu, and Palolo. The project site is located in the Nuuanu aquifer system. This aquifer consists of thick basal lenses and is hydrologically confined along the coast under artesian conditions by a thick, impermeable sequence of marine and alluvial sediments (the caprock formation). Groundwater flows more or less directly seaward—from the high rainfall areas, through the caprock formation, and then to the sea.

The groundwater resources of the Moanalua-Kaimuki Subarea originate from the 100 to 150 inches-per-year rainbelt located just leeward of the Koolau crest. Much of the rainfall percolates into the ground to become groundwater recharge, but runoff does occur. Streams are perennial in their upper reaches toward the Koolau Crest because of high rainfall. Only the major streams—Manoa, Nuuanu, and Kalihi—have small perennial flows in their lower reaches. Surface waters in the Moanalua-Kaimuki Subarea are not considered significant sources of water supply.

There are 59 producing wells in the Moanalua-Kaimuki Subarea; the Honolulu BWS owns 35 of them. A total of 24 privately owned wells are scattered throughout the subarea, but most of them produce small quantities of water. Many of the wells in the subarea produce groundwater under artesian conditions from the basalt aquifers which dip beneath the impermeable coastal caprock formations. Wells that are located close to the coastline must penetrate greater thickness of caprock in order to reach the basalt aquifer. Consequently, wells near the coast develop groundwater from the lower half of the basal lens and are sometimes sensitive to increases in salinity when pumped.

Hydrologically, the project site has potential for groundwater development. The nearest well is the Honolulu BWS Manoa II well, located about 1,100 feet northeast of the Manoa parcel. It is 786 feet deep and has a pump capacity of 1.0 mgd. This well taps an alluvial aquifer.

3.4.2 Project Impacts

Between 1960 and 1990, the chloride content of the two major pumping centers within the Nuuanu aquifer appears to have reached 65 to 70 parts per million (ppm), while pumpage has averaged 17 million gallons per day. According to the Honolulu Board of Water Supply, due to rising chloride levels in the Nuuanu Basal Aquifer monitoring wells, the average pumpage from the Beretania and Wilder Wells has been reduced to 14 mgd. Additional pumpage in the Nuuanu aquifer system appears to be possible while keeping the salinity of these two major pumping stations below 100 ppm. In addition, salt water intrusion is not expected to be a problem.

Pumping 1 million gallons of water per day during the 7-day pump test is not expected to have a significant effect on the aquifer because the test will utilize a very small portion of the total capacity of the aquifer system.

Therefore, no significant impacts from development of the alluvial aquifer exploratory well are expected.

3.4.3 Mitigation Measures

No mitigation is proposed or required.

3.5 Flora

A botanical inventory survey report of the Manoa Alluvial Exploratory Well site was prepared by Char & Associates, which is included in Appendix A.

3.5.1 Field Survey

A survey of the Manoa Alluvial Exploratory Well site was conducted on June 12, 1992. The vegetation on the site is composed almost exclusively of alien (or introduced) plants.

Along the lower boundary of the site, where it abuts the residential area and Kumulani Street, are a number of ornamental landscape plantings which include the following species:

- Large clumps of red and pink torch gingers (*Nicolaia elatior*)
- Crepe ginger (*Costus speciosus*)
- Various lobster claw cultivars (*Heliconia spp.*)
- Golden and green bamboos (*Bambusa vulgaris*)
- Variegated hala (*Pandanus sp.*)

- *Monstera deliciosa*
- Silk Oak (*Grevillea robusta*)
- Ironwood (*Casuarina equisetifolia*)
- Lychee (*Litchi chinensis*)
- *Paraserianthes falcataria*

Mixed shrubland with scattered trees occurs on the remainder of the property. The shrub cover is largely closed, and in many places, forms a dense, tangled growth from 12 to 18 feet high. The more commonly occurring shrubs are as follows:

- Guava (*Psidium guajava*)
- Strawberry guava (*Psidium cattleianum*)
- Shoebuttton ardisia (*Ardisia elliptica*)
- Christmas berry (*Schinus terebinthifolius*)
- Gardenia (*Gardenia angustata*)
- Fiddlewood (*Citharexylum caudatum*)
- Octopus tree (*Schefflera actinophylla*)

The ground cover composition is variable. Ground cover species include:

- Palm grass (*Setaria palmifolia*)
- Shampoo ginger (*Zingiber zerumbet*)
- Downy woodfern (*Christella parasitica*)
- Basketgrass (*Oplismenus hirtellus*)

3.5.2 Project Impacts

None of the plants on the site are officially listed as threatened or endangered, nor are any proposed or candidates for such status. The two native species found on the site occur throughout the Hawaiian Islands in similar environmental habitats. They are both indigenous (native to the islands and elsewhere throughout the Pacific). Therefore, the proposed well, water tank, and access road will not have a significant impact on vegetation. Of some concern is the soil erosion that may occur, as the site is in a high rainfall area, and is on a slope.

3.5.3 Mitigation Measures

Because no significant impacts to vegetation are expected, no mitigation is proposed or required. Areas that are cleared for construction and access to the project site should be revegetated as soon as possible to prevent soil loss.

3.6 Fauna

A faunal survey report of the Manoa Alluvial Exploratory Well site was prepared by Phillip L. Bruner, and is included as Appendix B.

3.6.1 Research Methods

Both published and unpublished reports of birds known from similar habitats were consulted to acquire a more complete picture of the possible species that might be expected in the project area. In conjunction, a bird and mammal field survey was conducted on December 13, 1992.

3.6.2 Existing Conditions

Resident Endemic (Native) Land Birds - No endemic land birds were recorded during the field survey.

Resident Endemic (Native) Waterbirds - No waterbirds were recorded during the survey, and none would be expected at this site.

Migratory Indigenous (Native) Birds - No migratory species were recorded during the survey.

Resident Indigenous (Native) Birds - No resident indigenous species were recorded during the field survey, and none would be expected at this location.

Resident Indigenous (Native) Seabirds - No nesting seabirds were observed on the property. The presence of predators renders this site unsuitable for nesting or roosting seabirds.

Exotic (Introduced) Birds - A total of ten species of exotic birds were recorded during the field survey, as shown in Table 3-1. The following species may also occur at this site: Barn Owl (Tyto alba), Hwamei (Garrulax canorus), House Sparrow (Passer domesticus), and Japanese Bush-warbler (Cettia diphone).

Ferral Mammals - Scats of the Small Indian Mongoose (Herpestes auropunctatus) were found along with pig tracts. No bats were found on this survey. Whether or not the endemic and endangered Hawaiian Hoary Bat occurs in this area is unknown.

3.6.3 Project Impacts

No significant impact on bird or mammal species is expected, as no waterbirds, endemic birds, unusually exotic birds, unusual concentrations of mammals, nor any particularly special or unique bird or mammal habitat, were discovered at this site.

3.6.4 Mitigation Measures

No mitigation measures are proposed or required.

Table 3-1 Exotic (introduced) birds recorded at property proposed for an Alluvial Exploratory Well, Manoa Valley, Oahu.		
Common Name	Scientific Name	Relative Abundance
Spotted Dove	<u>Streptopelia chinensis</u>	C = 7
Zebra Dove	<u>Geopelia striata</u>	C = 8
Common Mynah	<u>Acridotheres tristis</u>	U = 3
Red-vented Bulbul	<u>Pycnonotus cafer</u>	A = 12
Red-whiskered Bulbul	<u>Pycnonotus jocosus</u>	C = 8
White-rumped Shama	<u>Copsychus malabaricus</u>	U = 4
Northern Cardinal	<u>Cardinalis cardinalis</u>	U = 2
Red-crested Cardinal	<u>Paroaria coronata</u>	R = 2
Japanese White-eye	<u>Zosterops japonicus</u>	A = 14
House Finch	<u>Carpodacus mexicanus</u>	C = 6
Relative (estimate) abundance = Number observed on eight minute counts in appropriate habitat. A = abundant (10+) C = common (5-10) U = uncommon (less than 5) R = recorded on only one count (number which follows is total observed)		

3.7 Archaeological and Cultural Resources

An archaeological inventory survey report of the Manoa Alluvial Exploratory Well site was prepared by Paul H. Rosendahl, Ph.D., Inc. (PHRI), which is included in Appendix C.

3.7.1 Research Methods

PHRI researched existing archaeological and historical literature relevant to the project area. No previous archaeological research has been performed in the project area. However, there has been work performed in the general vicinity of Manoa. This literature search indicated that three previous archaeological studies were performed in the Manoa Valley.

Limited historical information was found regarding the project area. The earliest accounts of Manoa are tales and legends documented by ethno-historians. Manoa was bisected into Manoa-alii and Manoa-kanaka. The alii resided in the west side of the valley, and the commoners (makaainana) lived on the east side of the valley. The parcel containing the project area lies in the Manoa-alii. In addition, several heiau have been identified in Manoa Ahupuaa.

The level land in upper Manoa was once extensively cultivated with taro. Guava was once planted on Bishop Estate lands and was the forerunner of the large influx of foreign plants and animals that would be incorporated into the Manoa landscape and Hawaii in general. Queen Kaahumanu's house once stood near the project area on Bishop Estate lands. The first sugar plantation on Oahu was located at Puu Pueo, south of the project area. The Manoa Valley appears not to have been permanently occupied until the 13th century.

3.7.2 Field Survey

An archaeological inventory survey of the 14,850-square-foot Manoa Alluvial Exploratory Well site was conducted June 17, 1992. The survey consisted of two persons walking north-south, and east-west transects were approximately 10 to 25 feet apart.

The survey revealed no archaeological sites or features of any kind within the project area. The lack of identified remains is probably due to the terrain of the area, which is highly eroded and lacks building materials for construction of features. In addition, recent use and alteration of the area were exhibited, and urban development within the immediate area has probably accelerated the erosion process. No further work is recommended for the project area.

3.7.3 Project Impacts

Because no sites were identified during the survey, no significant impact on archaeological and cultural resources is expected. According to the archaeological report, there is always the possibility, however remote, that potentially significant unidentified surface and

subsurface cultural remains will be encountered during other archaeological investigations or subsequent development activities.

3.7.4 Mitigation Measures

If any historic or prehistoric surface or subsurface archaeological features or deposits are uncovered during well construction activities, work will be stopped in that immediate vicinity, and the Department of Land and Natural Resources-State Historic Preservation Division will be contacted for a determination of significance.

3.8 Noise

3.8.1 Existing Conditions

Noise levels along Kumulani Street and Kumulani Place reflect the residential nature of the area. Ambient noises include personal automobiles and domestic noises such as lawn mowers and children playing outdoors. Residential areas are considered to be noise-sensitive areas because they are areas where people spend significant time and where people expect a sense of quiet.

3.8.2 Project Impacts

Ambient noise levels are expected to increase during development of the alluvial aquifer exploratory well. However, certain measures have been incorporated into the proposed project to minimize effects on ambient noise levels during the 10 to 14 month construction period. These measures include:

- The use of an electrical pump instead of a diesel pump during the 7-day pump test. Use of an electrical pump will result in no discernible noise generated from the pump test.
- Limiting work hours as follows: no construction on weekends or holidays and limiting clearing, grading, and drilling activities to between the hours of 7:30 a.m. and 4:30 p.m.
- Properly muffled construction equipment will be used at the project site.
- A Department of Health noise permit will be obtained and conditions specified in the permit will be adhered to.

The residual impact on ambient noise levels after implementation of these project mitigation measures is not considered significantly adverse.

3.8.3 Mitigation Measures

No mitigation measures are proposed or required beyond the measures that have been incorporated into the proposed project to reduce effects on ambient noise levels.

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Appendix A
Botanical Assessment Survey

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June 1992

**BOTANICAL ASSESSMENT SURVEY
KAMEHAMEHA SCHOOLS/BERNICE PAUHI BISHOP ESTATE LANDS
MANOA VALLEY WELL SITE
HONOLULU DISTRICT, ISLAND OF O'AHU**

INTRODUCTION

A field study of the Manoa Valley well site was conducted on 12 June 1992. The primary objectives of the study were to gather information on the vegetation and to search for threatened and endangered plants protected by Federal and State endangered Species law.

The proposed well site is located upslope of parcel TMK 2-9-64:40 at the end of Kumulani Street, near the mauka end of Manoa Valley. The well site is approximately 110 ft. long by 135 ft. wide. The site will be reached via an access road from Kumulani Street. A well and a 5,000-gallon water tank are planned for the site.

DESCRIPTION OF THE VEGETATION

The scientific names used in the discussion below follow Wagner et al. (1990) for the flowering plants, for the most part; the names for cultivated, non-adventive species are from St. John (1973). Fern names are in accordance with Lamoureux (1984).

The vegetation on the site is composed almost exclusively of alien (or introduced) plants; these are species which were introduced

intentionally or accidentally by humans after Cook's discovery of the Hawaiian Islands in 1778. Along the lower boundary of the site, where it abuts the residential area and Kumulani Street, are a number of ornamental, landscape plantings which include large clumps of red and pink torch gingers (Nicolaia elatior), crepe ginger (Costus speciosus), various lobster claw cultivars or Heliconia spp., golden and green bamboos (Bambusa vulgaris), a variegated hala or Pandanus sp., and Monstera deliciosa. Scattered among these plantings are a few, large trees of silk oak (Grevillea robusta), ironwood (Casuarina equisetifolia), lychee (Litchi chinensis), and Paraserianthes falcataria.

Mixed shrubland with scattered trees occurs on the remainder of the property. The shrub cover is largely closed, and, in many places forms a dense, tangled growth, from 12 to 18 ft. high. The more commonly occurring shrubs are guava (Psidium guajava), strawberry guava (Psidium cattleianum), shoebutton ardisia (Ardisia elliptica), Christmas berry (Schinus terebinthifolius), and gardenia (Gardenia angustata). Although gardenia is usually grown as an ornamental, the plants have escaped and become naturalized in this area. They produce fruit and there are many plants of different size classes on the site. Scattered through this shrubland are trees of fiddlewood (Citharexylum caudatum) and octopus tree (Schefflera actinophylla), 15 to 20 ft. high.

The ground cover composition is variable. Where the shrub cover is somewhat more open, that is, the shrubs are more widely spaced apart, sunlight can reach the lower stratum; these open areas support dense culms of palm grass (Setaria palmifolia). Where the shrub cover is closed, the ground cover may consist of dense mats of shampoo ginger or 'awapuhi kuahiwi (Zingiber zerumbet) or a mixed fern and grass association composed primarily of downy woodfern (Christella parasitica) and basketgrass (Oplismenus hirtellus).

DISCUSSION AND RECOMMENDATIONS

The vegetation on the proposed project site is dominated by introduced species with large groups of ornamental plantings along the boundary abutting the residential area. The only native species observed were the pakahakaha (Pleopeltis thunbergiana) and pala'a (Sphenomeris chinensis) ferns. None of the plants on the site are officially listed threatened and endangered species (U.S. Fish and Wildlife Service 1989); nor are any proposed or candidate for such status (U.S. Fish and Wildlife Service 1992). The two native species found on the site occur throughout the Hawaiian Islands in similar environmental habitats. They are both indigenous, that is, they are native to the islands and elsewhere throughout the Pacific.

Given the findings above, the proposed well, water tank, and access road will not have a significant negative impact on the botanical resources. Of some concern, is soil erosion as the site is in a high rainfall area and on a slope. It is recommended that areas cleared of vegetation be landscaped as soon as possible to prevent soil loss.

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Appendix B
Survey of the Avifauna and Feral Mammals

SURVEY OF THE AVIFAUNA AND FERAL MAMMALS FOR THE
MANOA ALLUVIAL EXPLORATORY WELL, MANOA VALLEY, OAHU

Prepared for

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by

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18 December 1992

INTRODUCTION

The purpose of this report is to summarize the findings of a one day (13 December 1992) bird and mammal field survey of land proposed for an Alluvial Exploratory Well in Manoa Valley, Oahu (Fig. 1). Also included are references to pertinent literature as well as unpublished faunal reports.

The objectives of the field survey were to:

- 1- Document what bird and mammal species occur on the property or may likely be found there given the type of habitats available.
- 2- Provide some baseline data on the relative (estimated) abundance of each species.
- 3- Determine the presence or likely occurrence of any native fauna particularly any that are considered "Endangered" or "Threatened".
- 4- Evaluate the quality of the habitat for native wildlife and note any special or unique habitat.

GENERAL SITE DESCRIPTION

Figure One indicates the limits of the property surveyed for birds and mammals. This site is covered in a dense tangle of introduced trees and brush. A small drainage ditch occurs along one boundary.

Weather during the field survey was clear and cool. Winds were from the NNE at 5-10 mph.

STUDY METHODS

Field observations were made with binoculars and by listening for vocalizations and were concentrated during the peak bird activity period of early morning. At a few scattered locations eight minute counts were made of all birds seen or heard (Fig. 1). Between these count (census) stations any unusual observations of birds were also noted. These data provide the basis for the relative (estimated) abundance figures given in this report (Table 1). Published and unpublished reports of birds known from similar habitat were also consulted in order to acquire a more complete picture of the possible species that might be expected (Pratt et al. 1987; Hawaii Audubon Society 1989; Pyle 1987, 1988, 1989; Bruner 1988, 1992). Observations of feral mammals were limited to the presence of scats and tracks.

No attempts were made to trap mammals in order to obtain data on their relative (estimated) abundance and distribution.

Scientific names used herein follow those given in Hawaii's Birds (Hawaii Audubon Society 1989); Field guide to the birds of Hawaii and the Tropical Pacific (Pratt et al. 1987) and Mammal species of the World (Honacki et al. 1982).

RESULTS AND DISCUSSION

Resident Endemic (Native) Land Birds:

No endemic land birds were recorded on the survey. The Short-eared Owl or Pueo (Asio flammeus sandwichensis) occurs in grasslands, agricultural fields and forests (Pratt et al. 1987). Pueo are listed as an endangered species on Oahu by the State of Hawaii Division of Forestry and Wildlife. Common Amakihi (Hemignathus virens) and 'Elepaio (Chasiempis sandwichensis) are two other endemic species known to occur in upper Manoa Valley. Neither are endangered, however, 'Elepaio have declined markedly in the last decade. An increase in competitive introduced birds may be in part to blame for this decline.

Resident Endemic (Native) Waterbirds:

The drainage ditch was dry and overgrown with vegetation. No

waterbirds were recorded on the survey and none would be expected at this site.

Migratory Indigenous (Native) Birds:

No migratory species were recorded. Pacific Golden Plover (Pluvialis fulva) utilize lawns in Manoa but would not occur in the forested habitat of this site.

Resident Indigenous (Native) Birds:

No resident indigenous species were recorded nor would any be expected at this location.

Resident Indigenous (Native) Seabirds:

No nesting seabirds were observed on the property. The presence of predators renders this site unsuitable for nesting or roosting seabirds.

Exotic (Introduced) Birds:

A total of ten species of exotic birds were recorded during the field survey (Table 1).

Based on the location and type of habitats found on the property as well as information provided in Pratt et al. 1987; Hawaii Audubon Society, 1989; Pyle 1987, 1988, 1989; Bruner 1988, 1992) the following species may also occur at this site: Barn Owl (Tyto alba), Hwamei (Garrulax canorus), House Sparrow (Passer domesticus) and Japanese Bush-warbler (Cettia diphone).

Feral Mammals:

Scats of the Small Indian Mongoose (Herpestes auropunctatus) were found along with pig tracks. No trapping was conducted in order to assess the relative abundance of feral mammals.

Oahu records of the endemic and endangered Hawaiian Hoary Bat are limited (Tomich 1986; Kepler and Scott 1990). No bats were found on this survey. Whether or not this species occurs in this area is unknown. Our knowledge of the bat's distribution and behavior is extremely limited. They are known to roost solitarily in trees and occur in upland forests as well as in coastal habitats. This species feeds on insects.

CONCLUSION

A brief field survey such as this one can provide only a limited perspective of the wildlife which utilize the area. The number and relative abundance of each species may vary throughout the year due to available food resources and reproductive success. Exotic species sometimes prosper only to later disappear or become a less significant part of the ecosystem (Williams 1987; Moulton et al. 1990). Thus only long term studies can provide a comprehensive view of the bird and mammal populations in a particular area. Nevertheless some general conclusions related to bird and mammal activity at this site can be drawn. The following comments summarize the findings of this survey.

- 1- All major habitats on and near the property were visited and census stations were distributed so as to provide a reasonable sample from which relative estimates of bird populations could be derived.
- 2- No endemic birds were recorded. The only possible species in this category are: Pueo, Common Amakihi and 'Elepaio.
- 3- The property supports the typical array of exotic birds one would expect at this locality on Oahu. No unusual or unexpected species were found. Some species that usually occur in this type of habitat were not recorded. This may be due to several factors some of which are: survey too brief, too few individuals to detect, birds were not vocalizing and presently no localized populations of these species occur on the property.
- 4- Based on the number of pig tracks this area must be used extensively by pigs. The neighbors (pers. comm.) reported seeing pigs come onto Kumulani Street. The endangered Hawaiian Hoary Bat was not recorded at this site but has been observed on Oahu.
- 5- This property contains the usual mix of introduced plants and animals typical of second growth disturbed forests on Oahu. No unique or special habitat features essential to native wildlife were discovered.

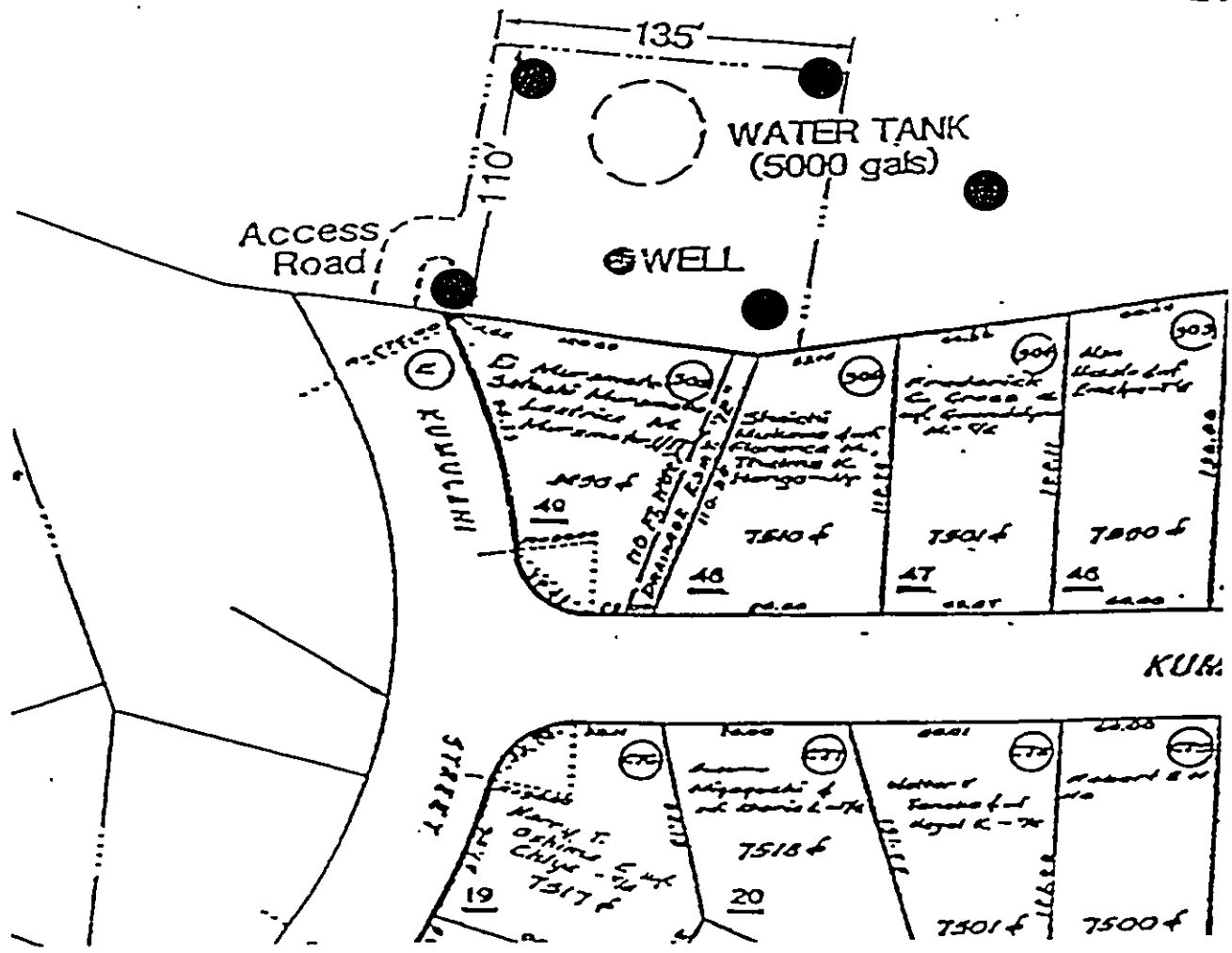


Fig. 1 Location of faunal survey with faunal census stations shown as solid circles.

TABLE 1

Exotic (introduced) birds recorded at property proposed for an Alluvial Exploratory Well, Manoa Valley, Oahu.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE
Spotted Dove	<u>Streptopelia chinensis</u>	C = 7
Zebra Dove	<u>Geopelia striata</u>	C = 8
Common Myna	<u>Acridotheres tristis</u>	U = 3
Red-vented Bulbul	<u>Pycnonotus cafer</u>	A = 12
Red-whiskered Bulbul	<u>Pycnonotus jocosus</u>	C = 8
White-rumped Shama	<u>Copsychus malabaricus</u>	U = 4
Northern Cardinal	<u>Cardinalis cardinalis</u>	U = 2
Red-crested Cardinal	<u>Paroaria coronata</u>	R = 2
Japanese White-eye	<u>Zosterops japonicus</u>	A = 14
House Finch	<u>Carpodacus mexicanus</u>	C = 6

Relative (estimate) abundance = Number observed on eight minute counts in appropriate habitat.

A = abundant (10+)

C = common (5-10)

U = uncommon (less than 5)

R = recorded on only one count (number which follows is total observed)

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Appendix C
Archaeological Inventory Survey

Report 1269-070792

**Archaeological Inventory Survey
Prospective Well Site Project Area**

**Land of Manoa, Kona District
Island of Oahu**

PHRI

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Archaeological Inventory Survey Prospective Well Site Project Area

Land of Manoa, Kona District
Island of Oahu
(TMK: 2-9-55:Por.4)

by

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July 1992

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SUMMARY

At the request of Ms. Carol Thompson, of CH2M HILL, Paul H. Rosendahl, Ph.D., Inc. (PHRI) recently conducted an archaeological inventory survey of the approximately 14,850 sq. ft. Prospective Well Site project area, located in the Land of Manoa, Kona District, Island of Oahu (TMK:2-9-55: Por.4). The basic objective of the survey was to provide information appropriate to and sufficient for satisfying the archaeological inventory requirements of the City and County of Honolulu and the Department of Land and Natural Resources - State Historic Preservation Division (DLNR-SHPD). The present survey encountered no potentially significant archaeological sites or features of any kind within the project area. Based on the negative results of this survey, no further work of any kind is necessary in the project area, and it is recommended that the project area be granted full archaeological clearance.

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INTRODUCTION

BACKGROUND

At the request of Ms. Carol Thompson, of CH2M HILL, Paul H. Rosendahl, Ph.D., Inc. (PHRI) recently conducted an archaeological inventory survey of the approximately 14,850 sq. ft. Prospective Well Site project area, located in the Land of Manoa, Kona District, Island of Oahu (TMK:2-9-55: Por.4). The basic objective of the survey was to provide information appropriate to and sufficient for satisfying the archaeological inventory requirements of the City and County of Honolulu and the Department of Land and Natural Resources - State Historic Preservation Division (DLNR-SHPD).

The survey field work was conducted June 17, 1992, by Crew Chief Mikele W. Fager, B.A. and Howard Haygood, B.A., under the overall supervision of PHRI Projects Manager Donna K. Graves, M.A. The field work took approximately 16 labor-hours to complete.

SCOPE OF WORK

The basic purpose of an inventory survey is to identify—to discover and locate on available maps—features of potential archaeological significance present within the specified project area. An *inventory survey* is an initial level of archaeological investigation. It is extensive rather than intensive in scope, and is conducted with the primary aim of determining the presence or absence of archaeological resources within a specified project area. A survey of this type indicates both the general nature and the variety of archaeological remains present, and the distribution and density of such remains. It permits a general significance assessment of the archaeological resources and facilitates formulation of recommendations and estimates for any *mitigation* work that might be necessary or appropriate. Such work could include intensive survey—further data collection involving detailed recording of sites and features, and selected test excavations. It might also include subsequent data recovery research excavations, construction monitoring, interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

The basic objectives of the present survey were fourfold: (a) to identify (find and locate) all significant historic sites within the parcel identified as TMK:2-9-55:Por.4, Land of Manoa, Kona District, Island of Oahu; (b) to evaluate the

potential general significance of all identified archaeological remains; (c) to determine the possible impacts of proposed development upon the identified remains; and (d) to define the general scope of any subsequent further data collection and/or other mitigation work that might be necessary or appropriate.

Based on a review of readily available background literature, and on familiarity with the general project area, the following specific tasks were determined to constitute an appropriate scope of work for the inventory survey:

1. Conduct archaeological and historical documentary background research involving review and evaluation of readily available archaeological and historical literature, historic documents and records, and cartographic sources relevant to the immediate project area. Interview available, knowledgeable local informants;
2. Conduct inventory-level survey (including detailed recording—written descriptions, scaled maps, photographs) of all previously identified sites and any newly identified sites present within the project area;
3. Conduct limited subsurface testing of selected sites and features identified within the project area (a) to determine the presence or absence of potentially significant buried cultural features or deposits, and (b) to obtain suitable samples for age determination analyses; and
4. Analyze field and historical research data, and prepare appropriate reports.

The inventory survey was carried out in accordance with the standards for inventory-level survey recommended by the DLNR-SHPD. The significance of all archaeological remains within the project area was to have been assessed in terms of (a) the National Register criteria contained in the Code of Federal Regulations (36 CFR Part 60), and (b) the criteria for evaluation of traditional cultural values prepared by the National Advisory Council on Historic Preservation. DLNR-SHPD and the Oahu County Planning Department both use these criteria to evaluate eligibility for both the Hawaii State and National Registers of Historic Places.

PROJECT AREA DESCRIPTION

The Manoa Prospective Well Site project area consists of approximately 14,850 sq. ft., in the land of Manoa, Kona District, Island of Oahu (TMK:2-9-55:por.4). The parcel measures 135 ft. north-south by 110 ft. east-west. The project is bounded immediately to the east by parcels 48 and 49 at the corner of Kumulani Street and Kumulani Place. To the north is a drainage easement that truncates the parcel from near the southeast corner. It is bordered to the south and west by sloping land covered with apparently altered forest. The southeast corner of the parcel begins at the end of Kumulani street and is located north of that street. The parcel is situated c. 520 ft. AMSL (above mean sea level) and receives an average yearly rainfall of 40-90 inches (Armstrong 1983). The soil in the project area is described as *Lolekaa* silty clay (Foote et al. 1972), characterized by steep, well to excessively drained, rocky soil. The project contains an approximate 10-25 degree slope. Vegetation within the parcel is moderately dense and consists of mainly introduced, ornamental species. These include heliconia (*Heliconia* spp.), Lantana (*Lantana camara*), variegated puhala (*Pandanus variegatus*), 'awapuhi ko'oko'o (*Phaemeria magnifica*), guava (*Psidium guajava*), vines and grasses. In addition, ironwood (*Casuarina equisetifolia*) and silver oak (*Grevillea robusta*) were noted in the general vicinity of, but not within, the parcel.

PREVIOUS ARCHAEOLOGICAL WORK

No previous archaeological research has been performed in the project area. There has been such work, however, in the general vicinity of Manoa.

In a memo to the University of Hawaii files, Francis Ching, in 1968, reported a platform-mound he inspected on newly acquired property of the University of Hawaii. He was inconclusive on the function and type of this structure, because of its poor condition. He conjectured it could be a house site, a burial site, or a *heiau*.

M.L.K. Luscomb (1975) inspected the *heiau* reported to be on Andrew Maretzky's property, at 2626 Anuenue St., in Manoa. Luscomb documented the *heiau* as a platform with internal features. Luscomb theorized that this structure may well be Kawapopo, one of two unlocated *heiau* mentioned by McAllister (1971:80).

Rosendahl (1987) conducted an archaeological field inspection of the Waahila Ridge Temporary Boring Access Road, in the land of Manoa, Honolulu District. This c. 300 ft.

by 40 ft. wide corridor was located on the lower southern slope of Waahila Ridge, east of the University of Hawaii Residential Housing Complex. This corridor was SW of the present project area. No previously known sites were believed to be in the immediate area, and none was identified.

SUMMARY OF HISTORICAL DOCUMENTARY RESEARCH

PHRI Historical Researcher Lehua Kalima conducted limited historical documentary research on the lands of Manoa. Manoa translates as "wide or vast" (Pukui, Elbert and Mookini 1974:146), an apt description of the *ahupua'a* containing the project area. The earliest accounts of Manoa are tales and legends documented by ethno-historians. These legends concern the creation of natural forces (wind, rain), unique land forms (sacred stones), as well as the creation and manipulation of faunal, floral, and human forms.

In addition, *menehune* were said to reside at a fort called Ulumau (Thrum 1892). The legends further elaborate on the conquest of this hilltop structure by the Hawaiians, under the leadership of Kualii'i. This was subsequently turned into a *heiau*-fort called Kukaoo. Manoa was bisected into Manoa-ali'i and Manoa-kanaka. The *ali'i* resided in the former, on the west side of the valley, and the commoners (*maka-ainana*) lived in the latter, on the east side of the valley. The parcel containing the present project area lies in this Manoa-ali'i.

McAllister (1971:80) cites Thrum (1892) and Westervelt (1916) in describing some of the known *heiau* in Manoa Ahupua'a. These *heiau* include Puuhonua Heiau, Kapua Heiau, Mauoki Heiau, Hipawai Heiau, as well as two unlocated *heiau* (Kawapopo and Hakika). A cave on the east side of Manoa Valley, in which Kamehameha and a group of warriors lived for a time, is also mentioned by McAllister (1971).

According to Handy (1940), the level land in upper Manoa was extensively cultivated with taro (*kalo*). Handy and Handy (1972) mentioned Manoa was well watered and was well adapted to agricultural terracing, but by 1931 much of this land was abandoned and only about 100 terraces remained. Connections with the coast through the numerous branching trails were reported by John Papa I'i (1959:92).

Queen Kaahumanu's house once stood near the project area on Bishop Estate lands. Guava (*Psidium guajava*) was first planted here, a forerunner of the large influx of foreign plants and animals that would be incorporated into the Manoa landscape and Hawaii in general. Commercial interests were

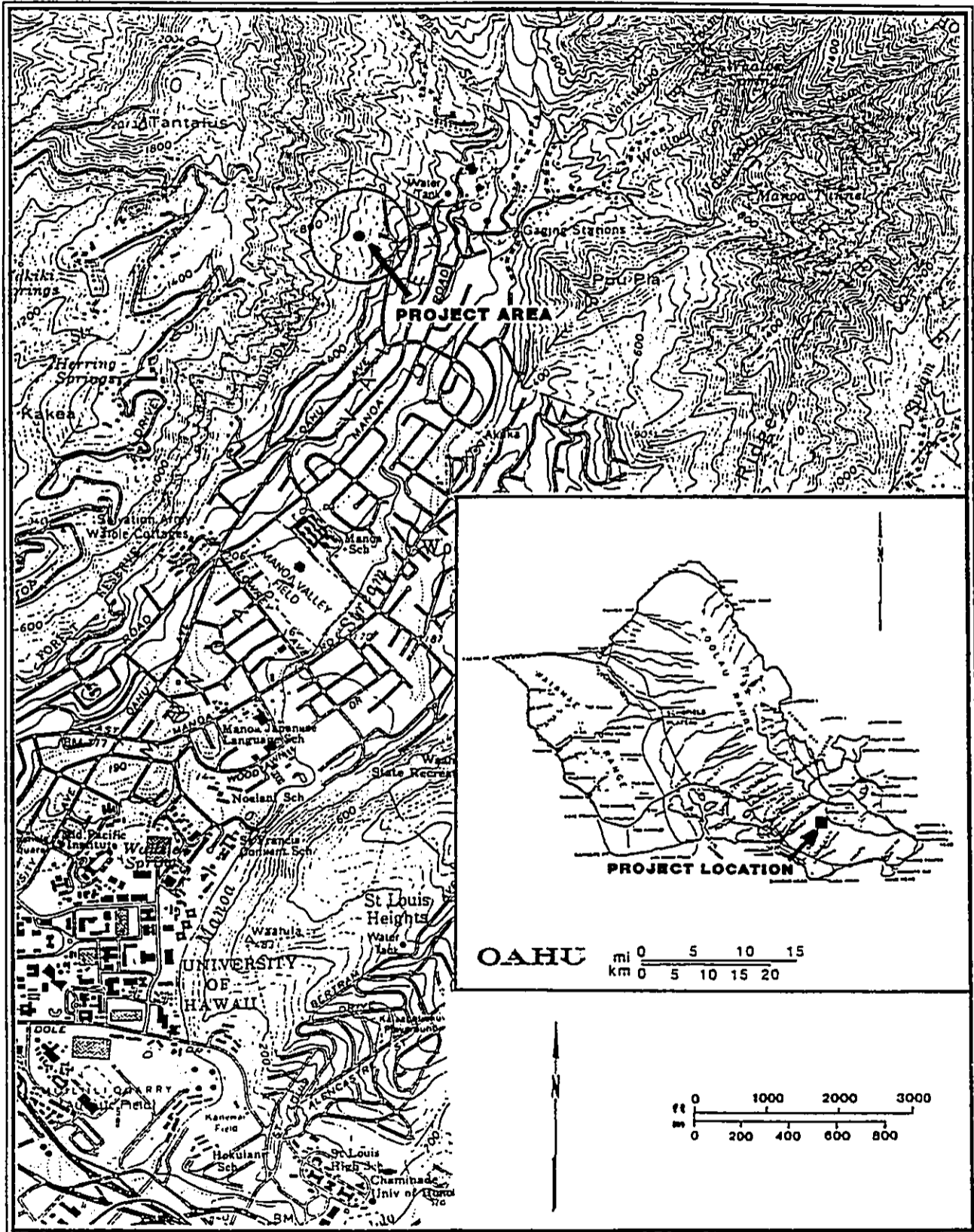


Figure 1. PROJECT AREA AND SITE LOCATION MAP

established by the first sugar plantation on Oahu, in 1825, by John Wilkinson at Puu Pueo, south of the project area.

In 1848, the traditional Hawaiian land ownership system was replaced by a western-style system. This restructuring was called the Great Mahele (division). The Great Mahele separated and defined the undivided land holdings of King Kamehameha III, the high ranking chiefs, and the *konohiki* (land managers). A land commission was also formed to award tracts of land to native tenants who used the land for subsistence. These awards became known as *kuleana* lands. No land commission awards fall within the present project, however it was once part of Grant 110 to Miriam Kekuanaoa in 1848.

SETTLEMENT PATTERN

On Oahu, there is archaeological evidence to support early occupation of windward stream basins and coastal areas, i.e. Waimanalo, Maunawili, He'eia, Kahalu'u, Waikane, and Kane'ohe Bay. The Bellows Dune site, on the banks of the Waimanalo Stream, provides radiocarbon dates as early as the 4th century. Additional chronometric data provides evidence that these rich valleys continued to be centers of population growth and agricultural development well into the historic period (Kirch 1985:70).

The leeward (drier) side of Oahu, of which the Manoa Valley is a part, may have presented environmental constraints, including variable stream flow and frequent droughts, that contributed to a later occupation period. While coastal sites have provided evidence for use of the leeward areas as early as the 10th century, inland sites do not appear to have been permanently occupied until the 13th century (e.g., Halawa Valley). These settlements may have been in response to population pressures, an intensification of agriculture, or both. In the Manoa Valley this is evidenced by water control devices such as taro irrigation complexes (Kirch 1985:20).

While Manoa may have been considered a "marginal" agricultural area, it evidently became an area favored by high ranking *ali'i*, at least by the historic period, if not earlier. Historical documentary research concludes that it was an

important and frequently traversed land, with trails leading to Honolulu. This conjecture is also supported by the number of *heiau* in the vicinity.

The Manoa Valley continues to play an integral part in the development of the Kona District. Presently Manoa Valley is part of an urban complex, which includes the University of Hawaii-Manoa Campus as well as a large residential and commercial district. Unfortunately, as this area has become urbanized, many prehistoric and contact-era sites have been lost. Thus the chronological framework is based on bits and pieces of evidence and any settlement pattern model must be largely conjectural.

Implications for the Current Project

No previously identified archaeological sites were known to exist within or immediately adjacent to the present project area. However, previous archaeological research and historic documentation provided a set of expectations for the current project. These expectations included agricultural sites (terraces, enclosures, mounds, walls, and outcrops) and habitations (represented by such feature types as platforms, terraces, caves and enclosures). In addition, the possible existence of ceremonial structures such as *heiau* and shrines was indicated by the many that are already documented in the general area.

FIELD METHODS AND PROCEDURES

Field work was conducted June 17, 1992 by Crew Chief Mikele W. Fager and field Archaeologist Howard Haygood. The field work primarily consisted of 100% ground coverage of the parcel. This was accomplished by way of systematic pedestrian transects oriented cross-slope (north-south) across the parcel. These were marked by red and white surveyors' flagging tape. Intervals between the two sweeping crew members were approximately 10-25 ft., depending on vegetation and terrain. In addition, several informal walk-throughs were conducted perpendicular to the formal pedestrian transects (*mauka-makai*, east-west). Ground surface visibility generally was poor, due to the relatively dense vegetation (which also hindered crewmembers' movement).

CONCLUSION

DISCUSSION

The present survey revealed no archaeological sites or features of any kind within the project area, despite expectations developed from historical research and settlement pattern analysis. Manoa was a well-populated area with defined, socially stratified areas, as evidenced by the *ali'i* and *maka'ainana* partition. Due to the numbers of documented *heiau*, and the residence there of high ranking *ali'i* during the historic period, Manoa Valley would have been a politically important area. As the present project lies in the former high status area, habitation, ceremonial, and agricultural features were expected to be identified. Because of the geographical setting of this fertile valley, any cultural remains within the project would have been expected to date to as early as Kirch's Phase II Developmental Period (AD 600-1100).

The lack of identified remains is probably due primarily to the terrain in the area, which is highly eroded and lacks building materials for construction of features. In addition, the existence of large amounts of exotic foliage currently growing in the project area indicates recent use and alteration. Urban development within the immediate area has probably impacted the project area, if only indirectly, by accelerating the erosion process, thus subsurface deposits are unlikely to be present. Other archaeological work in similar terrain has documented the alteration and subsequent erosional deterioration of the inland slopes from the historic period, possibly obliterating pre-existing features (Dunn and Haun 1990).

GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

Significance categories used in the potential site evaluation process are based on the National Register criteria for

evaluation, as outlined in the Code of Federal Regulations (36 CFR Part 60). The DLNR-SHPD uses these criteria for evaluating cultural resources. Sites determined to be potentially significant for information content fall under Criterion D, which defines significant resources as ones which "...have yielded, or may be likely to yield, information important in prehistory or history."

Sites potentially significant as representative examples of site types are evaluated under Criterion C, which defines significant resources as those which "...embody the distinctive characteristics of a type, period, or method of construction...or that represent a significant and distinguishable entity whose components may lack individual distinction."

Sites with potential cultural significance are evaluated under guidelines prepared by the Advisory Council on Historic Preservation (ACHP) entitled "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (ACHP Draft Report, August 1985). The guidelines define cultural value as "...the contribution made by an historic property to an ongoing society or cultural system. A traditional cultural value is a cultural value that has historical depth." The guidelines further specify that "[a] property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value."

Based on the negative results of this inspection, it is concluded that no further work of any kind is necessary in the project area. It is also recommended that the project area be granted full archaeological clearance. These recommendations are based on the surface survey of the project area, and they are made with the general qualification that during construction activity involving extensive land-surface modification, there is always the possibility, however remote, that previously unknown or unexpected subsurface cultural features or deposits might be encountered. In such situations, archaeological consultation should be sought immediately.

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APPENDIX A

HISTORICAL DOCUMENTARY RESEARCH by Lehua Kalima, B.A.

The project area is within the *ahupua'a* of Manoa, Kona District, Island of Oahu. Manoa translates as "wide or vast" (Pukui, Elbert and Mookini 1974:146), and is probably descriptive of the wide valley that makes up the inland portion of this *ahupua'a*.

Below are brief summaries of just a few of the many legends and tales of the popular area of Manoa. Perhaps the most famous legend associated with Manoa is the story of Kahalaopuna, a princess so beautiful that rainbows constantly appeared above her. Kahalaopuna, the daughter of Kuahine, a chiefess, and Kahaukani, lived in Manoa Valley. Kahalaopuna was betrothed to a young chief. One day he heard two men gossiping, both claiming that they had made love to Kahalaopuna. He was so angry that he beat Kahalaopuna until she was unconscious. She was revived by an owl god, but when the young chief heard more false gossip, he killed her. In grief, her mother became the Kuahine rain. From this evolved the Hawaiian epithet "*Ka Ua Kuahine o Manoa*" (the Kuahine rain of Manoa). Kahalaopuna's father adopted two forms- the wind Kahaukani, and a special *hau* tree. It was said that this tree moaned in grief whenever a member of royalty died (Pukui 1983:1574).

Another wind known in Manoa was the Kakea. This was the strongest wind in the valley and was described in the saying "*He Kakea, ka makani kulakula'i kauhale o Manoa*" (It is the Kakea, the wind that pushes over the houses of Manoa) (ibid:664). This saying was also used to describe those who made a habit of shoving others.

Upper Manoa Valley was known in ancient days as home to *menehune*. T.G. Thrum briefly describes a *menehune* fort and tells a tale associated with it:

The Menehune's fort was on the rocky hill, Ulumau, on the opposite side of the road, just above Kukaoo. Previous to the battle, they had control of all upper Manoa. After Kualii obtained possession, he made it the principal temple fort of a system of heiaus...Kukaoo heiau and hill is connected also, in legend, with that of Punahou Spring, as the place where the twin brother and sister Kauawaahila and Kauakuahine obtained temporary shelter from the persecutions of a cruel step-mother, as shown in the following extract... 'The children went to the head

of Manoa Valley, but were driven away and told to return to Kaala, but they ran and hid themselves in a small cave on the side of the hill of Kukaoo, whose top is crowned by the temple of the Menehunes. Here they lived for some time and cultivated a patch of potatoes, their food meanwhile being grass-hoppers and greens. The latter were the tender shoots of the popolo, aheahea, pakai, laulele and potato vines, cooked by rolling hot stones around among them in a covered gourd. When the potatoes were fit to be eaten, the brother made a double imu, having a kapu, or sacred, side for his food and a noa, or free, side for his sister. The little cave was also divided in two, a sacred and a free part for brother and sister, the cave, with its wall of stone dividing it in two was still intact a few years ago, and the double imu was also to be seen (Thrum 1892:112-113).

Waiakeakua is the name of a stream and swimming pool at the head of Manoa Valley. This pool was said to have been made by the gods Kane and Kanaloa who, after finding excellent *awa* there, struck a staff into a precipice and created a large pool (Westervelt 1916:36). This area was supposedly where the *menehune* slept in the daytime before beginning their work of building ponds, *heiau*, or whatever else they decided on during the night.

Another legend of this area is that of a woman named Luahine, who had the power to change into a lizard. She traveled about annoying many people until finally the goddess Pele drove her to the back of Manoa Valley, where she then lived at Pali Luahine.

Another tale tells of the gods Kane and Kanaloa, who had been walking through Manoa near Punahou Spring when they saw a goddess named Kameha'ikana and her attendant. The attendant tried to prevent them from coming near the goddess, and as Kameha'ikana tried to flee, Kane attempted to stop her. As the attendant leaped into the pool between the gods and the goddess, she was turned into a stone, and as Kane stepped forward, his footprint was left in the stone (Pukui IN Sterling and Summers 1978:288).

In ancient times, Manoa Valley was divided into two areas, Manoa-alii and Manoa-kanaka. An imaginary line was

said to have been drawn from Puu o Manoa to Pali Luahine, with the chiefs living on the left side and the commoners on the right (ibid:283).

E.S.C. Handy, in his book *Hawaiian Planter* (1940), writes that in ancient days, all of the level land in upper Manoa was developed into taro flats. Handy and Handy (1972) mentioned Manoa as having well-watered, level land which was better adapted to terracing than neighboring Nuuanu. In 1931, much of this land was abandoned, with only about 100 terraces still in existence.

John Papa I'i, a Hawaiian historian, wrote of the many trails leading into and throughout Honolulu and the surrounding areas (Figure A-1). The following excerpt mentions the trails that led into Manoa Valley:

A trail led out of town at the south side of the coconut grove of Honuakaha and went on to Kalia. From Kalia it ran eastward along the borders of the fish ponds and met the trail from lower Waikiki. At Kawaiahao a trail passed in front of the stone house of Kaina, late father of Kikaha. The trail went above Kalanipuu's place, along the stream running down from Poopoo to the sea, close by Kaaihee in Makiki, to Puu o Manoa, then below Puupueo, where a trail branched off to go to upper Kaaipu and Kahoiwai, and another to go below Kaahulue, to Kapulena and Kolowalu (I'i 1959:92).

Figure A-2 is a map showing the location of various sites in the Kona District of Oahu. One site in Manoa (Site 405) is near the present project area. This site was once the location of Queen Kaahumanu's house. She was King Kamehameha's favorite wife. It was here in the area known as Puahuula in her home Pukaoma'oma'o that the queen died in 1832. A newspaper article in 1932 described the foundation of the home as being "just past the junction of Manoa road and Oahu avenue in upper Manoa Valley, surrounded by market gardens...a green, overgrown path leads off the highway to a tiny clearing, shaded by fine old hau trees and bushes in which

there is a stone foundation of a former house" (Sterling and Summers 1978:287). This site was reported to be on Bishop Estate Land. It was also to this property that the first guavas and the first goldfish were brought by the queen. Mary Kawena Pukui spoke to a woman who remembered a *kapu* being placed on the guavas. No one was to pick them unless the queen allowed them to, but the birds pecked the fruit, and soon the guavas spread all over the islands (Sterling and Summers 1978:288).

Puu Pueo, an area south of the project area (Figure A-2), was where Oahu's first sugar plantation was established, in 1825, by an Englishman named John Wilkinson. Apparently his endeavor was not very successful, because by 1892, when Thrum published an article on Manoa, he cited the only evidence of the plantation as being the cisterns and stones marking the western portion of the foundation of the sugar house (Thrum 1892:111-112).

At the time of the Great Mahele in 1848, many *kuleana* awards were granted to natives in Manoa. According to tax maps, no Land Commission Awards (LCA) fall within the present project area; however, it was once part of Grant 110 to Miriam Kekuanaoa in 1848.

Manoa Valley is now home to the University of Hawaii-Manoa campus, University High School, and a large residential and commercial area. The present project area is as yet undeveloped.

In summary, the *ahupua'a* of Manoa was once a well-populated area. The existence of *heiau* and trails leading from Honolulu indicate it was an important and frequently traversed land. It was also a notable place because *ali'i* once lived there. The evidence of numerous agricultural terraces indicates an abundant food source, probably to support a fairly large population. Its inclusion in many legends and tales also suggests Manoa Ahupua'a was a significant and well-loved area. The project area itself lies close to the house site of Queen Kaahumanu. This area is now a part of the Bishop Estate and has not yet been developed.

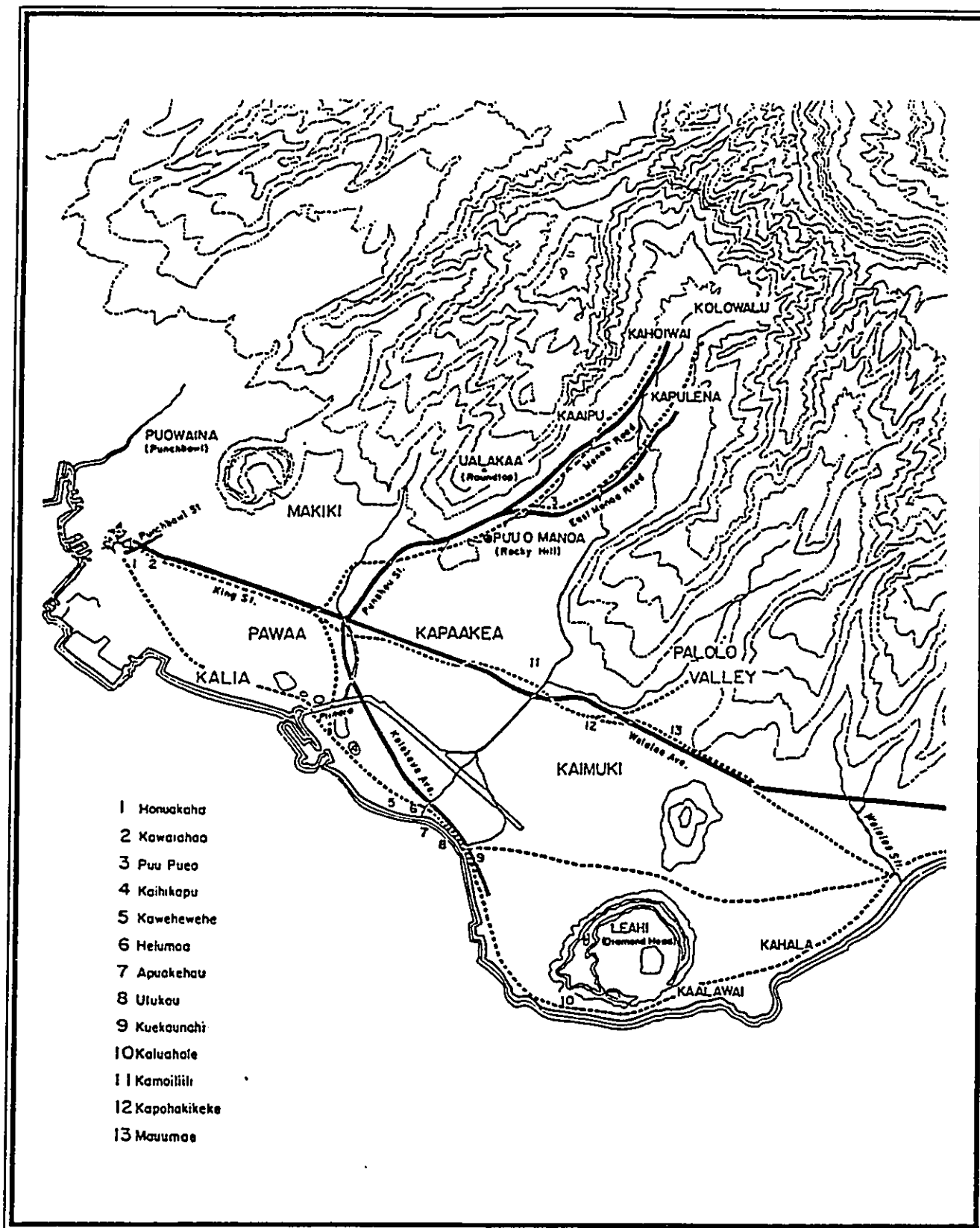


Figure A-1. Trails from Punchbowl Street to Waialae as described by I'i (Taken from I'i 1959:93)

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Appendix A

A-4



Figure A-2. Locations of Sites in Kona District (Taken from Sterling and Summers 1978)

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