

JOHN WAHEE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

P. O. BOX 621
HONOLULU, HAWAII 96809

SEP 14 1993

FILE NO.: OA-2649
DOC. ID.: 3451

5042
KEITH W. AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JOHN P. KEPPELER, II
DONA L. HANAIKE

RECEIVED
'93 SEP 15
DEPT. OF ENVIRONMENTAL QUALITY
AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND ENVIRONMENTAL AFFAIRS
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

MEMORANDUM

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

FROM: Keith W. Ahue, Chairperson *OK*
Board of Land and Natural Resources

SUBJECT: Negative Declaration for Repairs to Nuuanu Tunnel No. 3A,
Upper Nuuanu Valley, Oahu, TMK: 1-9-07: 1

The Department of Land and Natural Resources has reviewed the comments received during the 30-day public comment period which began on July 8, 1993 in the OEQC Bulletin. The Department has determined that this project will not have significant environmental effect and has issued a negative declaration. Please publish this notice in the next OEQC Bulletin.

We have enclosed a completed OEQC Bulletin form and four copies of the Final EA.

Please contact Sam Lemmo of the Office of Conservation and Environmental Affairs, at 587-0377, should you have any questions.

Enclosure

cc: C&C Board of Water Supply

1993-10-08-0A-PEA - Tunnel Tunnel No 34 Repair OCT 8 1993
February 1983

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

DEPARTMENT MASTER APPLICATION FORM

FOR DLNR USE ONLY

Reviewed by _____
Date _____
Accepted by _____
Date _____
Docket/File No. _____
180-Day Exp. _____
EIS Required _____
PH Required _____
Board Approved _____
Disapproved _____
Well No. _____

DLNR
OCEA

(Print or Type)

0A-2049

I. LANDOWNER/WATER SOURCE OWNER
(If State land, to be filled
in by Government Agency in
control of property)

Name State of Hawaii

Address _____

Telephone No. _____

SIGNATURE _____

Date _____

II. APPLICANT (Water Use, omit if applicant
is landowner)

Name Board of Water Supply

Address 630 South Beretania Street

Honolulu, Hawaii 96843

Contact: Mr. Andrew Okada

Telephone No. 527-5202

Interest in Property _____

Renovation of existing BWS facility
(Indicate interest in property; submit
written evidence of this interest)

*SIGNATURE *Kejo Hayashida*

Date APR 2 1993

*If for a Corporation, Partnership,
Agency or Organization, must be signed
by an authorized officer.

III. TYPE OF PERMIT(S) APPLYING FOR

() A. State Lands

(x) B. Conservation District Use

() C. Withdraw Water From A Ground
Water Control Area

() D. Supply Water From A Ground
Water Control Area

() E. Well Drilling/Modification

IV. WELL OR LAND PARCEL LOCATION REQUESTED

District Nuuanu

Island Oahu

County Honolulu

Tax Map Key 1-9-07:1

Area of Parcel 788.032 acres
(Indicate in acres or
sq. ft.)

Term (if lease) _____

V. Environmental Requirements

Pursuant to Chapter 343, Hawaii Revised Statutes, and in accordance with Title 11, Chapter 200, Environmental Impact Statement Rules for applicant actions, an Environmental Assessment of the proposed use is attached (see Exhibit A).

VI. Summary Of Proposed Use

The Board of Water Supply of the City and County of Honolulu proposes to renovate its existing Nuuanu No. 3A Tunnel located off Pali Highway in upper Nuuanu valley (see Figure 1).

The existing water development tunnel is approximately 5 feet in diameter and 200 feet long. The tunnel lining near the entry has deteriorated and must be constantly maintained by removal of intruding roots from surrounding vegetation. The project is required to repair the deteriorating lining and eliminate the intrusion of roots.

To perform the necessary work, the project will include the construction of a temporary access road approximately 12 feet wide and 170 feet long from Pali Highway to the entrance portal (see Figure 2). The temporary access road will follow a foot trail that leads to the tunnel. Estimated area to be graded is 0.25 acres. The estimated excavation and embankment required is 1,300 cu. yd and 200 yd. respectively. The temporary access road will be demolished and the area restored upon completion of the repair work.

Renovation of the tunnel includes reconstruction of the entrance portal structure and the tunnel's lining within approximately 80 feet of the tunnel entrance (see Figure 3). The renewed tunnel lining will prevent future root intrusions, minimize maintenance requirements, and eliminate the hazards of tunnel cave-ins. The new entry structure will also minimize the potential for contamination of the water supply by vandals and entry of storm runoff.

INFORMATION REQUIRED FOR ALL USES

I. Description of Parcel

A. Existing Structures/Use

The subject parcel is located in upper Nuuanu valley on the northern side of the Pali Highway right-of-way (see Figure 1). The parcel is designated by Tax Map Key (TMK) 1-9-07:1 and is owned by the State of Hawaii (see Figure 4). The Honolulu Board of Water Supply (BWS) currently uses the Nuuanu No. 3A water development tunnel as a high level groundwater source to supplement water from other sources. The tunnel is believed to have been constructed in the 1920's and has a yield of approximately 0.5 million gallons per day (MGD). The tunnel is approximately 5 feet in diameter and 200 feet long. The entry area of the tunnel is lined with concrete. Entry to the tunnel is through a fabricated steel hatch installed on a reinforced concrete headwall structure.

B. Existing Utilities

Utility infrastructure at the project site includes the tunnel facility itself and the 6-inch transmission main which conveys the water across the Pali Highway to BWS storage reservoirs and distribution facilities. A 4-inch line and valve near the tunnel entrance is used to discharge blowoff water into the nearby Makuku Stream.

A small concrete-lined drainage ditch run parallel to and is located just off the Pali Highway.

C. Existing Access

Access between Pali Highway and the tunnel portal structure is by an existing foot path. Access is restricted by a chain-link fence and locked gate.

D. Vegetation

The botanical assessment survey concluded that there is little of botanical interest or concern on the project site (see Appendix A of the Environmental Assessment). With the exception of the hau thicket, the vegetation on the site is largely dominated by introduced or alien species. All of the plants found on the site can be found in similar environments throughout the Hawaiian Islands.

E. Topography

The project site is situated at approximately the 900 foot elevation and consists of moderate (15 percent) to steeply (60 percent) sloping terrain (see Figure 2). A portion of the site is located within the Pali Highway right-of-way and contains highway associated features consisting of a metal guardrail, a concrete lined ditch, and a metal chain link fence. Makuku Stream is located just north of the proposed access road.

F. Shoreline Description

Not applicable.

G. Existing Covenants, Easements, Restrictions

There are no major covenants, easements or restrictions on the subject property. The State of Hawaii is the landowner of record. The Land Management Division of the Department of Land and Natural Resources (DLNR) indicated that the parcel is designated by proclamation as a Honolulu watershed. There are no executive orders exempting the project site from CDUA permitting requirements. The Division of Forestry and Wildlife of DLNR indicated that the project site encroaches into an archery only hunting area and that the division should be notified prior to construction to enable them to warn hunters of the work.

H. Historic Sites Affected

An archeological survey was conducted within and just beyond the boundaries of the project site (see Appendix C of Environmental Assessment). No archeological sites were observed during the survey. Piles of large boulders adjacent to the chain link fence indicate land alteration associated with the construction of Pali Highway. Evidence of agricultural features such as terraces for taro cultivation, which have been discovered in other areas of Nuuanu valley, were not observed within the project site.

II. Description

The Board of Water Supply of the City and County of Honolulu proposes to renovate and refurbish its existing Nuuanu No. 3A Tunnel located in upper Nuuanu valley on the northern side of the Pali Highway right-of-way. The lining near the entry of the existing 5 foot diameter 200 foot long water development tunnel has deteriorated and must be constantly maintained by removal of intruding roots from surrounding vegetation. The project is required to repair the deteriorating lining and eliminate the intrusion of roots.

To perform the necessary work, the project will also include the construction of a temporary access road approximately 12 feet wide and 170 feet long from Pali Highway to the entrance portal (see Figure 2). The temporary access road will follow a foot trail that leads to the tunnel. Estimated area to be graded is 0.25 acres. The estimated excavation and embankment required is 1,300 cu. yd and 200 yd. respectively. The temporary access road will be demolished and the area restored upon completion of the repair work.

Renovation of the tunnel includes reconstruction of the entrance portal structure and the tunnel's lining within approximately 80 feet of the tunnel entrance (see Figure 2). The renewed tunnel lining will prevent future root intrusions, minimize maintenance requirements, and eliminate the hazards

of tunnel cave-ins. The new entry structure will also minimize the potential for contamination of the water supply by vandals and entry of storm runoff.

III. Commencement and Completion Dates

- A. Commencement Date: Fiscal year 1993-94 upon approval of CDUA.
- B. Completion Date: Approximately 1 year from commencement.

IV. Type of Use Requested

A. Permitted Use

Permitted Use, DLNR Title 13, Chapter 2, Section 11, Subzone P -- "government use where public benefit outweighs any impact on the conservation district"

B. Area of Proposed Use: 0.25 acres

C. Name and Distance of Nearest Town or Landmark: Honolulu

D. Boundary Interpretation

The project site is clearly within the Conservation District and is subject to Conservation District rules and regulations. No boundary interpretation is required.

E. Conservation District Subzone

The Conservation District Subzone is P, Protective.

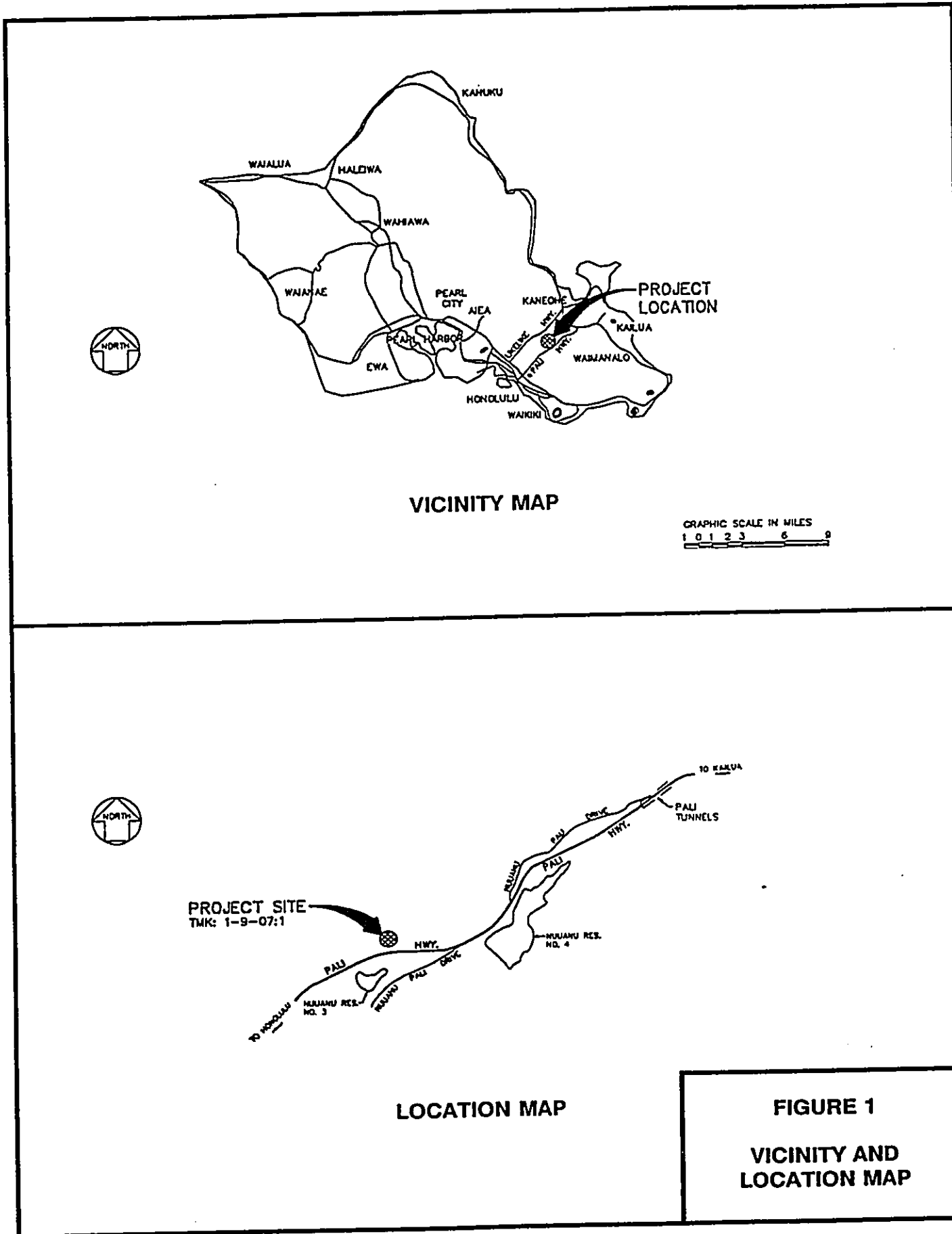
F. County General Plan Designation

The County General Plan designation is Preservation.

V. Filing Fee

A filing fee of \$50.00 is enclosed.

A public hearing is not required since the proposed use is not commercial in nature and the application is not for conditional use.



VICINITY MAP

GRAPHIC SCALE IN MILES
 1 0 1 2 3 6 9

LOCATION MAP

FIGURE 1
VICINITY AND
LOCATION MAP

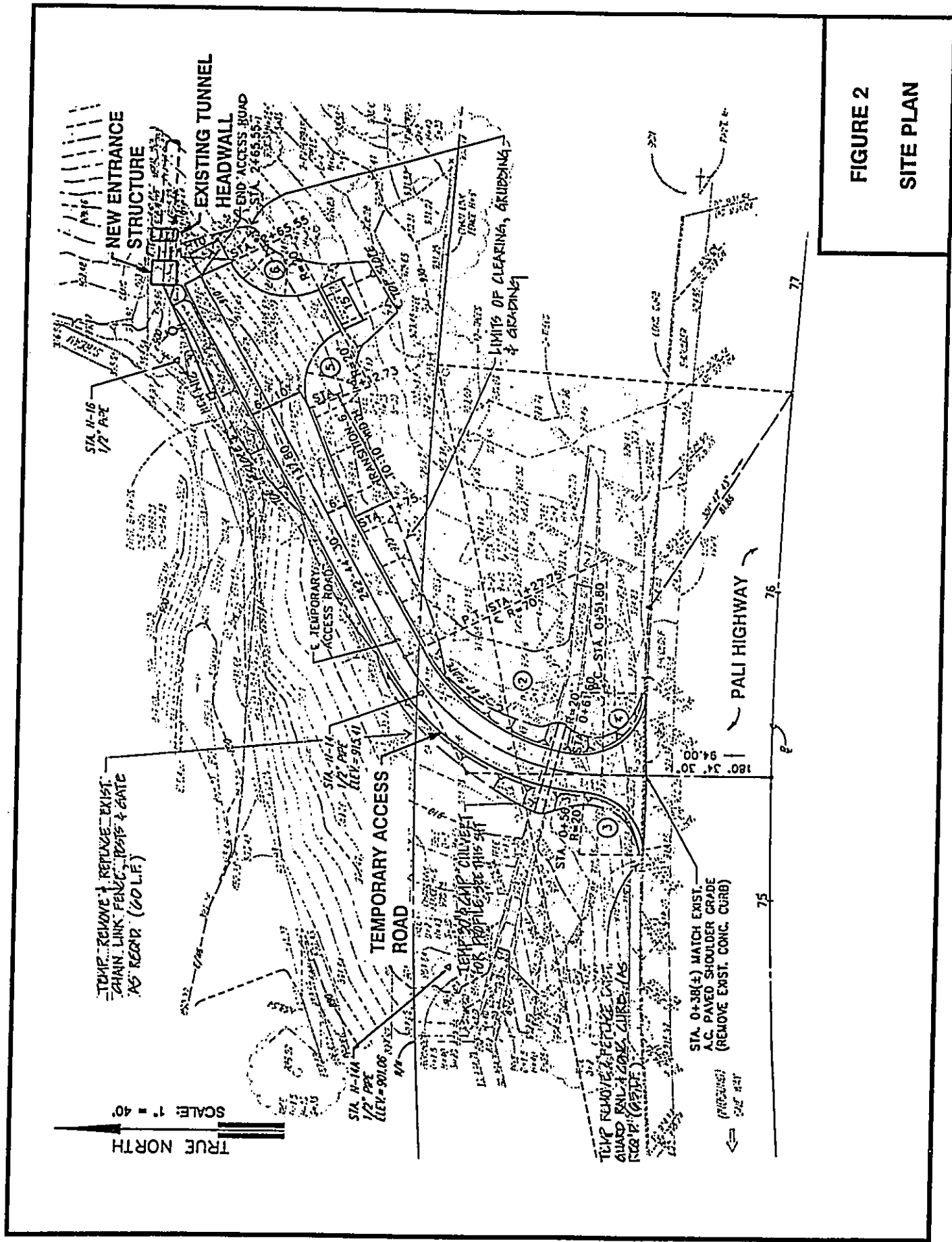
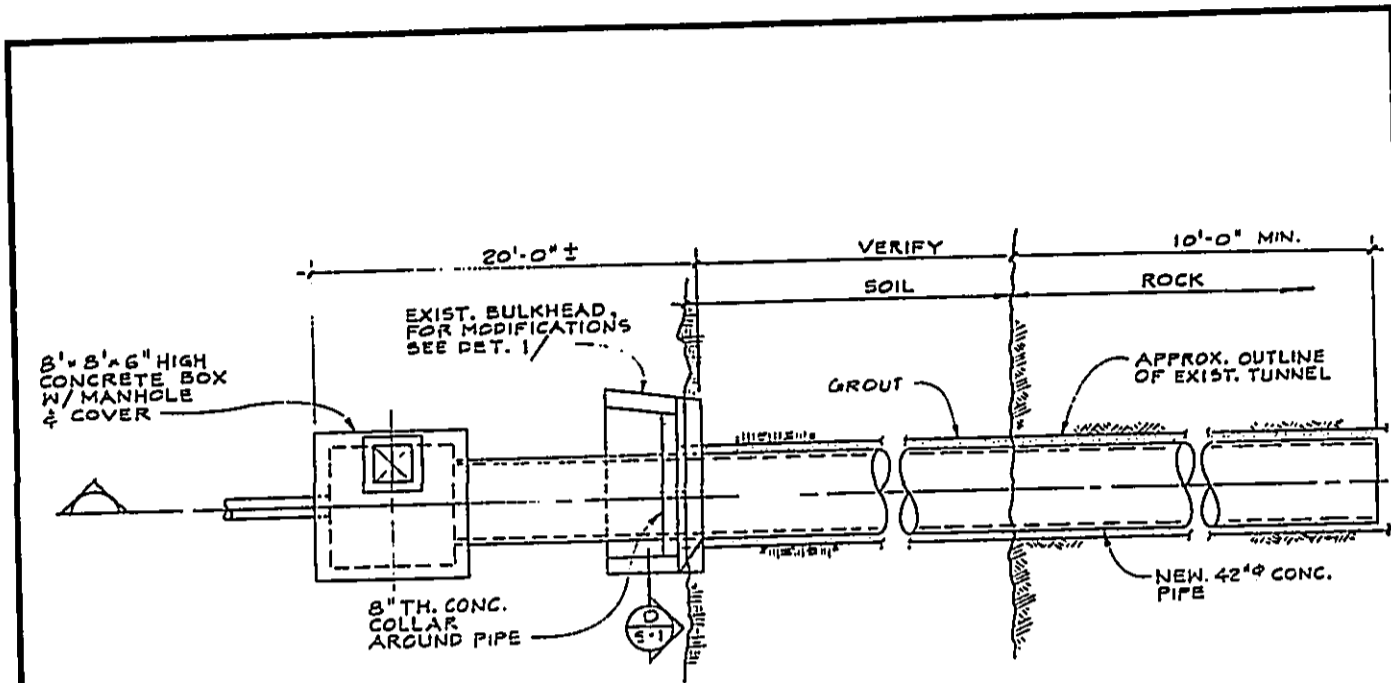
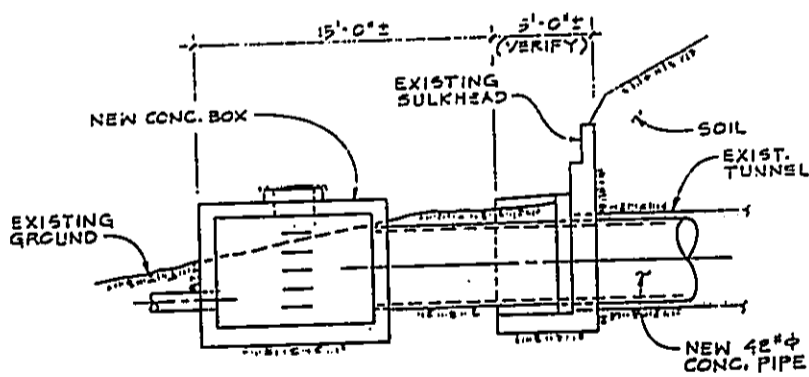


FIGURE 2
SITE PLAN



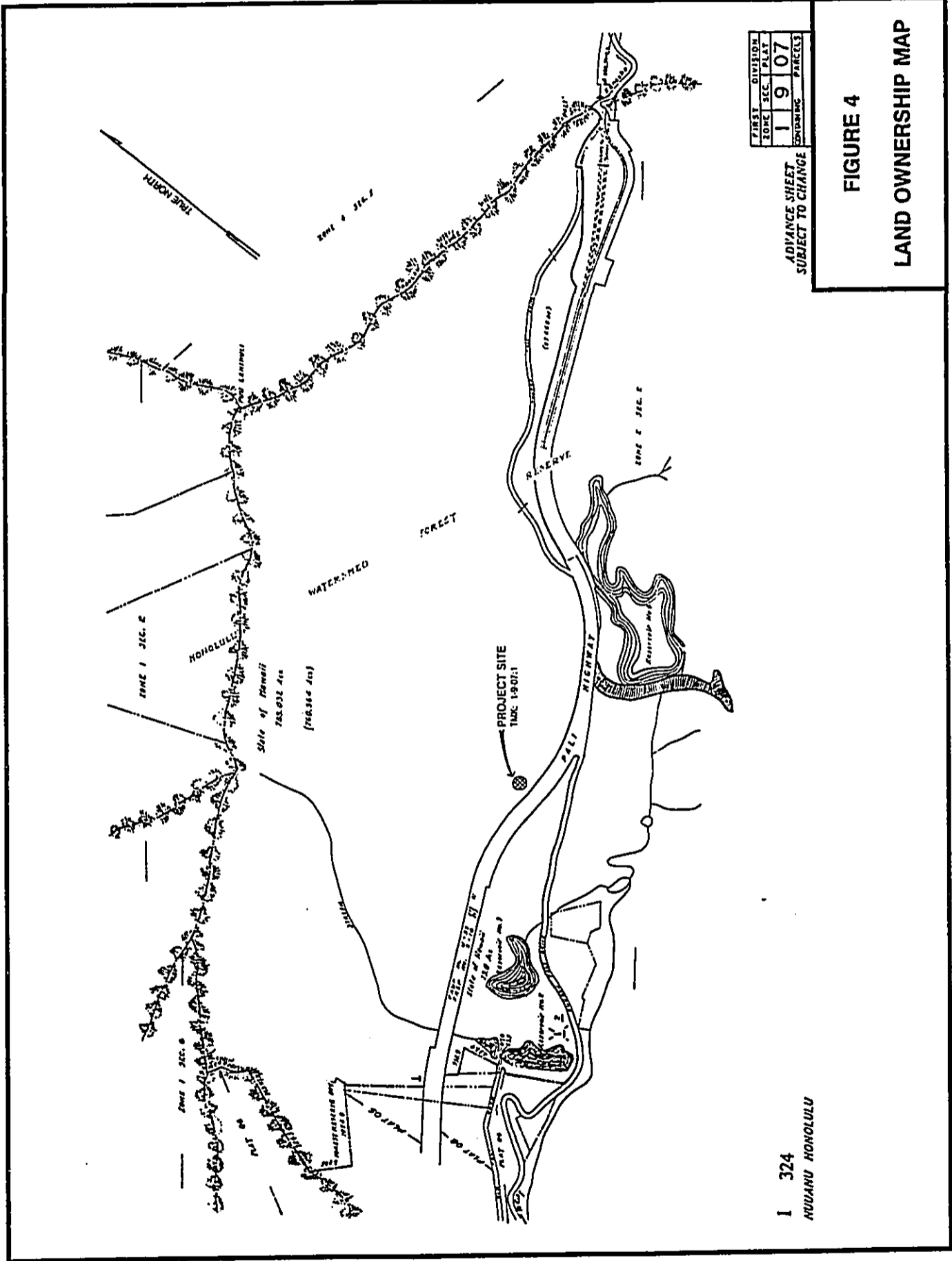
PLAN
SCALE: 1" = 10'



SECTION
SCALE: 1" = 10'

FIGURE 3
TUNNEL REPAIR PLAN
AND SECTION

() ()



FIRST	DIVISION
ZONE	SEC. PLAT
1	9 07
ADVANCE SHEET	
SUBJECT TO CHANGE	
CONDENSED	PARCELS

FIGURE 4
LAND OWNERSHIP MAP

1 324
NUUANU HONOLULU

EXHIBIT A
ENVIRONMENTAL ASSESSMENT

DRAFT

ENVIRONMENTAL ASSESSMENT

for

REPAIRS TO NUUANU TUNNEL NO. 3A

**BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU**

**Prepared by:
Hawaii Pacific Engineers, Inc.**

CITY AND COUNTY OF HONOLULU
BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

DRAFT
ENVIRONMENTAL ASSESSMENT
FOR
REPAIRS TO NUUANU TUNNEL NO. 3A
Nuuanu, Oahu, Hawaii

PROPOSING AGENCY: Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

BOARD MEMBERS:

Walter O. Watson, Jr. Chairman
Maurice H. Yamasato, Vice Chairman
Sister M. Davilyn Ah Chick, O.S.F.
John W. Anderson, Jr.
Rex D. Johnson
Melissa Y.J. Lum

KAZU HAYASHIDA
Manager and Chief Engineer

PREPARED BY:
Hawaii Pacific Engineers, Inc.
222 N. School Street, Suite 302
Honolulu, Hawaii 96817-3186

DRAFT ENVIRONMENTAL ASSESSMENT
for
REPAIRS TO NUUANU TUNNEL NO. 3A
Nuuanu, Oahu, Hawaii

I. PROPOSING AGENCY

Board of Water Supply
City and County of Honolulu

II. APPROVING AGENCY

Department of Land and Natural Resources
State of Hawaii

III. AGENCIES CONSULTED

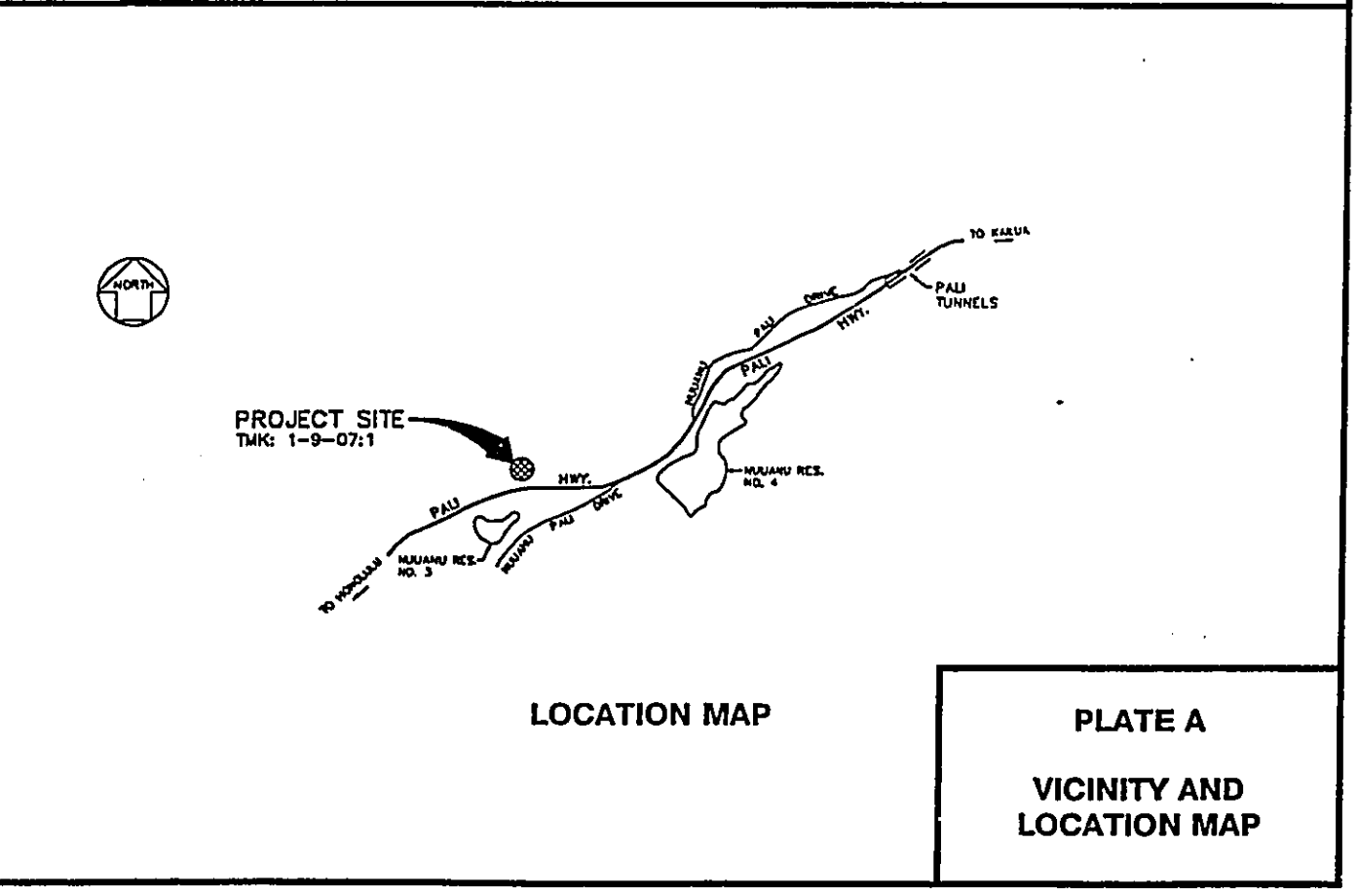
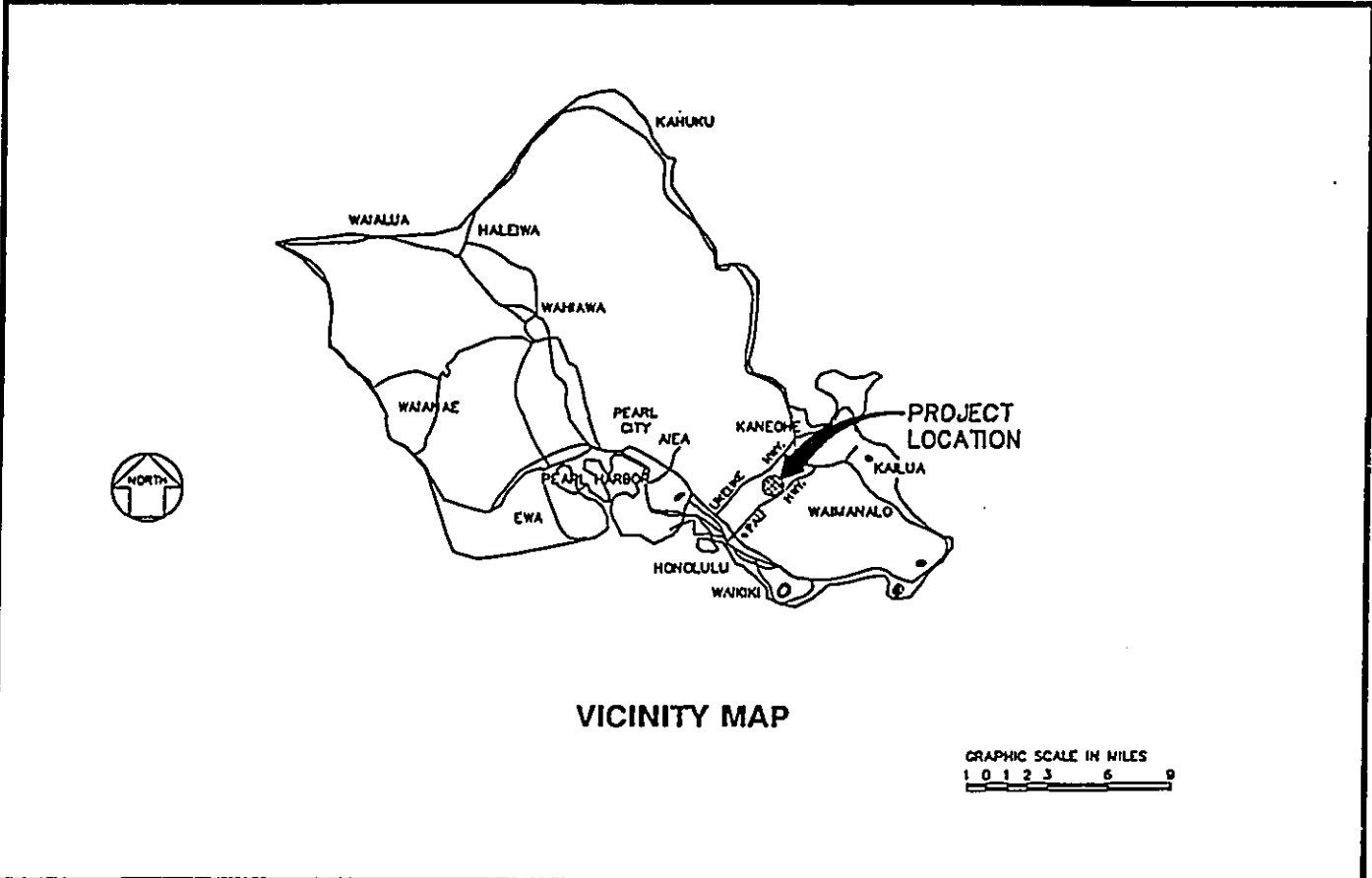
State of Hawaii

Historic Preservation Division, Department of Land and Natural Resources
Division of Forestry and Wildlife, Department of Land and Natural Resources

IV. DESCRIPTION OF THE PROPOSED ACTION

The project site is located in a vegetated area in upper Nuuanu valley just off Pali Highway in Honolulu (TMK 1-9-07:1; see Plate A).

The project proposes to renovate and refurbish the existing Honolulu Board of Water Supply (BWS) Nuuanu No. 3A Tunnel located approximately 80 feet north of the Pali Highway right-of-way. The lining near the entry of the existing 5 foot diameter 200 foot long water development tunnel has deteriorated and must be constantly



maintained by removal of intruding roots from surrounding vegetation. The project is required to repair the deteriorating lining and eliminate the intrusion of roots.

To perform the necessary work, the project will include the construction of a temporary access road approximately 12 foot wide and 170 feet long from Pali Highway to the entrance portal (see Plate B). The temporary access road will follow an existing foot trail that leads to the tunnel. Estimated area to be graded is 0.25 acres. The estimated excavation and embankment required is 1,300 cu. yd and 200 cu. yd. respectively. The temporary access road will be demolished and the area restored upon completion of the repair work.

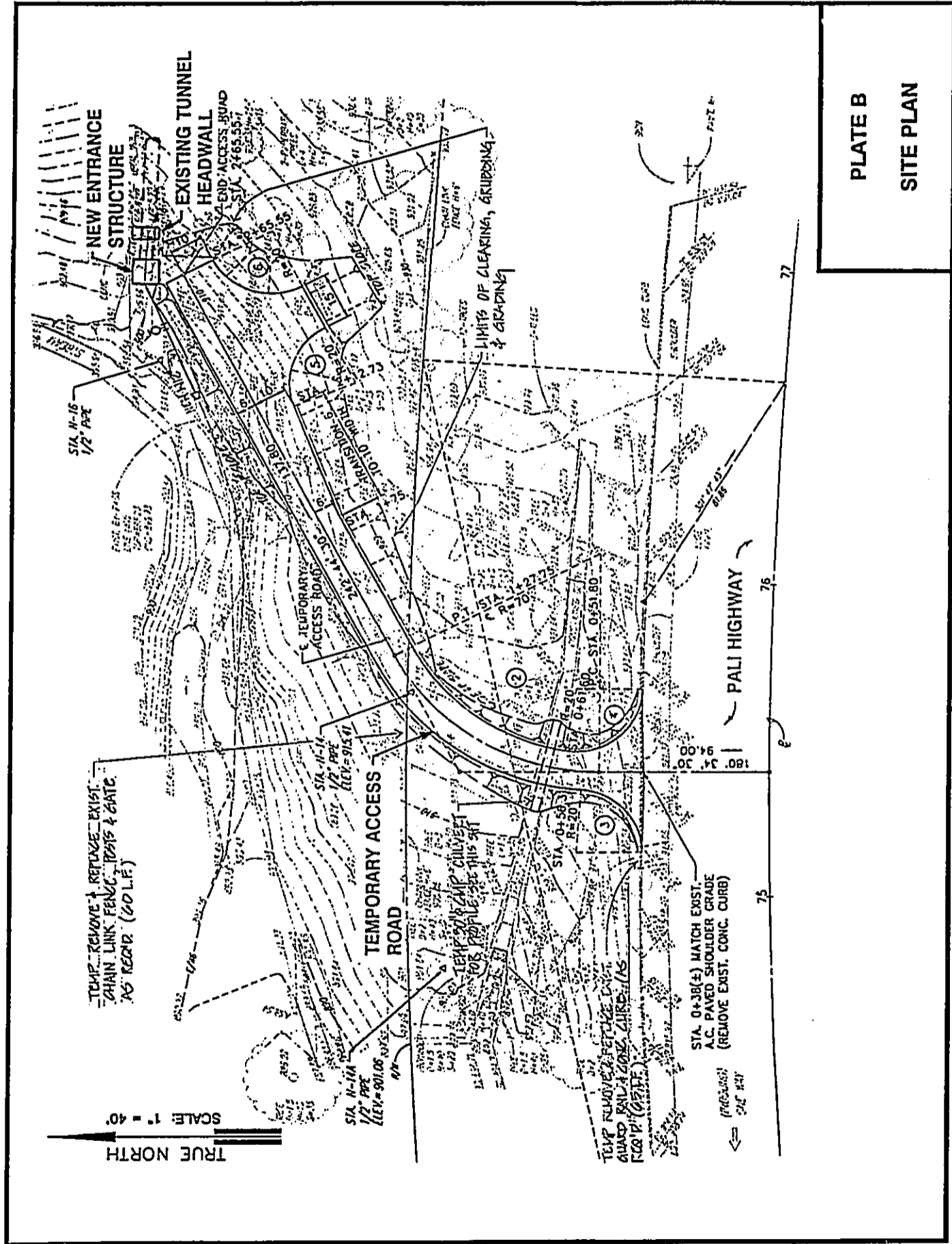
Renovation of the tunnel includes reconstruction of the entrance portal structure and the tunnel's lining within 80 feet of the tunnel entrance (see Plate C). The renewed tunnel lining will prevent future root intrusions, minimize maintenance requirements, and eliminate the hazards of tunnel cave-in. The new entry structure will also minimize the potential for contamination of the water supply by vandals and entry of storm runoff.

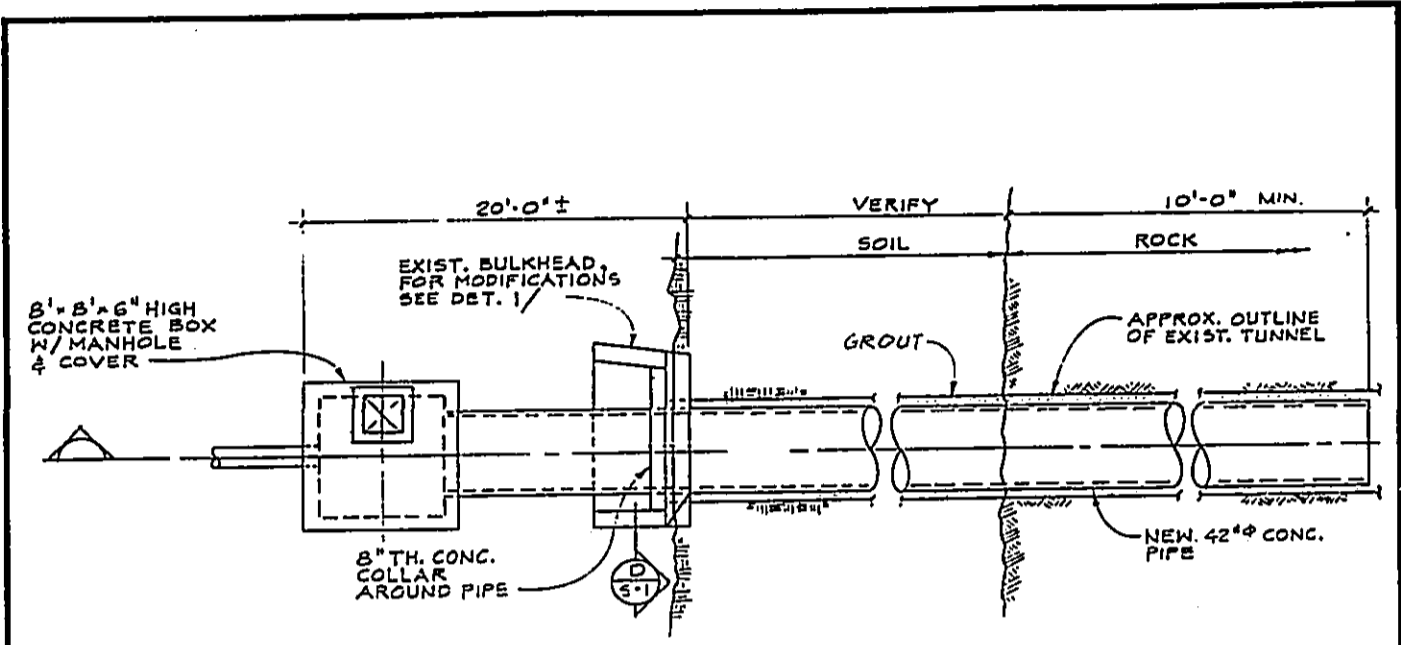
The construction period is estimated to be 12 months and is scheduled to be implemented during the 1993-94 fiscal year. The estimated project cost is \$286,000.

V. DESCRIPTION OF THE EXISTING ENVIRONMENT

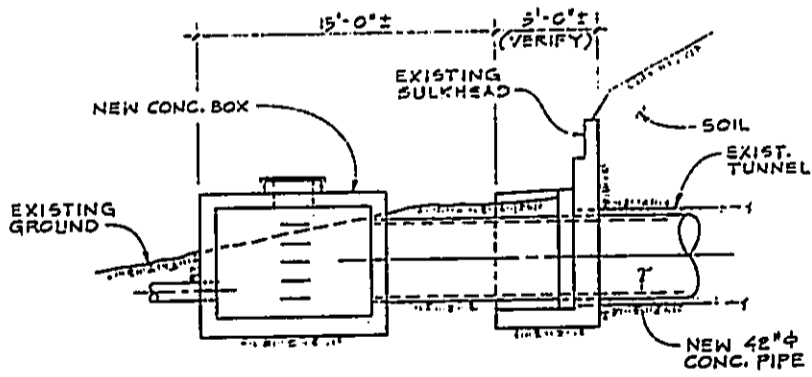
Existing Site and Land Use

The land on which the project site is located is owned by the State of Hawaii. The site is in a State designated Conservation District and is zoned P-1, Restricted Preservation District by the City and County of Honolulu. A Conservation District Use Application (CDUA) permit will be required for the project. The State of Hawaii Department of Land and Natural Resources, the agency administering the CDUA permit, is the approving agency responsible for making a negative declaration determination for this project.





PLAN
SCALE: 1" = 10'



SECTION
SCALE: 1" = 10'

PLATE C
TUNNEL REPAIR PLAN
AND SECTION

Topography and Soils

The project site is situated at approximately the 900 foot elevation and consists of moderate to steeply sloping terrain. A portion of the site is located within the Pali Highway right-of-way and contains highway associated features consisting of a metal guardrail, a concrete lined ditch, and a metal chain link fence. Makuku Stream is located to the north of the proposed access road.

Soil types for all lands in the state have been identified and mapped by the U.S. Department of Agriculture, Soil Conservation Service (SCS). The soil in the project area is classified as the Lolekaa Series (LoB). This soil series consists of a well-drained soil developed in old, gravelly colluvium and alluvium typically characterized by dark brown silty clay upper surface layer, dark yellowish-brown loam subsoil, and strongly weathered gravel subsoil.

Climate

The region's climate is equable throughout the year. The average temperature between the coolest and warmest month only differ by 6.5° F. January is the coldest month (averaging 72° F) and August is the warmest month (averaging 78° F).

The watersheds on the island of Oahu are recharged primarily from orographic rainfall that is most persistent between May and September. Kona storms and other tropical disturbances contribute to the yearly recharge. Annual rainfall at the site averages approximately 80 inches.

Water Resources

The Nuuanu Tunnel No. 3 is a water development tunnel designed to capture alluvial water. Alluvial water consists of water contained in deposits of stream origin and is derived from the infiltration of stream water and rainfall as well as leakage of high level groundwater into the alluvium. The Nuuanu Tunnel No. 3A presently yields approximately 0.5 million gallons per day. The tunnel is believed to have been constructed in the 1920's.

Flora and Fauna

Flora and fauna assessment surveys were conducted as part of this environmental assessment.

The botanical assessment survey (see Appendix A) concluded that there is little of botanical interest or concern on the project site. With the exception of the hau thicket, the vegetation on the site is largely dominated by introduced or alien species. All of the plants found on the site can be found in similar environments throughout the Hawaiian Islands.

The survey of avifauna and feral mammals (see Appendix B) found no unusual or unexpected species. No endemic birds were recorded. The survey indicated 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.

The Division of Forestry and Wildlife of DLNR indicated that the project site encroaches into an archery only hunting area and that the division should be notified prior to construction to enable them to warn the hunters of the work.

Archeology and Historical Sites

An archeological survey was conducted within the boundaries of the project site (see Appendix C). No archeological sites were observed during the survey. Piles of large boulders adjacent to the chain link fence indicate land alteration associated with the construction of Pali Highway. Evidence of agricultural features such as terraces for taro cultivation, which have been discovered in other areas of Nuuanu valley, were not observed within the project site.

VI. SUMMARY OF IMPACTS AND MITIGATION MEASURES

General

There are no significant long term impacts associated with the project. Environmental impacts are limited primarily to short-term disruptions associated with sitework activities involving the construction of the temporary access road and repair of the tunnel. Assessment of potential impacts were based on the results of archeological, botanical and wildlife surveys conducted by a team of qualified specialists.

Land Alteration and Aesthetics

Short-term impacts associated with land alteration and aesthetics will result from the access road sitework and tunnel repairs. Sitework will include clearing, grading, and stockpiling. Potential adverse impacts include generation of runoff and erosion, and visual/aesthetic deterioration. These impacts will cease upon completion of construction. Mitigative measures include enforcement of City and County of Honolulu grading ordinances and soil erosion standards and guidelines. Visual impacts will be minimal since the project site is far removed from urban developments. Existing vegetation and grade differences will screen the construction site from motorists travelling along the Pali Highway. The BWS will provide construction inspection and monitoring so that the Contractor performing the work adheres to all environmental regulations controlling construction activities.

Air Quality and Noise

Impacts such as noise and deterioration of air quality resulting from dust generation will be minimal due to the relatively isolated location of the site and the small scale of the proposed construction.

Traffic

Although construction vehicle access will be from Pali Highway, the project will not have significant impacts on highway traffic and safety due to the small scope of the

project. A temporary turnaround area will be provided to assure safety in ingressing and egressing the site. Sufficient space will also be available at the site for parking and overnight storage of vehicles and construction equipment.

Water Resources

The proposed project is not intended to increase the yield of the Nuuanu Tunnel No. 3A. The yield of the tunnel facility is expected to remain at approximately 0.5 million gallons per day. The flow from the Nuuanu No. 3A tunnel is limited by the size of the transmission line conveying water from the tunnel to its entry point into the municipal water distribution system. It is further limited by the rate at which the water infiltrates into the tunnel.

The proposed project will: 1) eliminate the expense and manpower associated with periodic removal of roots intruding into the tunnel from surrounding vegetation, 2) promote increased worker safety from hazards of tunnel cave-ins, if and when the tunnel must be entered for inspection and maintenance, and 3) minimize potential contamination of the water source and violations of the Safe Drinking Water Standards than could result from vandalism and entry of storm runoff.

Flora and Fauna

Based on a reconnaissance walk-through survey of the project site, no endangered flora or fauna were found at the project site (see Appendices A and B).

Archeology and Historical Sites

No significant archeological or historical sites were identified based on a reconnaissance walk-through survey (see Appendix C). The proposed access roadway construction will essentially alter a landscape already modified by the construction of the Pali Highway.

Utilities

The project will have the beneficial impact of allowing the continued use of a high level ground water source which is substantially more economical than obtaining basal water utilizing deepwell pumps.

Social-Economic

This project will benefit the residents of Honolulu by allowing the continued use of an economical high level groundwater source. The project will reduce maintenance costs, promote worker safety, minimize the potential for contamination of the water source, and ensure compliance with drinking water standards.

The capital cost of the project is estimated to be \$ 286,000. The project is being funded by the Honolulu BWS's Research and Facility Improvement Program (RFIP) funds.

V. ALTERNATIVES CONSIDERED

There were no alternatives that were identified as being more cost-effective and environmentally sound than the proposed alternative. A "no-action" alternative involving either abandonment of the Nuuanu Tunnel No. 3A water source or continuation costly and ineffective periodic maintenance of the tunnel was deemed substantially less cost-effective than the proposed action. Replacement of the Nuuanu No. 3A source of potable water with a new surface or groundwater source would be significantly more costly and potentially have greater environmental impacts than the proposed alternative.

VI. DETERMINATION

This assessment for the proposed Nuuanu No. 3A Tunnel shows that no significant impact on the environment will occur and an Environmental Impact statement is not required. Therefore, in accordance with the provisions of Chapter 343, Hawaii Revised Statutes, a Negative Declaration is deemed to be in order.

Appendix A
Botanical Survey

CHAR & ASSOCIATES

Botanical/Environmental Consultants

4471 Puu Panini Ave.
Honolulu, Hawaii 96816
(808) 734-7828

September 1992

BOTANICAL ASSESSMENT SURVEY HONOLULU BWS NU'UANU TUNNEL 3A REPAIRS HONOLULU DISTRICT, ISLAND OF O'AHU

INTRODUCTION

The proposed Honolulu Board of Water Supply (BWS) project involves the construction of a temporary access road and a construction equipment parking/turn around area. The proposed access road follows along an existing trail that services the tunnel site, for the most part. The proposed road will be approximately 200 ft. long; it will be accessed from the Pali Highway. Because the project site is located within the State Conservation District, a Conservation District Use Application (CDUA) permit is required.

Field studies to assess the botanical resources found along the alignment of the access road were conducted on 01 September 1992. The alignment was flagged and staked by the survey engineers prior to our field studies. The primary objectives of the survey were to 1) provide a general description of the vegetation, 2) search for threatened and endangered plant species protected by Federal and State laws, and 3) identify areas of potential environmental problems or concerns and propose mitigation measures.

The botanical assessment report will be incorporated into the document for the CDUA permit.

Appendix A
Botanical Survey

Environmental
Assessment

DESCRIPTION OF THE VEGETATION

The scientific names used in this report follow Lamoureux (1984) for the ferns and Wagner et al. (1990) for the flowering plants.

Where the proposed construction access road adjoins the Pali Highway, the vegetation is infrequently maintained. It consists of wedelia (Wedelia trilobata), a yellow-flowered ground cover species used widely in landscaping, and various weedy grasses and herbaceous plants such as beggar's tick (Bidens pilosa), pua-lele (Emilia fosbergii), and Vasey grass (Paspalum urvillei).

From the guardrail to where the alignment follows along the top break of an embankment to the tunnel site, the vegetation consists of a dense thicket of hau (Hibiscus tiliaceus) with scattered, emergent trees of Formosa koa (Acacia confusa), paperbark (Melaleuca quinquenervia), and fiddlewood (Citharexylum caudatum), from 35 to 40 ft. tall. Padang cassia (Cinnamomum burmannii) forms a subcanopy layer, up to 12 ft. tall, beneath the taller trees and hau. The ground is largely barren soil and leaf litter; a few patches of more shade-tolerant species such as basketgrass (Oplismenus hirtellus), shampoo ginger or 'awapuhi kuahiwi (Zingiber zerumbet), and lauwa'e fern (Phymatosorus scolopendria) can be found scattered here and there.

To the north of the alignment is a small stream and shallow swale where the vegetation is more open and consists of a dense tangle of maile pilau vine (Paederia scandens), moon flower (Ipomoea alba), and wood fern (Christella parasitica). A grove of kukui (Aleurites moluccana) and a few trees of octopus tree (Schefflera actinophylla), Chinese banyan (Ficus microcarpa), and Brisbane box (Lophostemon confertus) are found along the edge of the swale.

Along the small stream, plants which prefer a wetter habitat can be found. These include basketgrass, woodfern, palmgrass (Setaria palmifolia), Asiatic pennywort or pohekula (Centalla asiatica), Athyriopsis japonica, maiden-hair fern (Adiantum raddianum), pipili (Drymaria cordata), primrose willow or kamole (Ludwigia octovalvis), and pamakani (Ageratina riparia).

DISCUSSION AND RECOMMENDATIONS

With the exception of the hau thicket, the vegetation on the site is largely dominated by introduced or alien species. Introduced species are those plants which were brought to the islands by humans either deliberately or accidentally after Cook's discovery of the islands in 1778. Hau is thought to be an indigenous species, that is, it occurs naturally (native) in the islands and elsewhere through the Pacific. A list of all the native plants and plants thought to be of Polynesian introduction, which occur on the site, is presented in Table 1. None of the plants found during the field studies 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 1990).

There is little of botanical interest or concern on the site. All of the plants found on the site can be found in similar environments throughout the Hawaiian Islands. Given the findings above, and, the limited nature of the project, clearing of the vegetation for the temporary construction road and parking/turn around area is not expected to have a significant negative impact on the botanical resources. There are no botanical reasons to impose any restrictions or conditions to the project.

TABLE 1. Native plants and plants of early Polynesian introduction found on the BWS Nu'uauu tunnel 3A repairs project site.

Scientific name	Common name	*Status
<i>Aleurites moluccana</i> (L.) Willd.	kukui	P
<i>Cordyline fruticosa</i> (L.) A. Chev.	ki, ti	P
<i>Hibiscus tiliaceus</i> L.	hau	I?
<i>Ipomoea indica</i> (. Burm.) Merr.	koali	I
<i>Oxalis corniculata</i> L.	yellow wood sorrel, 'ihi 'ai	P?
<i>Zingiber zerumbet</i> (L.) Sm.	'awapuhi kuahiwi, shampoo ginger	P

* Status (from Wagner et al. 1990)

I = indigenous, native to the Hawaiian Islands and also elsewhere

I? = probably indigenous, but possibly naturalized

P = introduced by the Polynesians migrating to the Hawaiian Islands prior to Western contact (1778)

P? = probably a Polynesian introduction, but possibly introduced in historic times

LITERATURE CITED

Lamoureux, C. H. 1984. Checklist of the Hawaiian pteridophytes. Manuscript, University of Hawai'i, Manoa.

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_____. 1990. Endangered and threatened wildlife and plants; Review of plant taxa for listing as Endangered and Threatened Species; Notice of review. Federal Register 55(35): 6184-6229.

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Appendix B
Avifauna and Feral Mammals Survey

SURVEY OF THE AVIFAUNA AND FERAL MAMMALS AT
HONOLULU BWS NUUANU TUNNEL 3A, OAHU

Prepared for

Hawaii Pacific Engineers, Inc.

by

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INTRODUCTION

The purpose of this report is to summarize the findings of a one day (16 June 1992) bird and mammal field survey of lands around BWS Nuuanu Tunnel 3A, 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 features if any such resources occur on the property.

GENERAL SITE DESCRIPTION

Figure One indicates the limits of the property surveyed for birds and mammals. This site is covered in a mixture of introduced trees and brush. The ridges and ravines in this area provide a steep

topography. A small drainage ditch adjoins the BWS Pipeline. Pali Highway parallels the site.

Weather during the field survey was cloudy with brief passing showers. Winds were from the east at 10-15 mph.

STUDY METHODS

Field observations were made with binoculars and by listening for vocalizations. These observations were concentrated during the peak bird activity period of early morning. This was done in order to gain a more accurate estimate of bird populations. 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, 1989, 1992). Observations of feral mammals were limited to visual sightings and 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 on grasslands, agricultural fields and forests (Pratt et al. 1987). Pueo are listed as an endangered species on Oahu by State of Hawaii Division of Forestry and Wildlife. Common Amakihi (Hemignathus virens) and 'Elepaio (Chasiempis sandwichensis) are two other endemic species which could potentially be found on or near this property.

Resident Endemic (Native) Waterbirds:

The drainage ditch is too small and overgrown with vegetation to be used by waterbirds. No waterbirds were recorded on the survey.

Migratory Indigenous (Native) Birds:

Migratory shorebirds winter in Hawaii between the months of August through May. Some juveniles will stay through the summer months as well (Johnson and Johnson 1983). Of all the shorebird

species which occur in Hawaii the Pacific Golden Plover (Pluvialis fulva) is the most abundant. Plover prefer open areas such as exposed intertidal reef, rocky shorelines, mud flats, lawns, plowed fields, pastures, upland grasslands and roadsides. They arrive in Hawaii in early August and depart to their arctic breeding grounds during the last week of April (Johnson et al. 1981). Plover are extremely site-faithful on the wintering grounds and most establish foraging territories which they defend vigorously. Such behavior makes it possible to acquire a fairly good estimate of the abundance of plover in any one area. These populations likewise remain relatively stable over many years (Johnson et al. 1989). No plover were found on this survey for two obvious reasons: 1- time of year and 2- presently unsuitable habitat (too over grown). Depending on the extent of area cleared for the BWS tunnel access road plover may utilize this site as long as it remains clear of dense vegetation.

Resident Indigenous (Native) Birds:

No resident indigenous species were recorded nor would any be expected at this location. It is unlikely the Black-crowned Night Heron (Nycticorax nycticorax) would utilize the ditch due to the overburden of vegetation.

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 six 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, 1989, 1992) the following species may also occur at this site: Barn Owl (Tyto alba), Spotted Dove (Streptopelia chinensis), Zebra Dove (Geopelia striata), Hwamei (Garrulax canorus) and Japanese Bushwarbler (Cettia diphone).

Feral Mammals:

Scats of the Small Indian Mongoose (Herpestes auropunctatus) were found along with tracks of feral cats. 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 understanding 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 and is active at dusk.

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- Migratory birds such as Pacific Golden Plover do not occur on the site but may utilize the area once it is opened up. The extent of their use will be dependent on the size of open space created by development and how long this spot remains free of dense brush.

- 4- The property supports a typical array of exotic birds one would expect at this locality on Oahu. No unusual or unexpected species were found. Some species that usually can be found 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 or presently no localized populations of these species.

- 5- A trapping program would be required in order to obtain more definitive data on mammals. The brief observations of this survey did not reveal any unusual observations of mammals. It is likely that the number of rats, cats, mice and mongoose are typical of similar habitats elsewhere. The endangered Hawaiian Hoary Bat was not recorded at this site but it is known from Oahu.

- 6- 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.

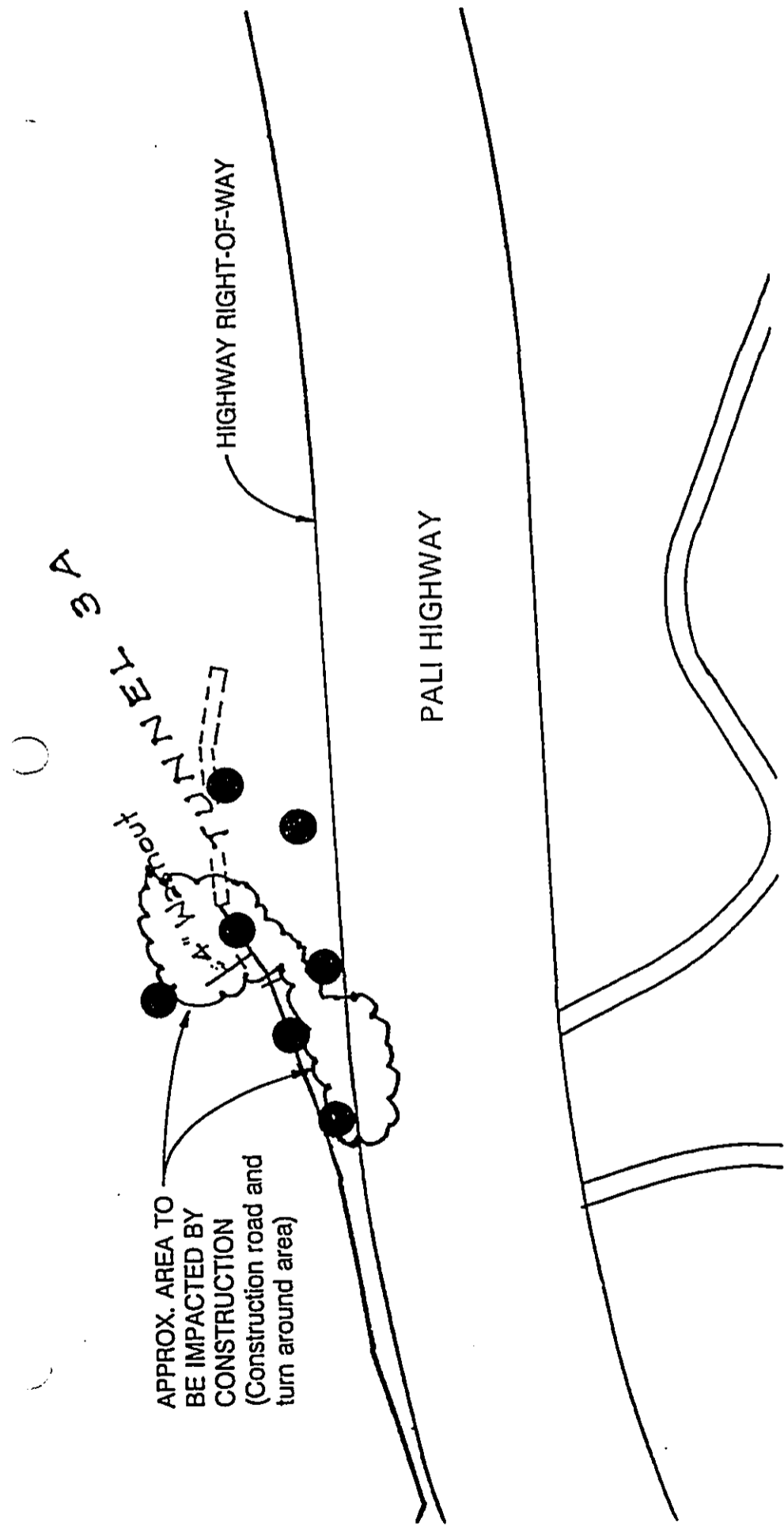


Fig. 1. Location of faunal survey with census (faunal count) stations marked by solid circles.

TABLE 1

Exotic (introduced) birds recorded at BWS Nuuanu Tunnel 3A, Oahu.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*
Red-vented Bulbul	<u>Pycnonotus cafer</u>	C= 8
Red-whiskered Bulbul	<u>Pycnonotus jocosus</u>	A= 12
White-rumped Shama	<u>Copsychus malabaricus</u>	C= 6
Northern Cardinal	<u>Cardinalis cardinalis</u>	U= 4
Japanese White-eye	<u>Zosterops japonicus</u>	A= 10
House Finch	<u>Carpodacus mexicanus</u>	C= 8

KEY TO TABLE 1

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

A= abundant (10+)

C= common (5-10)

U= uncommon (less than 5)

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Appendix C
Archeological Survey

**Archaeological Survey
for the Proposed Nu'uanu Tunnel 3A Repair
Project Area (TMK 1-9-07:por)**

by

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Cultural Surveys Hawaii
August 1992

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I. Introduction

A. Project Background

Cultural Surveys Hawaii conducted, at the request of Hawaii Pacific Engineering, Inc., an archaeological survey for the proposed Nu'uaniu Tunnel 3A repair project area. The repairs will be to an existing water tunnel under the control of the Board of Water Supply. The project area encompasses approximately one acre of land adjacent to the Pali Highway (Fig. 1). The repairs to the tunnel will necessitate construction of an access road to the tunnel. The road will allow vehicular access, off Pali Highway, to the tunnel itself, which is presently accessible only by a foot trail.

B. Scope of Work and Methods

The basic scope of work includes:

1. Surface survey of an approximately one acre parcel;
2. Review of historic research including maps, Land Commission Awards (LCAs);
3. Preparation of a report on findings.

The survey was accomplished on August 11, by a single archaeologist. The project area was well marked with colored flagging tape by surveyors. The survey progressed northward from the Pali Highway road shoulder following along the proposed 12 foot wide access road. Ground visibility was good as the vegetation was mostly a canopy with forest litter as ground cover.

Review of historic and archaeological sources was cursory because of the absence of archaeological sites and the overall small scale of the project. However, the background research did include procurement of historic maps, perusal of land records, and review of

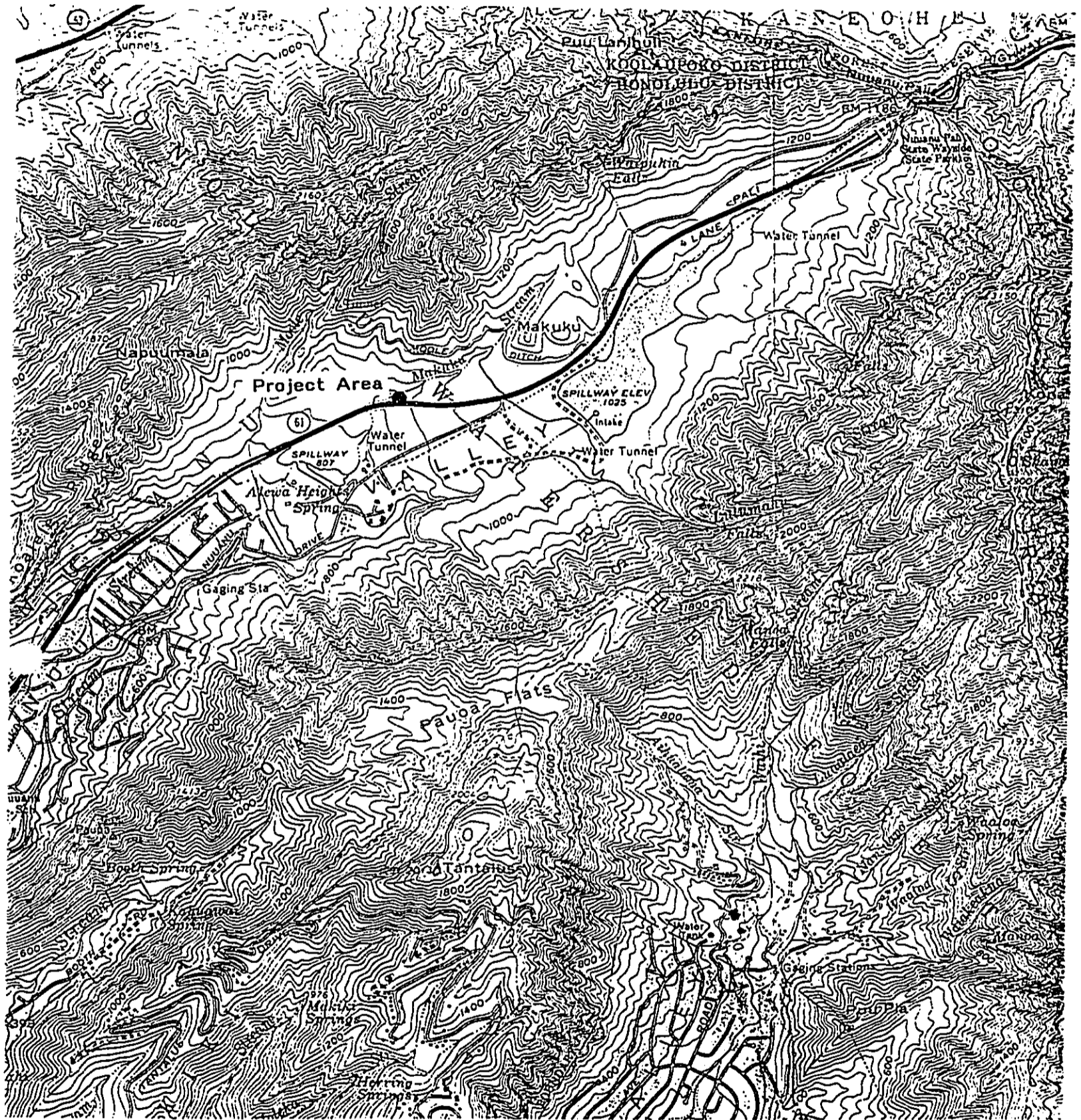


Figure 1 USGS Honolulu Quad Showing Project Location

archaeological literature concerning the *'ili* (land unit) of Luakaha in which the project area lies.

Dr. Tom Dye, of the State Historic Sites Division of the Department of Land and Natural Resources was consulted (8/13/92 personal communication) on the report requirements specific to this project. Based on this conversation report preparation is in the form of a letter report, which differs from a more comprehensive inventory survey report in that there is no in-depth discussion on previous research and settlement patterns as they pertain to Nu'uuanu Valley as a whole.

II. Project Area Description

The project area is situated at the 900 foot elevation on the northern side of the Pali Highway. It consists of moderate to steeply sloping terrain. The project area presently contains Highway associated features (see Fig. 2) consisting of a metal guardrail, a concrete lined drainage ditch, and a metal chain link fence. Additionally, the chain link fence has a pedestrian gate which allows access to the existing Tunnel 3A.

III. Historic Background

As mentioned previously, the project area is within the *'ili* of Luakaha. Luakaha is a large *'ili* (approximately 2,200 acres, Lyons 1874) which encompasses virtually the entire back of Nu'uuanu Valley.

During the mid 1800s, at the time of the Mahele, Luakaha was retained by Kamehameha III as Crown Land. Kamehameha III also built (ca 1845), and maintained a "Summer Palace," Kaniakapupu, in the *'ili* of Luakaha, the remains of which are still standing off of the Old Pali Road.

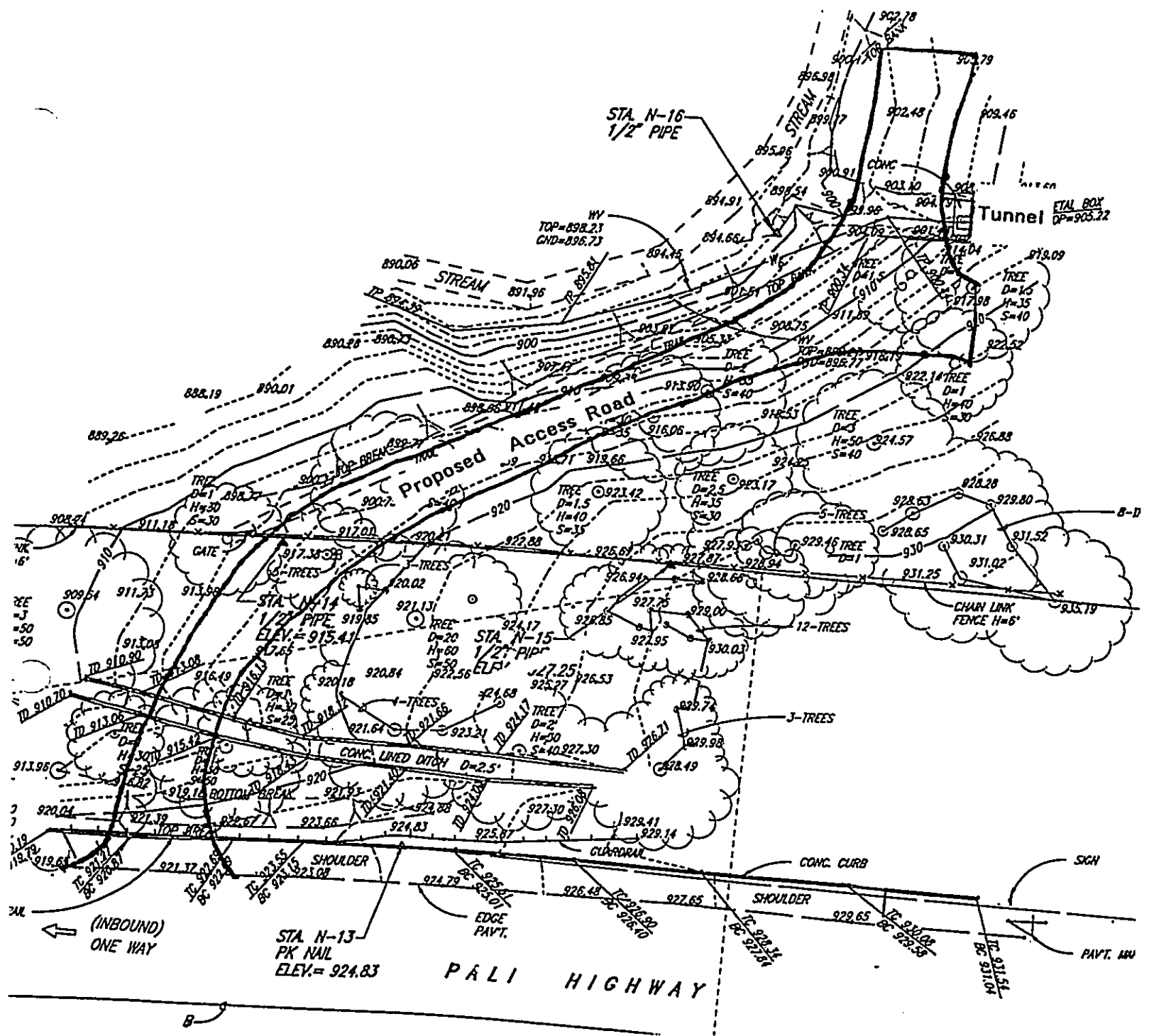


Figure 2 Contour Map of the Project Area Showing Highway Features, Proposed Access Road, and Tunnel 3A

Additionally, two Land Commission Awards (LCAs) were granted within Luakaha; LCA 5 to George Pelly and 8515 to Keoni Ana (Fig. 3) LCA 5 to George Pelly was for 16.5 acres and has been used continuously, since the mid 1800s, as a residential lot (Hammatt, 1988). Keoni Ana's award, of 81 acres, in Luakaha was one of many parcels of land, or *apana* granted under Award 8575. Keoni Ana was a son of Kamehameha I's most influential foreign advisors, John Young. Keoni Ana also became very influential in the Hawaiian Government and was "*Kuhina-nui* (premier) from 1845 until 1854, and a member of the Privy Council" (Kelly, 1983:24). The use of the 81 acre parcel, which is situated up the valley from the project area remains uninvestigated at this time. The location, size, and configuration of the award (See Fig. 5) is unusual in that it encompasses some very steep terrain, suggesting forest resource procurement, possibly for commercial purposes.

By the early 1900s the water resources of upper Nu'uanu (i.e. Luakaha) were being collected to service Honolulu's urbanization. Large reservoirs were built in the center of the valley with ditches diverting stream flows to them. Nu'uanu Reservoirs 2, 3, and 4 are shown on the 1920 Island of O'ahu Fire control Map (Fig. 4). Tunnel 3A, which is to be repaired, was built during the 1920s (Board of Water Supply, personal communication 8/13/92).

In the 1950s and 60s Pali Highway was being constructed. Grading for the highway and associated improvements (i.e., cement ditch, chain link fence) have directly impacted the majority of the project area, altering the pre-existing landscape.

IV. Survey Results

No archaeological sites were observed during the survey. Piles of large boulders adjacent to the chain link fence are evidence of the amount of land alteration associated with Pali Highway construction.

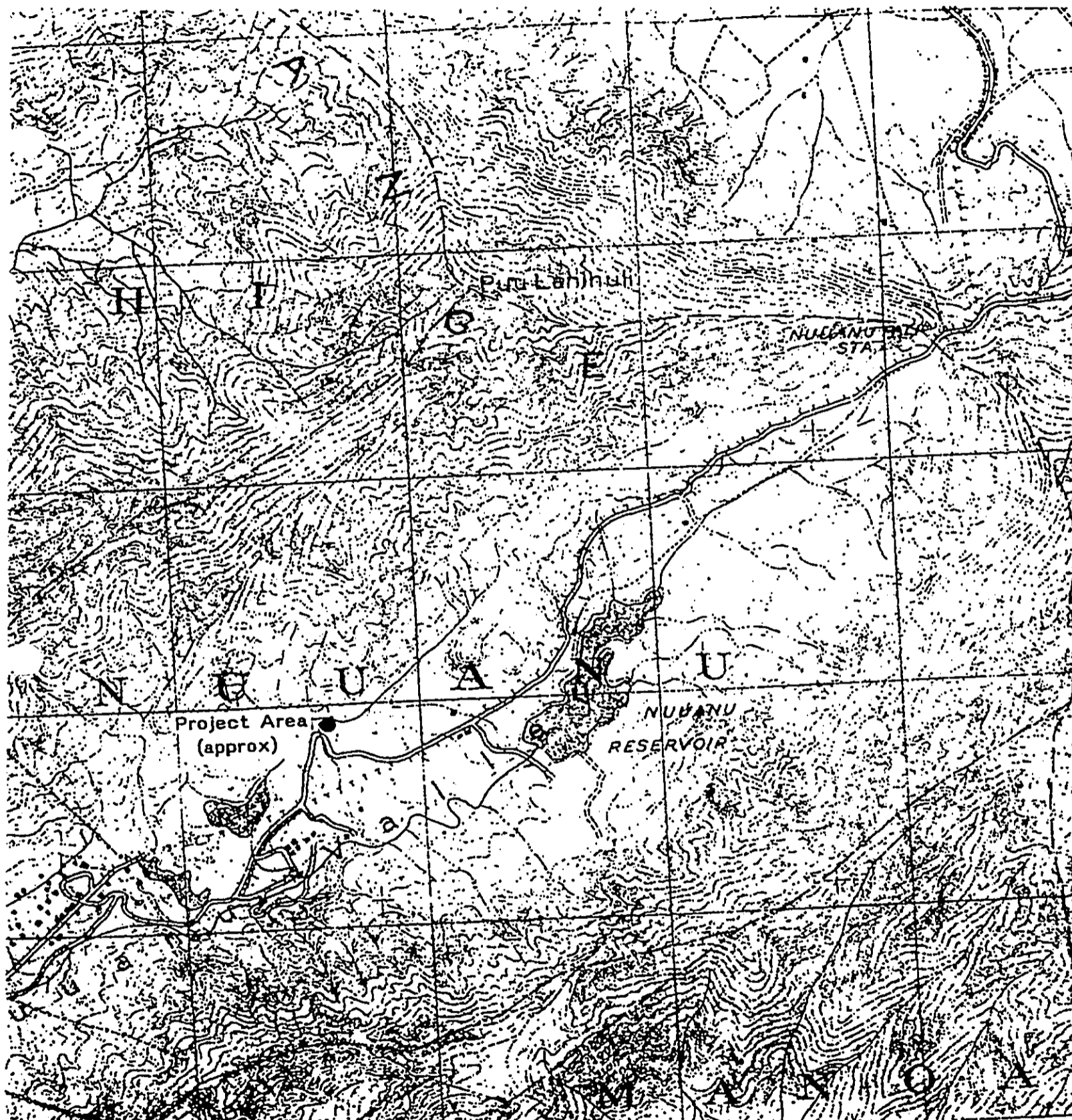


Figure 4 Portion of 1920 O'ahu Island Fire Control Map

V. Summary

Perusal of historic and archaeological sources indicated that no known historic sites were to be found specific to the project area. However, Luakaha did contain some very important sites (e.g., Kaniakapupu), which were, and still are, adjacent to what we now call Old Pali Road. Research suggested that agricultural features, such as terracing for taro, were associated with tributaries and Nu'uuanu Valley.

In upper Nuuan there are many small valleys which open into the main valley on either side of its stream. Traces of ancient terraces have been discovered in several valleys on the steep slopes above the stream beds, below the falls and on small flat areas along the sides of streams. Probably all these small valleys were used for planting taro in ancient times; Luakaha (Stream) doubtless had many inland gardens; but there were not wet terraces that far up (Handy 1940, 78-79).

Evidence of agricultural features were looked for during the survey but none were observed.

Board of Water Supply information indicates that Tunnel 3A itself can be viewed as an historic site, i.e., older than 50 years. However, maintenance and repair work is based on prolonging the active use of the tunnel and not its destruction. Based on the absence of archaeological sites, no further archaeological research specific to access road construction is deemed necessary. Basically, the proposed roadway construction will alter a landscape already modified by Pali Highway construction.

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