BOARD OF WATER SUPPLY

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

June 6, 2013

Office of Environmental Quality Control
Department of Health
State of Hawaii
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

To Whom It May Concern:

Subject: Final Environmental Assessment and Finding of No Significant Impact for Proposed Nuuanu Reservoir No. 4 Repair Project, Nuuanu, Kona District, Honolulu, Oahu, Hawaii, Tax Map Key (1) 2-2-054:001 (portion)

We hereby transmit the Final Environmental Assessment and Finding of No Significant Impact (FEA-FONSI) for the above subject project for publication in the next available edition of the Office of Environmental Quality Control's (OEQC) Environmental Notice.

Included in the FEA-FONSI are copies of comments that were received during the 30-day public comment period for the Draft Environmental Assessment and Anticipated Finding of No Significant Impact and copies of the responses to these comments.

Enclosed are the completed OEQC Publication Form, one (1) electronic copy of the publication form in Microsoft Word, two (2) hard copies of the FEA-FONSI and one (1) Adobe Acrobat PDF version of the FEA-FONSI. Simultaneously with this letter, we have submitted the Summary of the Action in a text file by electronic mail to your office.

If you have any questions, please contact Michael Matsuo at 748-5951 or Chester Koga of project consultant R.M. Towill Corporation at 842-1133.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

Enclosures

AGENCY ACTIONS
SECTION 343-5(B), HRS
PUBLICATION FORM (JULY 2012 REVISION)

Project Name: Nu‘uanu Reservoir No. 4 Repair Project
Island: O‘ahu
District: Honolulu
TMK: (1) 2-2-54: 001 (portion)
Permits: CWB-Individual NPDES Form C and SSCBMP
Proposing/Determination Agency:
(*Address, Contact Person, Telephone*)

Board of Water Supply, City and County of Honolulu
630 South Beretania Street
Honolulu, Hawai‘i 96843
Michael Matsuo, P.E.
Tel. (808) 748-5951 mmatsuo@hbws.org

Consultant:
(*Address, Contact Person, Telephone*)

R.M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawai‘i 96819-3494
Chester Koga, AICP
Tel. (808) 842-1133 chesterk@rmtowill.com

Status (check one only):

_DEA-AFNSI	Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of DEA, a completed OEQC publication form, along with an electronic word processing summary and a PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov); a 30-day comment period ensues upon publication in the periodic bulletin.
_X_ FEA-FONSI	Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and a PDF copy (send both summary and PDF to oeqchawaii@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.
__FEA-EISPN	Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov); a 30-day consultation period ensues upon publication in the periodic bulletin.
__Act 172-12 EISPN	Submit the proposing agency notice of determination on agency letterhead, an OEQC publication form, and an electronic word processing summary (you may send the summary to oeqchawaii@doh.hawaii.gov). NO environmental assessment is required and a 30-day consultation period upon publication in the periodic bulletin.
__DEIS	The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the DEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the DEIS (you may send both the summary and PDF to oeqchawaii@doh.hawaii.gov); a 45-day comment period ensues upon publication in the periodic bulletin.
__FEIS	The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the FEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the FEIS (you may send both the summary and PDF to oeqchawaii@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.
__ Section 11-200-23 Determination	The accepting authority simultaneously transmits its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS to both OEQC and the proposing agency. No comment period ensues upon publication in the periodic bulletin.

__Section 11-200-27 Determination

The accepting authority simultaneously transmits its notice to both the proposing agency and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is not required. No EA is required and no comment period ensues upon publication in the periodic bulletin.

__Withdrawal (explain)

Summary (Provide proposed action and purpose/need in less than 200 words. Please keep the summary brief and on this one page)**:**

The purpose of the project is to undertake priority maintenance and repair work identified in the most recent DLNR Dam Safety Program inspection report, dated January 13, 2010, and a Phase 1 Investigation Report previously commissioned by DLNR for the Nu‘uanu Reservoir No. 4. The repair work is required in order maintain the integrity and operational adequacy of the Nu‘uanu Reservoir No. 4 dam infrastructure for purposes of safety and control.

Repair work will include, but is not limited to: excavation of the reservoir near the intake tower to remove accumulated debris, repairing and rehabilitation of the intake tower structure and bridge, construction of downstream measuring weirs, improvements to the outlet receiving area, inspection and cleaning of the outlet tunnel structure, restoration of the downstream embankment, repairing and repaving the access road on top of the dam, and inspection and repairing of CRM riprap deficiencies on the dam slope.

Final Environmental Assessment

Nu‘uanu Reservoir No. 4 Repair Project

Nu‘uanu, Kona District, Honolulu, O‘ahu, Hawai‘i

June 2013

Prepared For:
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawai‘i 96843

Final Environmental Assessment

Nu‘uanu Reservoir No. 4 Repair Project

Nu‘uanu, Kona District, Honolulu, O‘ahu, Hawai‘i

June 2013

Prepared For:
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawai‘i 96843

Prepared by:

R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawai‘i 96819-3494

1-21734-00

PROJECT SUMMARY

Project:	Nu‘uanu Reservoir No. 4 Repair Project
Applicant:	Board of Water Supply (BWS) City and County of Honolulu
Accepting Agency:	BWS City and County of Honolulu
Agent:	R.M. Towill Corporation Chester Koga, AICP, Project Manager Email: ChesterK@rmtowill.com 2024 North King Street, Suite 200 Honolulu, Hawai‘i 96819 (808) 842-1133
Location:	Honolulu, Island of O‘ahu
Tax Map Key:	(1) 2-2-54: 001 (portion)
Proposed Action:	BWS plans to undertake various repairs to the Nu‘uanu Reservoir No. 4 Dam to meet safety requirements listed in the State of Hawai‘i Department of Land and Natural Resources Dam Safety Program inspection report (dated January 13, 2010) and the Gannett Fleming Phase 1 Investigation Report, August 2008 on the Nuuanu Reservoir No. 4. Planned repair work will be undertaken in two increments as follows: Increment 1: 1. Remove, stockpile, dewater, and dispose of accumulated sediments from the reservoir basin. 2. Repair and rehabilitate the existing reservoir intake tower structure, including repairs to the lower level sluice gate, debris cages (trash racks) over the three sluice gates, exterior ladder structure, and operational controls located within the tower. 3. Replace shattered window panes in the intake tower. 4. Inspect and repair cables supporting the gangway leading to the intake tower. Inspect and repair the handrails along the gangway flanks. 5. Recalibrate and repaint water level markings on the existing intake tower. 6. Construct measuring weirs at existing seepage points on the downstream slope and outlet structure of the reservoir dam. 7. Improve the outlet receiving area. Replace the existing outlet pipe and extend the 24-inch drain pipe to a total length of approximately 188 LF. Construct a hydro-geo stilling basin to the north of the outlet pipe. 8. Inspect and clean the existing outlet tunnel structure. 9. Remove the temporary access road located on the downstream face of the dam embankment and restore the embankment slope to a uniform condition. 10. Repair and repave the existing reservoir access road on the top of the dam. 11. Inspect the downstream dam slope and repair CRM riprap deficiencies and depressions on the upstream face of the reservoir dam.

Proposed Action (Continued):	12. Lower the "normal pool" to the invert of the lowest sluice gate at 974.75' above MSL Increment 2: 1. Conduct geotechnical investigative borings. 2. Install new measuring devices, including piezometers, analyze and monitor dam stability as required based on geotechnical investigation. 3. Create a subdivision map for Nu'uanu Reservoir No. 4.
Land Area:	4.9 Acres
Present Use:	Primary use of Nu'uanu Reservoir No. 4 is for flood control. Surrounding area is undeveloped conservation land. Pali Highway, State Route 61 is aligned along the west side of the reservoir.
State Land Use District:	Conservation
PUC Development Plan Land Use Designation:	Preservation
County Zoning District:	P-1 Preservation
Special Management Area:	No
FEMA/FIRM Designation	Zone D - Unstudied areas where flood hazards are undetermined, but possible.
Permits Required:	*Clearances and permits needed from the various Federal, State and City and County of Honolulu agencies include but are not limited to the following.* <u>Federal</u> U.S. Army Corps of Engineers - Department of the Army Permit (CWA Section 404) <u>State of Hawai'i</u> Department of Health (DOH) - CWA Section 401 - CWA Section 402, National Pollutant Discharge Elimination System (NPDES) permits (construction storm water discharges) Department of Land and Natural Resources (DLNR) - Coastal Zone Management Consistency Determination <u>City and County of Honolulu (CCH)</u> Department of Planning and Permitting (DPP) - Construction plan review and approval - Grading and erosion control plan review - Building Permit - Grading, Grubbing, and Stockpiling Permit - Subdivision Application and Permit Honolulu Board of Water Supply (BWS) - "No effect" determination from State Historic Preservation Division Office of Planning - Plan review and approval

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ACRONYMS

ACOE	Army Corps of Engineers
ADA	Americans with Disabilities Act
AIS	Archaeological Inventory Survey
BMPs	Best Management Practices
BWS	Board of Water Supply, City and County of Honolulu
CCH	City and County of Honolulu
CDUP	Conservation District Use Permit
CFS	Cubic Feet per Second
CIA	Cultural Impact Assessment
CRM	Cement Rubble Masonry
CSH	Cultural Surveys Hawai‘i, Inc.
CWA	Clean Water Act of 1972, as amended
CWB	Clean Water Branch (DOH), State of Hawai‘i
CWRM	Commission on Water Resources Management, (DLNR), State of Hawai‘i
CZM	Coastal Zone Management
CZMP	Coastal Zone Management Program, State Office of Planning
DAR	Division of Aquatic Resources (DLNR)
DLNR	Department of Land and Natural Resources, State of Hawai‘i
DO	Dissolved Oxygen
DOH	Department of Health, State of Hawai‘i
DOT-H	Department of Transportation, Highways Division, State of Hawai‘i
DPP	Department of Planning and Permitting
EA	Environmental Assessment (343 HRS)

EIS	Environmental Impact Statement (343 HRS)
ESA	Environmental Site Assessment
FEMA/FIRM	Federal Emergency Management Agency, Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
GP	General Plan
HAR	Hawai‘i Administrative Rules
HECO	Hawaiian Electric Company
HEER	Hazard Evaluation and Emergency Response, State DOH
HRS	Hawai‘i Revised Statutes
LF	Linear Feet
LUO	Land Use Ordinance (Chapter 21, ROH)
LUC	Land Use Commission
MBTA	Migratory Bird Treaty Act of 1918
MS4	Municipal Separate Storm Sewer System
MSL	Mean Sea Level (elevation in relation to)
NOI	Notice of Intent, NPDES Permit
NPDES	National Pollutant Discharge Elimination System Permit
OCCL	Office of Conservation and Coastal Land
PUC	Primary Urban Center
PUC DP	Primary Urban Center Development Plan
PMF	Probable Maximum Flood
ROH	Revised Ordinances of Honolulu
ROW	Right-of-Way
SCP	Sustainable Community Plan
SDOT-H	Department of Transportation, Highways Division, State of Hawai‘i
SHPD	State Historic Preservation Division
SHPO	State Historic Preservation Officer
SIHP	State Inventory of Historic Places
SLUD	State Land Use District
SMA	Special Management Area (CCH Jurisdiction)
TMK	Tax Map Key
USDA	U. S. Department of Agriculture
USEPA	U. S. Environmental Protection Agency
USFWS	U. S. Fish and Wildlife Service

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SECTION 1
Introduction

1.1 PROJECT OVERVIEW

The Honolulu BWS is undertaking repair work to the Nu‘uanu Reservoir No. 4. The reservoir is located in Nu‘uanu Valley adjacent to the Pali Highway, State Route 61, approximately 4 miles northeast of downtown Honolulu. The reservoir is located on land owned by the State of Hawai‘i and identified by TMK (1) 2-2-54: 001 (portion). Reservoir infrastructure, including the dam and appurtenances, is owned and operated by the BWS. See **Figure 1 – Project Location Map**.

The primary function of the reservoir is to provide flood control for Nu‘uanu Valley and part of downtown Honolulu that lies within the Nu‘uanu Stream corridor. Discharges from the reservoir flow into Nu‘uanu Stream and through downtown Honolulu before entering the Pacific Ocean at Honolulu Harbor.

The Nu‘uanu Reservoir No. 4 Dam consists of a 65-foot high earthen embankment dam with a 1,750-foot long crest. Appurtenances to the dam include an intake tower with three manually controlled sluice gates (to control water level) and footbridge access, outlet tunnel and drain pipe, spillway, monitoring wells, riprap facing, and access road. The top of the dam embankment is at elevation 1,038’ above MSL. The outlet receiving area at the downstream toe of the dam is at elevation 965’ above MSL. The reservoir “normal pool” elevation is 993.5’ above MSL. Under “normal pool” conditions, the reservoir has a water surface area of approximately ten acres, with storage capacity of 120 acre-feet.

Planned repair work is based on the DLNR Dam Safety Program inspection report, dated January 13, 2010 and the Gannett Fleming Phase 1 Investigation Report, dated August 2008 (DLNR, 2010a; Gannett Fleming, August 2008). Repair work is proposed to be undertaken in two increments, summarized as follows:

Increment 1:

1. Remove, stockpile, dewater, and dispose of accumulated sediments from the reservoir basin.
2. Repair and rehabilitate the existing reservoir intake tower structure, including repairs to the lower level sluice gate, debris cages (trash racks) over the three sluice gates, exterior ladder structure, and operational controls located within the tower.
3. Replace shattered window panes in the intake tower.
4. Inspect and repair cables supporting the gangway leading to the intake tower. Inspect and repair the handrails along the gangway flanks.
5. Recalibrate and repaint water level markings on the existing intake tower.
6. Construct measuring weirs at existing seepage points on the downstream slope and outlet structure of the reservoir dam.
7. Improve the outlet receiving area. Replace the existing outlet pipe and extend the 24-inch drain pipe to a total length of approximately 188 LF. Construct a hydro-geo stilling basin to the north of the outlet pipe.
8. Inspect and clean the existing outlet tunnel structure.

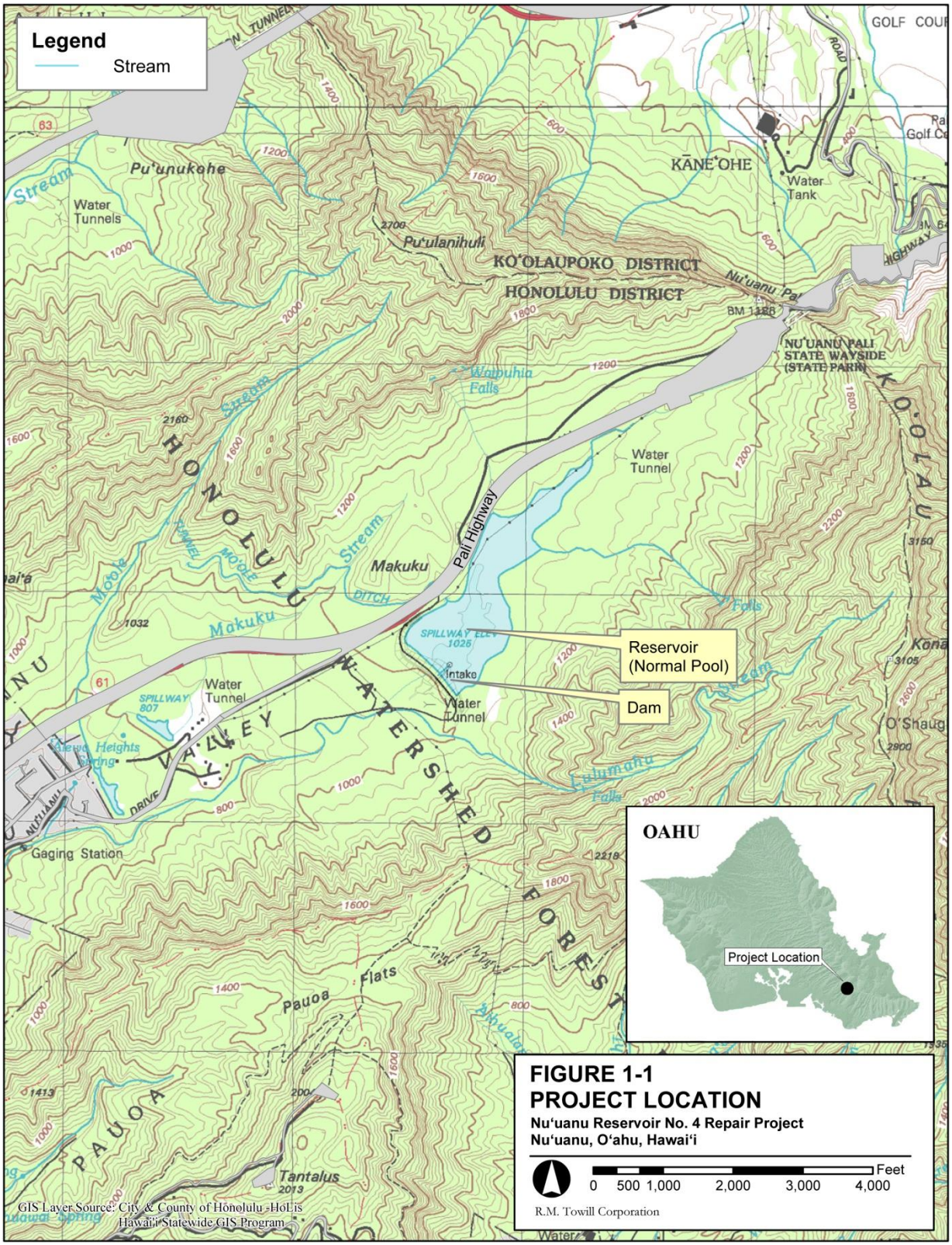

FIGURE 1-1
PROJECT LOCATION
Nu'uanu Reservoir No. 4 Repair Project
Nu'uanu, O'ahu, Hawai'i

Figure 1-1: Project Location Map of Nu‘uanu Reservoir No. 4

9. Remove the temporary access road located on the downstream face of the dam embankment and restore the embankment slope to a uniform condition.
10. Repair and repave the existing reservoir access road on the top of the dam.
11. Inspect the downstream dam slope and repair CRM riprap deficiencies and depressions on the upstream face of the reservoir dam.
12. Lower the “normal pool” to the invert of the lowest sluice gate at 974.75’ above MSL

Increment 2:

1. Conduct geotechnical investigative borings.
2. Install new measuring devices, including piezometers, analyze and monitor dam stability as required based on geotechnical investigation.
3. Create a subdivision map for Nu‘uanu Reservoir No. 4.

A more detailed description of planned improvements is included in **Section 2.2** of this document.

1.2 PROJECT PURPOSE AND NEED

The State DLNR is responsible for administering the Hawai‘i Dam Safety Program in accordance with HRS, Chapter 179D (The Hawai‘i Dam and Reservoir Safety Act of 2007), and HAR, Section 13-7-190. Under this program, the DLNR’s Engineering Division is authorized to inspect and assess the overall condition of reservoirs and dams, identify visible deficiencies, and recommend additional studies, monitoring, and corrective actions as necessary.

The purpose of the project is to undertake priority maintenance and repair work identified in the most recent DLNR Dam Safety Program inspection report, dated January 13, 2010, and a Phase 1 Investigation Report previously commissioned by DLNR for the Nu‘uanu Reservoir No. 4 (Gannett Fleming, August 2008). Recommendations in these reports are based on visual inspections conducted by the DLNR and BWS, engineering records, monitoring data collected by the BWS, and dam performance modeling conducted by the ACOE.

The repair work is required in order maintain the integrity and operational adequacy of the Nu‘uanu Reservoir No. 4 dam infrastructure for purposes of safety and control. Existing conditions that will be addressed by the proposed work include the following:

- Sediment build-up in the reservoir has buried the lowest sluice gate of the intake tower (elevation 974.75’ above MSL), thereby preventing its operation and limiting control of the reservoir water levels to the two functioning sluice gates at elevations 993.50 and 1011.25’ above MSL. Restoring the intake tower to full function will allow the reservoir to be maintained at the lowest design level and thus increase available capacity for flood control.
- Intake tower fixtures, including the sluice gates, trash racks, and calibration markings, are corroding and in disrepair.
- Windows in the intake towers need replacing. Several of the glass panes are shattered allowing strong winds and rain to come in and possibly harm the measurement and recording equipment.

- Cables supporting the gangway are in poor condition showing various degrees of corrosion. In some cases, sections of cables and bolts appear to be rusted through.
- At the north end of the handrail along the east flank of the gangway the handrail has completely separated from its connection to the tower, apparently due to corrosion. The handrail is "floating" and loose at this end.
- The access road on the dam crest is in disrepair with degraded pavement, potholes, and ruts.
- Plant overgrowth on the face and toe of the dam structure hinders access and obstructs visual inspection of the reservoir infrastructure and embankment surfaces.
- Riprap on the upstream face of the dam embankment shows minor degradation in spot locations.
- The downstream face of the dam embankment is cut with a temporary maintenance access road and requires restoration to original design grades.
- There is no vehicular access to the toe of the dam to facilitate inspections and early detection of changed conditions.
- There is no permanent instrumentation to monitor conditions at surface seepage flow areas on the downstream face of the dam embankment.

1.3 BASIS FOR THE ENVIRONMENAL ASSESSMENT

In accordance with Chapter 343, HRS, Section 5, this project involves the following actions that require the preparation of an EA:

> *(1) Propose the use of state or county lands or the use of state or county funds;*
>
> *(2) Propose any use within any land classified as a conservation district by the state land use commission under chapter 205;*

Pursuant to the requirements of Chapter 343, HRS, and Chapter 11-200, HAR, the proposing agency, BWS, has determined that the proposed project is not expected to have significant environmental effects. Based on analysis and review of environmental conditions, project effects, and proposed mitigation measures, it is anticipated that a FONSI will be issued for this project.

A Draft EA was published for public review in the March 23, 2013 issue of the State Department of Health, Office of Environmental Quality and Control, Environmental Notice. Comments were received during the public comment period and are included along with the responses in **Appendix H**.

The Final EA provides additional information based on the comments received that further describes the proposed project, the environmental conditions of the site, the potential for significant adverse impacts, and the application of mitigation measures, as appropriate, to reduce the potential for significant environmental impacts. This Final EA and accompanying Finding of No Significant Impact (FONSI) will be filed with the Office of Environmental Quality Control.

1.4 PROPOSING AGENCY AND ACCEPTING AUTHORITY

Despite how the project is occurring on state land, the repair work will be performed on BWS owned and operated infrastructure using county funds provided through BWS. The proposing agency for this EA is the BWS. The accepting authority is the BWS.

SECTION 2
Project Description and Alternatives Considered

2.1 BACKGROUND INFORMATION

2.1.1 PROJECT LOCATION

Nu‘uanu Reservoir No. 4 is located in the Ko‘olau Mountain range approximately 4 miles northeast of downtown Honolulu, Hawai‘i, on the island of O‘ahu, adjacent to the Pali Highway, State Route 61. The project is in the Honolulu ahupua‘a within the moku (district) of Kona. Both the Kona moku and Honolulu ahupua‘a begin at the ridgeline of the Ko‘olau Mountains, extend to the south encompassing the downtown area, and five miles out into the ocean. The moku of Kona is the southern moku on O’ahu bounded by the Kuli‘ou‘ou Ridge to the east, which delineates the boundary with the Waimānalo ahupua‘a, and the Moanalua ahupua‘a to the west, the boundary of the moku of ‘Ewa. The Honolulu ahupua‘a is the central ahupua‘a within the moku of Kona bordered by the ahupua‘a of Waikīkī to the east, Kalihi to the northwest, and Kapālama to the west.

Access to the reservoir dam is via a gated service road with driveway connection to the windward-bound lanes of the Pali Highway, located approximately 0.5 miles north-east of the highway’s intersection with the Old Pali Road (Nu‘uanu Pali Drive). Approximate coordinates of the dam are 21.35 degrees latitude and 157.81 degrees longitude.

2.1.2 OWNER INFORMATION

Nu‘uanu Reservoir No. 4 is located on land owned by the State of Hawai‘i and managed by the DLNR. The property is identified by TMK (1) 2-2-54: 001 (portion). Reservoir infrastructure, including the dam and appurtenances, is owned and operated by the BWS.

2.1.3 RESERVOIR HISTORY

The Nu‘uanu Reservoir No. 4 was originally constructed between 1905 and 1910 with the purpose to provide water supply, hydroelectric power, and flood control for the city of Honolulu. It was the largest and the last of four reservoirs constructed as part of the Nu‘uanu Valley water collection storage system. Before the dam was constructed, the Nu‘uanu Stream was used by the original Hawaiian occupants as a main source of fresh water. As the island was later settled by westerners the demand for surface water increased, requiring the development of Nu‘uanu Stream as a potable water source.

In 1919 the surface water stored in the reservoir was no longer needed as the main source of water for the city of Honolulu. It was discovered shortly after construction of the dam that groundwater sources from artesian wells in the Honolulu District provided a safer supply of water. However, the reservoir continued to serve as the primary electric power source for the city. Power supply from the dam was provided through a 30-inch penstock, which connected to a powerhouse downstream at Open Reservoir No. 1. The hydroelectric plant generated enough power for the lights in the city to remain on from 6 P.M. to 5 A.M. as well as for operating sewage lift stations throughout the day. The system was operated until 1930.

In the 1930's, the BWS undertook major modifications to the dam embankment and related infrastructure to address seepage that had been observed at the site since the time of the original dam construction. Modifications included widening the dam crest by an additional 10 feet; construction of a continuous wall of interlocking sheetpiles at the heel of the dam; flattening the upstream slope from 3H:1V to 4H:1V (horizontal:vertical); installation of riprap facing on the upstream slope to provide erosion protection; and construction of a new intake tower and discharge outlet to replace the original tower and outlet. Reconstruction and modification of the dam began on June 16, 1933 and was completed on February 1, 1934. These modifications created the dam infrastructure and appurtenances as they exist today.

In the mid-1980's, ten piezometers for monitoring water levels and leakage were installed across the upstream and downstream face of the dam embankment. Weekly monitoring of dam conditions began at that time. Currently, the primary function of the existing reservoir is as a flood control structure for Nu'uanu Valley and part of downtown Honolulu that lies within the Nu'uanu Stream corridor.

2.1.4 RESERVOIR TECHNICAL DATA

Reservoir Inflow and Discharge	
Median Annual Precipitation	130 Inches
Inflow Source	Nu'uanu Stream and surface runoff from 1.40 square mile watershed drainage area.
Average Daily Inflow	6 CFS
Spillway Capacity	4,000 CFS
PMF	16,000 CFS
Elevations (feet above MSL)	
Top of Dam	1,038
Primary Spillway	1,024.5
Maximum Pool (water level)	1,033
Normal Pool (water level)	993.5
Streambed at Toe of Dam	965
Intake Tower Sluice Gate Inverts	
Bottom Gate	974.75 (design depth = 10.75 feet)
Middle Gate	993.50 (design depth = 28.5 feet)
Top Gate	1,011.25 (design depth = 46.25 feet)
Reservoir Storage	
Normal Pool	120 acre-feet approximately
Top of Dam	3,600 acre-feet approximately
Reservoir Surface Area	
Normal Pool	10 acres approximately
Top of Dam	110 acres approximately
Dam Features	
Length	1,750 feet
Height	65 feet
Crest Width	20 feet
Upstream Slope	4H:1V
Downstream Slope	
Upper 2/3	2H:1V

Lower 1/3	1H:1V
Intake Tower Size	78 feet high / 15 feet diameter
Drain Tunnel Size	5'-6" diameter
Drain Tunnel Type	Reinforced concrete
Drain Pipe Size	24" diameter
Drain Pipe Length	464 feet approximately
Drain Pipe Type	Ductile Iron Pipe

Source: Gannett Fleming, 2008; and ACOE, 2008

2.1.5 RESERVOIR FEATURES

Inflows

Inflows to Nu'uanu Reservoir No. 4 come from Nu'uanu Stream and surface runoff from the surrounding 1.4 square mile drainage area upstream of the dam. The contributing watershed area is approximately 1.4 miles in length, elliptical in shape, undeveloped, and heavily vegetated with natural forest growth. It is comprised of the valley bottom on the east side of the Pali Highway up to the Nu'uanu Pali overlook, and includes the steep, north-east valley walls up to an elevation of 3,150' above MSL. There are no diversions from other watersheds into this reservoir. **Figure 2-1** shows the watershed boundary for Nu'uanu Reservoir No. 4.

Daily inflows are reported by the ACOE to average approximately 6 CFS, except during and immediately following heavy precipitation (Gannet Fleming, 2008). Due to the size of the drainage area and overall consistent gradients, stream flow in the watershed increases uniformly in response to high-intensity precipitation. Peak flows into the reservoir occur approximately 4 hours after heavy rainfall. No metering devices are presently installed to measure inflows. See **Figure 2-2: Nu'uanu Reservoir No. 4 Area Map**, and **Figure 2-3: Nu'uanu Reservoir No. 4 Dam Features**.

Reservoir Basin

The Nu'uanu Reservoir No. 4 has a "normal pool" elevation of 993.5' above MSL and a maximum pool elevation of 1,033' above MSL with 5 feet of freeboard to the dam crest at elevation 1,038' above MSL. Under normal pool conditions, the reservoir has a water surface area of approximately 10 acres, with storage capacity of 120 acre-feet. Under maximum pool conditions, the reservoir has a water surface area of approximately 110 acres, with storage capacity of 3,600 acre-feet. Normal pool elevation is designed to maintain sufficient storage capacity for flood control under heavy rainfall storm events.

The reservoir design depth at the intake tower is approximately 28.5 feet under normal pool conditions, which corresponds with the middle sluice gate invert elevation of 993.5' above MSL (Drawing No. 707, BWS, 1932). Currently, approximately 17 feet of accumulated sediments are deposited in the reservoir at the intake tower. As a result, the existing condition water depth under normal pool conditions is approximately 11.5 feet at the tower. See **Figure 2-4**.

Dam Embankment

The Nu'uanu Reservoir No. 4 dam is a gravity earthfill embankment. The basic structure of the dam consists of a cutoff "diaphragm" constructed from concrete and timber, which essentially forms an

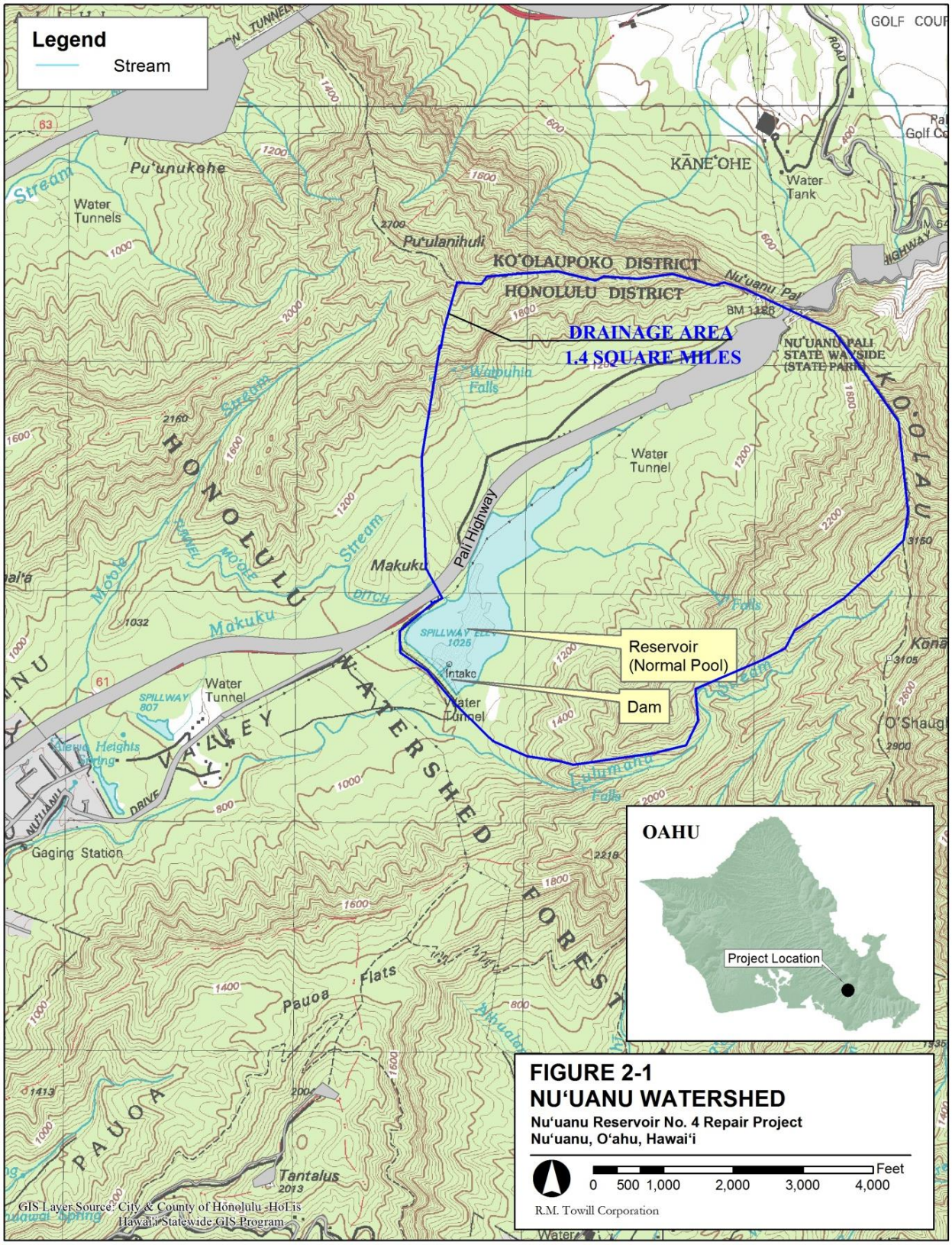

Figure 2-1: Map of Nu'uanu Watershed showing Nu'uanu Reservoir No. 4. (BWS, 2010)

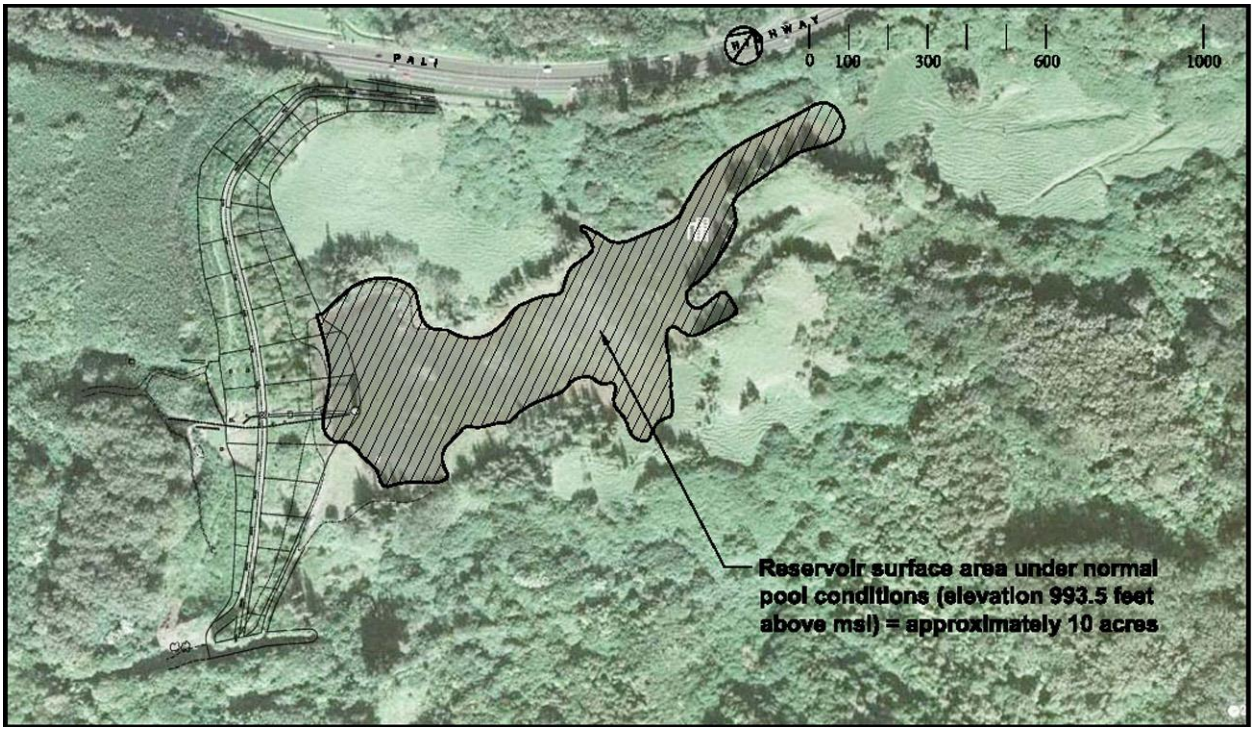

Figure 2-2: Nu‘uanu Reservoir No. 4 Area Map.

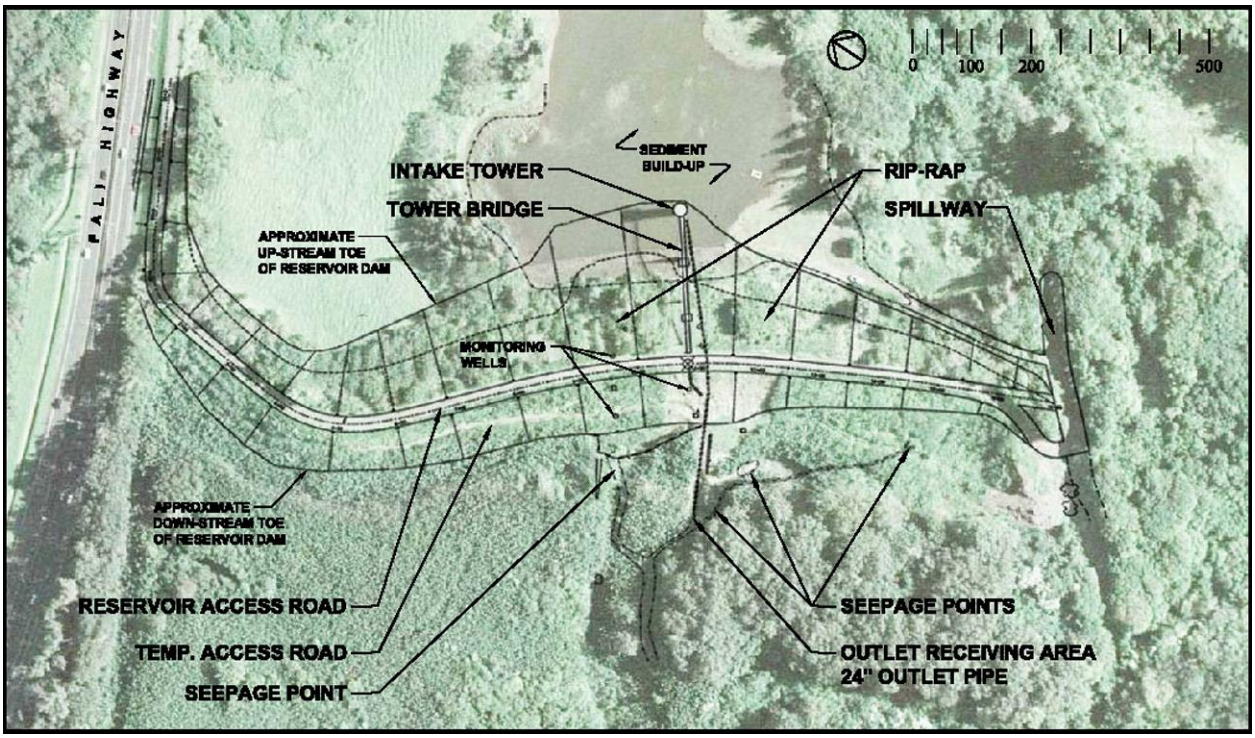

Figure 2-3: Nu‘uanu Reservoir No. 4 Dam Features.

Figure 2-4: Intake Tower and Reservoir Basin Looking Towards the Pali (east).

internal wall across the stream channel between the upstream (heel) and downstream (toe) embankments. For the concrete cutoff, a trench was excavated across the original Nu‘uanu Stream bed to a depth of 15 to 45 feet below natural grade. Concrete was poured to a height of 72 feet from the bottom of the trench and extended 150 across the stream bed. Redwood timber was used to extend the cutoff up to the dam design height.

On the upstream side of the cutoff, the dam embankment is constructed of hydraulic fill, whereby native soil materials were pumped and sluiced into place and compacted by water forces. On the downstream side of the cutoff, the dam embankment is constructed of hand-placed rock which extends across the stream channel for a top length of approximately 170 feet. The remainder of the dam embankment is constructed of rolled earth fill. During the 1934 modifications, a continuous wall of interlocking steel sheetpiles was driven 45 feet (or to refusal) into the embankment across the upstream face. In addition, hand-placed basalt riprap (12-inch) was installed from toe to the crest of the dam across the upstream embankment to provide protection against erosion and wave wash.

The upstream slope of the embankment has a 4H:1V (horizontal:vertical) slope. The downstream slope of the dam was constructed with a compound slope where the upper two-thirds of the dam are approximately 2H:1V and the lower one-third is approximately 1H:1V. The lower one-third of the dam is covered by hand placed rock-fill. The downstream slope facing the Pali Highway, State Route 61, is a grassy, well maintained mowed face. The upstream slope is partially overgrown with grasses and shrubs. The immediate downstream slope of the dam is heavily vegetated with dense areas of bamboo, ginger, pockets of overgrown trees, and vines. To facilitate recent removal of the vegetation, a temporary access road was cut into the downstream face of the embankment.

The dam crest is approximately 20 feet wide and 1,750 feet long, with an elevation of 1038’ above MSL. A single lane, partially paved, partially graveled access road, approximately 12 feet wide with grassed shoulders runs along the crest. The road surface is in fair condition, but has potholes and ruts due to use during wet weather conditions. Large Norfolk pine trees were removed from the crest of the dam in 2008, and the stumps remain in place. Electrical utilities cross the dam on the right side, with a power pole located on the crest of the dam. No erosion, cracks, or sinkholes were observed on the dam embankment during the January 13, 2010 DLNR safety inspection. See **Figure 2-5** and **Figure 2-6**.

Figure 2-5: Access Road on Dam Crest.

Figure 2-6: Downstream Embankment Face.

Spillway

The spillway is a concrete lined structure located beyond the dam abutment on the east end of the embankment. The spillway is an uncontrolled, 180-foot long, 50-foot wide structure with concrete trapezoidal training walls. The concrete spillway structure transitions into an earthen discharge channel on the downstream side of the dam embankment to convey water back to the Nu‘uanu Stream. The spillway has an invert elevation of 1,024.5’ above MSL, and discharge capacity of 4,000 CFS.

In 2008, the ACOE conducted a dam break study of Nu‘uanu Reservoir No. 4 (ACOE, 2008). The study included hydrologic modeling of maximum flood conditions calibrated using the largest observed rainfall event on record. The hydrologic model indicated that the spillway structure would adequately pass a 1-percent flood event and PMF event. The model calculated peak inflow to the reservoir to be 5,492 CFS for the 1-percent flood, and 11,193 CFS for the PMF event. See **Figure 2-7** and **Figure 2-8**.

Intake Tower and Outlet

The intake tower is a 78-foot-high circular-shaped reinforced concrete structure with a diameter of 15 feet. Access to the tower is by a gangway, a suspension footbridge and an approach walkway on piers

Figure 2-7: Spillway in Reservoir Basin.

Figure 2-8: Spillway at Dam Crest.

extending from the crest in the center of the dam. Three intake ports are located in the face of the tower and are equipped with 24-inch by 24-inch sluice gates and trashracks. The invert elevations of the intake ports are 974.75' above MSL at the bottom sluice gate, 993.50' above MSL at the middle sluice gate, and 1011.25' above MSL at the top sluice gate. The existing gates and trashracks are corroded and in need of repair. Manual controls for the three sluice gates are located in the operating room at the top of the intake tower. Several of the glass panes of the intake tower windows are shattered allowing for strong winds and rain to come in and possibly harm the measurement and recording equipment. See **Figure 2-9** and **Figure 2-10**.

Figure 2-9: Top Gate and Trash Rack.

Figure 2-10: Intake Tower Gate Controls.

The intake tower connects to a 5.5-foot diameter, reinforced concrete discharge tunnel that extends approximately 464 feet through the dam embankment and cutoff diaphragm to the discharge outlet area at the downstream toe of the dam. The discharge tunnel houses a 24-inch diameter ductile iron pipe that conveys outflow from the sluice gates in the intake tower. Water from the pipe discharges to an outlet receiving area that correlates approximately with the original natural channel of Nu'uanu Stream. The stream channel flows through a heavily vegetated bamboo forest, is joined by Lulumahu Stream and continues down the valley as Nu'uanu Stream. Nu'uanu Stream flows through urban neighborhoods, meets with Waiolani Stream and Pauoa Stream, passes through downtown Honolulu, and ultimately drains into Honolulu Harbor.

Gangway

Access to the tower is by a gangway, a suspension footbridge and an approach walkway on piers extending from the crest in the center of the dam. The cables supporting the gangway are in poor condition showing varying degrees of corrosion. In some cases, sections of cables and bolts appear to be rusted through. At the north end of the gangway the handrail along the east flank has completely separated from its connection with the tower, apparently due to corrosion. The handrail is "floating" and loose at this end. BWS personnel must enter the intake tower at least weekly to check rainfall and water level measurements as recorded by the equipment installed inside the intake tower. Although staff is currently able to proceed along the gangway and enter/exit the tower, as corrosion advances it may prevent safe access to the tower. See **Figure 2-11** and **Figure 2-12.**

Figure 2-11: Gangway Bolt and Cable.

Figure 2-12: Handrail at Intake Tower

Instrumentation

The dam uses two different methods for measuring the depth of water in the reservoir: 1) a staff gage is cast into the exterior wall of the concrete intake tower, spaced at one foot increments and referenced from the bottom of the reservoir; 2) a water well level sounder in a stilling well is located inside of the intake tower. In addition, a cutthroat flume is located approximately 500 feet from the downstream toe of the dam embankment and used to measure outflow and seepage from the dam. Finally, ten piezometers were installed in the mid-1980's on the upstream and downstream slopes of the dam to monitor the presence of water in the embankment structure.

2.2 PROJECT DESCRIPTION

Proposed maintenance and repairs to the Nu‘uanu Reservoir No. 4 are based on the DLNR Dam Safety Program inspection report, dated January 13, 2010, and a Phase 1 Investigation Report previously commissioned by DLNR for the Nu‘uanu Reservoir No. 4 (Gannett Fleming, August 2008). Repair work is proposed to be undertaken in two increments, summarized as follows:

Increment 1:

1. Remove, stockpile, dewater, and dispose of accumulated sediments from the reservoir basin.
2. Repair and rehabilitate the existing reservoir intake tower structure, including repairs to the lower level sluice gate, debris cages (trash racks) over the three sluice gates, exterior ladder structure, and operational controls located within the tower.
3. Replace shattered window panes in the intake tower.
4. Inspect and repair cables supporting the gangway leading to the intake tower. Inspect and repair the handrail along the gangway flanks.
5. Recalibrate and repaint water level markings on the existing intake tower.
6. Construct measuring weirs at existing seepage points on the downstream slope and outlet structure of the reservoir dam.

7. Improve the outlet receiving area. Replace the existing outlet pipe and extend the 24-inch drain pipe to a total length of approximately 188 LF. Construct a hydro-geo stilling basin to the north of the outlet pipe.
8. Inspect and clean the existing outlet tunnel structure.
9. Remove the temporary access road located on the downstream face of the dam embankment and restore the embankment slope to a uniform condition.
10. Repair and repave the existing reservoir access road on the top of the dam.
11. Inspect the downstream dam slope and repair CRM riprap deficiencies and depressions on the upstream face of the reservoir dam.
12. Lower the "normal pool" to the invert of the lowest sluice gate at 974.75' above MSL

Increment 2:

1. Conduct geotechnical investigative borings.
2. Install new measuring devices, including piezometers, analyze and monitor dam stability as required based on geotechnical investigation.
3. Create a subdivision map for Nu'uanu Reservoir No. 4.

Proposed improvements are described in the following sections. See **Figure 2-13: Nu'uanu Reservoir No. 4 Repair Work General Plan.**

2.2.1 SEDIMENT REMOVAL

Sediment removal will be conducted by means of a pump that is floated into the pond. The pump will remove sediment and deposit it into a basin that will be used to dewater and dry the removed sediment. A boom crane or excavator will be used to remove the accumulated sediment along the banks. The stockpile dewatering area will be located on the east side of the sediment basin above elevation 1,000' above MSL. The sediment removal activities will be conducted based on the following construction methodology:

Reservoir Draw-down

Water in the reservoir may be drawn down and maintained at levels that will accommodate sediment removal operations. Current water surface elevation is 993.5' above MSL, corresponding to the invert of the middle sluice gate in the intake tower. The initial draw-down will reduce the water level from 993.5' above MSL to approximately 980.00' above MSL, approximately 5 feet above the invert of the bottom sluice gate.

A temporary pipe using a pump or siphon pressure will be used to draw water from the reservoir and convey it into the middle sluice gate pipe within the intake tower. The inflow end of the temporary pipe will be positioned within an isolated area of the reservoir approximately 280 feet upstream from the intake tower and will be fixed by means of an anchored flotation device to draw water from the upper level of the water column. The pipe segment will be floated within the reservoir using fixed flotation devices. A filter rack and screen will be affixed to the end of the temporary pipe to prevent fish, debris, and sediment from entering the pipe. The inlet filter rack and screen will be cleaned and maintained throughout the period of work to prevent clogging and monitor for damage.

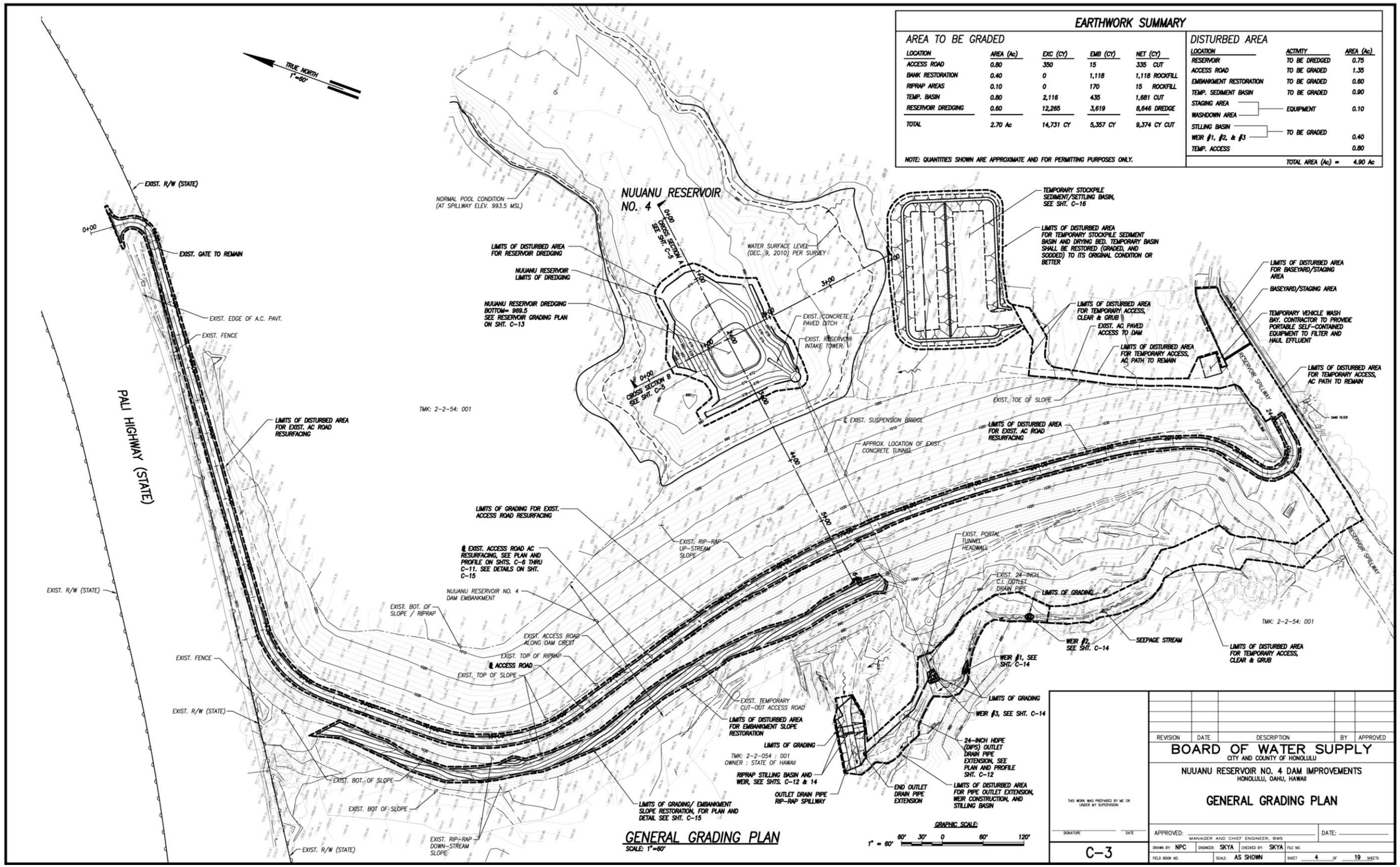

Figure 2-13: Nu‘uanu Reservoir No. 4 Repair Work General Grading Plan.

The outlet end of the temporary pipe will be inserted into the middle sluice gate and extended into the intake tower to discharge below the lowest sluice gate. The temporary pipe will then be secured in place. As water is drawn from the reservoir pool, the water elevation will drop below the middle sluice gate invert and the temporary pipe will provide the primary means to convey reservoir inflow water through the reservoir, with natural seepage also contributing to downstream flows. The temporary pipe will be operated as necessary to maintain the reservoir at levels sufficient for sediment removal operations.

Turbidity Curtain

A floating turbidity curtain will be used to isolate the sediment removal area, including the area surrounding the intake tower, from the rest of the reservoir. The curtain provides a controlled area of containment where solids suspended in the water as a result of sediment removal operations can settle out without affecting the larger water body. The inflow end of the temporary pipe will be positioned outside of the turbidity curtain in the isolated area of the reservoir.

The curtain will consist of an impermeable barrier constructed of a flexible fabric material. The upper hem of the fabric will enclose flotation material along the entire length. The lower hem of the material will enclose ballast material, such as a chain or load line. Curtain skirt depth will vary with water depth. The curtain will extend across the reservoir from the dryland bank on the east side to the dryland bank on the west side and will be positioned to isolate an equipment access way between the work area and stockpile/dewatering basin from the rest of the reservoir.

Sediment Removal/Excavation

The accumulated sediment in the reservoir will be removed through the use a pump floated out with a pontoon over the pond with a pipe lowered into the sediment. Material excavated by the pump will be sent via another pipe which is floated on the water and deposited directly into a stockpile area and dewatering basin. Excess water will be removed via a series of filters before release into the dam's spillway. The dewater sediment will be loaded onto lined dump trucks for transport to an approved disposal site. Dump trucks used will be lined to prevent dewatering discharges during material transport.

The stockpile and dewatering site will be located above elevation 1,000' above MSL on the east side of the reservoir. A temporary, stabilized access way will be constructed between the stockpile and dewatering site for use by dump trucks to transport excavated sediment material. Where the access way traverses previously inundated areas containing soft soils, access stabilization may be achieved by use of a portable road or vehicle mat.

The area of excavation is approximately 0.60 acres around the intake tower. The total quantity of material to be removed from the reservoir basin is approximately 12,265 CY. Upon completion of excavation activities, the reservoir basin contours would be restored to design slopes of 20:1 in the upstream/downstream direction, maximum 3:1 slopes for the side banks of the basin, and 4:1 slopes at the toe of the embankment dam. Sediment removal will expose the invert of the lowest sluice gate in the intake tower, at elevation 974.75' above MSL, and will expose an existing 40-foot long paved ditch leading through the bottom of the reservoir basin to the sluice gate. The paved ditch has an invert elevation of 974.25' above MSL.

Sediment Dewatering

Removed sediment will be deposited in a temporary stockpile and dewatering site located on the east side of the reservoir basin above elevation 1,000' above MSL. The stockpile site will be constructed as a

detention basin to detain and eliminate dewatering effluent through ground percolation and evaporation. A temporary structural barrier will be constructed around the perimeter of the stockpile/dewatering site to prevent the release of any dewatering effluent from the stockpile site. The barrier may be constructed using earthen berms lined with geotextile fabric, sand bags, concrete 'jersey' type barriers, or other methods deemed appropriate by the project contractor. Two turbidity curtains will be installed along the downslope perimeter of the stockpile site outside of the structural barrier to capture sediment from the removed reservoir sediment or stormwater runoff originating from the stockpile site while filtering the leaching water from the stockpile. This filtered water will then be pumped to the existing spillway.

Sediment Disposal

Excavated sediment material will be tested for the presence of contaminants in accordance with State DOH, HEER guidelines. A Sampling and Analysis Plan (SAP) will be prepared and submitted to HEER for approval. The SAP will include a multi-incremental soil sampling methodology to collect and test material samples as excavated sediment is stockpiled. If no regulated contaminants are detected, sediments will be classified as "inert fill" and may be re-used without remediation. If the material exceeds DOH Environmental Action Levels for residential levels, it will be disposed at the Waimānalo Gulch or PVT landfills in accordance with State and County regulations.

A Phase 1 ESA report prepared for the project did not identify any current or historical activities within the watershed area of Nu'uanu Reservoir No. 4 that are likely to have contributed to contamination of reservoir sediments. (Owen, 2011). The Phase 1 ESA report is included as **Appendix F** of this document. Based on the ESA findings, it is anticipated that the sediments will be suitable for off-site re-use as fill material or topsoil.

2.2.2 INTAKE TOWER

Repairs to the intake tower will be undertaken after the cofferdam around the intake tower it erected. The water level in the work area will be reduced and sediment removal has commenced. Reservoir water levels will be maintained below the invert elevation of the bottom sluice gate, or lower by means of the temporary pump or siphon pipe described earlier. The work area at the base of the intake tower, including the 40-foot long paved ditch segment, will be isolated to create a "dry" work area. The pump system will be operated as necessary during the period of the intake tower repair work to maintain dry work conditions.

Repair work to the intake tower will include:

- The lowest level sluice gate will be repaired to fully operable condition, including repair or replacement of the sluice gate door, frame and connecting control rod and couplings.
- The middle and upper level sluice gates will be cleaned and serviced.
- The debris cages (trash racks) over all three intake sluice gates will be replaced.
- Controls in the intake tower control room (hand wheel, stand, bevel gear, couplings, and connecting rods), will be serviced, repaired or replaced as necessary to ensure full operability of the three intake sluice gates.
- The reservoir water level is indicated by indentations spaced at one foot intervals on the exterior wall of the intake tower. The water level markings will be recalibrated and repainted. Indentations are spaced and sized as follows:

Height Interval	Length of Mark
10 feet	18 inches
5 feet	12 inches
1 foot	6 inches

Hazardous Material Remediation

A hazardous materials survey of Nu‘uanu Reservoir No. 4 prepared for the project identified the presence of lead-based paint on painted surfaces within the intake tower control room and on the suspension bridge leading to the intake tower. The U.S. Department of Housing and Urban Development defines lead-based paint as a paint coating with a total lead content of greater than 0.5% lead by weight. Testing indicates that the silver paint on the manual control valves inside the intake tower control room and on the hand rails of the suspension bridge contain lead at concentrations ranging from 3.2% to 5.5% lead by weight.

Repairs to the control apparatus within the intake tower and the suspension bridge handrail that require removal of paint or replacement of painted components will be undertaken by the contractor in compliance with applicable State and Federal laws, which specify the handling, treatment, and disposal of contaminated materials.

Demobilization

Throughout the period of work within the sediment basin, including work required for sediment removal and repairs to the intake tower, the turbidity curtain will remain in place and the temporary pump/siphon pipe will be operated to maintain the water in the reservoir at an elevation sufficient to accommodate work activities.

Upon completion of repairs to the intake tower, the lowest sluice gate will be closed and all construction staging equipment and materials, including mobile roads / vehicle mats, heavy machinery, vehicles, and all other miscellaneous project materials and accouterments will be removed to a construction staging area located above elevation 1,000’ above MSL.

Upon completion of demobilization activities around the intake tower, the temporary pipe used to control water levels in the reservoir and the turbidity curtain will be removed. The three intake tower sluice gates will remain closed for at least 24 hours to allow suspended sediments to settle and conditions in the reservoir basin to assume their normal variability.

2.2.3 INTAKE TOWER BRIDGE GANGWAY

The gangway provides access from the top of the dam to the intake tower where the controls for the sluice gates and rain gauge are located. Repairs to the cables of the gangway are necessary due to the extent of corrosion on the supporting cables. The scope of the repairs is as follows:

- Replace all badly rusted 3/4 – inch cables and hanger rods including connectors and accessories.
- Replace all badly rusted 1/2 – inch diagonal crossed-brace threaded rods including connectors and accessories at the underside of the bridge.
- Replace all badly rusted 5/8 – inch crossed guy cables including connectors and accessories at the underside of the bridge.

- Replace all rusted and broken cast iron floor flange handrail attachments to the piers and intake tower.
- Clean and rustproof all cable terminal bars.
- Replace badly rusted chain link mesh.
- Paint all cables, cable connectors, cable terminal bars, chain link mesh and handrails, and all exposed metals and wood decking on the bridge.
- Repair and/or replace all bridge wood decking with ruts.

2.2.4 OUTLET PIPE AND RECEIVING AREA

The reservoir outlet receiving area at the downstream toe of the dam embankment will be repaired and stabilized. The 24-inch cast iron outlet pipe will be extended by approximately 188 LF. Permanent concrete blocks will be installed to anchor and support the pipe extension, based on the original dam design. Coarse riprap surrounding the outlet pipe will be repaired using minimum 2' diameter boulders per the original dam design. The outlet tunnel structure will also be inspected, cleaned and repaired as necessary. Repair work might include concrete patch work and sealing of the inner face of the tunnel wall.

Structural BMPs, including silt fencing, filter socks and diversion berms, will be installed and maintained throughout construction to isolate the work area and prevent the discharge of sediments and other pollutants in stormwater runoff into the stream. Disturbed areas will be stabilized by the placement of coarse riprap.

2.2.5 SEEPAGE AREA MEASURING WEIRS

To facilitate monitoring of dam conditions and functions, measuring weirs are proposed at several locations. One of the measuring weirs will be installed at the dam outlet tunnel. Two more weirs will be installed on the downstream face of the dam embankment where seepage has been observed. A stilling basin with rectangular weir is to be constructed north of the outlet pipe. The weirs will be used to measure seepage flows and establish baseline data under various environmental conditions for correlation with readings from existing monitoring instrumentation (piezometers) located elsewhere on the dam.

Each measuring weir will consist of a low, concrete bulkhead wall installed on the reservoir embankment perpendicular to the flow route emanating from the seepage point. The locations of the measuring weirs are shown in **Figure 2-13.** The concrete bulkhead will be approximately 6 feet to 12 feet in length. A V-shaped notch will be created in the center of the weir crest and affixed with a shaped metal strip calibrated and marked to measure the rate of flow through the notch.

2.2.6 DAM EMBANKMENT AND ACCESS ROAD REPAIRS

Dam Embankment Slope

A temporary dirt access road is located on the downstream face of the dam embankment. The temporary road was created in 2008 to assist in the removal of vegetation and a row of Norfolk pine trees that were originally planted along the crest of the dam embankment. The road consists of a cut in the dam embankment extending from the north-west end of the embankment near the Pali Highway to the approximate center of the dam above the outlet receiving area; a total length of approximately 950 LF.

Planned repair work to the embankment includes removal of the temporary access road and restoration of the embankment slope to a uniform condition. Restoration will be performed with hand-placed stones

greater than 6" in size and covered with topsoil equating to approximately 1,118 CY of fill material. The fill material will be compacted and graded to achieve the original 2H:1V design grades of the downstream embankment. Vegetative controls will be utilized to prevent erosion. The total area of grading is approximately 17,400 sf (0.40 acres).

Riprap Repair

Riprap facing on the upstream embankment slope will be inspected and repaired as necessary. The existing riprap consists of hand-placed basalt stones (12-inch) installed from toe to the crest of the dam along a 4H:1V design slope. In general, the existing riprap is in good condition. As part of the proposed repair work, new basalt stone riprap will be hand placed without mortar in spot locations where the existing riprap is loose or missing or where depressions occur in the face of the embankment.

Access Roads

The existing paved access road along the crest of the dam embankment will be regraded and repaved. The access road has a total length of approximately 2,460 LF and a paved width of 12 feet. The new pavement will be crowned to facilitate drainage. The access road is lined with 4-foot grassed shoulders on each side.

Vegetation Removal

Vegetation is routinely removed as part of BWS' ongoing dam maintenance activities. Vegetation on both the upstream and downstream faces of the dam embankment will be cleared during the planned repair activities to facilitate easier dam inspections. Vegetation will be cleared by cutting to avoid disturbing underlying soils.

2.3 PROJECT SCHEDULE AND COST

2.3.1 SCHEDULE

Completion of permits	May 2014
Start of construction	June 2014
Completion of construction	November 2014

2.3.2 COST

The planned repair work is estimated to cost $1.59 million.

2.4 ALTERNATIVES CONSIDERED

2.4.1 NO ACTION

State legislation requires that a "no-action" alternative be considered to serve as a baseline against which potential actions can be measured. The no-action alternative would involve no effort to repair existing deficiencies or construct improvements to the reservoir dam infrastructure.

Under this option, environmental impacts resulting from work activities would be averted and project costs would be spared. However, the "no-action" alternative would fail to repair and improve the reservoir dam infrastructure in accordance with the DLNR Dam Safety Inspection Report recommendations as required by the Hawai'i Dam Safety Program and HRS Chapter 179D. Failure to repair deficiencies in the dam infrastructure would be a violation of the dam operators legal responsibility to ensure the integrity of the dam for public safety, would prevent the dam from being operated at its full design capacity and function for flood control, and would create an unacceptable level of risk of dam failure. For these reasons, this alternative was eliminated from further consideration.

2.4.2 DELAYED ACTION

The delayed action alternative would postpone necessary repairs and improvements to an unspecified future date. Under this alternative, environmental impacts resulting from work activities would be delayed, but are anticipated to be generally the same as with the proposed project. Project costs would also be postponed to a later date. It is reasonable to assume that future costs for labor and materials will be greater than present day costs due to inflation. Delayed action would fail to address in a timely manner, existing deficiencies in the condition and operability of the reservoir and dam infrastructure, and would result in increased costs when the rehabilitation work is inevitably undertaken. For these reasons, this alternative was eliminated from further consideration.

2.4.3 PARTIAL REPAIR / NO SEDIMENT REMOVAL

This alternative would involve undertaking partial repair of the dam based on prioritization of the recommendations in the DLNR Dam Safety Inspection Report. Under this alternative, the sediment in the reservoir basin would not be removed. Instead, a new sluice gate would be installed in the intake tower at the current level of the sediment build up. Construction of a new sluice gate would require reservoir water draw-down and/or the installation of sheet piles to isolate the work area and facilitate creation of dry work conditions. This alternative would simplify construction requirements and reduce construction costs by eliminating the need for heavy equipment operations for sediment removal and transport, and eliminating the need to install and maintain BMPs for sediment dewatering. These savings would be offset somewhat by the labor and material costs to cut a new sluice gate aperture and install a new gate mechanism in the intake tower. Other repair work would be undertaken as planned.

Aside from the elimination of sediment removal operations and dewatering, potential environmental impacts resulting from this alternative would be generally the same as with the proposed project. However, this alternative would fail to restore the reservoir to the original design capacity and function. Without removing the sediments, the BWS would be unable to repair the intake tower to allow water levels in the reservoir to be reduced. For these reasons, this alternative was eliminated from further consideration.

SECTION 3
Description of Affected Environment, Potential Impacts and Proposed Mitigation Measures

3.1 PHYSICAL ENVIRONMENT

3.1.1 CLIMATE

The climate in Nu‘uanu Valley is characterized by persistent trade winds, relatively constant temperatures, abundant rainfall and sunshine, and moderate humidity. The valley is named for its refreshing climate: the name “Nu‘uanu” translates as “cool heights”. Temperatures in the valley are generally 5 to 10 degrees Fahrenheit (F) cooler than along the urbanized shoreline areas of Honolulu. Average temperatures in the valley range from 65 degrees F in February to 83 degrees F in September. Prevailing trade winds funnel through the valley and further contribute to the cooling effect. Average annual rainfall in the valley in the vicinity of the reservoir ranges from 160 inches at the peak of the Ko‘olau Mountains to 120 inches at the upper valley floor (UH, 1998). A rain gauge maintained at Nu‘uanu Reservoir No. 4 by the BWS (Station no. 516928, Nu‘uanu Reservoir No. 4, 783) recorded average annual precipitation of 107.6 inches based on 61 years of recorded data (WRCC, 2010). Most of the rainfall occurs between November and April.

Impacts and Mitigation Measures

The proposed project will not have any significant effect on the existing climatic conditions. No mitigation measures are required.

3.1.2 TOPOGRAPHY

Topography varies considerably at the scale of both the reservoir watershed area and of the project site. The Nu‘uanu Reservoir No. 4 watershed is comprised of a 1.4 square mile drainage area located on the slopes of the Ko‘olau Mountains below Pu‘u Konahuanui. The watershed area consists of steep valley walls that have a maximum elevation of 3,150’ above MSL at the rim of the drainage divide, and a low point of 965’ above MSL at the toe of the dam. The area varies in width from approximately 0.5 miles to 1.3 miles and is about 1.4 miles in length. The topography at the valley floor has generally consistent gradients averaging 3 to 8 percent from the back of the valley below the Pali Overlook (elevation 1,250’ above MSL) to the reservoir. See **Figure 3-1: Project Location**.

The dam is a gravity embankment dam that extends 1,750 feet across the original Nu‘uanu Stream channel to create the reservoir retention basin. Seventy-three feet of grade difference separates the crest of the dam (el. 1,038’ above MSL) from the designed invert of the intake tower discharge tunnel and the downstream outlet (el. 965’ above MSL). The dam embankment has a 4H:1V slope on the upstream side. On the downstream side, the embankment has a compound slope of 2H:1V for the upper two-thirds, and 1H:1V for the bottom one-third. A temporary maintenance access road is constructed into the downstream face of the dam.

The sides of the reservoir basin have mild gradients of approximately 5 to 10 percent slope. At normal pool elevation of 993.5’ above MSL, the water surface area is approximately 10 acres. An increase of 40 feet in elevation to maximum pool elevation of 1,033’ above MSL, increases the water surface area to 110

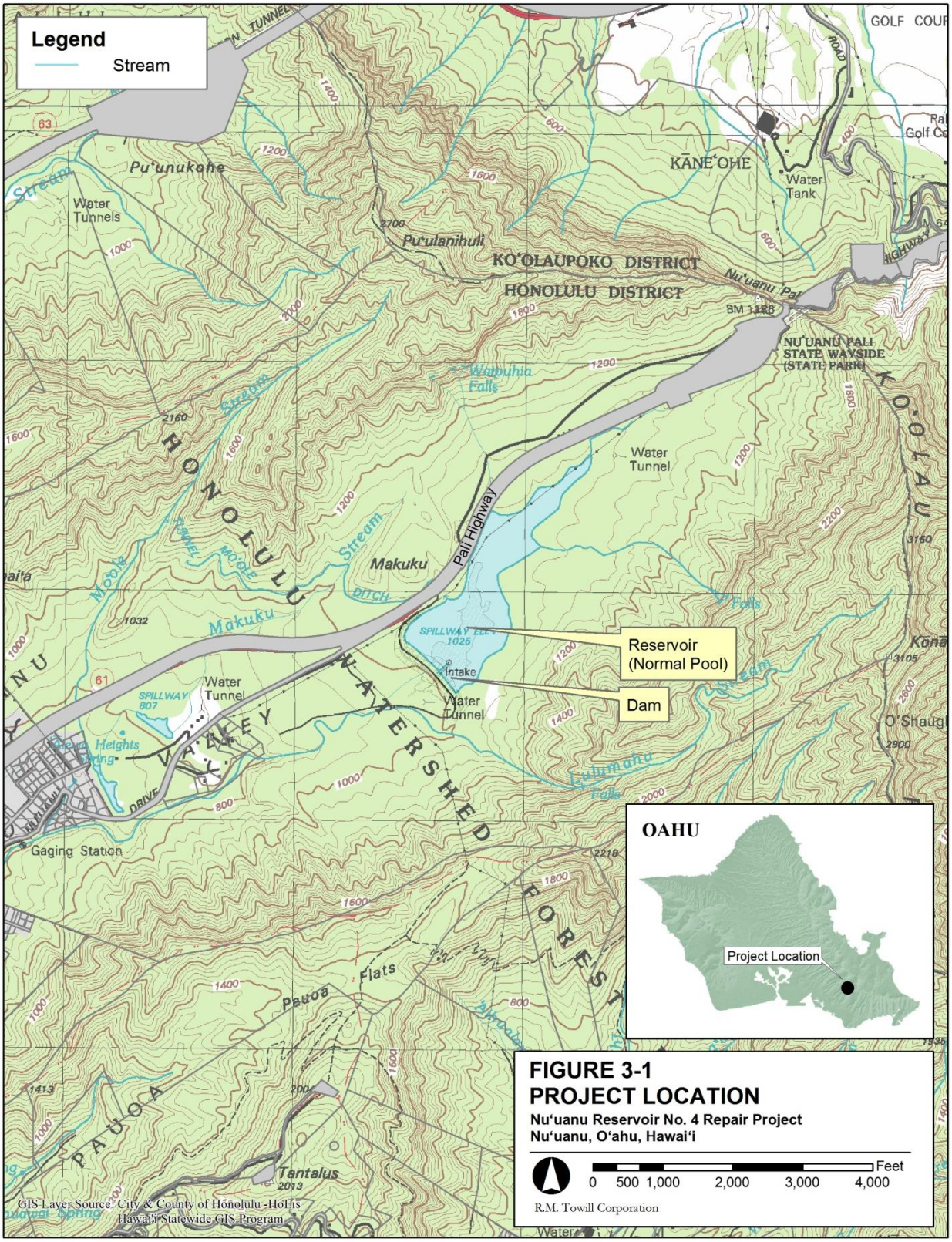

Figure 3-1: Project Location Map of Nu'uanu Reservoir No. 4

acres. Since the last modifications to the dam in 1934, accumulated sediments have filled in the reservoir basin by as much as 17 feet in depth, thereby changing the bottom contours.

Impacts and Mitigation Measures

No adverse effect to topographic conditions will result from the proposed work. Temporary and permanent changes to existing topographic conditions will result from the following activities:

- The existing temporary access road will be removed and the downstream dam embankment slope will be restored to a uniform designed condition of 2H:1V.
- Accumulated sediments in the reservoir basin will be removed as required to undertake repairs to the intake tower sluice gates. The total volume of sediment to be removed is estimated to be 12,265 CY from an approximately 0.60 acre area around the intake tower. Removal of accumulated sediments will return the reservoir bottom relief to the original design contours.
- Removed sediments will be temporarily stockpiled on the east bank of the reservoir basin for dewatering and contaminant testing. The stockpile site is located above the normal pool elevation of 993.5 feet above MSL, which delineates State jurisdictional waters as determined by the ACOE. The sediment stockpile site will be surrounded by a detention berm to detain dewatering effluent and facilitate its elimination through evaporation and percolation into the soil. The sediment stockpile will occupy approximately 3 acres and be approximately 15 feet high. The sediment will ultimately be removed for off-site use and/or disposal. The temporary stockpile site will be restored to pre-existing grades and stabilized with vegetative ground cover.

Overall, the project will result in beneficial changes to topographic conditions by restoring dam features to design grades to ensure continued dam integrity and function.

3.1.3 SOILS AND GEOLOGY

Soils

Soil Types existing in and around the project area consist primarily of Lolekaa Series soils of varying slopes, as depicted in **Figure 3-2, Soils Map,** and described below (USDA Soil Conservation Service, August 1972). The reservoir basin itself is contained within an area identified with the LoB soil classification. Sediments within the basin consist of accumulations of Lolekaa soils along with other decomposed organic matter deposited by storm water runoff. The different soil types and descriptions are as follows:

LoB Lolekaa silty clay, 3 to 8 percent slopes. This soil is on terraces and fans. The surface layer is dark-brown silty clay about 10 inches thick. The subsoil is 46 to more than 70 inches thick. The upper part is dark-brown silty clay that has subangular blocky structure, and the lower part is dark-yellowish brown loam that has subangular blocky structure. The substratum is strongly weathered gravel. The soil is strongly acid in the surface layer and strongly acid to extremely acid in the subsoil. Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 1.3 inches per foot of soil. Soft, weathered gravel is common in the subsoil but does not

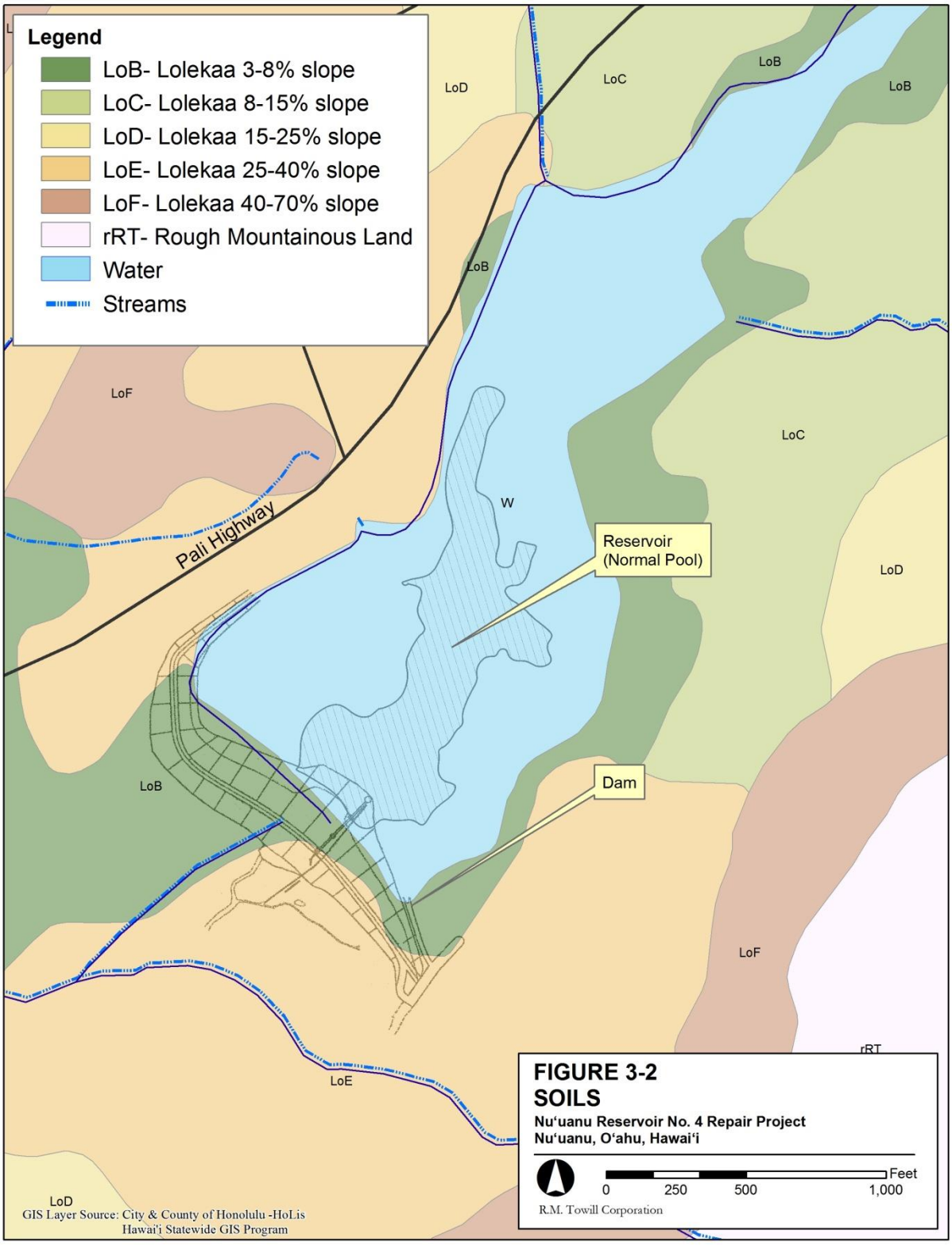

Figure 3-2: Soils Map of Area Surrounding Nu'uanu Reservoir No. 4

affect the use and management of soil for farming. In places roots penetrate to a depth of 5 feet or more.

LoC Lolekaa silty clay, 8 to 15 percent slopes. On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. Workability is slightly difficult because of the slope. This soil is used for pasture, home sites, papaya and banana.

LoD Lolekaa silty clay, 15 to 25 percent slopes. This soil is on side slopes of terraces and along drainage ways. Runoff is medium and the erosion hazard is moderate. Workability is slightly difficult because of the slope.

LoE Lolekaa silty clay, 25 to 40 percent slopes. This soil occurs along drainage ways and fans adjacent to the Koʻolau Range. Runoff is medium to rapid and the erosion hazard is moderate to severe. Workability is difficult because of the slope. This soil is used for pasture.

LoF Lolekaa silty clay, 40 to 70 percent slopes. This soil occurs along drainage ways and fans adjacent to the Koʻolau Range. Runoff is rapid and the erosion hazard is severe.

The mountain ridges that form the valley are classified as Rock Land (rRK) and Rough Mountainous Land (rRT).

rRK Rock land is made up of areas where exposed rock covers 25 to 90 percent of the surface. Rock outcrops and very shallow soils are the main characteristics. Rock outcrops are composed mainly of basalt and andesite.

rRT Rough mountainous land consists of very steep land broken by numerous intermittent drainage channels. In most places it is not stony. Over much of the area, the soil mantle is very thin, ranging from 1 to 10 inches over saprolite. In most places the saprolite is relatively soft and permeable to roots and water. Local relief typically exceeds 500 feet.

Soils in the project area were not given a classification by the Hawaiʻi State Department of Agriculture in the *Agricultural Lands of Importance to the State of Hawaiʻi* (ALISH) soil survey, nor by the University of Hawaiʻi Land Study Bureau (LSB) productivity rating map.

Regional Geology

Oʻahu is the third largest of the eight major islands of the Hawaiian Archipelago and covers approximately 604 square miles. Oʻahu was formed by the eroded remnants of two great shield volcanoes; the Waiʻanae Volcano on the west and the Koʻolau Volcano on the east. The younger Ko'olau Volcano Series (Tkb) forms an elongated shield built by eruptions along a northwest trending rift zone forming the eastern and central portions of the island.

The Koʻolau Range was formed during the Tertiary Period, about 2.5 million years ago and is estimated to have been roughly 5,000 feet in elevation. Most of the original shield outline of the Koʻolau Volcano eroded to form a long narrow ridge with deeply dissected drainage ways except where the volcano banked against the already eroded slope of the Waiʻanae Volcano to form the gently sloping surface known as the Schofield Plateau.

Erosion and sea level changes have resulted in the present topography of Nuʻuanu Valley, comprising an approximately 3,000 foot-wide bowl-shaped depression roughly 1,500 to 2,000 feet below the adjacent ridgeline. The valley begins at the head of Nuʻuanu Stream near the Pali overlook, and extends approximately 4.5 miles in the south-west direction toward the south shore of Oʻahu and downtown

Honolulu. Rainfall of up to 160 inches per year on the ridges continues the process of erosion and geologic shaping. Exposures along the banks and drainage ways consist of highly weathered basalts (saprolite). The unweathered portions (Koʻolau Volcanics) are highly permeable. Deposition of the eroded materials in the valley has resulted in relatively highly permeable soils. The high permeability soils are recharged by the continuing rainfall creating springs and streams throughout the valley.

Site Geology

The Nuʻuanu Reservoir No. 4 dam is situated near the head waters of Nuʻuanu Stream. Before the reconstruction and modification of the dam in 1930, a series of borings were drilled along the upstream toe of the existing dam to determine the underlying geology. A summary of those findings and geological profile is as follows (Hirata, November 1993 and May 1999):

> *"The borings showed that the subsurface geology beneath the Nuʻuanu Dam to consist mainly of highly to moderately weathered basalt with some interbedded loose volcanic ejecta consisting of ash and pumice overlying dense, hard basalt. The foundation beneath the left side of the embankment appears to be a well defined and a fairly uniform profile of 20 to 60 feet of older alluvium with an approximately 2 to 3 feet thick pervious interbedded layer of wind deposited friable vitric tuff consisting mostly of small scoria fragments gently sloping towards the old Nuʻuanu Stream channel beneath the center of the dam, overlying completely to partly decomposed basalt which extends to irregular depths of elevation 920 to 965 feet. The alluvium layer can be traced across the centerline of the dam to where it pinches out approximately at Station 8+00 along the axis of the dam.*
>
> *The pervious interbedded layer exists at an elevation of approximately 981 to 983 feet on the left side of the centerline of the dam and the original Nuʻuanu Stream channel (near Station II +00), sloping gently to an elevation of approximately 1010 feet at the left abutment, and at an elevation of approximately 975 to 978 feet on the right side of the original channel. Beneath the right side of the embankment (between Stations 3+00 and 8+00), the subsurface consists of partly to completely decomposed basalt to irregular depths of approximate elevations of 920 to 985 feet. Beneath the decomposed basalt across the entire length of the dam is a basement of dense hard basalt with a few streaks of loose clinker. Beneath the right side of the dam between Stations 2+00 and 6+00, a 3 to 10 foot thick layer of loose scoria was found cutting through the geologic profile sloping from depths of approximately 985 feet in the vicinity of Station 2+00, to 950 feet near Station 6+00."*

Impacts and Mitigation Measures

No adverse effects to soils or geological conditions are expected to result from the project. Removal of accumulated sediment around the existing intake tower is proposed. Excavated sediment material will be tested for the presence of contaminants in accordance with State DOH, HEER guidelines. A Sampling and Analysis Plan (SAP) will be prepared and submitted to HEER for approval. The SAP will include a multi-incremental soil sampling methodology to collect and test material samples as excavated sediment is stockpiled. If no regulated contaminants are detected, sediments will be classified as "inert fill" and may be re-used without regulation. If the material exceeds DOH Environmental Action Levels for residential levels, it will be disposed at the Waimānalo Gulch or PVT landfills in accordance with State and County regulations.

A Phase 1 ESA report prepared for the project did not identify any current or historical activities within the watershed area of Nuʻuanu Reservoir No. 4 that are likely to have contributed to contamination of reservoir sediments. (Owen, 2011). The Phase 1 ESA report is included as

Appendix F of this document. Based on the ESA findings, it is anticipated that the sediments will be suitable for off-site re-use as fill material or topsoil.

In order to reduce erosion of the existing soils, site-specific BMPs for soil stabilization will be in place and monitored at all times during construction activities in accordance with the projects erosion control plan and NPDES permit conditions. Areas of ground disturbance will be immediately stabilized by seeding or hydro-mulching following completion of construction activities.

The project site is not classified as important or productive agricultural land, and thus no adverse effects to agricultural lands will occur as part of the project.

3.1.4 WATER RESOURCES

Nu‘uanu Reservoir No. 4 watershed is located on the leeward slopes of the Ko‘olau Mountains. The 1.40 square mile drainage area above the reservoir varies in width from 0.5 to 1.3 miles and about 1.4 miles in length. A map showing the delineated contributing drainage area upstream of Nu‘uanu Dam No. 4 is presented on **Figure 3-3.** The watershed area is elliptical in shape and comprises steep valley walls that have a maximum elevation of 3,150’ above MSL at the rim of the drainage divide, and a low point of 965’ above MSL located at the existing dam. The drainage basin is heavily vegetated. Discharges from the dam flow into the Nu‘uanu Stream and through the city of Honolulu before entering the Pacific Ocean.

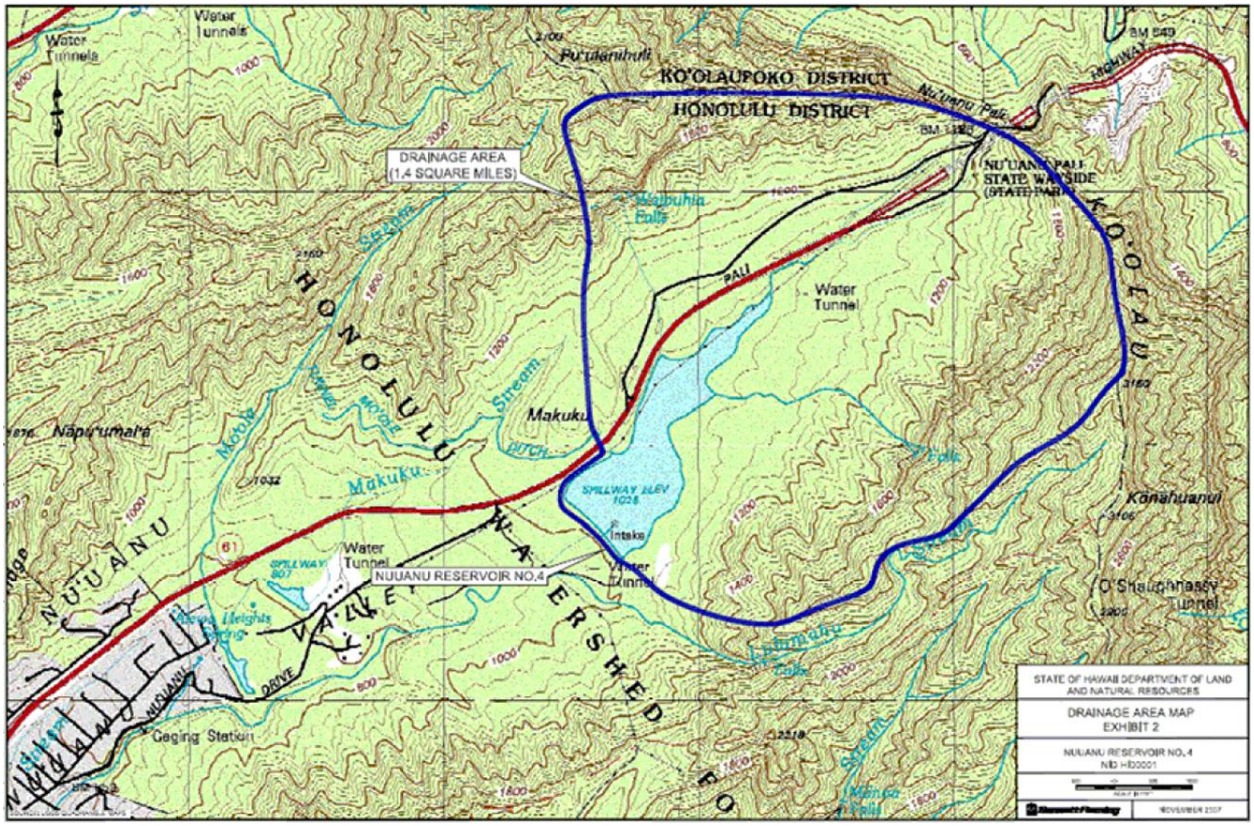

Figure 3-3: Map of Nu‘uanu Watershed showing Nu‘uanu Reservoir No. 4

Average rainfall for the reservoir is recorded at 107.6 inches annually at the BWS rain gauge whereas the reservoir's watershed, which encompasses the upper valley floor to the peak of the Koʻolau Mountains, has a range mean annual rainfall of 120 inches to 160 inches, respectively. This precipitation is mainly from rainfall that is caused by orographic, mountain rains that develop from the moist trade winds as they move inland from the sea over the steep high terrain. The greatest amounts of rainfall are between 2,000 and 3,000 feet in elevation. The wettest months of the year are during the winter months from November to April.

Surface Water

Surface water in the project area is comprised of other reservoir waters, wetlands, and streams. Surface waters are shown on **Figure 3-4**. Four open reservoirs, numbered 1 through 4, were built in Nuʻuanu Valley between 1890 and 1910. Their original purposes included hydropower, domestic water supply, and flood control. The dam's function for domestic water and hydroelectricity was soon replaced by other sources. Today the primary function of the reservoir system is for flood control.

The waters of Nuʻuanu Reservoir No. 4 originate in the surrounding 1.4 square mile watershed as bifurcated streamlets and cascades fed by rainfall and cloud drip along the upper ridges of Nuʻuanu and Moʻole Valleys on the leeward slopes of the Koʻolau Mountains. Nuʻuanu Stream is the primary surface water flow feeding the reservoir. From the reservoir discharge outlet, Nuʻuanu Stream continues downstream and is joined by Lulumahu Stream. Tributaries contributing input to the reservoir include Waipuhia also known as Upside Down Falls (Pukui et al, 1974) and an unnamed stream. Both originate as cascades above the 1,400-foot (425-m) elevation. Water from Moʻole Stream is also diverted to the reservoir via a tunnel and ditch that enters from the west, just downslope from Makuku Ridge. The daily inflows into the reservoir are reported by the ACOE to average approximately 6 CFS, except during and immediately following heavy precipitation.

Nuʻuanu Stream

Nuʻuanu Stream is a perennial stream that originates in the upper watershed elevations of Nuʻuanu Valley, about a half mile upslope from the reservoir. The stream flows southwest for approximately 6 miles through Nuʻuanu Valley and downtown Honolulu before emptying into its coastal estuary south of Beretania Park, between Piers 15 and 16 in Honolulu Harbor. On its route, the stream flows through the four reservoirs of the Nuʻuanu Reservoir system. The stream is in a natural channel until it reaches the vicinity of Liliʻuokalani Gardens. From there to its discharge into Honolulu Harbor, the stream banks are lined with a concrete rubble masonry revetment. (Kimura, 2008).

Nuʻuanu Stream flows through the Nuʻuanu Reservoir No. 4 basin. Reservoir waters discharge through the reservoir outlet pipe into a stabilized area at the toe of the dam embankment that correlates approximately with the original natural channel of Nuʻuanu Stream. Water from the reservoir outlet combines with dam seepage and flows through a heavily vegetated bamboo forest before being joined by Lulumahu Stream and continuing down the valley as Nuʻuanu Stream.

Seepage

Seepage has been observed at Nuʻuanu Dam dating back to original construction. Observations over time indicate that seepage is limited to the downstream toe of the dam and not on the downstream slope. Seepage rates correlate with the dam water level. At the normal pool elevation, corresponding to the invert elevation of the intake tower's middle sluice gate, the rate of seepage is estimated to be 0.4 MGD based on BWS monitoring data.

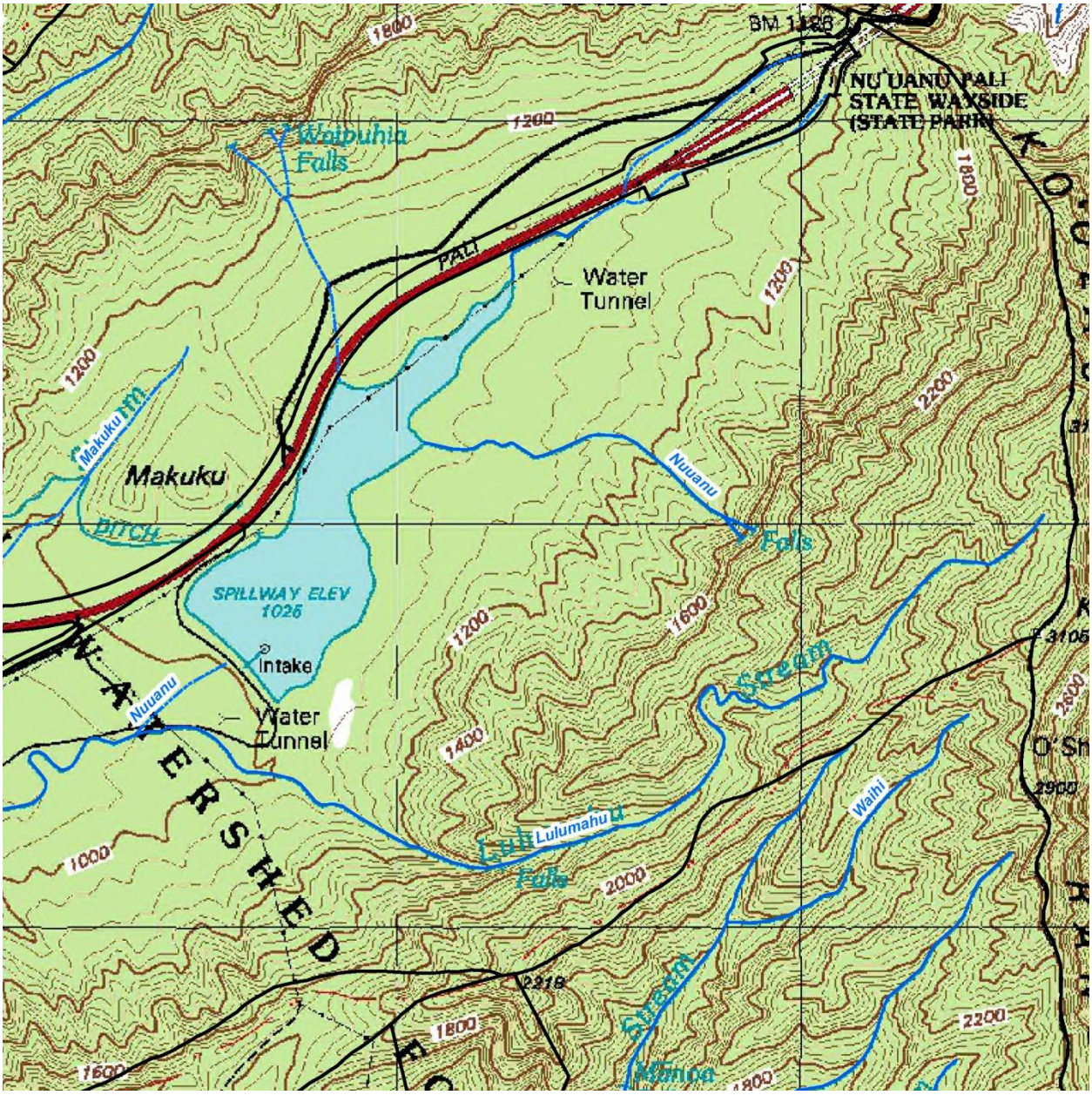

Figure 3-4: Streams and Surface Waters in the Reservoir Watershed (source: CWRM).

Wetlands

The USFWS classifies wetland areas according to identifying features such as general appearance, dominant form of vegetation, composition of bottom, and permanency. USFWS classifies the permanent portions of the Nu'uanu Reservoir No. 4 as lacustrine, limnetic, mud bottom, permanently flooded and diked/impounded wetland (wetland code L1OWHh). Exposed areas within and immediately surrounding the basin are identified as limnetic, littoral, mud bottom, seasonally flooded, and diked/impounded wetland (wetland code L2UB3Ch). Wetland boundaries are shown in **Figure 3-5**.

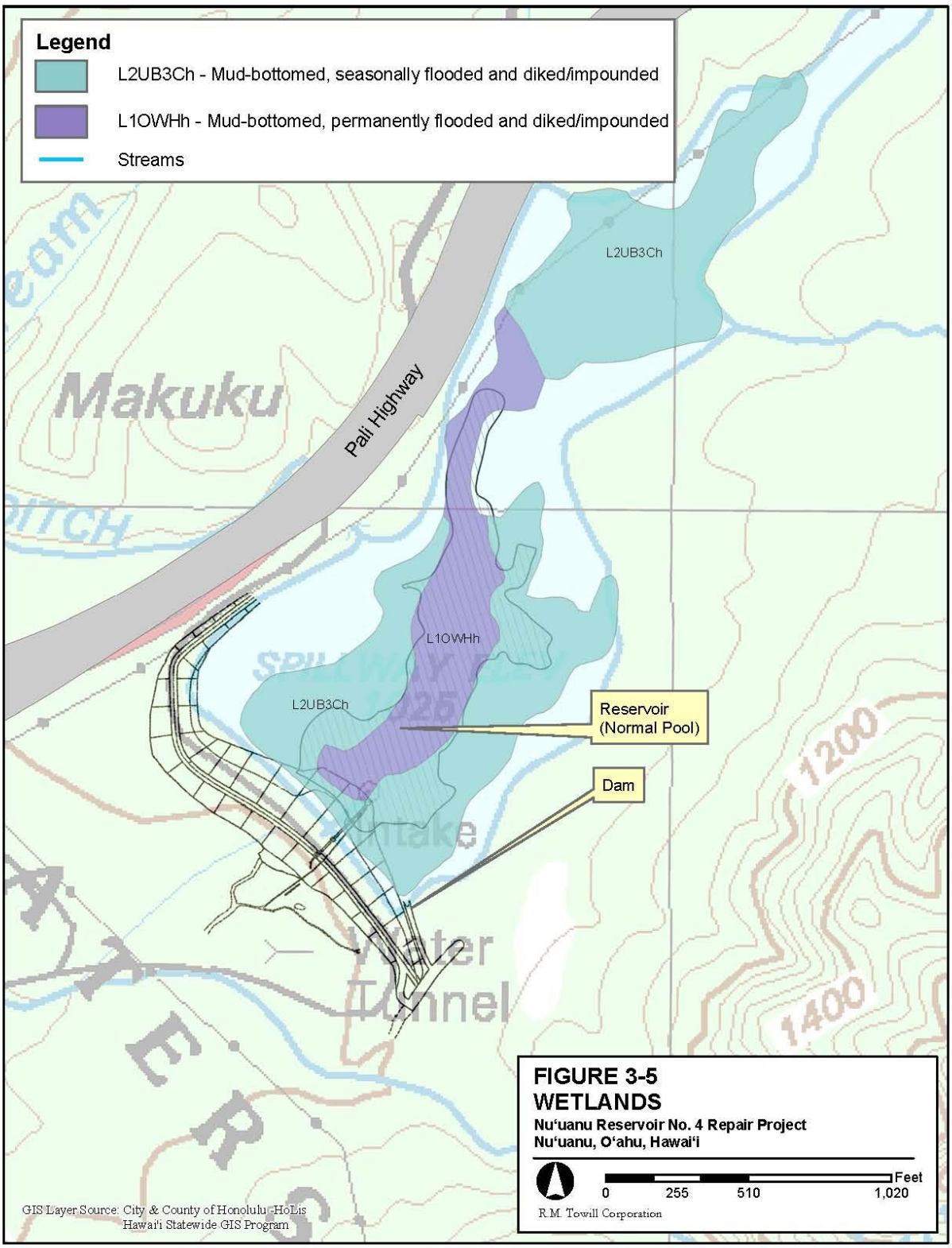

Figure 3-5: Wetlands Boundaries of Nu'uanu Reservoir No. 4

Water Quality

Field measurements for temperature, DO, and pH were conducted and water samples for analyses of conductivity, total suspended solids (TSS), turbidity, ammonia nitrogen, nitrate-nitrite nitrogen, total nitrogen (N), and total phosphorus (P) were collected from three stations in Nuʻuanu Reservoir No. 4. All water samples were collected in screw cap-polypropylene bottles on October 5, 2010 and delivered to *AECOS*, Inc. in Kaneʻohe, Oʻahu for laboratory analyses (*AECOS* Log No 26689). **Table 3-1** lists analytical methods and instrumentation used in the analyses.

Station "North End" was collected from the north end of the reservoir, approximately 1,000 feet (305 m) from the embankment dam in 4.5 feet (1.5 m) of water. Station "Mid Reservoir" was near the center of the reservoir, approximately 500 feet (152 m) from the embankment dam. Station "Tower" was collected from the north side of the intake tower located along the embankment dam. Water quality stations are depicted alongside avian count stations in **Figure 3-6.**

Results from *in situ* measurements and analyses of water samples collected from three stations located in the reservoir are provided in **Table 3-2**. Generally, the water quality in the reservoir is typical for impounded waters in Hawaiian watersheds. Sluggish water movement created by the impoundment allows sediments and biotic waste to accumulate in the water body. Particulates in the water column, as measured by TSS and turbidity, were high, reflecting the brown water observed during the surveys. Temperature and pH readings varied little from station to station; concentrations of DO, N, and total P were also similar at all three stations. Only ammonia varied substantially between locations, presumably reflecting local conditions of water exchange or perhaps breakdown of accumulated organic matter on the bottom.

Table 3-1: Water Quality Sampling Analytical Methods

Analysis	Method	Reference	Instrument
Ammonia Conductivity	EPA 350.1 M SM 2510-B	USEPA (1993) Standard Methods, 20th Edition (1998)	Technicon AutoAnalyzer II Hydach pH/conductivity meter
Dissolved Oxygen	SM 4500-O G	Standard Methods 20th Edition (1998)	YSI Model 550A Dissolved Oxygen Meter
Nitrate + Nitrite pH	EPA 353.2 Rev 2.0 SM 4500 H+	USEPA (1993) Standard Methods 20th Edition (1998)	Technicon AutoAnalyzer II Hannah pocket pH meter
Temperature	thermister calibrated to NBS. Cert. thermometer SM 2550 B	Standard Methods 20th Edition (1998)	YSI Model 550A
Total Nitrogen	persulfate digestion / EPA 353.2	Grasshoff et al (1986)/ USEPA (1993)	Technicon AutoAnalyzer II
Total Phosphorus	EPA 365.1 Rev 2.0	USEPA (1993)	Technicon AutoAnalyzer II
Total Suspended Solids	Method 2540 D	Standard Methods 20th Edition (1998)	Mettler H31 balance
Turbidity	EPA 180.1 Rev 2.0	EPA (1993)	Hach 2100N Turbidimeter

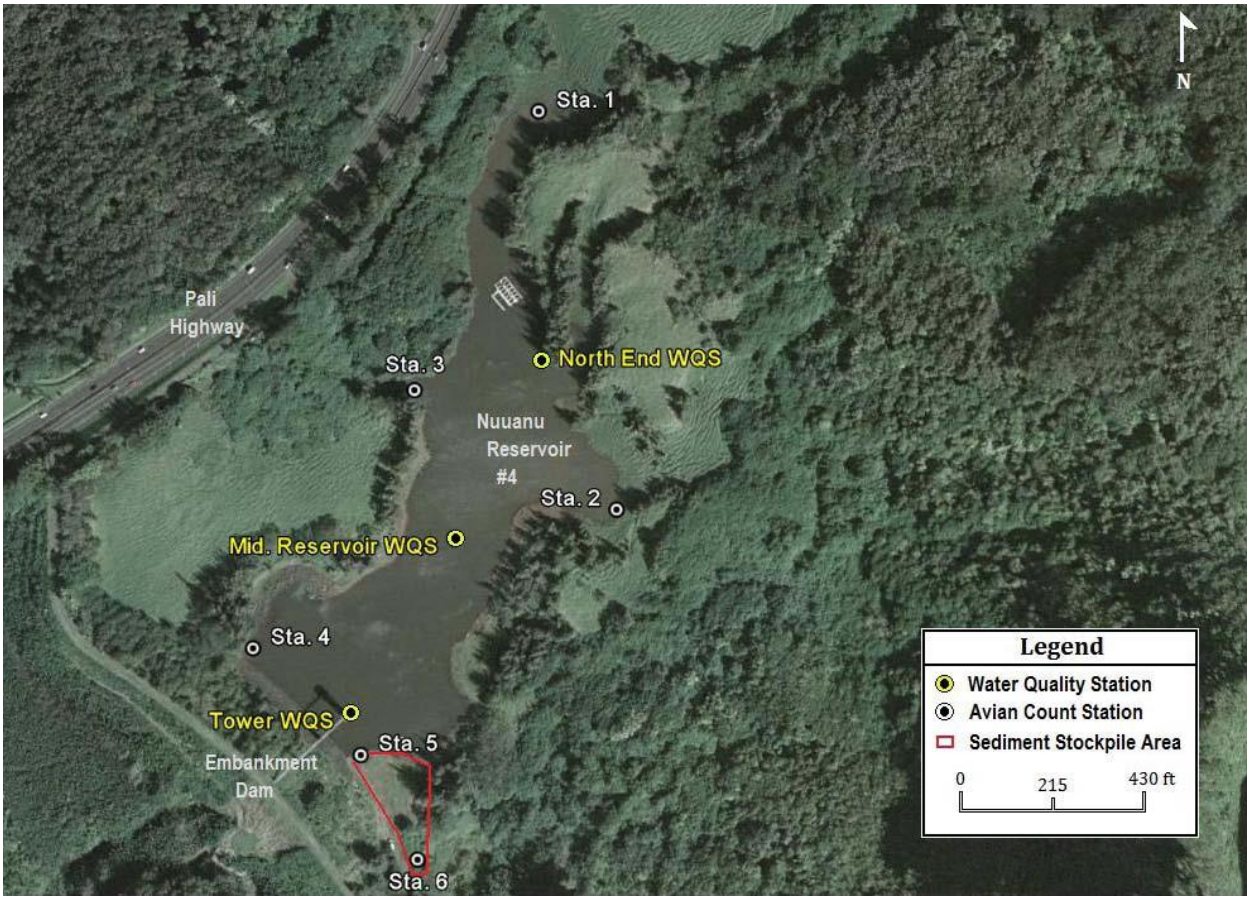

Figure 3-6: Locations of Water Quality Stations and Avian Count Stations.

Table 3-2: Water quality results for samples collected on October 5, 2010 from three stations in Nu‘uanu Reservoir No. 4.

Station	Time	Temp. (°C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% sat.)	pH --	Conductivity (mhos/cm)
North End	1031	23.3	6.31	74	7.05	94
Mid. Reservoir	1046	23.2	6.38	75	7.07	195
Tower	1059	23.3	6.49	76	7.25	93

	TSS (mg/l)	Turbidity (ntu)	Ammonia (µg N/l)	Nitrate+ Nitrite (µg N/l)	Total N (µg N/l)	Total P (µg P/l)
North End	7.0	6.48	94	<9	497	23
Mid. Reservoir	10	8.56	<3	<9	512	27
Tower	9.0	7.53	40	<9	504	27

Water quality in Nu‘uanu Stream in the vicinity of the reservoir is generally excellent due to the undeveloped wilderness environment and relative absence of human activities. The primary pollutant source is turbidity from eroded sediments which are most evident during storm events. In its lower segments through the urbanized environment, the stream is impaired from trash, turbidity, nutrients, and pesticides from urban runoff (CWB, 2006).

Within the reservoir area, Nu‘uanu Stream is designated as “Class 1" inland water by the State DOH. “Class 1" waters are to be protected in their natural state as nearly as possible with an absolute minimum of pollution from any human-caused source. To the extent possible, the wilderness character of these areas shall be protected. Waste discharge in to these waters and activities that result in demonstrable increases in levels of point or non-point source contamination is prohibited.

Approximately one-half mile downstream from the reservoir, Nu‘uanu Stream is designated as “Class 2” inland water. Class 2 waters are to be protected for recreational use, propagation of aquatic life, and as a source of water for agricultural and industrial uses**.**

Impacts and Mitigation Measures

No adverse impacts to water quality are anticipated from this project. The project consists of maintenance and repair work to an existing, currently serviceable dam structure. Planned repairs will restore the reservoir and dam to full, designed capacity and operability for flood control. The planned improvements will not modify the character, scope, or size of the original reservoir and dam design and function. Though the design capacity will be restored, the normal water levels will be substantially lowered to further reduce the risk of infrastructure failure.

Project activities will comply with DOH regulations as set forth in HAR, Title 11 Chapter 54 - Water Quality Standards, and Chapter 55 - Water Pollution Controls. Construction activities will be conducted in compliance with NPDES permit conditions, which will include the preparation of an erosion control plan and site-specific BMPs to prevent soils loss and discharge of pollutants, including sediments, in construction stormwater and dewatering effluent. BMPs will include structural (e.g., berms, silt fences, barriers), vegetative (e.g., grass, mulch, ground cover, soil stabilization), and management measures (e.g., project phasing and good housekeeping practices), as appropriate.

Sediment removal activities, including the draw-down of reservoir waters to expose the work area, will be undertaken with appropriate measures to prevent the discharge of sediments and other pollutants into Nu‘uanu Stream. These measures will include:

- A floating turbidity curtain to isolate the sediment removal area, including the area surrounding the intake tower, from the rest of the reservoir. The curtain will provide a controlled area of containment where solids suspended in the water as a result of excavation activities can settle out without affecting the larger water body.
- A temporary pipe using a pump or siphon pressure draw water from the reservoir and convey it into the middle sluice gate pipe within the intake tower. The inflow end of the temporary pipe will be positioned within an isolated area of the reservoir. A filter rack and screen will be affixed to the end of the temporary pipe to prevent debris and sediment from entering the pipe. The inlet filter rack and screen will be cleaned and maintained throughout the period of work to prevent clogging and monitor for damage.
- Removed sediment will be deposited in a temporary stockpile / dewatering site located on the east side of the reservoir basin above elevation 1,000’ MSL. The stockpile site will be

constructed as a detention basin to detain and eliminate dewatering effluent through ground percolation and evaporation.

- A temporary structural barrier constructed around the perimeter of the stockpile/dewatering site to prevent the release of any dewatering effluent from the stockpile site. The barrier may be constructed using earthen berms lined with geotextile fabric, sand bags, concrete 'jersey' type barriers, or other methods deemed appropriate by the project contractor.
- Silt fencing along the downslope perimeter of the stockpile site outside of the structural barrier to capture sediment in stormwater runoff originating from the stockpile site.
- A temporary, stabilized access way between the boom crane staging area and the stockpile/dewatering site for use by dump trucks to transport excavated sediment material. Where the access way traverses previously inundated areas containing soft soils, access stabilization may be achieved by use of a portable road or vehicle mat.
- Dump trucks used for sediment transport between the work area and dewatering basin will be lined to prevent discharges.

The following measures will be undertaken during work on the reservoir outlet area:

- Structural BMPs, including silt fencing and diversion berms, will be installed and maintained throughout work on the reservoir outlet area to isolate the work area and prevent the discharge of sediments and other pollutants in stormwater runoff. Disturbed areas at the outlet will be stabilized by the placement of coarse riprap or vegetative ground cover.
- Vegetation to be cleared as part of required maintenance will be cleared by cutting to avoid disturbing underlying soils.

  Additional, general BMPs that will be employed throughout the period of construction include the following:

  - Clearing and excavation shall be held to a minimum necessary to meet project design and construction plan requirements.
  - Construction entrances will be stabilized to minimize ground disturbance and prevent vehicle tracking of dirt, mud and debris off of the project site.
  - Construction shall be phased to minimize the exposure time of cleared or excavated areas. Existing ground cover shall not be destroyed, removed or disturbed more than 20 calendar days prior to the start of construction.
  - Storm water flowing toward active project areas shall be diverted as much as practicable using appropriate controls, such as berms and silt fences, as determined by the contractor according to site conditions.
  - Areas that remain unfinished for more than 20 calendar days shall be hydro-mulched or seeded to provide temporary soil stabilization.
  - The project contractor will select locations for stockpiling construction material. As appropriate to the site, a sediment retention berm or silt fence will be installed around the down-slope side of stockpile sites to retain sediment discharge during heavy rainfall.

- Fueling of construction equipment will be performed off-site or within an area designated by the contractor. Any site designated for refueling shall be located away from surface water and constructed to contain spills and seepage and prevent storm water runoff from carrying pollutants into state coastal waters.

3.1.5 AIR QUALITY

The present ambient air quality in the project area is considered excellent due to the prevailing northeasterly tradewinds and the absence of "heavy" industries. Air quality in the area can be affected by air pollutants from natural and/or human sources. Natural sources include wind-blown dust, wild fires, and occasional distant volcanic emissions from the Island of Hawai'i. Human sources include vehicular emissions from motorists traveling on Pali Highway and residential streets located lower in the valley, refuse burning, barbeques, and other intermittent sources. There are no air quality monitoring stations located in the project vicinity. The nearest air quality monitoring station is located on Punchbowl Street in downtown Honolulu. The DOH requires criteria pollutant levels remain below state and federal ambient air quality standards at all State and Local Air Monitoring Stations. (DOH, 2010).

Impacts and Mitigation Measures

The proposed project is not expected to have a significant impact on air quality. Construction activities might result in short-term air quality impacts from fugitive dust and equipment emissions. Dust control measures will include, but not be limited to, watering of active work areas, using wind screens, keeping adjacent paved roads clean, and covering open-bodied trucks. Construction-related exhaust emissions will be mitigated by ensuring that project contractors properly maintain their internal combustion engines and comply with DOH Rules Title 11, Chapters 59 and 60, regarding Air Pollution Control. Construction related impacts to air quality will be temporary and will cease when construction is completed.

Long-term impacts from vehicular sources are not anticipated to increase significantly over existing conditions as a result of this project. Traffic use levels are anticipated to remain the same, thus, no mitigation measures are required or recommended.

3.1.6 NOISE

Ambient noise conditions in the project area are generally low due to the remote valley location. The dominant noise is from wind and from vehicular traffic along Pali Highway.

Impacts and Mitigation Measures

Short-term noise impacts would result from construction activities, particularly noise generated during mobilization activities, and from operation of heavy construction equipment and hand tools. Construction equipment typically generates noise in the range of 55 to 90 dBA in close proximity to the site. There are no residential areas or other human uses in the vicinity of the project that would be sensitive to temporary increased noise levels. Noise from construction activities may temporarily disrupt routine behavior patterns of common birds, but will not result in permanent displacement. When project activities are complete, bird activity is expected to return to current conditions. To mitigate short-term construction related impacts, the contractor will ensure that project activities are undertaken in compliance with the provisions of HAR, Chapter 11-46, "Community Noise Control".

No long-term noise impacts will result from the proposed project. Upon project completion, noise conditions will return to pre-existing conditions.

3.1.7 NATURAL HAZARDS

Flood

The FEMA FIRM No. 15003C0360F, dated January 19, 2011, shows that the project site is in Flood Zone D. This designation is used for areas where there are possible but undetermined flood hazards. No analysis of flood hazards has been conducted by FEMA.

Land downstream of the project site is designated as Zone X, which are areas outside of the 500-year flood zone. No base flood elevations or depths are noted on the FEMA maps for this zone. See **Figure 3-7: FEMA Flood Insurance Rate Map.**

Hurricane

The Hawaiian islands are seasonally affected by Pacific hurricanes from the late summer to early winter months. The State has been affected twice since 1982 by significant hurricanes: ‘Iwa in 1982 and ‘Iniki in 1992. During hurricanes and storm conditions, high winds cause strong uplift forces on structures. Wind-driven materials and debris can attain high velocity and cause devastating property damage and harm to life and limb. It is difficult to predict these natural occurrences, but it is reasonable to assume that future events will occur. The project area is, however, no more or less vulnerable than the rest of the island to the destructive winds and torrential rains associated with hurricanes.

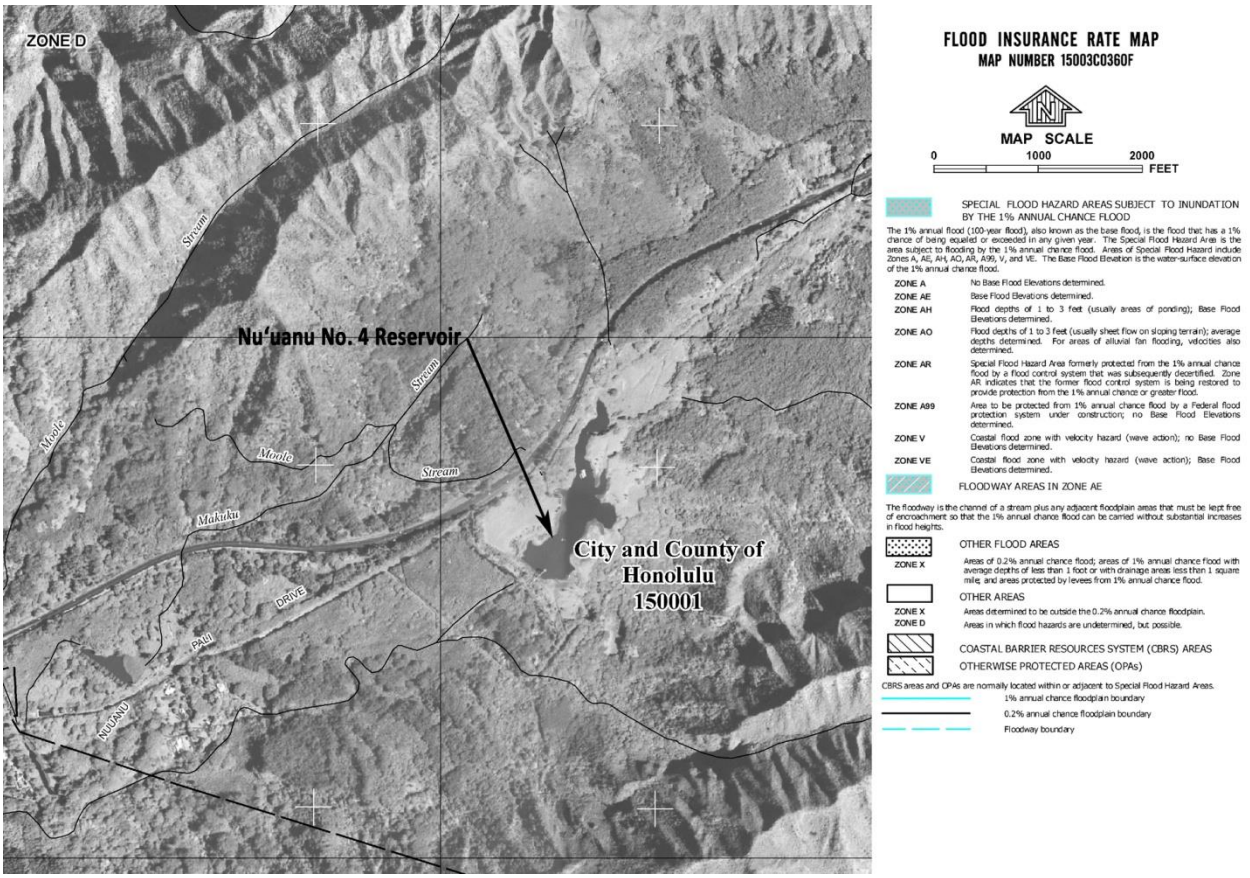

Figure 3-7: FEMA Flood Insurance Rate Map No. 15003C0360F.

Seismic Hazard

The Hawaiian islands experience thousands of earthquakes each year but most are so small that they can only be detected by instruments. Some are strong enough to be felt and a few cause minor to moderate damage. Most of Hawai‘i's earthquakes are directly related to volcanic activity and are caused by magma moving beneath the earth's surface. The USGS list of historic earthquakes for Hawai‘i does not list any significant earthquakes for O‘ahu.

According to a 1978 Phase I Inspection Report of Nu‘uanu Reservoir No. 4 on O‘ahu, submitted by the ACOE, explorations by geophysical methods have shown that faults and rift zones cut through the major islands and that these faults are branches of a fracture system known as the Moloka‘i Fracture Zone. It also concludes that seismic risk for O‘ahu should be determined from the major earthquakes that have occurred close to the Molokai Fracture Zone and not from earthquakes that have their epicenters close to the very seismically active areas close to the island of Hawai‘i (Big Island).

The USGS list of historic earthquakes for the state does not list any significant earthquakes for O‘ahu. The vast majority of earthquakes (1990-2006) have occurred on or near the island of Hawai‘i. During the most recent large earthquake (magnitude 6.7) on Hawai‘i island in October 2006, the O‘ahu experienced ground shaking equivalent to a Modified Mercalli rating of IV to V (magnitude 4.0 to 4.9). The Nu‘uanu Reservoir No. 4 embankment dam is routinely inspected and has been analyzed for stability. Throughout its working life, no embankment failures or conditions that would indicate adverse effects from seismic activity have been observed.

Tsunami

The project site is located outside of the City and County of Honolulu Tsunami Evacuation Zone.

Impacts and Mitigation Measures

Nu‘uanu Reservoir No. 4 is classified as a High Hazard dam according to the degree of its potential to create adverse incremental consequences such as loss of life, property damage, or environmental impacts of a failure or mis-operation of a dam. The 3 hazard classifications are High, Significant and Low. The High hazard classification is due to the presence of a significant amount of residential and commercial development in Nu‘uanu Valley below the dam and does not relate to the dam’s condition or stability.

Flood

Nu‘uanu Reservoir No. 4 provides flood control to down-stream residential areas and part of downtown Honolulu that lies within the Nu‘uanu Stream corridor. The planned repair work will ensure that the dam infrastructure is fully operable as designed to control stormwater runoff and flood waters. As a precautionary measure BWS currently keeps the water level in the reservoir at approximately ½ full which increases safety and the flood control capacity of the reservoir. The planned repairs will allow BWS to reduce the water levels to the lowest gate as designed, and thereby further reduce the risk of flood hazard.

Hurricanes

Although it is difficult to predict hurricanes, it is reasonable to assume that future events will occur. The project area and facility sites are, however, no more or less vulnerable than the rest of the island to the destructive winds and torrential rains associated with hurricanes.

Hurricanes pose a significant threat during the period of construction. Active construction sites and staging and stockpile areas are subject to inundation from heavy rains. High winds can topple equipment and structures, dislodge materials, and propel unsecured objects at high velocity creating significant hazard.

Measures to protect construction operations from potential hurricane damage involve early preparation upon notification of an impending hurricane event. The National Hurricane Center issues a "Hurricane Watch" 48 hours in advance of a potential hurricane event, and issues a Hurricane Warning" when sustained winds of at least 74 mph are expected within 36 hours. Upon issuance of a "Hurricane Watch" notice, work crews will begin securing the construction site as follows:

- Remove or secure equipment, machinery, construction materials, and portable toilets.
- Clean up all construction debris.
- Stop scheduled deliveries of building materials
- Remove jobsite signage, dust screens, silt screens, and other temporary installations.
- Locate and turn off jobsite utilities, including electricity and water connections.

Upon issuance of a "Hurricane Warning", construction operations will cease, work crews will finalize securing the project site and evacuate until the hurricane threat has passed.

Seismic Hazard

Earthquakes pose a threat throughout Hawai'i, but disruptive seismic events are relatively uncommon in this region. Nu'uanu Reservoir is one of the few dams in the State, which has gone through both a Phase I and II dam safety investigation, which is an in-depth analysis of the stability of the dam, and the investigations have found that the dam is safe and poses no immediate safety hazard.

In the event of an earthquake, heavy rainfall or storm event, security threat, or other emergency condition that could jeopardize the integrity of the reservoir or dam infrastructure, the reservoir facilities will be inspected by BWS in coordination with emergency response agencies and appropriate action will be initiated in accordance with an Emergency Action Plan (EAP) prepared specifically for Nu'uanu Reservoir No. 4. The EAP is a multi-agency action plan prepared by the BWS and the DLNR Dam Safety Program (DSP) that outlines procedures to minimize risks to life and property during emergency events that could affect the Nu'uanu Reservoir No. 4 dam facility. No other mitigation measures are recommended for seismic hazards.

Tsunami

No mitigation measures related to tsunami hazard are required.

Wildland fires

No mitigation measures related to wildland fires are required. See Section 3.2.6 for fire station information.

3.1.8 FLORA AND FAUNA

Field inventory surveys of terrestrial and aquatic flora and fauna were conducted for the project. The biological survey report is included as **Appendix D** at the end of this document. A summary of the findings and recommended mitigation measures is included as follows:

Flora

A list of all ferns, conifers, and flowering plants encountered during the survey is presented in **Appendix D.** Endemic and indigenous plant species identified during the survey are listed in **Table 3-3**. A total of 103 plant species were recorded. Eight of the species (7.7%) are native plants (7 indigenous, 1 endemic); all of the remaining species were introduced to the Hawaiian islands after 1778 and have become naturalized. The native species are types commonly found in low to moderate elevations in the

islands. The vegetation around the immediate vicinity of the dam is partly ruderal weeds (plants that favor disturbed areas) and partly plant species invading from the surrounding lands, as this area is frequently disturbed by mowing or other activities related to maintenance. Around much of the reservoir, the ground is a patchwork of small forest copses and open grassy areas. See **Figure 3-8**.

Forest copses are typically dominated by ironwood trees (*Casauarina equisetifolia*), although *hau* (*Hibiscus tiliaceus*), Java plum (*Syzigium cuminii*), Padang cassia (*Cinnamomum burmanni*), gunpowder tree (*Trema orientalis*), fiddlewood (*Citharexyllum caudatum*), eucalyptus (*Eucalyptus* spp.), native koa (*Acacia koa*), common guava (*Psidium guajava*), and paperbark (*Melaleuca quinquenervia*) are mixed in. In some areas, a closed canopy forest is more extensive, particularly on the upper west side of the reservoir. This forest is dominated by *hau*. Further from the reservoir monotypic bamboo forests cover large swaths of ground. While the reservoir is mostly an open body of water, some flooded areas are covered by either *hau* or California grass (*Urochloa mutica*). The latter grass also occurs in large patches away from the water. Draw-downs of the reservoir create areas of bare, red soil, but these are usually colonized rapidly by herbaceous plants, mostly sedges and grasses close to the water line.

Both the reservoir and the surrounding vegetation function in reducing particulate loading in Nu‘uanu Stream. As to the nature of the vegetation, this would likely be all forest in this location were it not for the reservoir and selected clearings made as part of reservoir maintenance. However, the flora is one very much dominated by non-native species. Other than a few *koa* trees towards the middle and upper end of the reservoir, no particular plants are deserving of preservation. Endemic and indigenous plant species located within the project area are listed in **Table 3-3**.

Figure 3-8: Nu‘uanu Reservoir No. 4 as seen from the eastern end of the dam.

Table 3-3:
Endemic and Indigenous Plants in the Project Area

Scientific Name	Common Name	Abundance
LINDSAEACEAE *Sphenomeris chinensis* (L.) Maxon	*palaʻā*	*R*
THELYPTERIDACEAE *Cyclosorus interruptus* (Wild.) H. Ito	*neke*	R
CONVOLVULACEAE *Ipomoea indica* (Burm.) Merr.	*koali ʻawa*	R
FABACEAE *Acacia koa* A. Gray	koa	U
MALVACEAE *Hibiscus tiliaceus* L.	*hau*	AA
OXALIDACEAE *Oxalis corniculata* L.	yellow wood sorrel	R
SOLANACEAE *Solanum americanum* Mill.	*pōpolo*	R
CYPERACEAE *Cyperus polystachyos* Rottb.	___	C

Key: AA=Abundant, C=Common, U=Uncommon, R=Rare

Avifauna

A total of 67 individual birds of 12 different species representing eight families were recorded in the project area during the avian surveys. Very few birds were observed during surveys at the six avian count stations, as most individuals were observed during the perimeter surveys of the reservoir or during transit between count stations. A complete list of all avian species observed and the number of individuals encountered in three of the proposed work areas within the project site: embankment dam, reservoir, and the proposed sediment stockpile site is included in **Appendix D**. No birds were observed at the seepage work areas or the outlet receiving area in Nuʻuanu Stream.

Ten of the twelve species recorded are considered to be introduced or naturalized to the Hawaiian islands. Two species sighted consistently and comprising nearly half of the birds encountered during the survey: the Pacific Golden Plover or *kolea* (*Pluvialis fulva*) and the *ʻaukuʻu* or Black-crowned Night Heron (*Nycticorax nycticorax*), are indigenous to the main Hawaiian islands. These two species are a winter migrant and a waterbird, respectively, with stable, widespread Hawaiian populations (Mitchell et al, 2005). Neither species is listed by the Endangered Species Act or its amendments (USFWS, 2009).

Four species encountered at the project site: Pacific Golden Plover, Duck, Zebra Dove, and Spotted Dove are protected by the MBTA of 1918. Protection via the MBTA is administered by the USFWS and implemented through the protection or regulation of taking of a listed species including nests, eggs, and feathers.

In addition to the species listed above, the U.S. Fish and Wildlife Service has indicated the possibility that four additional Hawaiian waterbirds listed as endangered species may also be present in the vicinity of the

project area. These Hawaiian waterbirds include: the federally endangered Hawaiian stilt (*Himantopus mexicanus knudseni*) endangered Hawaiin moorhen (*Gallinula chloropus sandvicensis*), endangered Hawaiian coot (*Fulica alai*), and the endangered Hawaiian duck (*Anas wyvilliana*).

Aquatic Biota

The aquatic biota in Nu‘uanu Reservoir No. 4 comprises mostly naturalized, non-native species. A complete list of all aquatic species identified during the survey is included in **Appendix D**. The only native species encountered during the survey was the globe skimmer dragonfly (*Pantala flavescens*), which is circumglobal in distribution throughout both tropical and temperate climate regions (Clausnitzer and Suhling, 2008). Tilapia and poeciliids are the predominant fishes in the reservoir surface waters. Two tilapia species, the black-chinned tilapia (*Sarotherodon melanotheron*) and the Mozambique tilapia (*Oreochromis mossambicus*) appear to be common, though correct field identification of these fishes to species level is difficult due to hybridization. Mollies (*Poecilia* sp.) are common, while other Poeciliids, like swordtails (*Xiphophorus helleri*), mosquitofish (*Gambusia affinis*), and guppies (*Poecilia reticulata*) are encountered less regularly. Channel catfish (*Ictalurus punctatus*) are occasionally seen, usually resting on *hau* (*Hibiscus tiliaceus*) branches or swimming slowly along the shore. Red-rimmed melania snails (*Melanoides tuberculatus*) are uncommon, generally only observed where basaltic bedrock or boulders occur as substratum in the reservoir. The Asiatic flume clam (*Corbicula fluminea*) is found in the reservoir and broken shells of this species are ubiquitous in shallow waters.

Aquatic biota observed during the October 2010 surveys consisted almost entirely of naturalized species. The Nu‘uanu watershed is reported (Parham et al., 2008) to host some native fish and invertebrate species including *‘o‘‘ōpū nākea* (*Awaous guamensis*), *‘o‘opu nōpili* (*Sicyopterus stimpsoni*i), *‘o‘opu alamo‘o* (*Lentipes concolor*) and *‘opae kala‘ole* (*Atyoida bisulcata*). Although these populations are reported from the estuarine, lower, and middle reaches of the stream, these species are also found in the upper reaches of O‘ahu streams at similar elevations to Nu‘uanu Reservoir No. 4. However, species accounts of fishes and invertebrates in reservoirs of the Hawaiian Islands suggest that the environment favors non-native species (Parham et al, 2008; AECOS, 2008). Competition and predation may prevent significant populations of native species inhabiting a reservoir.

The Oceanic Hawaiian damselfly (*Megalagrion oceanicum*) is reported to historically inhabit the Nu‘uanu watershed (Parham et al, 2008; Polhemus, 2007) However, recent (1991-2003) O‘ahu surveys indicate that populations are limited to eight stream catchments from Kahalu‘u Stream in the southeast to Kahamainui Stream in the northwest of the windward side of the Ko‘olau Ridge (Polhemus, 2007). No Oceanic Hawaiian Damselflies were observed during the October 2010 surveys and none is anticipated to utilize resources in the reservoir or project work area since preferred habitat for the species is stream riffles, rapids and waterfall faces, habitats which do not exist within the project area.

Mammalian Resources

Tracks of feral pigs (*Sus scrofa*) were identified along the western shore of the reservoir. It is likely that one or more of the four established alien rodents known on O‘ahu (Tomich, 1986): roof rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans*), and European house mice (*Mus domesticus*), use resources within the general project area, on at least on a seasonal basis. Likewise, the Indian mongoose, also known as the small Asian mongoose (*Herpestes javanicus*), may be found in the project area. All of these mammalian species are pest species naturalized to the Hawaiian islands without value from a resource conservation perspective.

The endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), known locally as *ōpe‘ape‘a*, was not detected during the survey. However, bats are known to forage over a wide variety of habitats and have been documented to roost in a variety of trees (Mitchell et al., 2005), so it is possible they could occur in this area. The species is listed as endangered and protected by the Endangered Species Act of 1972.

Critical Habitat

There are no federally designated Critical Habitats for any plant or animal species currently protected under the Endangered Species Act of 1973, as amended within the project area (USFWS, 2002). The Oʻahu ʻElepaio (*Chasiempis sandwichensis ibidis*) does have designated critical habitat in the Koʻolau mountains nearby. However, the area is over 330 feet (100m) from the southeast end of the reservoir access road. Anticipated project work will not impinge on this critical habitat or adversely impact the species.

Impacts and Mitigation Measures

The proposed project at Nuʻuanu Reservoir No. 4 is not anticipated to have any adverse impacts on the population or habitat of any avifauna, terrestrial and aquatic wildlife. Nor will project activities diminish the availability of any plant species as a resource. None of the botanical, avian, or aquatic species observed during the survey is listed as threatened or endangered by the USFWS under the Endangered Species Act of 1973, as amended, or by the State of Hawaiʻi under its endangered species program (DLNR 1998; USFWS, 2009). Furthermore, the proposed action will not result in modification of any federally designated Critical Habitat, as there is none present on or adjacent to the subject property.

Construction activities may temporarily disrupt routine behavior patterns of common birds, but will not result in permanent impacts. When project activities are complete, bird activity is expected to return to current conditions.

Any documented nests or broods within the project vicinity will be reported to the U.S. Fish and Wildlife Service within 48 hours. A 100-foot buffer will be established and maintained around all discovered active nests and/or broods until the chicks/ducklings have fledged. No potentially disruptive activities or habitat alteration will occur within this buffer. If a listed Hawaiian waterbird is observed within the project site, or flies into the site while activities are occurring, a biological monitor will halt all activities within 100 feet of the individual(s). Work shall not resume until the Hawaiian waterbird(s) leave the area on their own accord. If Hawaiian waterbird(s) or their nests are discovered during construction, a post-construction report will be submitted to the U.S. Fish and Wildlife Service within 30 days of completion of the project.

To prevent potential impacts to bat populations, removal or trimming of trees over 4.5 m (15 ft.) will not be permitted during bat birthing and rearing season (June 1 to September 15). If the project schedule requires vegetation clearing to take place during this period, a bat survey of the area proposed for clearing will be undertaken by a knowledgeable biologist prior to commencement of clearing activities.

3.2 SOCIAL AND ECONOMIC ENVIRONMENT

3.2.1 LAND USE

The Nuʻuanu Reservoir No. 4 is located within the State Conservation District. The area is zoned Preservation (P-1) by the City and County of Honolulu. The existing reservoir and the planned *repair work are compatible uses within these land use designations.*

Lands surrounding the reservoir site are preserved in their natural state as undeveloped, forested watershed lands. One function of the reservoir and surrounding vegetation is to promote infiltration of rainwater to recharge the groundwater in the Honolulu aquifer. Nuʻuanu Reservoir No. 4 is the largest of

four reservoirs in the Nuʻuanu reservoir system that provides flood control for downstream residential areas within Nuʻuanu Valley and downtown Honolulu.

The Pali Highway (State Highway 61) runs adjacent to the reservoir along the west side. The Pali Lookout at Nuʻuanu Pali State Park is located approximately 1.5 miles northeast of the dam. The nearest developed areas are the residential neighborhoods of upper Nuʻuanu Valley, which are located approximately one-half mile south of the project site off of Nuʻuanu Pali Drive. The surrounding forest lands are used.

Impacts and Mitigation Measures

The planned repair work will have a beneficial effect by ensuring that the reservoir and dam infrastructure continue to function as designed for flood control. This entails lowering the "normal pool" levels as to further reduce the risk of a dam failure. Project activities, including construction staging equipment operations, and stockpiling, will result in temporary ground disturbance and occupation of open space areas in the reservoir basin. Following construction, the active work areas will be restored to pre-existing conditions. Project activities will have no adverse effects on existing land uses. The nearest residential areas and public recreation area at the Pali Lookout will not be adversely affected due to the intervening distance. In light of the anticipated benefits resulting from the proposed improvements, no additional mitigation measures are required or recommended.

3.2.2 HISTORIC AND ARCHAEOLOGICAL RESOURCES

An AIS was conducted for the project by CSH. A copy of the AIS report is included as **Appendix B**. Two separate field investigations were conducted by CSH archaeologists, including an initial field survey conducted on January 31, 2011 and a second field survey on March 31, 2011 to examine three possible historic sites pointed out by members of ʻAhahui Mālama o Kaniakapūpū during their visit to the site on January 9, 2011.

The entire project area is comprised of Nuʻuanu Reservoir No. 4 itself and several appurtenances. These include an intake tower set within the reservoir and a suspension footbridge leading from the intake tower to the top of the embankment dam (**Figure 3-9).** The upstream side of the embankment dam consists of a partial riprap surface. To the southeast of the reservoir itself, a spillway leads to the south and down the valley. An outlet receiving area with a 24-inch pipe (**Figure 3-10)** is located at the bottom of a paved trail on the downstream slope of the embankment dam (**Figure 3-11).** Several seepage points and monitoring wells are also located on the downstream slope of the embankment dam. Access to the reservoir complex is by the reservoir access road that leads off of the Pali Highway and travels along the top of the dam embankment. An old access road is located partway down the downstream side of the embankment dam.

To the southeast of the reservoir, in a paved parking area, is a water valve protruding from the side of a small concrete-lined embankment (**Figure 3-12).** This water valve supplied the whole of downtown Honolulu with water at the beginning of the nineteenth century, until the discovery of a vast groundwater source (Daws 2006:269-273). Following this discovery, artesian wells were drilled throughout Honolulu and became the main source of supplied water for the city (BWS 2004; Daws 2006:273). Farther to the southeast of the paved parking area and along a trail through the woods that starts at the water valve is an area for water filtration**.** Two large concrete-lined vats are situated in the ground and would have been filled with sand (**Figure 3-13)**. Water would have been placed into the vats and filtered through the sand to purify it. Further along the trail into the woods, lies a concrete and rock wall alongside a stream (**Figure 3-14)**. It appears to function as a dam for the stream.

Figure 3-9: Reservoir Intake Tower

Figure 3-10: Reservoir Outlet Tunnel

Figure 3-11: Access steps, Dam Embankment.

Figure 3-12: Water Valves (no longer used)

Figure 3-13: Sand Filter Pits (no longer used).

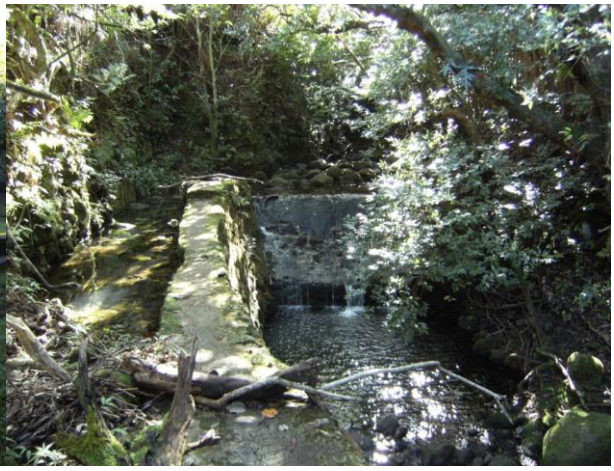

Figure 3-14: Concrete Wall at Lulumahu Stream

On March 31, 2011, CSH archaeologists examined three of the possible historic sites pointed out by members of ʻAhahui Mālama o Kaniakapūpū during their visit on January 9, 2011. It should be noted that all three of these possible sites lie outside of (although near) the current project area boundary, to the south. The possible sites were noted to be comprised of rock structures, ti plants, and/or *ʻieʻie* and are thought by community members to represent habitation sites. CSH observed ti plants throughout the forested area to the south of the project area; the plants did not appear to represent sites of former habitation as proposed by members of ʻAhahui Mālama o Kaniakapūpū. Natural collections of boulders were also seen throughout the area.

After viewing the three possible sites, CSH determined that two of the possible sites appear to be natural collections of boulders and plants, while the third possible site represents a mound of basalt boulders that show evidence of mechanical rock quarrying.

Historic Properties

During the current AIS, it became apparent that the entire project area has been substantially modified by the reservoir construction. Field investigations of the project area identified no pre-contact historic properties. However, Nuʻuanu Reservoir No. 4 and the entire Nuʻuanu Reservoir system are considered historically significant.

A total of 44 historic properties were identified within the study area. All 44 historic properties are related to reservoir system infrastructure features described above. All are assessed as significant under Hawaiʻi Register of Historic Places eligibility Criterion D, meaning that each of the historic properties have "yielded, or is likely to yield, information important for research on prehistory or history."

The AIS study recognizes the historic significance of the entire Nuʻuanu Reservoir system, comprised of reservoirs 1 through 4 and their associated features. The reservoir system meets the Hawaiʻi Register of Historic Places eligibility Criterion A: *Historic property reflects major trends or events in the history of the state or nation.* The Nuʻuanu Reservoir No. 4 is historically significant due to its role in the early development of modern Honolulu as a source of drinking water, hydroelectricity, and flood control.

Impacts and Mitigation Measures

No adverse effects to these historic properties are anticipated to result from the planned improvements. The planned improvements are necessary to maintain the function and integrity of the reservoir infrastructure and dam embankment. The improvements will restore full operability to the dam infrastructure, as designed, and will not result in any significant modification or destruction of the existing features. As part of the AIS conducted for this project, a SIHP site number is being assigned to the Nuʻuanu Reservoir system, comprised of four reservoir basins and associated infrastructure. The SIHP number is assigned in recognition of the historic significance of these facilities to the development of Honolulu.

If any unexpected cultural features, deposits or burials are encountered during work activities, work in the immediate area will be suspended until the monitoring archaeologist evaluates the significance of the findings. The SHPD will be immediately notified to determine the appropriate course of action. No additional mitigation measures are recommended or required at this time.

3.2.3 CULTURAL RESOURCES AND PRACTICES

A CIA was prepared for the project by CSH. The report is included in **Appendix C**. The following summarizes the findings and recommendations from the study.

Background research on the project area and surrounding region of the Nuʻuanu Ahupua'a indicates the following chronology of uses:

1. Coastal settlers in the traditional village of Kou (Honolulu) likely constructed fishponds in Honolulu Bay and developed wetland agriculture close to the mouth of Nuʻuanu Stream (Dixon et al. 1994:7). Irrigated, pondfield cultivation of taro with stone-lined *ʻauwai* (ditches) extended *mauka* (inland) to the lower valley of Nuʻuanu (Handy 1940:78-79; Handy and Handy 1972:475; Leidemann 1989, 1991; Yent and Ota 1980), while terraces in the vicinity of the project area in the upper valley would have likely been used for dryland taro or sweet potato cultivation (Dixon et al. 1994:12).

2. The Nuʻuanu Ahupuaʻa contains numerous *wahi pana* (storied places) and associated *mo'olelo* (stories, oral traditions) that place the specific project area within a broad cultural context. Two waterfalls, Waipuilani and Waipuhia, feed the upper tributaries of Nuʻuanu Stream that flow into the Nuʻuanu Reservoir No. 4. The original construction plans (1907) for the reservoir indicate that a spring called Keiliohia was located in the project area, but was inundated by the filling of the reservoir.

3. The project area is located in the cool, forested *ʻili* (land division smaller than an ahupua'a) of Luakaha (Lyons 1874), which means "a place for relaxation" and neatly captures how Hawaiians during various time periods have similarly used the land for rest and respite. In ancient times, Luakaha *ʻili* had been set aside as a relaxation spot for the high *ali'i* (chiefs) and royalty (C.H. Cooke 1938, cited in Sterling and Summers 1978:307). According to Charles Kenn, a *heiau* (sacred place of worship, temple) called Kaniakapūpū *makai* (seaward) of the project area was a place where people came for comfort and medical attention, with guards stationed at a sacred *hau* (hibiscus) grove *mauka* of the project area (Pacific Worlds 2003a). In one version of the Battle of Nuʻuanu in 1795, Kamehameha I rested at Kaniakapūpū while his men made the final assault on the remaining O'ahu forces, 300 of which made a final stand in Luakaha *ʻili* in an attempt to allow the others to escape down the *pali* (cliffs) or over the mountains (Pacific Worlds 2003a). Then, Kamehameha III built Kaniakapūpū into his summer palace, one of several places of refuge from the politics taking place in Honolulu, as well as from the heat of the plain of Honolulu. Kaniakapūpū was the scene of a historic feast on July 31, 1847, in which 10,000 people celebrated the fourth anniversary of La Hoʻihoʻi Ea (Restoration Day) (Hawaiian Annual 1930:102-105, cited in Sterling and Summers 1978:308). The following year the Chiefs Children School held a picnic at Kaniakapūpū (Helen Judd manuscript, cited in Anderson and Williams 1993), but afterwards the site fell into disuse (Pacific Worlds 2003a).

4. A trail once wound up Nuʻuanu Valley toward the Nuʻuanu Pali and then traversed the sheer rock cliffs to reach windward Oʻahu (ʻĪʻī 1959:92). Parts of this steep path later became incorporated into the stone-paved horse trail in 1845, the newly constructed Pali Road in 1897, and recent improvements starting in 1952 that led to the existing Pali Highway that runs next to the project area (Devaney et.al. 1982).

5. The middle nineteenth century marked the introduction of private and public land ownership laws to Hawaiian society during the Mahele (division of Hawaiian lands). Most of the *ʻili* of Luakaha became Crown Lands, including the royal residence of Kaniakapūpū *makai* of the Project area. No Land Commission Awards were awarded in the current Project area (Waihona 'Aina 2000).

6. There has been very limited development in the *'ili* of Luakaha in the upper valley of Nuʻuanu during the twentieth century. The four reservoirs in Nuʻuanu Valley were constructed from 1890

to 1910 for hydropower, flood control, and domestic water (DLNR, 2010b). The Nu‘uanu Reservoir No. 4 was constructed between 1905 and 1910, and after modifications in 1934, it has since been used as a flood control structure by regulating the flow of Nu‘uanu Stream (Gannet Fleming 2008:2; Townscape, Inc. and Dashiell 2003: 18). The reservoir has also been used for seasonal recreational fishing since 1969 for introduced channel catfish (DLNR, 2010b), and also supports freshwater clams, tilapia, and cichlids (Hollier 2007; Kawanami 2010).

7. A previously recorded oral history indicates that children in the early twentieth century swam in streams and went *ti-leaf* sliding in the lower valley *makai* of the project area (Pacific Worlds 2003d).

A total of 28 community members, government agency and community organization representatives were contacted. Of the 16 people that responded, seven *kupuna* (elders) and/or *kama‘āina* (Native-born) participated in formal interviews. The community consultation indicates:

1. *Mo‘olelo* (oral traditions) demonstrate that Nu‘uanu Valley is a place with deep ancestral and historical significance. From his reading of documented sources, Mr. Baron Ching relates that Nu‘uanu Valley was a place of godly residence and travel, the location of the birth of the first human and the construction of the first *heiau*, the main passage between the *moku* (district) of Kona and Ko‘olaupoko, and the site of several historic battles.

2. The site of Kaniakapūpū spans several time periods. Mr. Baron Ching and Mr. Mel Kalahiki share *mo‘olelo* of a *heiau* dedicated to Lono (the god of agriculture) and medicinal gardens maintained by *kahuna* (priests). Mr. Ching identifies rock-lined *‘auwai* that once channeled water to lo‘i kalo (irrigated taro fields). Mr. Kalahiki narrates how Kamehameha I’s army rested on a waterfall near Kaniakapūpū during their ascent to their final battle at Nu‘uanu Pali while the O‘ahu forces fatalistically fled toward a side valley *mauka* of Kaniakapūpū and the Nu‘uanu Reservoir No. 4 (likely Lulumahu Valley). Mr. Ching describes the construction of Kamehameha III’s summer palace at Kaniakapūpū, the elaborate commemoration of the fourth anniversary of Lā Ho‘iho‘i Ea, and the training of noble children for future leadership roles. Now, the vision of ‘Ahahui Mālama o Kaniakapūpū is to restore the site, document any features and artifacts outside the currently known boundary, and develop a cultural preservation and education center, including the cultivation of medicinal plants for *lā‘au lapa‘au* (traditional plant medicine). Mrs. Laurel “Seeti” Douglass recounts that Val Ching, another expert of Nu‘uanu Valley, previously mentioned to her that medicinal gardens were once maintained in the region, and that the spores of the plants most likely have survived and could be collected to restore the gardens.

3. Numerous archaeological and cultural sites are located in the forested region *makai* of the Nu‘uanu Reservoir No. 4 that may be connected culturally to Kaniakapūpū. Mr. Baron Ching, Ms. Lynette Cruz, Ms. Spencer Leineweber, and Ms. Ulla Hassager identified concentrations of *pōhaku* (stones), *laua‘e*, (fragrant ferns), tī, and *‘ie‘ie* (endemic woody, branching climbers) near the reservoir’s spillway that indicate possible former habitation sites. In the dense bamboo forest farther *makai*, Mr. Ching identified *‘ie‘ie,* a network of *‘auwai,* and a rock structure indicative of a potential habitation site. Mr. Ching also identified a three-to-five foot high dry stacked stone wall that extends from an area near the western portion of the reservoir’s access road approximately 1,000 feet to the trailhead leading toward Kaniakapūpū, noting a possible shrine at the wall and described terraces and enclosures that abut the wall. Mr. Ching also identified several large *pōhaku* in the dense forest that are indicative of former human activity. He suggests that the entire region contains similar cultural features. Mr. Bayman is aware of other cultural features

mauka of the main site of Kaniakapūpū, including a carriage road, a guard station, and a wall. Cultural sites may also continue farther *makai* of Kaniakapūpū. Mrs. Douglass remembers that a series of five stone terraces lined the properties adjacent to her grandmother's house (the second residence *makai* of Kaniakapūpū) and that cobbled stone trails traversed the region.

4. A cultural resource may still be located underneath the Nu'uanu Reservoir No. 4. Mrs. Douglass noted that a freshwater spring was once located in the areas now covered by the water of the reservoir. She described how travelers had to provide an offering for safe passage from the medicinal gardens of Kaniakapūpū to this *mauka* spring.

5. Childhood memories of Nu'uanu Valley shared by Mrs. Douglass include playing with other missionary children in the gulch and shallow waters of Nu'uanu Stream as well as climbing Luakaha Falls, and discovering the ruins of Kaniakapūpū. Mrs. Hinaleimoana Falemei laments how development has impacted the landscape of Nu'uanu since her childhood, especially the once freely flowing *wailele* (waterfalls) ever present mist, and lush vegetation.

6. Mr. Ching believes that the proposed action to substantially drain the reservoir levels would complement the vision of 'Ahahui Malama o Kaniakapūpū. This involves restoring Kaniakapūpū and the surrounding area to former conditions of extensive irrigated taro cultivation. Mr. Ching recommends that the fertile sediment should be left in place and utilized as a base for *lo'i kalo*.

7. Mr. Shad Kāne is concerned that the project may restrict the already diminished flow of Nu'uanu Stream, while Ms. Leineweber is concerned that any overflow will directly impact the site of Kaniakapūpū.

8. To improve access to Kaniakapūpū in order to restore the structures and re-cultivate the land, Mr. Ching requests that the BWS grant 'Ahahui Mālama o Kaniakapūpū access to the gate and reservoir access road, and to grant permission to use the old water pipe access road that leads toward Kaniakapūpū from the spillway.

Impacts and Mitigation Measures

Participants in the CIA identified the following potential impacts to customary and traditionally exercised cultural practices, and cultural, historic, or natural resources:

1. Land and water disturbing activities may uncover cultural resources. The original construction plans for the reservoir indicate that a spring called Keiliohia was located in the project area but was covered with the filling of the water for the reservoir. Keiliohia Spring may have been associated with agricultural and cultural practices. Community participant Mrs. Douglass describes a trail that connected the medicinal gardens of Kaniakapūpū to this spring.

2. The project could potentially impact sites of cultural, historical, archaeological, and botanical interest. Kaniakapūpū is located about a half mile south of the project area. Community participants Ms. Leineweber and Mr. Kāne are concerned that an increase or decrease in the flow of Nu'uanu Stream may adversely impact Kaniakapūpū. In addition, an exploratory excursion with members of 'Ahahui Mālama o Kaniakapūpū into the forested region immediately *makai* of the reservoir's spillway identified four sites with characteristics indicative of possible habitation based on a combination of rock concentrations and nearby endemic plants used for cultural practices (*tī, 'ie'ie, laua'e*). Mr. Ching also described a stone wall near the western portion of the dam. There is also

potential for other cultural sites located *makai* of the dam in the dense bamboo forest, possibly within the extreme southern portion of the project area, that could be connected culturally to Kaniakapūpū.

3. ʻAhahui Mālama o Kaniakapūpū and other community members and organizations request to be consulted as the design progresses to ensure there are no unanticipated adverse cultural impacts, and to provide recommendations on alternative uses of the potential exposed sediment, in particular, the potential to use the sediment for and/or convert the area to *loʻi kalo*.

Regarding concerns about changes in flow rates in Nuʻuanu Stream, the planned repair work will not result in permanent changes to water quantities in Nuʻuanu Stream. During project activities, it will be necessary to draw-down the water levels in the reservoir through the controlled release of water through the intake tower. This may result in intermittent increases in stream flow, but the rate of flow will not exceed normal stream channel capacity and will not vary significantly from normal stream flow fluctuations.

Following completion of the reservoir repair work, flows will be consistent with normal reservoir operations. The reservoir water level will be drawn down to the invert elevation of the lowest inlet in the intake tower, thus the overall surface area of the impounded water will be reduced, however flows through the reservoir and intake tower will continue to convey that same quantity of water as existing conditions. Flows will continue to fluctuate in direct relation to rainfall conditions.

Regarding the potential habitation sites identified by ʻAhahui Mālama o Kaniakapūpū during field investigation for the CIA, CSH archaeologists subsequently examined three of the sites and determined that two of the possible sites appear to be natural collections of boulders and plants, while the third possible site represents a mound of basalt boulders that show evidence of mechanical rock quarrying. Nevertheless, the potential for encountering previously unknown cultural sites and historic properties remains.

To address comments and concerns expressed by participants in the CIA, the following mitigation measures are proposed:

- If construction work extends beyond the AIS study area into the forested region *makai* of the dam, an archaeologist or cultural anthropologist with botanical expertise in identifying vegetation indicative of former habitation will conduct a field investigation prior to activities involving vegetation clearing or ground disturbance. If such potential habitation sites are discovered, the construction contractor will implement BMPs to avoid impacting the potential cultural sites.
- Should historic, cultural or burial sites or artifacts be identified during ground disturbing activities, the construction contractor will immediately cease work in the area of the find, notify the SHPO to determine the appropriate course of action, and secure the site until it can be evaluated by a qualified archaeologist or cultural anthropologist as necessary.

3.2.4 SCENIC AND VISUAL RESOURCES

Scenic and visual resources in the project area include:

- The Pali Highway in Nuʻuanu Valley passes through a forested corridor flanked by the sheer green cliffs of the Koʻolau mountains. Numerous waterfalls are visible to motorists on the

highway, including Waipuhia (Upside-Down Waterfall), Lulumahu Waterfalls, and other unnamed falls. The west end of the Nu‘uanu Reservoir No. 4 dam embankment and access road are visible to the public from the adjacent Pali Highway, however the reservoir, intake tower, and other components of the dam infrastructure are not. The roadway offers striking visual relief from the urbanization of Honolulu.

- The surrounding forested conservation lands contain countless scenic natural features accessible by foot trail. In general, the trails in the surrounding mountains offer the only public views of the reservoir and dam infrastructure.
- The Pali Lookout, located approximately 1.5 miles away from the project site, is a major scenic attraction for residents and visitors. The reservoir and dam are not visible from the Pali Lookout, nor is the lookout visible from the reservoir.

Impacts and Mitigation Measures

Potential impacts to scenic and visual resources will be minimal. Major work activities within the reservoir and on the downstream face of the dam embankment will not be visible to the public travelling on the Pali Highway. Work activities on the dam access road at the west end of the dam embankment will be visible to passing motorists. Construction vehicles, equipment and material transport will be visible on the highway primarily during mobilization and staging only. Heavy truck traffic required for hauling equipment and materials to and from the project site will be intermittent and of short duration. Construction activities will be visible to hikers that traverse the area. Project activities will have no effect on scenic views from the Pali Lookout. Work will be conducted during daytime hours and no nighttime lighting is proposed.

Project impacts on scenic visual resources will be minimal, temporary and will cease when the project is complete. Following construction, the project site will be generally restored to its pre-existing appearance. No additional mitigation measures are recommended.

3.2.5 RECREATIONAL FACILITIES

The Nu‘uanu Reservoir No. 4 and dam is currently closed to general public access and no longer used for recreational purposes. From 1969 to 2008, the reservoir was used for a seasonal public fishing program regulated by the DLNR and conducted annually during May, August and November. The DLNR, DAR, ‘Ānuenue Fisheries Research Center formerly stocked catfish in the reservoir, however, the fish stocking and feeding program ended in 2008. DLNR has no current plans to restart the fishing program.

Conservation lands on both sides of the Pali Highway surrounding the reservoir are managed by the State DLNR as public bow hunting areas. A “no hunting” safety zone prohibits hunting within approximately 600 feet from the reservoir. Numerous foot trails traverse through the surrounding forests and mountains and are used by hunters, recreational hikers, and cultural practitioners.

There are no other recreational resources in the project area.

Impacts and Mitigation Measures

Recreational resources and activities will not be adversely impacted by the planned dam repair work. Project activities will not require closure of any hiking trails or other public access to recreational resources. The planned improvements will restore the dam infrastructure to full operational function and allow water levels in the reservoir to be maintained at designed levels. “Normal pool” levels will be lowered in order to reduce the risk of a dam failure. No mitigation measures are required or recommended.

3.2.6 FIRE, POLICE AND MEDICAL SERVICES

The Honolulu Fire Department provides firefighting services for Oʻahu. There are 42 engine companies, fourteen ladder companies, two rescue companies, two hazardous materials companies, two tower companies, one fireboat company, five tankers, one mobile command unit, two helicopters, and one helicopter tender. Fire stations in close proximity to the project site include the Kuakini, Kakaʻako, Downtown, Kalihi, and Kailua Fire Stations. Station #4, Kuakini, is the closest station 4.5 miles from the site. From the Kakaʻako, Downtown, Kalihi, and Kailua fire stations to the reservoir it is approximately 5.5 miles, 6 miles, 6.5 miles and 7 miles, respectively.

Police protection services are provided by the Honolulu Police Department. The project site is located within the jurisdiction of the Central Patrol Bureau which oversees the Central Honolulu, Kalihi, Waikīkī, and East Honolulu areas.

Major medical service providers located in central Honolulu include Queen's Medical Center, Straub Clinic and Hospital, Kuakini Hospital, and Kapiʻolani Women's and Children's Hospital.

The City and County of Honolulu Emergency Services Department has 19 ambulance units distributed throughout Oʻahu to serve the entire island. There are ambulance units in Makiki, Young Street, Pawaa, Kailua and Kāneʻohe which may be available to service the subject property.

Impacts and Mitigation Measures

The proposed project is not expected to result in an increase in calls for fire, police, or medical services. No mitigation measures are required or recommended.

3.2.7 SCHOOLS

The nearest public school in Nuʻuanu Valley is Nuʻuanu Elementary School, located approximately 2 miles away.

Impacts and Mitigation Measures

The proposed project will not adversely affect any school activities. No mitigation measures are required or recommended.

3.2.8 DEMOGRAPHICS AND SOCIO-ECONOMIC CONDITIONS

Nuʻuanu Valley is part of the CCH PUC. The project site at Nuʻuanu Reservoir No. 4 is located within the area represented by Nuʻuanu/Punchbowl Neighborhood Board No. 12. Nuʻuanu Stream flows through areas represented by the Downtown Neighborhood Board No. 13, Liliha/Kapalama Neighborhood Board No. 14, and Kalihi-Palama Neighborhood Board No. 15.

Resident population on Oʻahu has increased from 876,158 in the year 2000 to 953,207 in the year 2010. This represents an 8.8% increase for the decade. Within the Urban Honolulu Census Designated Place (CDP), the 2000 population was 371,657. A 2006 population estimate for Urban Honolulu CDP showed a population of 377,357 which was a 1.5% increase (US Census, 2011). These numbers indicate that most of the population increase on Oʻahu has occurred outside of the Urban Honolulu area.

The project site is located in Census Tract No. 45, Nuʻuanu-Punchbowl. A comparison of population by ethnicity, income, and housing tenure for Nuʻuanu-Punchbowl and Honolulu County is presented in **Table 3-4.** The census data indicates that the Nuʻuanu-Punchbowl area is generally more affluent, with a

Table 3-4: Population Characteristics, Nu‘uanu Census Tract 45 and Honolulu County.

	Nu‘uanu Census Tract 45		Honolulu County	
Category	**Population**	**Percent**	**Population**	**Percent**
Total population	5,145	100	953,207	100
White	1,117	21.7	198,732	20.8
Black or African American	31	0.6	19,256	2
American Indian and Alaska Native	2	0	2,438	0.3
Asian Indian	11	0.2	1,734	0.2
Chinese	579	11.3	51,743	5.4
Filipino	132	2.6	142,238	14.9
Japanese	1,625	31.6	149,701	15.7
Korean	117	2.3	22,179	2.3
Vietnamese	41	0.8	8,887	0.9
Other Asian [1]	304	5.9	41,928	4.4
Native Hawaiian	117	2.3	47,951	5
Guamanian or Chamorro	11	0.2	2,355	0.2
Samoan	22	0.4	17,154	1.8
Other Pacific Islander [2]	25	0.5	23,418	2.5
Some Other Race	19	0.4	10,457	1.1
Two or More Races	992	19.3	213,036	22.3
Median Family Income (estimated)	$101,962	--	$70,093	--
Per Capita Income	$53,584	--	$29,516	--
Housing Tenure				
Owner-occupied House	3,616	70.3	534,749	56.1
Renter-occupied House	1,528	29.7	525,217	43.9

Source: 2010 U. S. Census, http://hawaii.gov/dbedt/gis/census_online_maps.htm

higher median family and per capita income compared to the O‘ahu-wide median. The ethnic breakdown reveals a diverse population, with Chinese and Japanese comprising a much larger percentage of the population compared to the county-wide average.

Impacts and Mitigation

The project will not result in any changes to demographic characteristics or trends, or socio-economic conditions in the PUC, downtown Honolulu or Nu‘uanu Valley. The planned improvements to the reservoir will restore the reservoir and related infrastructure to its designed capacity and function for flood control. After the design capacity is restored, the “normal pool” levels will be lowered as to further reduce risk of a dam failure. The planned improvements are not a pre-condition for new development in the PUC, downtown Honolulu, or Nu‘uanu Valley. The reservoir does not function as a source of water or power that would stimulate demand for increased development or population growth in the region. Short term economic benefits will be realized through the expenditure of funds for material procurement and services and from the

creation of a limited number of jobs during construction. These benefits will be relatively small in scale and will cease when the project is complete.

3.3 INFRASTRUCTURE AND UTILITIES

3.3.1 TRAFFIC AND ROADWAYS

The project is located adjacent to the Pali Highway (State Highway 61), a 4-lane major arterial highway – two north-bound lanes and two southbound lanes – that connects Urban Honolulu on the south shore with Kailua-Kāneʻohe and Waimānalo on the windward side. The windward-bound side of the highway is reduced from three lanes to two lanes approximately 700' after Nuʻuanu Pali Road merges with the Pali Highway. Honolulu-bound traffic is two lanes until just prior to the Waokanaka Street intersection where it becomes three lanes. Access to the reservoir dam and project work site is via a gated service road with

driveway connection to the windward-bound lanes of the Pali Highway, located approximately 0.5 miles north-east of the highway's intersection with the Old Pali Road (Nuʻuanu Pali Drive).

Impacts and Mitigation Measures

The project is not anticipated to have a significant impact to traffic flow on the Pali Highway. Construction vehicles, equipment and material transport will be most noticeable on the highway during mobilization/de-mobilization and staging. Project-generated traffic will result primarily from workers commuting to and from the project site. Intermittent heavy truck traffic required for hauling equipment and materials to and from the project site will be less frequent and will not require closure of lanes on the highway. As required, construction personnel will use flags or other appropriate signaling devices along the Pali Highway to maintain safety when construction vehicles enter and leave the project site.

The DOT-H Oʻahu District will be consulted early and throughout the planning and design phase to identify the appropriate access requirements, permits and approvals for construction traffic and reconstruction of the reservoir access road.

No additional mitigation measures are proposed.

3.3.2 WATER SYSTEM

Although operated by the CCH BWS, Nuʻuanu Reservoir No. 4 is no longer utilized as a potable water source and there is no municipal water service to the project work site. Water used during construction for dust control, cement mixing, cleaning and other construction activities will be provided by mobile water tanks or tanker trucks.

Impacts and Mitigation Measures

The project will have no adverse effect on the BWS's water source and distribution system The planned reservoir repair work does not affect any potable water utilities. Construction activities will require a relatively minor, temporary increase in demand for water service. The demand will end when construction activities are completed. No mitigation measures are recommended or required.

3.3.3 DRAINAGE SYSTEM

The Nu‘uanu Reservoir No. 4 does not have a developed drainage system. Rainfall runoff in the reservoir, embankment dam, and surrounding lands drains via surface flow or collects as concentrated flows in natural rivulets, drainage channels and streams. Inflows to the reservoir are impounded and discharged at a controlled rate through the intake tower sluice gates to the reservoir outlet area. An additional amount of impounded water (approximately 0.4 mgd) discharges through the dam embankment as seepage.

The DOT-H is the owner and operator of a MS4 drainage system that runs along the Pali Highway. DOT-H’s MS4 is maintained to minimize the roadway’s contributions to water quality degradation.

Impacts and Mitigation Measures

The project consists of maintenance and repair work to restore full designed capacity and operability to the existing Nu‘uanu Reservoir No. 4 for flood control. The planned improvements do not involve work on an existing or proposed drainage system.

Site-specific BMPs will be implemented throughout construction to prevent the discharge of sediments and other pollutants in stormwater runoff or dewatering effluent. Sediments removed from the reservoir will be stockpiled within the reservoir basin and contained to prevent the release of dewatering effluent. Sediment spoils will be dewatered before being transported off-site for reuse or disposal. BMPs will be employed to prevent tracking of dust and sediments onto the State roadway by construction vehicles, and to prevent the release of dewatered sediment spoils or other materials that could pollute the DOT-H’s MS4 during transport.

3.3.4 WASTEWATER SYSTEM

The project site is not served by the CCH sewer system. There are no other existing wastewater facilities on the property.

Impacts and Mitigation Measures

Portable toilets will be used during construction and will be discharged off-site in compliance with State and County regulations. No additional mitigation measures are required or recommended.

3.3.5 ELECTRICAL AND COMMUNICATIONS SYSTEMS

Electrical power in the area is provided by underground HECO utility lines located along the Pali Highway. There is no electrical power service to the reservoir facilities.

The AT&T Wireless company maintains a solar-powered cellular communications facility adjacent to the Pali Highway at the entrance gate to Nu‘uanu Reservoir No. 4.

Impacts and Mitigation Measures

Electrical power required for construction activities will be provided by means of portable generators. Reservoir operations following construction will not require connection to HECO’s electrical utilities in the Pali Highway ROW. No new demand or adverse impacts to utility services will result from this project. No mitigation measures are recommended or required.

3.3.6 SOLID WASTE DISPOSAL SYSTEM

Solid waste collection, transport and disposal operations on O‘ahu are the responsibility of the CCH Department of Environmental Services, Refuse Division and private haulers. Normal reservoir operations do not generate solid waste and solid waste collection service is not provided at the reservoir facility.

Impacts and Mitigation Measures

The proposed project will not have an adverse impact on the solid waste disposal system. Solid waste generated during construction will consist of typical construction refuse and limited demolition debris from repair work on the intake tower. All solid waste generated by construction activities will be collected and disposed of off-site by the project contractor in compliance with CCH regulations. Construction waste will not be disposed of at the City-operated “convenience center”. Excavated sediment material will be tested for the presence of contaminants in accordance with State DOH, HEER guidelines. A Sampling and Analysis Plan (SAP) will be prepared and submitted to HEER for approval. The SAP will include a multi-incremental soil sampling methodology to collect and test material samples as excavated sediment is stockpiled. If no regulated contaminants are detected, sediments will be classified as “inert fill” and may be re-used without regulation. If the material exceeds DOH Environmental Action Levels for residential levels, it will be disposed at the Waimānalo Gulch or PVT landfills in accordance with State and County regulations. Excess excavated sediment not able to be stored within the detention basin will be removed from the site via lined dump trucks to prevent the release of any remaining dewatering effluent en route to Waimānalo Gulch or PVT landfills. Based on the Phase 1 ESA findings, it is anticipated that the sediments will be suitable for re-use as fill material or topsoil.

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SECTION 4
Relationship to State & County Land Use Plans and Policies

4.1 THE HAWAIʻI STATE PLAN

The Hawaiʻi State Plan, Chapter 226, HRS, serves as a written guide for the future long range development of the State. The Plan identifies statewide goals, objectives, policies, and priorities. The proposed project is in conformance with the following objectives and policies of the State Plan:

Section 226-13 Objectives and policies for the physical environment--land, air, and water quality.

(a) Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives:

(1) Maintenance and pursuit of improved quality in Hawaiʻi's land, air, and water resources.

(2) Greater public awareness and appreciation of Hawaiʻi's environmental resources.

(b) To achieve the land, air, and water quality objectives, it shall be the policy of this State to:

(5) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.

(6) Encourage design and construction practices that enhance the physical qualities of Hawaiʻi's communities.

§226-26 Objectives and policies for socio-cultural advancement--public safety.

(a) Planning for the State's socio-cultural advancement with regard to public safety shall be directed towards the achievement of the following objectives:

(1) Assurance of public safety and adequate protection of life and property for all people.

(2) Optimum organizational readiness and capability in all phases of emergency management to maintain the strength, resources, and social and economic well-being of the community in the event of civil disruptions, wars, natural disasters, and other major disturbances.

(d) To further achieve public safety objectives related to emergency management, it shall be the policy of this State to:

(1) Ensure that responsible organizations are in a proper state of readiness to respond to major war-related, natural, or technological disasters and civil disturbances at all times.

(2) Enhance the coordination between emergency management programs throughout the State.

The planned improvements to Nu‘uanu Reservoir No. 4 are being undertaken to address priority repairs identified in the most recent DLNR Dam Safety Program inspection report, dated January 13, 2010, and a Phase 1 Investigation Report previously commissioned by DLNR for the Nu‘uanu Reservoir No. 4 (Gannett Fleming, August 2008). The repair work is required in order maintain the integrity, capacity, and designed function of the Nu‘uanu Reservoir No. 4 dam infrastructure for purposes of public safety and flood control.

4.2 STATE LAND USE LAW

The subject property is located in the State Land Use (SLU) Conservation District, Resource Subzone. Activities within the Conservation District are regulated by the State DLNR, OCCL, in accordance with HRS, Chapter 183C. Nu‘uanu Reservoir No. 4 and related dam infrastructure is an approved land use within the Conservation District. The OCCL has determined that the proposed improvements to Nu‘uanu Reservoir No. 4 are in the interest of furthering public health, safety, and welfare and are consistent with the Governor of Hawai‘i’s 7th Supplementary Proclamation, which includes the suppression of HRS Chapter 183C. A CDUP is therefore not required for this project. Correspondence with OCCL and a copy of the Governor’s 7th Supplementary Proclamation is included as **Appendix G**.

4.3 CITY AND COUNTY GENERAL PLAN

The CCH GP serves as a written guide for the future long-range development and welfare of O‘ahu. The Plan identifies island-wide goals, objectives, policies, and priorities for achieving the aspirations of O‘ahu’s residents. The proposed project is in accordance with the following objectives of the CCH GP:

The proposed repairs meet the intent and objective of the GP’s Natural Environment, Objective A, Policy 6 which protects and preserves the natural environment by designing surface drainage and flood-control systems in a manner which will help preserve their natural settings. The proposed sediment removal and repair work will help to reduce potential flooding during heavy rains by restoring Nu‘uanu Reservoir No. 4 infrastructure to full operability.

The proposed improvements meet the intent and objective of the GP’s Public Safety, Objective B, Policy 3 which encourages protection of the people of O‘ahu and their property against natural disasters and other emergencies, by participating with State and Federal agencies in the funding and construction of flood control projects. The planned repair work will increase flood storage capacity at the reservoir, restore full operability of the reservoir intake tower to improve control of water levels and rate of water release from the reservoir basin, and allow for improved monitoring of water levels and seepage at the reservoir.

4.4 PRIMARY URBAN CENTER DEVELOPMENT PLAN

The PUC DP provides policies, guidelines, and conceptual schemes to serve as a guide for more detailed zoning maps and regulations and for public and private sector investment decisions. The current Development Plan was adopted by CCH ordinance 04-14 in 2004.

The Land Use Maps, which illustrate generalized categories of land use within the region, are conceptual in nature. The land use designations are broad classifications that refer to the desired character of the area and not the specific use of the individual parcels. Nu‘uanu Reservoir No. 4 is located within the PUC DP Land Use Designation “Preservation”. Nu‘uanu Reservoir No. 4 is recognized within the category of “Other Important Water Bodies and Wetlands” in Section 3.1.1 of the plan. The project will be developed in accordance with the following PUC DP land use policies, principles and guidelines (shown in italics):

2.1 Honolulu's Natural, Cultural and Scenic Resources are Protected and Enhanced

The mountain lands and shorelines that frame the city are protected and preserved, as are the natural, cultural and scenic areas and resources that lie within the urban area. Beaches and coastal waters, as well as historic sites and mountain lands, are actively managed and improved. Physical access to the mountains, the shoreline, streams and other resources is assured and continually enhanced.

Culturally- and historically-important sites, landforms and structures continue to be preserved and enhanced. Historic and cultural districts are improved and interpreted for visitors.

3.1 Protecting and Enhancing Natural, Cultural and Scenic Resources

The first Key Element, "Honolulu's natural, cultural, and scenic resources are protected and enhanced," addresses the natural and cultural setting of the Primary Urban Center (PUC), the need for natural areas and open space, and the concept of an open space network that pervades urbanized areas and links them to the mountains and the shoreline.

Nu'uanu Reservoir No. 4 is located at the head of Nu'uanu Valley in the Ko'olau Mountain Range. The mountain range defines the *mauka* edge of the PUC and is a dominant element in the PUC open space system. The reservoir is also identified in the PUC DP as one of several "other important water bodies or wetlands" and is part of the Nu'uanu Stream watershed. The planned improvements will restore Nu'uanu Reservoir No. 4 to its designed condition and function and will not result in a change in the appearance or environmental characteristics that contribute to the natural and scenic values identified in the PUC DP. Pertinent policies and guidelines are discussed as follows.

3.1.3.2 Mauka Conservation Areas

In Preservation areas, avoid disturbance to native species and prevent the visual intrusion of structures, including utility and telecommunications installations, when seen from below and from hiking trails.

The planned improvements to the reservoir will restore the reservoir and related infrastructure to its designed operability and will not result in any significant changes to the reservoir's appearance or natural setting. The vegetation is one very much dominated by non-native species. Of 103 plant species identified by the botanical survey conducted for the project, only 8 are native, including 7 indigenous and 1 endemic species. The native species are types commonly found in low to moderate elevations in the Hawaiian islands. Other than a few *koa* trees towards the middle and upper end of the reservoir that will not be affected by project activities, no particular plants are deserving of preservation. All of the remaining species are plants introduced to the Hawaiian islands after 1778 that have become naturalized.

The project is not anticipated to have any adverse impacts on the population or habitat of any avifauna, terrestrial and aquatic wildlife. Construction activities may temporarily disrupt routine behavior patterns of common birds, but will not result in permanent impacts. When project activities are complete, bird activity is expected to return to current conditions. Seasonal restrictions on vegetation removal will be employed to prevent potential impacts to the Hawaiian hoary bat, the only native mammal that could potentially occur in the area.

3.1.3.5 Stream Greenways and Drainage

- *Establish riparian zones for all streams to prevent the encroachment of buildings and structures – other than those for drainage, flood control or recreational purposes – and to establish and enforce policies for the protection and enhancement of stream habitats and water quality.*

- *In developing drainage and flood control, seek to limit stormwater velocity and reduce the transport of sediment and pollutants to coastal waters.*

Another function of the reservoir and surrounding vegetation is to promote infiltration of rainwater to recharge the groundwater in the Honolulu aquifer. Both the reservoir and the surrounding vegetation also function in reducing particulate loading in Nu‘uanu Stream. The planned improvements will restore the existing reservoir and dam infrastructure to full, designed operability for flood control purposes. The reservoir functions to reduce the velocity and volume of stormwater flows and impound sediments that would otherwise be conveyed downstream to coastal waters. The planned improvements will not result in a change in conditions that would adversely affect riparian environments.

4.6 Stormwater Systems

4.6.2 Policies Relating to Stormwater Systems

- *Require methods of retaining or detaining stormwater for gradual release into the ground as the preferred strategy for the management of stormwater.*
- *Manage stormwater flows through best management practices to minimize stormwater runoff and peak discharge rates.*
- *Preserve stream and estuarine habitats.*

Improvements to the reservoir will restore full operability to the intake tower. Restoring the intake tower to full function will allow the reservoir water to be maintained at the lowest design level and thus increase available capacity for flood control, including improved control over the rate of release of floodwater into downstream environments. The planned improvements will not result in a change in conditions that would adversely affect estuarine or riparian environments. The reservoir functions to reduce the velocity and volume of stormwater flows and impound sediments that would otherwise be conveyed downstream to coastal waters. In addition, construction activities will be conducted in accordance with NPDES Permit conditions that will include Site-Specific BMPs to control stormwater runoff and prevent the release of pollutants, including sediment, in runoff discharges.

4.6.3 Guidelines Relating to Stormwater Systems

- *Establish best management practices to guide stormwater management practices within the Primary Urban Center.*
- *Encourage community-based watershed planning, recognizing the array of stakeholders in the Primary Urban Center’s urban watersheds and the important role of education and community involvement in urban watershed management.*

The planned improvements are designed to restore full, designed capacity and operability to the Nu‘uanu Reservoir No. 4. Since its original construction in the early 1900’s and major renovation in the 1930’s the reservoir has served as a key component in the City’s system of stormwater control infrastructure. The reservoir functions to retain stormwater runoff, reduce the velocity and volume of stormwater flows in Nu‘uanu Stream, impound sediments that would otherwise be conveyed downstream to coastal waters, and promote infiltration of rainwater to recharge the groundwater in the Honolulu aquifer. During construction, site-specific BMPs, including structural, vegetative, and management measures, will be employed to control stormwater runoff and prevent the release of pollutants in runoff discharges.

Community involvement in the project is being solicited through public meetings that are being held as part of the EA process. The purpose of the meetings is to obtain information about public interests and concerns related to the planned repair of Nu‘uanu Reservoir No. 4. Mitigation measures will be developed where appropriate to address issues and conflicts raised during public review of the project.

4.5 CITY AND COUNTY LAND USE ORDINANCES (LUO)

Nu‘uanu Reservoir No. 4 is located entirely within the P-1 Preservation zoning district**.** Lands within the P-1 restricted preservation district are not subject to the LUO. The purpose of the preservation district is to preserve and manage major open space, recreation lands, and lands of scenic and other natural resource value. It is intended that all lands within a state-designated conservation district be zoned P-1 restricted preservation district. Within the P-1 district, all uses, structures and development standards are to be governed by the State DLNR. See additional discussion in **Section 4.2** of this document.

4.6 SPECIAL MANAGEMENT AREA (SMA) RULES AND REGULATIONS

The CCH has designated the shoreline and certain inland areas of O‘ahu as being within the SMA. SMA areas are designated sensitive environments that should be protected in accordance with the State’s CZM policies, as set forth in ROH, Chapter 25, Shoreline Management, and HRS, Section 205A, CZM.

Nu‘uanu Reservoir No. 4 is outside and away from the SMA.

4.7 COASTAL ZONE MANAGEMENT, HRS 205(A)

The State of Hawai‘i designates the CZMP to manage the intent, purpose and provisions of Chapter 205(A)-2 of the HRS, as amended, and federal regulations for the areas from the shoreline to the seaward limit of the State’s jurisdiction, and any other area which a lead agency may designate for the purpose of administering the CZMP.

The following is an assessment of the project with respect to the CZMP objectives and policies set forth in Section 205(A)-2 (HRS).

1. Recreational resources

Objective: *Provide coastal recreational opportunities accessible to the public*.

Policies:

A) Improve coordination and funding of coastal recreational planning and management; and

B) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

> *(i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;*
>
> *(ii) Requiring replacement of coastal resources having significant recreational value including, but not limited to, surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;*
>
> *(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*
>
> *(iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;*
>
> *(v) Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;*
>
> *(vi) Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;*

(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and

(viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.

Discussion:

Nu‘uanu Reservoir No. 4 is located approximately 6 miles inland from its coastal estuary of Honolulu Harbor. The reservoir is not located in the coastal zone and does not directly affect coastal recreational resources. The related Nu‘uanu Stream does not discharge into coastal waters that are used for recreational purposes.

The primary function of the reservoir and dam infrastructure is as a flood control structure. The reservoir serves to retain, store and allow the controlled release of stormwater flows through Nu‘uanu Valley and part of downtown Honolulu that lies within the Nu‘uanu Stream corridor. The planned improvements will restore the existing reservoir and dam infrastructure to full, designed operability for flood control purposes. The reservoir functions to reduce the velocity and volume of stormwater flows and impound sediments that would otherwise be conveyed downstream to coastal waters.

The planned improvements will not result in a change in conditions that would adversely affect coastal recreational resources. Water quality will be protected during construction through the application of BMPs in accordance with CWA regulations.

2. Historic resources

Objective: Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies:

(A) Identify and analyze significant archaeological resources;

(B) Maximize information retention through preservation of remains and artifacts or salvage operations; and

(C) Support state goals for protection, restoration, interpretation, and display of historic resources.

Discussion:

An AIS and CIA were prepared for the project in accordance with HRS Chapter 6E in order to identify any historic properties, cultural resources and cultural practices and evaluate potential project-related impacts. During the current AIS, it became apparent that the entire project area has been substantially modified by the reservoir construction. Field investigations of the project area identified no pre-contact historic properties. However, the entire Nu‘uanu Reservoir system, comprised of reservoirs no. 1 through 4 and their associated features, are considered historically significant.

The reservoir system meets the Hawai‘i Register of Historic Places eligibility Criterion A: *Historic property reflects major trends or events in the history of the state or nation.* The Nu‘uanu Reservoir No. 4 is historically significant due to its role in the early development of modern Honolulu as a source of drinking water, hydroelectricity, and flood control.

A total of 44 historic properties were identified within the study area. All 44 historic properties are related to reservoir system infrastructure features. All are assessed as significant under Hawai‘i Register of

Historic Places eligibility Criterion D, meaning that each of the historic properties have "yielded, or is likely to yield, information important for research on prehistory or history."

No adverse effects to these historic properties are anticipated to result from the planned improvements. The planned improvements are necessary to maintain the function and integrity of the reservoir infrastructure and dam embankment. The improvements will restore full operability to the dam infrastructure, as designed, and will not result in any significant modification or destruction of the existing features.

No impacts to cultural practices will result from the proposed improvements. Project activities will occur entirely within the developed reservoir and dam embankment area. Project activities will not diminish the availability of any plant type for use in cultural practices. The proposed project will not interrupt access to coastal areas or to hunting or gathering grounds. Proposed improvements will not block existing view planes, and will not obstruct any natural features or landmarks.

If any unexpected cultural features, deposits or burials are encountered during work activities, work in the immediate area will be suspended until the monitoring archaeologist evaluates the significance of the findings. The SHPD will be immediately notified to determine the appropriate course of action.

See **Section 3.2.1** for a detailed discussion of the findings and proposed mitigation measures.

3. Scenic and open space resources

Objective: Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

(A) Identify valued scenic resources in the coastal zone management area;

(B) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

(C) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and

(D) Encourage those developments that are not coastal dependent to locate in inland areas.

Discussion:

The planned improvements are in compliance with scenic and open space resource objectives and policies. Nu'uanu Reservoir No. 4 is not located near the coastline and is not visible within any scenic coastal settings or shoreline open space areas. The repairs do not involve construction of new facilities and will not result in any significant changes to the reservoir, dam infrastructure, and environmental setting. See **Section 3.2.4** for detailed discussion of scenic resources.

4. Coastal ecosystems

Objective: Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

(A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

(B) Improve the technical basis for natural resource management;

(C) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

(D) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

(E) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

Discussion:

The proposed reservoir improvements will not have an adverse effect on coastal ecosystems. The planned improvements will restore the existing reservoir and dam infrastructure to full, designed operability for flood control purposes. The reservoir functions to reduce the velocity and volume of stormwater flows in Nu‘uanu Stream, and impound sediments that could otherwise be conveyed downstream to coastal waters. The planned improvements will not result in a change in conditions that would adversely affect coastal ecosystems. Water quality will be protected during construction through the application of BMPs in accordance with CWA regulations to prevent pollutant discharge in storm water runoff.

5. Economic uses

Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:

(A) Concentrate coastal dependent development in appropriate areas;

(B) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and

(C) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

(i) Use of presently designated locations is not feasible;
(ii) Adverse environmental effects are minimized; and
(iii) The development is important to the State's economy.

Discussion:

The project is located inland and does not involve any new development or coastal-dependent development. The project consists of repairs to the existing Nu‘uanu Reservoir No. 4 infrastructure and dam embankment. The planned repair activities will not conflict with CZM policies regarding economic uses.

6. Coastal hazards

Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.

Policies:

(A) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;

(B) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards;

(C) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and
(D) Prevent coastal flooding from inland projects.

Discussion:

The project will comply with coastal hazard policies and will aid in the prevention of coastal flooding. The FEMA FIRM shows that the project is in flood zone D. No analysis of flood hazards has been conducted by FEMA in this zone. However, the primary function of the reservoir and dam infrastructure is as a flood control structure. The reservoir serves to retain, store and allow the controlled release of stormwater flows through Nu‘uanu Valley, part of downtown Honolulu that lies within the Nu‘uanu Stream corridor, and ultimately into Honolulu Harbor. The planned improvements will restore the existing reservoir and dam infrastructure to full, designed capacity and operability for flood control purposes, and will thereby reduce hazard to life and property from flooding.

7. Managing development

Objective: *Improve the development review process, communication, and public participation in the management of coastal resources and hazards.*

Policies:

(A) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;

(B) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and

(C) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

Discussion:

All work activities will be conducted in compliance with federal, state, and county environmental rules and regulations. This EA identifies and proposes mitigation, where necessary, measures to address impacts anticipated from the construction and operation of proposed improvements. This EA will be published for public review and comment in compliance with procedures set forth in HRS Chapter 343.

8. Public participation;

Objective: *Stimulate public awareness, education, and participation in coastal management.*

Policies:

(A) Promote public involvement in coastal zone management processes;

(B) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and

(C) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

Discussion:

Public notice of the proposed action will be provided through publication of the EA in the Environmental Notice of the Office of Environmental Quality Control. As part of the environmental review process, the public will have an opportunity to review and comment on the project during the 30-day public review period. All public comments will be addressed in writing. Mitigation measures will be developed where appropriate to address issues and conflicts raised during public review of the project. In addition, public

involvement meetings will be conducted as part of the EA and environmental permitting work. The purpose of the meetings is to obtain information about public interests and concerns related to the planned repair of Nu‘uanu Reservoir No. 4.

9. Beach protection;

Objective: Protect beaches for public use and recreation.

Policies:

(A) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;

(B) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and
(C) Minimize the construction of public erosion-protection structures seaward of the shoreline.

Discussion:

The proposed project does not involve any action which will adversely affect beaches for public use and recreation. The project is located approximately 6 miles inland from the shoreline of Honolulu Harbor. Project activities involve repair work to existing facilities only and will not result in significant change to existing environmental conditions.

10. Marine resources

Objective: Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

Policies:

(A) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

(B) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;

(C) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;

(D) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and

(E) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Discussion:

The proposed reservoir improvements will not have an adverse effect on marine and coastal resources. The planned improvements will restore the existing reservoir and dam infrastructure to full, designed operability for flood control purposes. The reservoir functions to reduce the velocity and volume of stormwater flows in Nu‘uanu Stream, and impound sediments that could otherwise be conveyed downstream to coastal waters. The planned improvements will not result in a change in conditions that would adversely affect marine and coastal resources. Water quality will be protected during construction through the application of BMPs in accordance with CWA regulations to prevent pollutant discharge in storm water runoff.

SECTION 5
Necessary Permits and Approvals

5.1 CITY AND COUNTY OF HONOLULU

The following permits and approvals are required from the CCH DPP:

- Grading, Grubbing, and Stockpiling Permits
- Subdivision Application and Permit

5.2 STATE OF HAWAIʻI

The following permits are required by the State of Hawaiʻi:

Department of Health
- NPDES Permit for Construction Stormwater and Dewatering Discharges

Department of Land and Natural Resources
- Determination of "no effect" on historic properties from the SHPD.
- Compliance with Chapter 183C HRS - Conservation District
- Compliance with Chapter 169-5 HRS Stream Channel Alteration Permit
- Dam Safety Construction/Alteration Permit
- Occupancy and Use Permit for activities within the State ROW

Office of Planning
- Coastal Zone Management Federal Consistency Review

5.3 FEDERAL AGENCIES

The following permits and approvals are required from the Federal government:

- ACOE Jurisdictional Determination for Nuʻuanu Stream
- Compliance with ACOE Clean Water Act Section 404

5.4 UTILITY COMPANIES

Construction documents will be reviewed by the following private utility companies:

- Hawaiian Electric Company, Inc.
- Hawaiian Telcom, Inc.

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SECTION 6
Organizations and Agencies Consulted During the Preparation of the Draft EA

Pre-consultation request letters were sent to approximately forty agencies, organizations and officials during the preparation of the Draft EA. The following agencies and organizations responded to the request. Letters received are included in **Appendix A**. Additional individuals and groups were consulted as part of the CIA, which is attached as **Appendix C.**

6.1 CITY AND COUNTY OF HONOLULU

Board of Water Supply
Department of Design and Construction
Department of Emergency Management
Department of Facility Maintenance
Department of Planning and Permitting
Honolulu Fire Department
Honolulu Police Department

6.2 STATE OF HAWAI‘I

Department of Accounting and General Services
Department of Defense
Department of Health, Clean Water Branch
Department of Land and Natural Resources
- Aquatic Resources Division
- Engineering Division
- Land Division
- Office of Conservation and Coastal Lands
- State Historic Preservation Division
- State Parks Division

Department of Transportation, Highways Division
Office of Hawaiian Affairs

6.3 FEDERAL AGENCIES

Army Corps of Engineers

6.4 PRIVATE ORGANIZATIONS / INDIVIDUALS

Hawaiian Electric Company, Inc.
Hawaiian Telcom, Inc.

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SECTION 7
Organizations and Agencies Consulted During the 30-Day DEA Review Period

Copies of the Draft EA were sent to the following agencies, organizations and individuals.

7.1 CITY AND COUNTY OF HONOLULU

Board of Water Supply
Department of Design and Construction
Department of Emergency Management
Department of Environmental Services
Department of Facility Maintenance
Department of Planning and Permitting
- Civil Engineering Branch
- Traffic Review Branch
- Zoning

Honolulu Fire Department
Honolulu Police Department
Department of Transportation Services

7.2 STATE OF HAWAI‘I

Commission on Water Resources Management
Department of Accounting and General Services
Department of Business, Economic Development and Tourism
Department of Defense
Department of Health,
Clean Water Branch
Noise and Radiation Branch
Department of Land and Natural Resources
- Aquatic Resources Division
- Division of Forestry and Wildlife
- Engineering Division
- Land Division
- Office of Conservation and Coastal Lands
- State Historic Preservation Division
- State Parks Division

Department of Transportation, Highways Division
Disability and Communication Access Board
Office of Environmental Quality Control
Office of Hawaiian Affairs
Office of Planning

7.3 FEDERAL AGENCIES

Army Corps of Engineers
Federal Highways Administration

U.S. Department of Homeland Security
U.S. Environmental Protection Agency, Region IX
U.S. Fish and Wildlife Service

7.4 ELECTED REPRESENTATIVES AND BOARDS

State Senator Brian Taniguchi or Lawrence Fenton, 11th Senatorial District
State Senator Brickwood Galuteria or Elisabeth Larson, 12th Senatorial District
State Senator Suzanne Chun Oakland, 13th Senatorial District
State Representative Sylvia Luke, 25th Representative District
State Representative Corinne W. L. Ching or Takashi Ohno, 27th Representative District
John Mizuno or Carol Kaapu, 28th Representative District
Councilmember, Honolulu City Council District 6
Nu‘uanu/Punchbowl Neighborhood Board

7.5 PRIVATE ORGANIZATIONS / INDIVIDUALS

Hawaiian Electric Company, Inc.
Hawaiian Telcom, Inc.
Historic Hawai‘i Foundation
Oceanic Time Warner
Sierra Club Hawai‘i Chapter
The Trust for Public Land Hawai‘i

SECTION 8
Determination

The potential effects of the proposed project are evaluated based on the significance criteria in section 11-200-12 (Hawai‘i Administrative Rules, revised in 1996). The following is a summary of the potential effects of the action.

(1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resource:

The project does not involve an irrevocable commitment to loss or destruction of any natural or cultural resource. No previously undisturbed areas are included in the project area. No loss or destruction of any cultural resource or protected plant or animal species is anticipated to result from the project. The planned improvements consist of repairs to the existing Nu‘uanu Reservoir No. 4 dam infrastructure and will not result in any significant changes over existing conditions.

(2) Curtails the range of beneficial uses of the environment:

The project will not curtail the range of beneficial uses of the environment. Planned repair work will restore Nu‘uanu Reservoir No. 4 and its related infrastructure to full, designed capacity and operability. Construction activities will not restrict existing access or use of the surrounding forests, mountains, hunting areas and hiking trails.

(3) Conflicts with the State’s long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS:

The project will be undertaken in a manner that conforms with Chapter 344, HRS, State Environmental Policy. The proposed improvements will provide a public benefit by restoring full capacity and functionality to Nu‘uanu Reservoir No. 4 for stormwater control, reduction of volume and velocity of stormwater flows in Nu‘uanu Stream, impoundment of sediments that would otherwise be conveyed downstream to coastal waters, and promotion of rainwater infiltration to recharge groundwater in the Honolulu aquifer.

(4) Substantially affects the economic or social welfare of the community or State:

The project will not result in any changes to demographic characteristics or trends, or socio-economic conditions that would affect the economic or social welfare of the community or State. The planned improvements to the reservoir will restore the reservoir and related infrastructure to its designed capacity and function for flood control, and thereby provide a social benefit of reducing the hazard to life and property from flooding.

The proposed project is not expected to have any adverse economic impacts. Economic impacts from the proposed project will result from construction jobs, services, and procurements in the form of construction supplies and equipment. These benefits will be temporary and will cease when the project is complete.

(5) Substantially affects public health:

The proposed project will not have an adverse effect on public health. The planned improvements to the reservoir will restore the reservoir and related infrastructure to its design capacity and function for flood control, and thereby reduce the hazard to life and property from flooding.

Water quality will be protected during construction through the application of site-specific BMPs, including structural, vegetative, and management measures to prevent pollutant discharge in storm water runoff, in accordance with CWA regulations and State regulations set forth in HAR, Title 11 Chapter 54 - Water Quality Standards, and Chapter 55 - Water Pollution Controls.

Noise and air quality impacts resulting from construction activities will be mitigated by requiring the project contractor to comply with the provisions of HAR, Chapter 11-46, Community Noise Control, and Chapter 11-59 and 11-60, regarding Air Pollution Control.

(6) Involves substantial secondary impacts, such as population changes or effects on public facilities:

The project will not result in any secondary impacts such as population changes, or changes to demographic characteristics or trends, or socio-economic conditions in the PUC, downtown Honolulu or Nu‘uanu Valley. The planned improvements to the reservoir will restore the reservoir and related infrastructure to its design capacity and function for flood control. The planned improvements are not a pre-condition for new development in the PUC, downtown Honolulu, or Nu‘uanu Valley. The reservoir does not function as a source of water or power that would stimulate demand for increased development or population growth in the region.

(7) Involves a substantial degradation of environmental quality:

The proposed project is not anticipated to involve a substantial degradation of environmental quality. Project activities consist of repair work to the existing reservoir and dam infrastructure within an area that has experienced extensive modification to the natural environment. The planned repairs will restore full, design capacity and functionality to the reservoir and will result in the following benefits to the environment:

- control the velocity and volume of stormwater flows in Nu‘uanu Stream and reduce the potential for erosion damage;
- impound sediments that would otherwise be conveyed downstream to coastal waters; and
- promote infiltration of rainwater to recharge the groundwater in the Honolulu aquifer.

Project activities will be conducted in compliance with state and county rules and regulations related to environmental quality and public health, as described elsewhere in this EA.

(8) Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions:

Cumulative impacts result from a series of projects that individually do not generate significant adverse effects, but collectively add up to a significant negative impact on the environment. The proposed project is being developed as a single project. No substantial effect to existing environmental conditions will result from this project. The proposed development does not involve a commitment to larger actions.

(9) Substantially affects a rare, threatened, or endangered species, or its habitat:

The proposed project at Nu‘uanu Reservoir No. 4 is not anticipated to have any adverse impacts on the population or habitat of any avifauna, terrestrial and aquatic wildlife. Nor will project activities diminish the availability of any plant species as a resource. None of the botanical, avian, or aquatic species observed during biological surveys of the project area is listed as threatened or endangered by the USFWS or by the State of Hawai‘i. Furthermore, the proposed action will not result in modification of any federally designated Critical Habitat, as there is none present on or adjacent to the subject property. Construction activities may temporarily disrupt routine behavior patterns of common birds, but will not result in permanent impacts. When project activities are complete, bird activity is expected to return to current conditions.

(10) Detrimentally affects air or water quality or ambient noise levels:

The project is not anticipated to result in significant adverse effects on the area's long-term air or water quality or ambient noise levels. Runoff from construction areas will be regulated under NPDES permit conditions. BMPs will be employed to prevent soil loss and sediment discharges from work sites. Project activities will comply with DOH regulations as set forth in HAR Title 11 Chapter 54 - Water Quality Standards, and Chapter 55 - Water Pollution Controls.

Construction-related exhaust emissions and dust generation will be mitigated by requiring that the project contractor comply with HAR Chapter 11-59 and 60, regarding Air Pollution Control. Construction related impacts to air quality will be temporary and will cease when construction is completed. No long-term air quality impacts will result upon project completion.

Temporary noise impacts related to construction activities will occur, but will cease when the project is completed. Project activities will be conducted in compliance with noise level standards as set forth in HAR, Chapter 11-46, "Community Noise Control".

(11) Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters

The primary function of Nu'uanu Reservoir No. 4 is to provide flood control for Nu'uanu Valley and part of downtown Honolulu that lies within the Nu'uanu Stream corridor. Discharges from the reservoir flow into Nu'uanu Stream and through downtown Honolulu before entering the Pacific Ocean at Honolulu Harbor. The planned repair work will ensure that the dam infrastructure is fully operable as designed to control stormwater runoff and flood waters.

The FEMA FIRM No. 15003C0360F, dated January 19, 2011, shows that the project site is in Flood Zone D. This designation is used for areas where there are possible but undetermined flood hazards. No analysis of flood hazards has been conducted by FEMA. Land downstream of the project site is designated as Zone X, which are areas outside of the 500-year flood zone. No base flood elevations or depths are noted on the FEMA maps for this zone.

Nu'uanu Reservoir No. 4 is classified as a High Hazard dam according to the degree of its potential to create adverse incremental consequences such as loss of life, property damage, or environmental impacts from a failure or mis-operation of the dam. The 3 hazard classifications are high, significant and low. The high hazard classification is due to the presence of a significant amount of residential and commercial development in Nu'uanu Valley below the dam and does not relate to the dam's condition or stability.

As a precautionary measure, BWS currently keeps the water level in the reservoir at approximately ½ full, at the middle gate of 30-feet, which increases safety and the flood control aspects of the reservoir. The planned repairs will allow BWS to reduce the water levels to the lowest gate at 10-feet elevation, as designed, and thereby further reduce the risk of flood hazard.

(12) Substantially affects scenic vistas and viewplanes identified in county or states plans or studies:

The Nu'uanu Reservoir No. 4 is not located within any scenic vistas and viewplanes identified in county or state plans or studies. In general, the trails in the surrounding mountains offer the only public views of the reservoir basin and dam infrastructure. The Pali Lookout, located approximately 1.5 miles away from the project site, is a major scenic attraction for residents and visitors. However, the reservoir and dam are not visible from the lookout, nor is the lookout visible from the reservoir. The west end of the Nu'uanu Reservoir No. 4 dam embankment and access road are visible to the public from the adjacent Pali Highway, however the reservoir basin, intake tower, and other components of the dam infrastructure are not.

Potential impacts to scenic and visual resources will be minimal. Major work activities within the reservoir basin and on the downstream face of the dam embankment will not be visible to the public travelling on Pali Highway. Work activities on the dam access road at the west end of the dam embankment will be visible to passing motorists. Construction vehicles, equipment and material transport will be visible on the highway during mobilization and staging only. Heavy truck traffic required for hauling equipment and materials to and from the project site will be intermittent and of short duration. Construction activities will be visible to hikers that traverse the area. Project activities will have no effect on scenic views from the Pali Lookout. Work will be conducted during daytime hours and no nighttime lighting is proposed.

Project impacts on scenic visual resources will be minimal, temporary and will cease when the project is completed. Following construction, the project site will be generally restored to its pre-existing appearance. No additional mitigation measures are recommended.

(13) Requires substantial energy consumption:

There is no electrical power service to the existing reservoir facilities. Construction activities associated with the project will require relatively high, short-term energy use compared to existing conditions. Reservoir operations following construction will not require connection to HECO's electrical utilities in the Pali Highway ROW. No new demand or adverse impacts to utility services will result from this project.

In accordance with the provisions set forth in Chapter 343, HRS, and the significance criteria set forth in HAR, Section 11-200-12, it is anticipated that the proposed project will have no significant adverse impacts to social welfare, natural resources economic conditions, water quality, air quality, existing utilities, noise levels, archaeological sites, or wildlife habitat. Potential impacts should be minor and will be mitigated by measures described in this EA.

SECTION 9
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APPENDICES

Appendix A Agency Pre-Consultation Letters

Appendix B Archaeological Inventory Survey

Appendix C Cultural Impact Assessment

Appendix D Biological and Water Quality Survey

Appendix E Hazardous Materials Survey

Appendix F Phase 1 Environmental Site Assessment

Appendix G OCCL Correspondence and Governor of Hawai‘i’s 7th Supplementary Proclamation

Appendix H Comments Received During the Draft EA Public Comment Period and Responses

Appendix A

Agency Pre-Consultation Letters

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8480 • Fax: (808) 768-4567
Web site: www.honolulu.gov

PETER B. CARLISLE
MAYOR

COLLINS D LAM, P.E.
ACTING DIRECTOR

LORITA M. KAHIKINA, P.E.
DEPUTY DIRECTOR

January 20, 2011

Mr. James Niermann, AICP LEED AP
R.M. Towill Corporation
2024 N. King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Niermann:

Subject: Pre- Assessment Consultation Request Nu'uanu No.4 Reservoir Repair Project Board of Water Supply Honolulu, Hawaii TMK: (1) 2-2-054:001(por.)

Thank you for inviting us to review the above Pre- Assessment Consultation Request. The Department of Design and Construction does not have any comments to offer at this time.

Should you have any questions, please contact me at 768-8480.

Very truly yours,

Collins D. Lam, P.E.
Acting Director

CL:pg(392583)

DEPARTMENT OF EMERGENCY MANAGEMENT
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET HONOLULU, HAWAII 96813
PHONE: (808)723-8960 FAX: (808)524-3439 WORLDWIDE WEB: www.oahudem.org

PETER B. CARLISLE
MAYOR

MELVIN N. KAKU
DIRECTOR

November 22, 2010

Mr. James Niermann, AICP, LEED AP
Senior Planner
R.M. Towill Corporation
2024 N. King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Niermann:

SUBJECT: Pre-Assessment Consultation Request, Nu'uanu No. 4 Reservoir Repair Project, Board of Water Supply, Honolulu, Oahu, TMK: (1) 2-2-054:001(por.)

Thank you for providing the Department of Emergency Management with the project overview and strategy for Nu'uanu No. 4 Reservoir. At this time, we do not have any comments or concerns about this project.

The Department of Emergency Management is looking forward to reviewing the Draft Environmental Assessment.

Sincerely,

Melvin N. Kaku
Director

DEPARTMENT OF FACILITY MAINTENANCE

CITY AND COUNTY OF HONOLULU

1000 Uluohia Street, Suite 215, Kapolei, Hawaii 96707
Phone: (808) 768-3343 • Fax: (808) 768-3381
Website: www.honolulu.gov

PETER B. CARLISLE
MAYOR

GEORGE "KEOKI" MIYAMOTO
ACTING DIRECTOR

IN REPLY REFER TO:
DRM 10-919

December 9, 2010

R.M. Towill Corporation
2024 N. King Street, Suite 200
Honolulu, Hawaii 96819-3494

Attention: Mr. James Niermann:

Subject: Pre-Assessment Consultation Request
Nuuanu No. 4 Reservoir Repair Project
Board of Water Supply
Honolulu, TMK: (1) 2-2-054:001 (por.)

Thank you for the opportunity to review and comment on the pre-assessment consultation for the subject project. We do not have any comments to offer at this time.

Should you have any questions, please call Thomas Takeuchi of the Division of Road Maintenance, at 768-3608.

Sincerely,

George "Keoki" Miyamoto
Acting Director

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
TELEPHONE: (808) 768-8000 • FAX: (808) 768-6041
DEPT. WEB SITE: www.honoluludpp.org • CITY WEB SITE: www.honolulu.gov

PETER B. CARLISLE
MAYOR

DAVID K. TANOUE
DIRECTOR

ROBERT M. SUMITOMO
DEPUTY DIRECTOR

2010/ELOG-2496(MH)

December 21, 2010

Mr. James Niermann, AICP, LEED AP
Senior Planner
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Niermann:

Subject: Pre-Consultation Request for Nu'uanu No. 4 Reservoir Repair Project, Board of Water Supply, Honolulu, Oahu, TMK 2-2-054:001 (por.)

In response to your request for comments of November 15, 2010 regarding the preparation of the Draft Environmental Assessment (DEA) for the subject project, we have the following comments:

1. The DEA should include a discussion of how the proposed project is consistent with the objectives and policies of the City and County of Honolulu's General Plan.

2. The DEA should also discuss how the proposed project is consistent with the Primary Urban Center Development Plan (PUC DP) dated August 2000. Relevant PUC DP Vision elements and policies that should be considered in the project's environmental assessment and design include:

   a. Section. 2.1 Honolulu's Natural, Cultural, and Scenic Resources are Protected and Enhanced (p. 2-1)
   b. Section. 3.1 Protecting and Enhancing Natural, Cultural, and Scenic Resources (p. 3-1)
   c. Section. 4.6 Stormwater Systems (p. 4-9)

3. To what extent will, or could the reservoir support growth within the PUC DP? Please include applicable discussion regarding this question in the DEA.

4. The DEA should further discuss the proposed project's relationship with the zoning of the site. Since the reservoir is in the State Conservation District, it is zoned P-1 Restricted Preservation and not subject to the Land Use Ordinance (LUO).

5. The DEA should include a complete listing of required permits and approvals.

We look forward to reviewing and commenting on the DEA. Should you have any questions, please contact Matt Higashida of our staff at 768-8045.

Very truly yours,

David K. Tanoue, Director
Department of Planning and Permitting

DKT:js

cc: Office of Environmental Quality Control
Board of Water Supply

PreConsult Nuuanu 4 Res

HONOLULU FIRE DEPARTMENT

CITY AND COUNTY OF HONOLULU

636 South Street
Honolulu, Hawaii 96813-5007
Phone: 808-723-7139 Fax: 808-723-7111 Internet: www.honolulu.gov/hfd

PETER B. CARLISLE
MAYOR

KENNETH G. SILVA
FIRE CHIEF

ROLLAND J. HARVEST
DEPUTY FIRE CHIEF

December 3, 2010

Mr. James Niermann, AICP, LEED AP
Senior Planner
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Niermann:

Subject: Preassessment Consultation
Nuuanu No. 4 Reservoir Repair Project
Board of Water Supply
Honolulu, Hawaii
Tax Map Key: 2-2-054: 001 (portion)

In response to your letter dated November 15, 2010, regarding the above-mentioned subject, the Honolulu Fire Department reviewed the material provided and determined there will be no significant impact to its services.

Should you have any questions, please call Acting Battalion Chief Gary Lum of our Fire Prevention Bureau at 723-7152.

Sincerely,

KENNETH G. SILVA
Fire Chief

KGS/SY:jl

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET · HONOLULU, HAWAII 96813
TELEPHONE: (808) 529-3111 · INTERNET: www.honolulupd.org

PETER B. CARLISLE
MAYOR

LOUIS M. KEALOHA
CHIEF

DELBERT T. TATSUYAMA
RANDAL K. MACADANGDANG
DEPUTY CHIEFS

OUR REFERENCE DMK-LKA

November 29, 2010

Mr. James Niermann, AICP, LEED AP
Senior Planner
R.M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Niermann:

This is in response to your letter of November 15, 2010, requesting comments on a Pre-Assessment Consultation, Draft Environmental Assessment, for the Nuuanu No. 4 Reservoir Repair Project in Honolulu.

This project should have no significant impact on the facilities or operations of the Honolulu Police Department. However, it may have a minimal effect on the Pali Highway traffic due to the movement of construction equipment and supplies.

If there are any questions, please call Major William Chur of District 5 (Kalihi) at.723-8200.

LOUIS M. KEALOHA
Chief of Police

ACTING ASSISTANT CHIEF
FOR

By
DAVE M. KAJIHIRO
Assistant Chief of Police
Support Services Bureau

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF:

December 1, 2010

Regulatory Branch

James Niermann, AICP, LEED AP
Senior Planner
R.M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, HI 96819-3494

Dear Mr. Niermann:

This responds to your pre-assessment consultation request for written comments for planning and design work as well as preparation of a draft Environmental Assessment (dEA) which will address activities and impacts of a proposed Board of Water Supply, City & County of Honolulu project for repairs to Nu`uanu Reservoir No. 4. The proposed project area consists of about 297 acres on a parcel identified as TMK: 122054001), Nuuanu, Oahu. The scope of the dEA includes 10 major areas of work.

The proposed dEA will be reviewed pursuant to Section 404 of the Clean Water Act (Section 404). Initial descriptions indicate that a Section 10 of the Rivers and Harbors Act of 1899 (Section 10) and Section 10 Department of Army (DA) permit will not be applicable for certain structures or work in or affecting navigable waters of the United States U.S (33 U.S.C. 403) as represented by Honolulu Harbor. Further, the structures or work in and adjacent to Nuuanu Stream do not appear to have the potential to affect the course, location, or condition of the Honolulu Harbor as to its navigable capacity.

Section 404 requires that a DA permit be obtained for the placement or discharge of dredged and/or fill material into waters of the U.S., including wetlands, prior to conducting the work (33 U.S.C. 1344). For regulatory purposes, the U.S. Army Corps of Engineers (Corps) defines wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The area of Corps jurisdiction under Section 404 extends to the Ordinary High Water Mark (OHWM) for navigable waters other than the Pacific Ocean, and to the upland boundary of any adjacent wetlands.

The dEA should delineate the lateral extent of Nuuanu Stream and Nuuanu Reservoir #4 waters , including riparian wetlands, and describe in appropriate sections the potential for them to be impacted by construction of project structures and associated ground disturbing activities. Initial information indicates that the potential discharge of dredged or fill material may occur with the stockpiling and dewatering of excavated material from the reservoir basin and outlet receiving area, repairs to the lower sluice gate, construction of measuring weirs at seepage points and outlet structure, extension of the reservoir outlet pipe, restoration of the dam embankment slope, construction of a new access road, and repair of the concrete facing on the upstream slope of the dam. Upon our receipt of the dEA, we will provide an Approved geographic Jurisdictional Determination for Nuuanu Stream as a water of the U.S. subject to regulation and whether a Department of Army (DA) permit for Section 404 activities of the Clean Water Act may, or may not be, required for activities associated with the proposed Repairs to Nu`uanu Reservoir No. 4 Project.

Thank you for your consideration of potential impacts to the aquatic environment of the Nuuanu watershed. Please contact Mr. Farley Watanabe of my staff at 438-7701, facsimile 438-4060, or by email at Farley.K.Watanabe@usace.army.mil if you have any questions or need additional information. Please refer to File Number **POH-2010-00320** in any future correspondence with us.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

Hawaiian Telcom

November 29, 2010

R.M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaii 96819-3494
Attention: James Niermann, AICP, LEED, AP

Dear Mr. Niermann:

Subject: **Pre-Assessment Consultation Request**
Nuuanu No. 4 Reservoir Repair Project
Board of Water Supply
Honolulu, Oahu, TMK: (1) 2-2-054: 001 (por.)

Thank you for the opportunity to review and comment on the Pre-Assessment Consultation Request for the subject project.

Hawaiian Telcom does not have any comments to offer at this time. Please continue to include us during the design stages of the project.

If you have any questions or require assistance in the future on this project, please call Les Loo at 546-7761.

Sincerely,

Lynette Yoshida
Senior Manager – OSP Engineering
Network Engineering & Planning

cc: File [Puunui]

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P)1287.0

DEC 3 2010

Mr. James Niermann, AICP, LEED AP
Senior Planner
R.M. Towill Corporation
2024 N. King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Niermann:

Subject: Pre-Assessment Consultation Request for
Nuuanu No. 4 Reservoir Repair Project, Oahu
TMK: (1) 2-2-054: 001 (por.)

Thank you for the opportunity to comment on the subject project. The proposed project does not impact any of the Department of Accounting and General Services' projects or existing facilities and we have no comments to offer at this time.

If you have any questions, please call me at 586-0400 or have your staff call Ms. Gayle Takasaki of the Public Works Division at 586-0584.

Sincerely,

RUSS K. SAITO
State Comptroller

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 23, 2010

R.M. Towill Corporation
2024 N. King Street Suite 200
Honolulu, Hawaii 96819-3494

Attention: Mr. James Niermann, AICP, LEED AP

Ladies and Gentlemen:

Subject: Pre-Assessment Consultation for Board of Water Supply Nu'uanu No. 4 Reservoir Repair Project

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR), Land Division distributed or made available a copy of your report pertaining to the subject matter to Division of Aquatic Resources for their review and comment.

The Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0414. Thank you.

Sincerely,

Charlene Unoki
Assistant Administrator

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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LAND DIVISION
2010 DEC 22 A 9:39
OFFICE OF LAND & NATURAL RESOURCES STATE OF HAWAII

3520

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 29, 2010

MEMORANDUM

TO: **DLNR Agencies:**

RECEIVED
NOV 30 2010
STATE OF HAWAII

x Div. of Aquatic Resources
__ Div. of Boating & Ocean Recreation
x Engineering Division
x Div. of Forestry & Wildlife
x Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division –Oahu District/Lydia
x Historic Preservation

FROM: Charlene Unoki, Assistant Administrator Charlene
SUBJECT: Pre-Assessment Consultation for Nu'uanu No. 4 Reservoir Repair Project
LOCATION: Island of Oahu
APPLICANT: RM Towill corporation on behalf of Board of Water Supply

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by December 13, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(X) Comments are attached.

Signed:
Date: 15 DEC 2010

ROBERT T. NISHIMOTO, Ph.D.
Aquatic Resources Program Manager

STATE OF HAWAII
Department of Land and Natural Resources
DIVISION OF AQUATIC RESOURCES

MEMORANDUM

TO: Robert T. Nishimoto, Environmental Program Manager
FROM: Glenn R. Higashi, Aquatic Biologist GRH
SUBJECT: Pre-Assessment Consultation for Nu'uanu No. 4 Reservoir Repair Project
Comments Requested By: Charlene Unoki, Assistant Administrator Land Division
Date of Request: 11/29/10 Date Received: 11/30/10

Summary of Project

Title: **Pre-Assessment Consultation for Nu'uanu No. 4 Reservoir Repair Project**
Project By: **RM Towill Corporation on behalf of Board of Water Supply, City & County of Honolulu**
Location: **Honolulu, O'ahu – TMK: (1) 2-2-054:001 (por.)**

Brief Description:

The applicant, RM Towill Corporation on behalf of Board of Water Supply (BWS), City & County of Honolulu (CCH), is currently undertaking planning and design work for repairs to the Nu'uanu No. 4 Reservoir. The reservoir is located in Nu'uanu Valley adjacent to the Pali Highway, State Route 61, approximately 4 miles northeast of downtown Honolulu. The reservoir infrastructure, including the dam and appurtenances, is owned and operated by the BWS and is located on land owned by the State of Hawaii.

The primary function of the existing reservoir is to provide flood control for Nu'uanu Valley and part of downtown Honolulu that lies within the Nu'uanu Stream corridor. Discharges from the dam flow into Nu'uanu Stream and through the city of Honolulu before entering the Pacific Ocean at Honolulu Harbor. The reservoir is also used for recreational fishing and is managed as a freshwater fish refuge by the State Department of Land and Natural Resources (DLNR), Division of Aquatic Resources (DAR).

The reservoir infrastructure consists of a 65-foot high earthen embankment dam with a 1,750-foot crest length and partial concrete rubble masonry (rip rap) facing on the upstream slope. Appurtenances to the dam include an intake tower, outlet access tunnel, spillway, tower footbridge, access road, and monitoring wells. The top of the dam is located at elevation 1,038 feet above mean sea level (msl). The reservoir has a normal pool storage capacity of 120-acre-feet at water surface elevation 993.5 feet above msl, with a surface area of 10 acres. The streambed at the toe of the dam is at elevation 965 feet above msl.

Planned repair work includes the following:

1. Drain reservoir and remove, stockpile, dewater, and dispose of accumulated sediments from the reservoir basin.
2. Repair and rehabilitate the existing reservoir intake tower structure, including repairs to the lower level sluice gate, debris cages (trash racks), and operational controls.
3. Recalibrate and repaint water level markings on the existing intake tower.

4. Construct measuring weirs at existing seepage points on the downstream slope and outlet structure of the reservoir dam.
5. Dredge the outlet receiving area and install an extension of the outlet pipe.
6. Inspect and clean the existing outlet tunnel structure.
7. Remove the temporary access road located on the downstream face of the dam embankment and restore the embankment slope.
8. Repair and pave the existing reservoir access road on the top of the dam.
9. Construct a new access road to the toe of the dam for future inspection purposes.
10. Inspect the downstream dam slope and repair CRM rip rap deficiencies and depressions on the upstream face of the reservoir dam.
11. Create a subdivision map for Nu'uanu No. 4 reservoir.
12. Undertake ground clearing, construction staging, material stockpiling, installation of Best Management Practices (BMPs) structural and vegetative controls, operation of temporary pumping equipment, and other activities required for repair work on the Nu'uanu No. 4 Reservoir dam and appurtenant structures.

Comments:

The proposed project is not expected to have any significant impact on the aquatic resource values in this area. However, the following mitigative measures should be implemented during the removal, dewatering, and disposal of accumulated sediments, repair of dam and appurtenant structures, construct and repair access roads, ground clearing, construction staging, and material stockpiling to minimize the potential for erosion, siltation and pollution of the aquatic environment.

1) channel banks and areas denuded of vegetation should be planted or covered as quickly as possible to prevent erosion and runoff into the stream/estuary environment;
2) schedule site work during periods of minimal rainfall; and,
3) prevent petroleum products mechanical equipment, debris and landscaping products from falling, blowing or leaching into the stream environment.

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 14, 2010

Mr. James Niermann, AICP, LEED AP
R.M. Towill Corporation
2024 N. King Street Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Niermann:

Subject: Pre-Assessment Consultation for Board of Water Supply Nu'uanu No. 4 Reservoir Repair Project

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR), Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comment.

Other than the comments from Office of Conservation & Coastal Lands, Division of State Parks, Land Division-Oahu District, Engineering Division, the Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0414. Thank you.

Sincerely,

Russell Y. Tsuji
Administrator

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RECEIVED
LAND DIVISION
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DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 29, 2010

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
x Div. of Forestry & Wildlife
x Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division –Oahu District/Lydia
x Historic Preservation

FROM: Charlene Unoki, Assistant Administrator Charlene
SUBJECT: Pre-Assessment Consultation for Nu'uanu No. 4 Reservoir Repair Project
LOCATION: Island of Oahu
APPLICANT: RM Towill corporation on behalf of Board of Water Supply

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by December 13, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(X) Comments are attached.

Signed:
Date: 12/6/10

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/CharleneUnoki
RE:PreAsessConsultNuuanu4ReservoirRepair
Oahu.806

COMMENTS

( ) We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone ___.

(X) Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zones D and X. The National Flood Insurance Program does not have any regulations for developments within Flood Zones D & X, however any proposed drainage alternatives may have flooding impacts downstream. Therefore, please contact the Department of Planning and Permitting, Mario Siu Li.

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

( ) Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

- ( ) Mr. Robert Sumitomo at (808) 768-8097 or Mr. Mario Siu Li at (808) 768-8098 of the City and County of Honolulu, Department of Planning and Permitting.
- ( ) Mr. Carter Romero at (808) 961-8943 of the County of Hawaii, Department of Public Works.
- ( ) Mr. Francis Cerizo at (808) 270-7771 of the County of Maui, Department of Planning.
- ( ) Ms. Wynne Ushigome at (808) 241-4890 of the County of Kauai, Department of Public Works.

( ) The applicant should include water demands and infrastructure required to meet project needs. Please note that projects within State lands requiring water service from the Honolulu Board of Water Supply system will be required to pay a resource development charge, in addition to Water Facilities Charges for transmission and daily storage.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

(X) Additional Comments: The project may require additional permits or approvals from DLNR, such as a Dam Safety Construction/Alteration Permit, Conservation District Use Application, and the Stream Channel Alteration Permit.

( ) Other: _____

Should you have any questions, please call Ms. Suzie S. Agraan of the Planning Branch at 587-0258.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: 12/6/10

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 29, 2010

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
x Div. of Forestry & Wildlife
x Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division –Oahu District/Lydia
x Historic Preservation

FROM: Charlene Unoki, Assistant Administrator
SUBJECT: Pre-Assessment Consultation for Nu'uanu No. 4 Reservoir Repair Project
LOCATION: Island of Oahu
APPLICANT: RM Towill corporation on behalf of Board of Water Supply

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by December 13, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed: T. Chee
Date: 12/1/2010

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

PAUL J. CONRY
ACTING FIRST DEPUTY

LENORE N. OHYE
ACTING DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

REF:OCCL:AB

Correspondence: OA-11-115

DEC - 2 2010

James Niermann
R.M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawai'i 96819-3494

SUBJECT: Nu'uanu No. 4 Reservoir Repair Project, Located at Nu'uanu, Honolulu, O'ahu, TMK: (1) 2-2-054:001 (portion)

Dear Mr. Niermann:

The Department of Land and Natural Resources (DLNR) Office of Conservation and Coastal Lands (OCCL) has reviewed the information provided on the Nu'uanu No. 4 Reservoir Repair Project, Located at Nu'uanu, Honolulu, O'ahu, TMK: (1) 2-2-054:001 (portion).

The OCCL previously provided early consultation comments on the proposed action in a letter dated March 17, 2009. The OCCL has no further comments to add regarding this request.

Should you have any questions regarding this correspondence, please contact the OCCL at 587-0377.

Sincerely,

Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

c: Chairperson
ODLO
DPP
BWS

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 29, 2010

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
x Div. of Forestry & Wildlife
x Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division –Oahu District/Lydia
x Historic Preservation

FROM: Charlene Unoki, Assistant Administrator Charlene
SUBJECT: Pre-Assessment Consultation for Nu'uanu No. 4 Reservoir Repair Project
LOCATION: Island of Oahu
APPLICANT: RM Towill corporation on behalf of Board of Water Supply

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by December 13, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

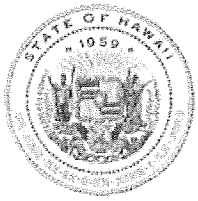
( ) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed:
Date: 12/5/10

LINDA LINGLE
GOVERNOR

MAJOR GENERAL ROBERT G. F. LEE
DIRECTOR OF CIVIL DEFENSE

EDWARD T. TEIXEIRA
VICE DIRECTOR OF CIVIL DEFENSE



PHONE (808) 733-4300
FAX (808) 733-4287

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

December 2, 2010

Mr. James Niermann
Senior Planner
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Niermann:

Pre-Assessment Consultation Request, Nu`uanu No. 4 Reservoir Repair Project,
Board of Water Supply, Honolulu, Oahu, Hawaii

Thank you for the opportunity to comment on these developments. After careful review of the project description and graphics that were provided, we agree with the inclusion of the input from various county, State, and Federal agencies, and community organizations into the Draft Environmental Assessment (EA). Our recommendation is to closely coordinate with the appropriate entities with regard to access, permitting, etc., and that activities undertaken are done so with the adjacent and surrounding communities in mind. We also recommend that repair plans be done in accordance with the Nu`uanu Reservoir Emergency Action Plan (EAP) throughout the life of the project.

We suggest careful study of the ramifications of these repairs to minimize any environmental, cultural, or historical consequences. The focus of the EA should speak to plans to address potential dam breaches, evacuations, and emergency road egress for both flooding and wildland fires.

We anticipate reviewing the Draft Environmental Assessment when it is completed and will make any further appropriate comments or suggestions at that time.

If you have any questions, please call Ms. Julie Greenly, State Civil Defense Planner, at (808) 733-4300, ext. 562.

Sincerely,

EDWARD T. TEIXEIRA
Vice Director of Civil Defense

c: Jonathan Suzuki, Board of Water Supply

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
INTERIM DIRECTOR

Deputy Directors
Ford N. Fuchigami
Jan S. Gouveia
Randy Grune
Jadine Urasaki

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

IN REPLY REFER TO:
DIR 1453
HWY-OM
2.10-1297

JAN 26 2011

Mr. James Niermann, AICP, LEED AP
Senior Planner
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaii 96819-3494

Subject: Pre-Assessment Consultation Request for Nuuanu No. 4, Reservoir Repair Project
Board of Water Supply, Honolulu, Oahu, TMK: (1) 2-2-054:001 (por.)

Dear Mr. Niermann:

Thank you for the opportunity to provide comments as part of the pre-assessment consultation phase for the Board of Water Supply's, Nuuanu No. 4, Reservoir Repair Project. We have read your letter dated November 15, 2010 and reviewed the provided project information. At this time, we have the following comments:

- The Draft Environmental Assessment (DEA) should consider and address roadway safety and traffic impact associated with construction. Of particular concern is the entering and exiting of construction vehicles onto Pali Highway.

- The State of Hawaii, Department of Transportation (HDOT) is the owner and operator of a Municipal Separate Storm Sewer System (MS4), or drainage system that runs along Pali Highway. HDOT's MS4 is maintained to minimize the roadway's contributions to water quality degradation. The DEA should consider measures to contain accumulated spoils from construction and dredging during transporting, stockpiling and dewatering. Appropriate precautions should be taken to prevent tracking onto the roadway and to prevent spills during transport.

- For reconstruction of the access road, HDOT's, Highways Division, Oahu District should be consulted early and throughout the planning and design phase to identify the appropriate access requirements, permits and approvals.

Should you have further questions, please contact Mr. George G. Abcede, Oahu Maintenance Engineer of our Highways Division, Oahu District office at (808) 831-6811.

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Interim Director of Transportation

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

PAUL J. CONRY
ACTING FIRST DEPUTY

LENORE N. OHYE
ACTING DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

REF:OCCL:AB

Correspondence: OA-11-115

DEC - 2 2010

James Niermann
R.M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawai'i 96819-3494

SUBJECT: Nu'uanu No. 4 Reservoir Repair Project, Located at Nu'uanu, Honolulu, O'ahu, TMK: (1) 2-2-054:001 (portion)

Dear Mr. Niermann:

The Department of Land and Natural Resources (DLNR) Office of Conservation and Coastal Lands (OCCL) has reviewed the information provided on the Nu'uanu No. 4 Reservoir Repair Project, Located at Nu'uanu, Honolulu, O'ahu, TMK: (1) 2-2-054:001 (portion).

The OCCL previously provided early consultation comments on the proposed action in a letter dated March 17, 2009. The OCCL has no further comments to add regarding this request.

Should you have any questions regarding this correspondence, please contact the OCCL at 587-0377.

Sincerely,

Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

c: Chairperson
ODLO
DPP
BWS

PHONE (808) 594-1888 FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD10/5340B

December 2, 2010

James Niermann, Senior Planner
R.M. Towill Corporation
2024 N. King Street, Suite 200
Honolulu, Hawai'i 96819-3494

RE: Pre-Draft Environmental Assessment consultation
Nu'uanu No. 4 Reservoir repairs
Nu'uanu Valley, Island of O'ahu

Aloha e James Niermann,

The Office of Hawaiian Affairs (OHA) is in receipt of your November 15, 2010 letter initiating consultation ahead of a draft environmental assessment (DEA) for repairs to the Nu'uanu No.4 Reservoir (reservoir) proposed by the City and County of Honolulu Board of Water Supply.

Your letter details that the primary function of the reservoir is to provide flood control for Nu'uanu Valley and portions of downtown Honolulu situated within the Nu'uanu Stream Corridor. The proposed repairs are intended to maintain safety requirements identified by the Department of Land and Natural Resources (DLNR) Dam Safety Program. OHA also recognizes that the reservoir is managed by the DLNR as a fresh water refuge and used for recreational fishing.

We have no substantive comments at this time. We look forward to the opportunity to review the DEA. Should you have any questions, please contact Keola Lindsey at 594-0244 or keolal@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Chief Executive Officer

Appendix B

Archaeological Inventory Survey

DRAFT

Archaeological Inventory Survey for the Nu‘uanu Reservoir No. 4 Project, Nu‘uanu Ahupua‘a, Honolulu District, Island of O‘ahu TMK: [1] 2-2-054:001

Prepared for
R. M. Towill Corporation

Prepared by
Kelly L. Burke, M.Sc.,
Douglas Borthwick, B.A.,
and
Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai‘i, Inc.
Kailua, Hawai‘i
(Job Code: NUUANU 6)

June 2012

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Management Summary

Reference	Archaeological Inventory Survey for the Nu‘uanu Reservoir No. 4 Project, Nu‘uanu Ahupua‘a, Honolulu District, Island of O‘ahu (TMK: [1] 2-2-054:001) (Burke, Borthwick, and Hammatt 2012)
Date	June 2012
Project Number(s)	Cultural Surveys Hawai‘i, Inc. (CSH) Project No.: NUUANU 6
Investigation Permit Number	CSH completed the fieldwork component of the archaeological inventory survey (AIS) under Hawai‘i Department of Land and Natural Resources/State Historic Preservation Division (DLNR/SHPD) permit No. 11-17, issued per Hawai‘i Administrative Rules (HAR) Chapter 13-13-282.
Project Location	Nu‘uanu Reservoir No. 4 is located in Nu‘uanu Valley, on the leeward side of the Ko‘olau Mountain Range and adjacent to (east of) the Pali Highway (State Route 61), approximately four miles northeast of downtown Honolulu.
Land Jurisdiction	Honolulu Board of Water Supply
Agencies	DLNR/SHPD
Project Description	The purpose of the planned repair work is to meet dam safety requirements listed in the State of Hawai‘i DLNR Dam Safety Program inspection report (Hawai‘i DLNR 2010a) and the Phase 1 Investigation Report (Durkee 2008) on Nu‘uanu Reservoir No. 4.
Project Acreage	Approximately 64 acres
Area of Potential Effect (APE) and Survey Acreage	The APE for the current AIS investigation is defined as the entire 64-acre project area.
Historic Preservation Regulatory Context	This document was prepared to support the proposed project's historic preservation review under Hawai‘i Revised Statutes (HRS) Chapter 6E-42 and HAR Chapters 13-13-275 and 13-13-284. In consultation with the DLNR/SHPD, the AIS investigation was designed to fulfill the state requirements for an AIS, per HAR Chapter 13-13-276.
Fieldwork Effort	Fieldwork was conducted on January 5 and March 31, 2011 by CSH archaeologists Douglas Borthwick, B.A., Kelly Burke, M.Sc., Josephine Paolello, M.S., and Trevor Yucha, B.S. and required approximately 3 person-days to complete. All fieldwork was performed under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator).
Number of Historic Properties Identified	Two historic properties were identified during the current AIS; one property was previously recorded (SIHP # 50-80-14-5697) and one is newly recorded as part of the current AIS (SIHP # 50-80-14-7380).

Historic Properties Recommended Eligible to the Hawai‘i Register of Historic Places	SIHP # 50-80-14-7380: Nu‘uanu Reservoir No. 4 and appurtenances, recommended eligible under Criteria A, B, and D.
Historic Properties Recommended Ineligible to the Hawai‘i Register	SIHP # 50-80-14-5697: linear stone and earthen berm containing an old water pipe, previously determined Hawai‘i Register eligible under Criteria A and D, but subsequently considered “no longer significant” as sufficient information was collected and documented during AIS fieldwork (Moore and Kennedy 1999:21).
Effect Recommendation	CSH’s project-specific effect recommendation is “effect, with proposed mitigation commitments” (in accordance with HAR 13-284-7). The project will potentially adversely affect SIHP # 50-80-14-7380. The recommended mitigation measure will reduce the project’s effect on this historic property.
Mitigation Recommendation	To reduce the proposed project’s potential adverse effect on SIHP # 50-80-14-7380, architectural recordation is recommended as a mitigation measure. Additionally, as Nu‘uanu Reservoir No. 4 is part of a larger system of reservoirs, a full study of the whole Nu‘uanu Reservoir system at some point in the future is recommended.

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Section 1 Introduction

1.1 Project Background

At the request of R. M. Towill Corporation, Cultural Surveys Hawai‘i, Inc. (CSH) conducted an archaeological inventory survey (AIS) for the Nu‘uanu Reservoir No. 4 Project, Nu‘uanu Ahupua‘a, Honolulu District, Island of O‘ahu (TMK: [1] 2-2-054:001). Nu‘uanu Reservoir No. 4 is owned by the Honolulu Board of Water Supply. The 64-acre reservoir is located in Nu‘uanu Valley, on the leeward side of the Ko‘olau Mountain Range, and adjacent to (east of) the Pali Highway (State Route 61), approximately four miles northeast of downtown Honolulu. The location of the project area is depicted on the 1998 Honolulu United States Geological Survey (U.S.G.S.) 7.5-minute topographic quadrangle map (Figure 1), Tax Map [1] 2-2-054 (Figure 2), and a 1998 aerial photograph (Figure 3).

Nu‘uanu Reservoir No. 4 consists of a 65-foot high earthen embankment dam with a 1,750-foot crest length and partial rip-rap on the upstream face. Appurtenances to the dam include an intake tower, outlet access tunnel, spillway, tower footbridge, access road, and monitoring wells (Figure 4). The reservoir has a normal pool storage capacity of 120 acre-feet with a surface area of 10 acres (Figure 5). Discharges from the dam flow into Nu‘uanu Stream and through the city of Honolulu before entering the Pacific Ocean at Honolulu Harbor.

The primary function of the existing Nu‘uanu Reservoir No. 4 is to provide flood control from the 1.4 square mile watershed on the heavily vegetated leeward slopes of the Ko‘olau Mountains for Nu‘uanu Valley and part of downtown Honolulu that lies within the Nu‘uanu Stream corridor. The reservoir is also used for recreation and as a fresh water fish refuge by the Department of Land and Natural Resources (DLNR), Division of Aquatic Resources (Durkee 2008:3).

The purpose of the planned repair work is to meet dam safety requirements listed in the State of Hawai‘i DLNR Dam Safety Program inspection report (Hawai‘i DLNR 2010a) and the Phase 1 Investigation Report (Durkee 2008) on Nu‘uanu Reservoir No. 4. Planned repair work includes the following:

1. Removal and disposal of accumulated sediments at the base of the existing reservoir intake tower structure and repair and rehabilitation of the existing lower level sluice gate and operational controls.
2. Repair of three existing debris cages (trash racks) and lower level sluice gate on the intake tower.
3. Construction of measuring weirs at three existing seepage points on the downstream slope and outlet structure.
4. Dredging of outlet receiving area and installation of extension of outlet pipe.
5. Removal of the temporary access road located on the downstream face of the dam embankment and restoration of the embankment slope.
6. Repair and repaving of the existing reservoir access road on the top of the dam.

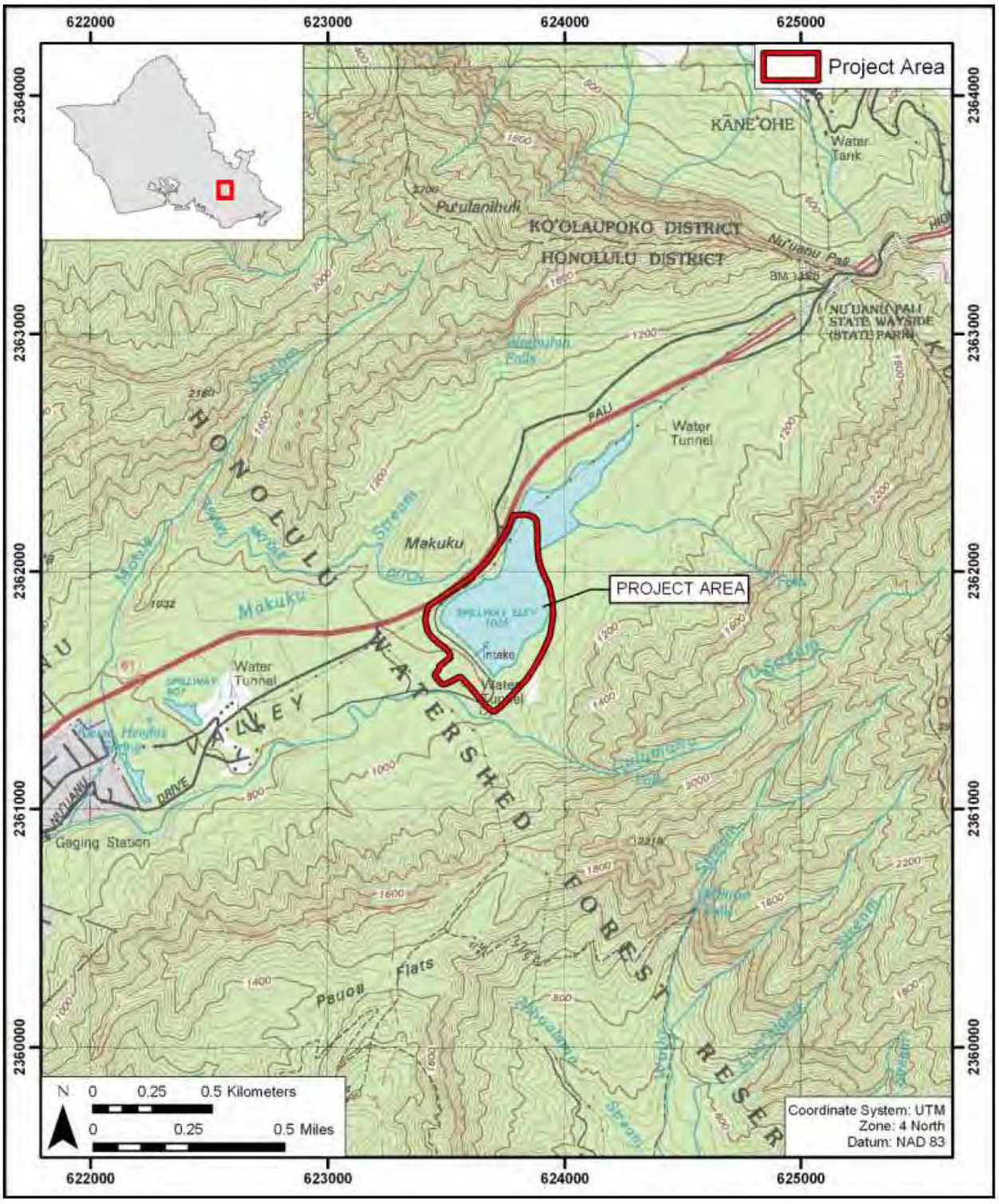

Figure 1. Portion of the 1998 Honolulu U.S.G.S. 7.5-minute topographic quadrangle map showing the location of the project area

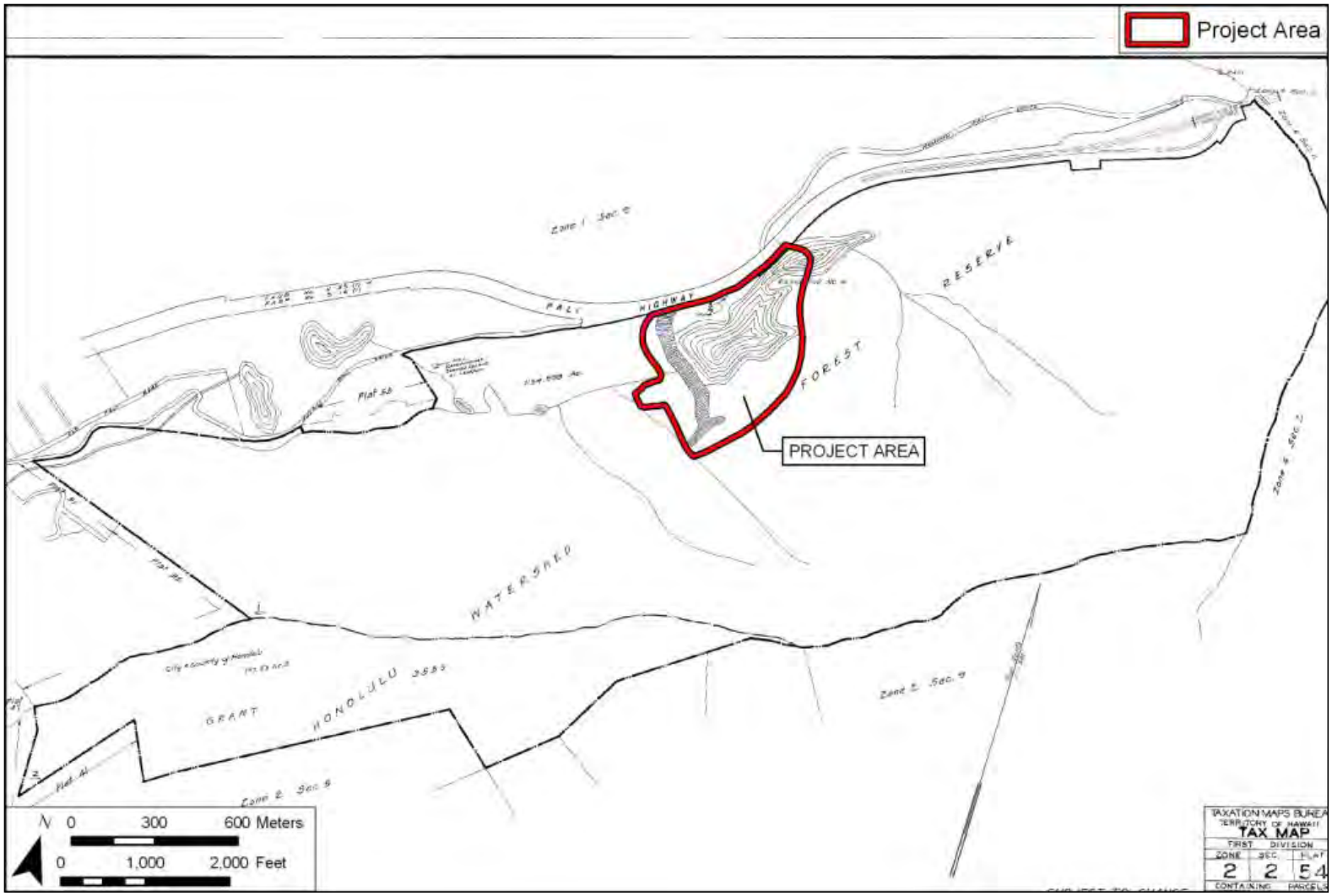

Figure 2. TMK: [1] 2-2-054 showing the location of the project area (Hawai‘i Tax Map Key Service 2010)

Figure 3. 1998 aerial photograph showing the location of the project area (U.S.G.S. Orthoimagery)

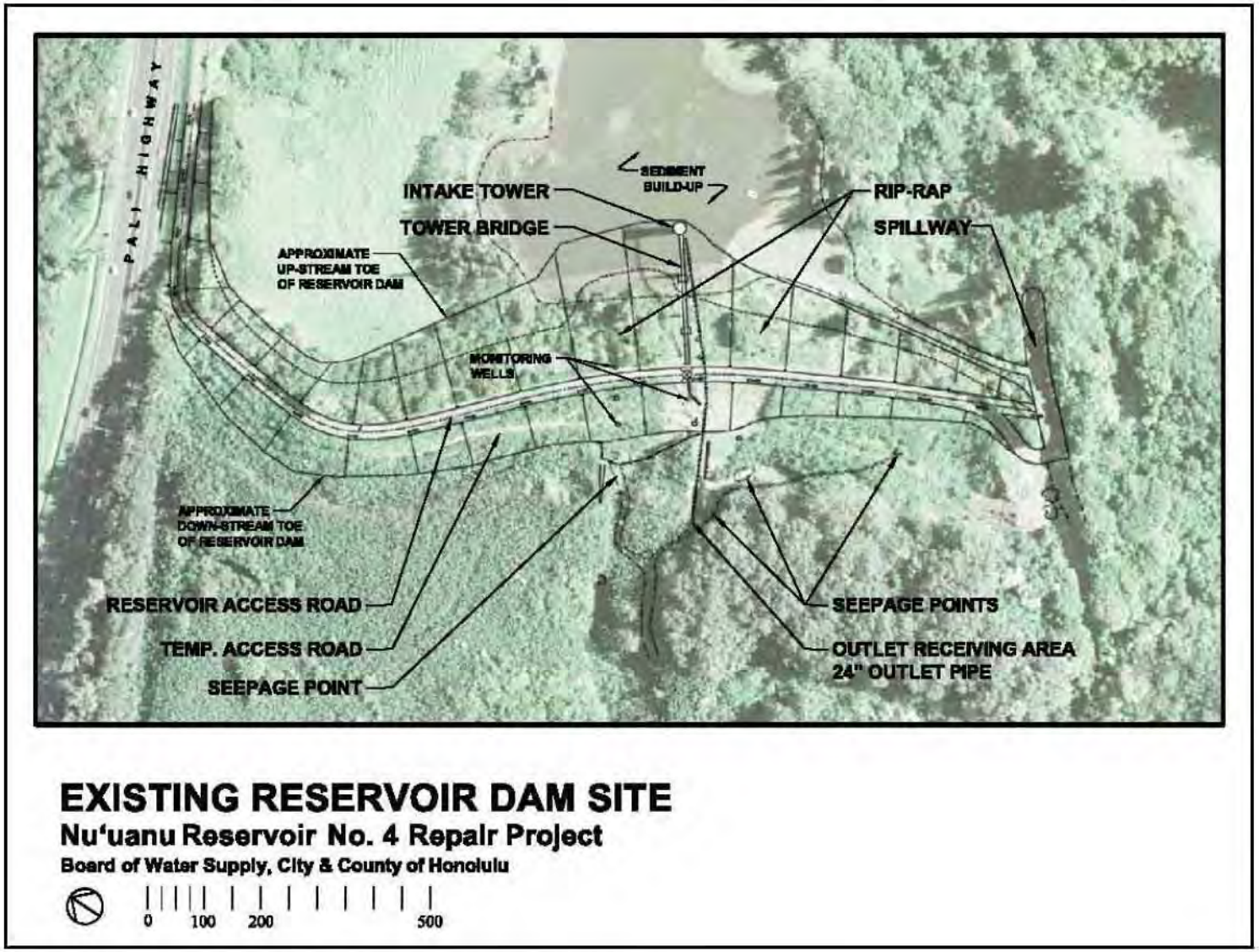

Figure 4. Existing Reservoir Dam Site (R. M. Towill Corp. 2010a)

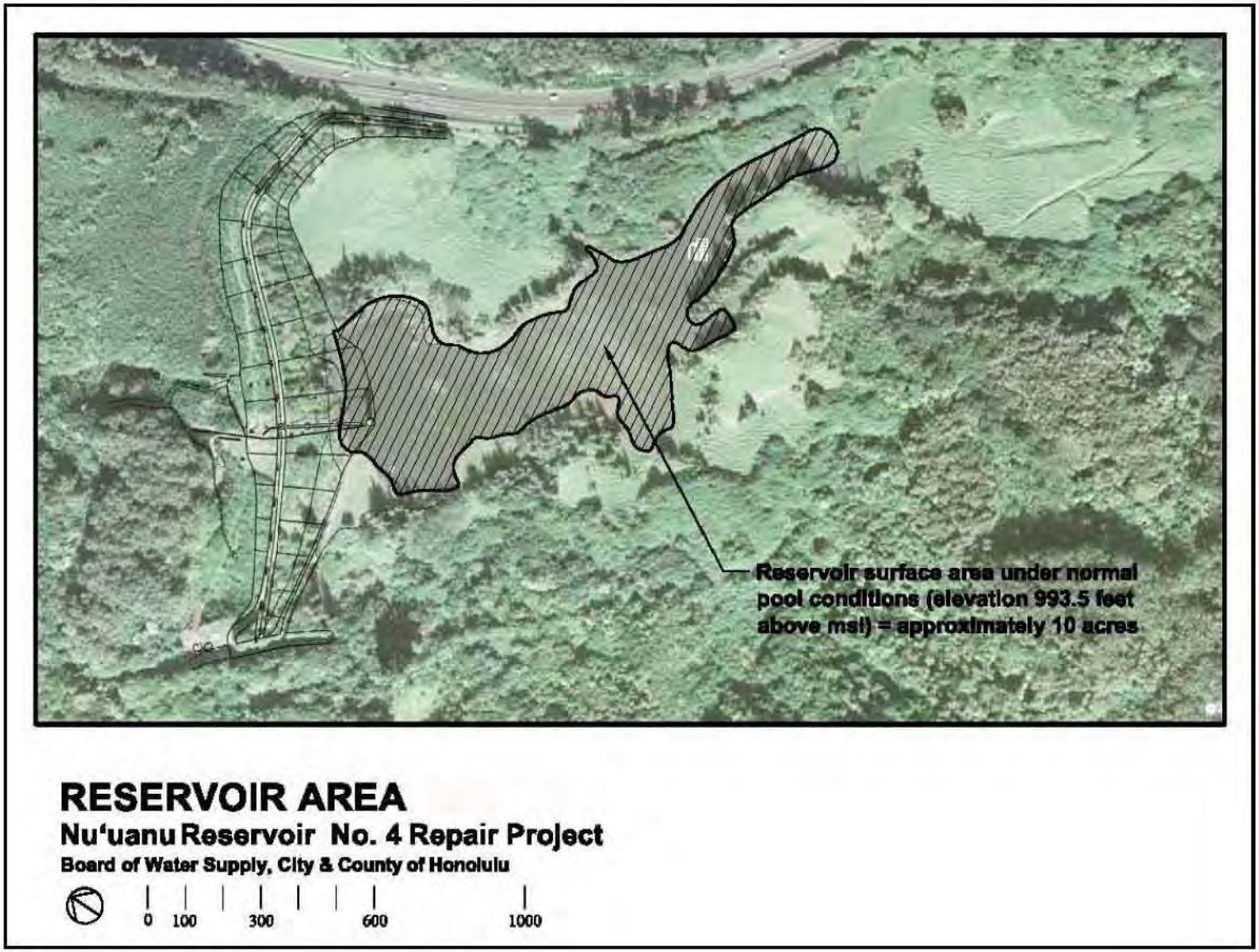

Figure 5. Reservoir Area (R. M. Towill Corp. 2010b)

7. Inspection of the downstream slope and repair of the upstream slope rip-rap deficiencies and depressions.
8. Inspection and cleaning of the existing outlet tunnel structure.
9. Recalibration/repainting of water level markings on the existing intake tower.
10. Creation of subdivision map for Nu‘uanu No. 4 reservoir.

1.2 Scope of Work

The following archaeological inventory survey scope of work was designed to satisfy the Hawai‘i state requirements for archaeological inventory surveys (Hawai‘i Administrative Rules [HAR] Chapter 13-13-275, 13-13-276, and 13-13-284):

1. Historic and archaeological background research, including a search of historic maps, written records, Land Commission Award documents, and reports from prior archaeological investigations. This research focused on the specific project area’s past land use, with general background on the pre-contact and historic settlement patterns of the *ahupua‘a* and district. This background information was used to compile a predictive model for the types and locations of historic properties that could be expected within the project area.
2. A field inspection of the project area to identify any potential surface historic properties. Surface historic properties were recorded with an evaluation of age, function, interrelationships, and significance. Documentation included photographs, scale drawings, and, when warranted, limited controlled excavation of select sites and/or features.
3. Based on t he project area’s environment and the results of the background research, subsurface testing with a combination of hand and backhoe excavation to identify and document subsurface historic properties that would not be located by surface pedestrian inspection, as deemed appropriate. Appropriate samples from these excavations were analyzed for cultural and chronological information. All subsurface historic properties identified were documented to the extent possible, including geographic extent, content, function/derivation, age, interrelationships, and significance.
4. As appropriate, consultation with knowledgeable individuals regarding the project area’s history, past land use, and the function and age of the historic properties documented within the project area.
5. As appropriate, laboratory work to process and gather relevant environmental and/or archaeological information from collected samples.
6. Preparation of an inventory survey report, which includes the following:
    a) A project description;
    b) A section of a U.S.G.S. topographic map showing the project area boundary and the location of all recorded historic properties;
    c) Historical and archaeological background sections summarizing prehistoric and historic land use of the project area and its vicinity;

d) Descriptions of all historic properties, including select photographs and scale drawings and discussions of age, function, laboratory results, and significance. Each historic property will be assigned a Hawai‘i State Inventory of Historic Properties number;

e) If appropriate, a section concerning cultural consultations.

f) A summary of historic property categories, integrity, and significance based upon the Hawai‘i Register of Historic Places criteria;

g) A project effect recommendation;

h) Treatment recommendations to mitigate the project’s adverse effect on any historic properties identified in the project area that are recommended eligible to the Hawai‘i Register of Historic Places.

This scope of work includes full coordination with the SHPD/DLNR and county relating to archaeological matters. This coordination takes place after consent of the owner or representatives.

1.3 Environmental Setting

1.3.1 Natural Environment

The amphitheater-shaped valley of Nu‘uanu on the leeward side of the Ko‘olau Mountain range is fronted by the coastal Honolulu Plain. The project area is located in the upper portion of Nu‘uanu Valley. The upper portion of Nu‘uanu Valley receives heavy rainfall annually (1500 mm or 60 in; Giambelluca et al. 1986:73). The soil in the project area consists of Lolekaa silty clay, with 3 to 8 percent slopes (LoB) and 25 to 40 percent slopes (LoE; Foote et al. 1972; Figure 6). Lolekaa silty clay is well-drained soil found on fans and terraces that developed in old colluviums and alluvium. For the lesser slopes, soil permeability is moderately rapid, runoff is slow, and the erosion hazard is slight (Foote et al. 1972:83). For the greater slopes, runoff is medium to rapid, and the erosion hazard is moderate to severe (Foote et al. 1972:84). Typical vegetation includes guava, Christmas berry, California grass, Hilo grass, and rice grass (Foote et al. 1972:83).

1.3.2 Built Environment

The project area contains the Nu‘uanu No. 4 Reservoir Dam, which consists of a 65-foot high earthen embankment dam, an intake tower, outlet access tunnel, spillway, tower footbridge, access road, and monitoring wells.

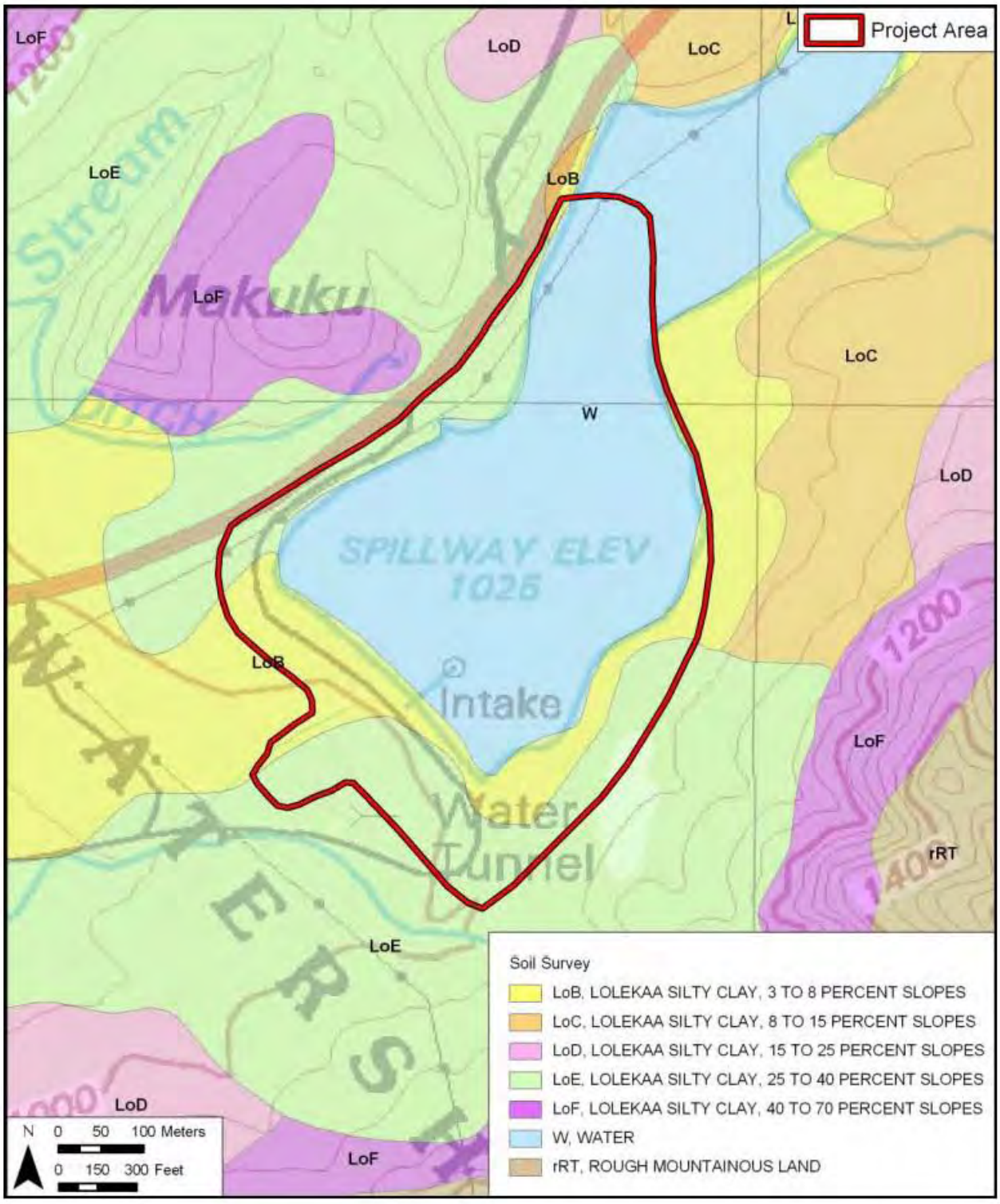

Figure 6. Overlay of Soil Survey of the State of Hawai‘i (Foote et al. 1972) showing project area (base map: the 1998 Honolulu U.S.G.S. 7.5-minute topographic quadrangle map)

Section 2 Methods

2.1 Field Methods

CSH completed the fieldwork component of the AIS under SHPD/DLNR permit No. 11-17, issued per HAR Chapter 13-13-282. The fieldwork component was conducted on January 5, 2011 and March 31, 2011 by CSH archaeologists Douglas Borthwick, B.A., Kelly Burke, M.Sc., Josephine Paolello, M.S., and Trevor Yucha, B.S. This effort required approximately 3 person-days to complete. All fieldwork was carried out under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator).

2.1.1 Pedestrian Inspection

A 100% pedestrian inspection of the proposed areas of repair work within the project area was undertaken for the purpose of historic property identification and documentation. The pedestrian survey was accomplished through systematic sweeps.

All historic properties within the project area were documented with photographs and detailed written descriptions including an evaluation of function, interrelationships, and significance. All properties were located using a Trimble ProXH (real-time sub-foot accuracy) GPS unit.

2.2 Document Review

Background research included: a review of previous archaeological studies on file at the SHPD/DLNR library; review of historical documents at Hamilton Library at the University of Hawai‘i, the Hawai‘i State Archives, the Mission Houses Museum Library, the Hawai‘i Public Library, and the Archives of the Bishop Museum; study of historic photographs at the Hawai‘i State Archives and the Archives of the Bishop Museum; study of historic maps at the Hawai‘i State Land Survey Division; and study of historic maps and photographs at the CSH library. Information on Land Commission Awards (LCAs) was accessed through Waihona ‘Aina Corporation’s Māhele Database (www.waihona.com) as well as a selection of CSH library references. This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources consulted were used to formulate a predictive model regarding the expected types and locations of historic properties that may be located in the project area.

2.3 Consultation

Community consultation for the current project was undertaken by CSH as part of a cultural impact assessment (refer to Genz and Hammatt 2011).

2.4 National Register of Historic Properties Form Completion

As a part of the AIS, CSH, with the help of Mr. Jim Niermann from R. M. Towill, completed a National Register of Historic Places Registration Form for Nu‘uanu Reservoir No. 4 (Appendix A). The Registration Form should be cosidered preliminary in nature and should be used as a guide for future nomination of Nu‘uanu Reservoir No. 4 itself or, perhaps preferably, the whole Nu‘uanu Reservoir System.

Section 3 Background Research

3.1 Mythological and Traditional Accounts

Nu‘uanu Valley was unique among most leeward valleys of O‘ahu in having the easiest trail access to the Windward Coast. Legendary material for the valley is rich, and it is reported by Thrum (1906:55) that the earliest *heiau* on the island was built at Waolani by Wākea, an ancestor of the Hawaiian people. Nu‘uanu was known as an important valley for taro cultivation. Handy describes the upper part of the valley as follows:

> In upper Nuuanu 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 [‘Ili] doubtless had many inland gardens; but there were not wet terraces that far up. From Waolani to Kapalama the terraces were continuous on the level and gently sloping land between the Nuuanu and Waolani streams, down what is now Liliha Street. In many vacant lots, yards, and gardens above and below Judd Street traces of terraces may still be seen [Handy 1940:78-79].

3.1.1 The Winds of Nu‘uanu and the Pali

Pukui and Elbert (1974:167) give the definition of Nu‘uanu as “cool height,” but C. J. Lyons (1901:181) states that the meaning is more complex. Although *nu‘u* means “height,” this portion of the name could also be a contraction of “*nuku*,” meaning “a mountain pass” (Pukui et al. 1976:272-273). Nuuanu is “cool terrace” or notch in mountain, referring to the cold wind at the Pali, the place at the top of the Pali being a nu‘u to those approaching from Koolau to the “nuku o Nuuanu.”

Several *‘ōlelo no‘eau* poetically describe the winds and rains of Nu‘uanu Valley:

> *Ako Nu‘uanu i ka hālau loa a ka makani; ‘āko Mānoa i ka hale a ke ehu.*
>
> Gathered in Nu‘uanu is the longhouse of the wind; gathered in Mānoa is the house of rainy sprays [Pukui 1983:13].
>
> *Ka makani kā‘ili kapa o Nu‘uanu.*
>
> The garment-snatching wind of Nu‘uanu.
>
> > The gale that blows at Nu‘uanu Pali, O‘ahu, could whisk away the top garment of a traveler there [Pukui 1983:158-159].
>
> *Ka makani kula‘i kanaka o Nu‘uanu*.
>
> The wind of Nu‘uanu that pushes people over.
>
> > The strong gales at Nu‘uanu were known to make travelers fall down [Pukui 1983:159].
>
> *Ku ka liki o Nu‘uanu i ka makani.*

Nu‘uanu draws her shoulders up in the wind.

Said of a show-off [Pukui 1983:203].

Kāhiko i Nu‘uanu ka ua Wa‘ahila.

Adorned in Nu‘uanu by the Wa‘ahila rain.

The Wa‘ahila rain makes Nu‘uanu grow green and beautiful [Pukui 1983:143].

Ka ua Pōpōkapa o Nu‘uanu.

The Tapa-bundling rain of Nu‘uanu.

The Popokapa rain is so called because anyone who came up Nu‘uanu Pali from the windward side had to bundle his garments and hold his arms against his chest to keep from getting wet [Pukui 1983:173].

Ola ke awa o Kou i ka ua Wa‘ahila.

Life comes to the harbor of Kou because of the Wa‘ahila rain.
It is the rain of Nu‘uanu that gives water to Kou (now central Honolulu) [Pukui 1983:272].

3.1.2 Wahi Pana

Wahi pana are sacred places that include such cultural properties as *heiau*, *loko i‘a* (fishponds), *ala hele* (trails), *ilina* (burials, graves), and *iwi kūpuna* (ancestral bone remains), land divisions, and natural geographic locations, such as streams, peaks, rock formations, ridges, and offshore islands and reefs that are associated with culturally significant beliefs or events. A *wahi pana* leaves an imprint on the landscape even if its tangible properties no longer exist, as the *mana* (divine power) of previous people and events associated with this space continues to manifest itself. For example, the stereotypical *heiau* is composed of terraces, enclosures, walls, mounds, or upright stones, but *heiau* can also be sacred places on a landscape that lack built structures, natural landscape features such as rock outcroppings, and earthworks where *mana* is concentrated and transferred between the deities and worshippers (Becket and Singer 1999:xix–xx). A Hawaiian *wahi pana* “physically and poetically describes an area while revealing its historical or legendary significance” (Landgraf 1994:v).

The *wahi pana* of Nu‘uanu link the *kama‘āina* and *kūpuna* to their past. This section traces the *wahi pana* from the mountain peaks to the lowland valley. The following measures clarify these *wahi pana*: the locations of the cultural properties are bolded in the text and labeled if their locations are known (Figure 7); all *wahi pana* meanings are cited from Pukui et al. (1974) unless otherwise noted; and spelling and use of diacriticals follow Pukui et al. (1974).

3.1.2.1 Place Names of Nu‘uanu

The name **Nu‘uanu** (cool height) may derive from the contraction of *nuku* (mountain pass) to reference the cold wind near the summit at the Pali (Lyons 1901:181). The lower portion of Nu‘uanu Valley is comprised of the *‘ili* (land section smaller than an *ahupua‘a*) of **Kunawai**

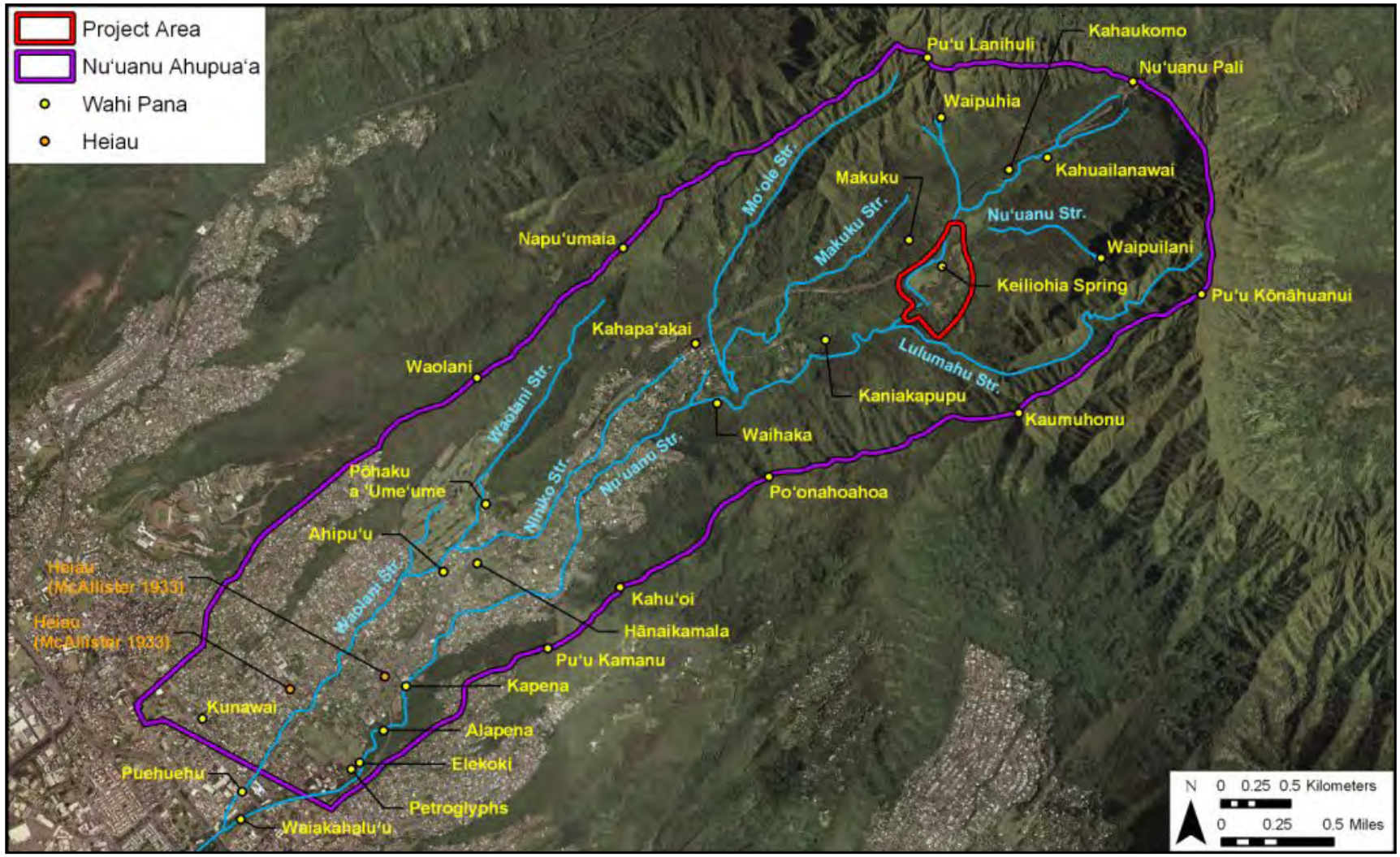

Figure 7. *Wahi pana* of Nu‘uanu Ahupua‘a (base image: orthoimagery of the 2004-2005 Honolulu U.S.G.S. 7.5-minute topographic quadrangle map)

(pool of the eel), **Kaliu**, **Pu‘unui** (big hill), **Kaukahoku**, **Kawānanakoa** (the fearless prophecy), **Niolopa**, **La‘imi** (day [of] seeking), **Pū‘iwa** (the startled), **Waolani** (heavenly mountain area), and **Kahapa‘akai** (salt place), and the upper part of Nu‘uanu Valley is comprised of the forested *‘ili* of **Luakaha** (place for relaxation). The project area is located within the *‘ili* of Luakaha.

Nu‘uanu Valley is watered by two main streams, the **Nu‘uanu Stream** and the **Waolani Stream** (once called Pūehuehu Stream), and by several tributary streams, including **Lulumahu**, **Makuku**, **Mo‘ole**, **Niniko**, and **Kauhipuna**. Feeding the Nu‘uanu Stream and Makuku Stream are the waterfalls **Waipuilani** (water spout) and **Waipuhia** (blown water; now called “Upside Down Falls”), respectively. Pools along the streams include **Kahuailanawai** (site of tranquil water), **Pueheuhu** (spray scattered), **Waihi**, **Waihaka**, **Kapena** (the package), **Alapena**, **‘Alekoki** (Elekoke; short ripples), **Kunawai**, **Waiakahalu‘u**, and **Kamanuwai** (the water bird). The original construction plans for Nu‘uanu Reservoir No. 4 i ndicate that a spring called **Keiliohia** was located in area since covered with water (1907, supplied by R. M. Towill Corporation).

The mountainous sections of Nu‘uanu Valley contain *wahi pana* connected to the stunning landscape, with towering *pu‘u* (peaks) overlooking the upland forests, as well as smaller hills and valleys. Towering above the northern *mauka* section of Nu‘uanu Valley are the peaks of **Pu‘u Kōnāhuanui** (large, fat innards) and **Pu‘u Lanihulu** (where the heavens change), which describes the abrupt changes in the winds at the peak (Raphaelson 1925). Nestled between these two peaks is **Ka Nuku** (Figure 8), the *nuku* (pass) that leads to the **Nu‘uanu Pali**. Smaller peaks and ridges include **Napu‘umaia** (the banana hills) and **Waolani** (heavenly mountain area) on the west side of the valley; **Kaumuhonu**, **Po‘onahoahoa**, **Kahu‘oi**, and **Pu‘u Kamanu** (bird hill) on the east side; and **Makuku** and **Ahipu‘u** (hill fire) in the central area.

A ***hōlua* slide** was located at the end of the ridge dividing the valleys of Wailani and Nu‘uanu (McAllister 1933:86). Several *pōhaku* (rocks) with **petroglyphs** of human figures and animals are located near the pool called Alapena (McAllister 1933:83-34). *Mo‘olelo* describe how *menehune* (a legendary race of small people)contended for the possession of a *pōhaku* called **Pōhaku a ‘Ume‘ume** (stone of contention), which was hurled back and forth between Waolani and Kupanihi (Pacific Heights) (Cummins:204).

Mauka of the project area is a region called **Kahaukomo** (the *hau* [Hibiscus] trees begin). In these *hau* groves awaited bandits who ambushed and sometimes killed travelers heading to and from the Nu‘uanu Pali (Raphaelson 1929:11). Two *pōhaku* named **Hapu‘u** and **Kala‘iola** located in Kahaumoko *mauka* of the *hau* grove and *makai* of the pool Kahuailanawai were female guardians of the *nuku* of the Nu‘uanu Pali that could grant safe passage to travelers scaling the precipice (Hawaiian Ethnological Notes:820). In addition, **Kahapa‘akai** (salt place) is the name of a *ko‘a* (shrine) and associated rock walls, as well as a nearby spring, in the upper valley (Figure 9).

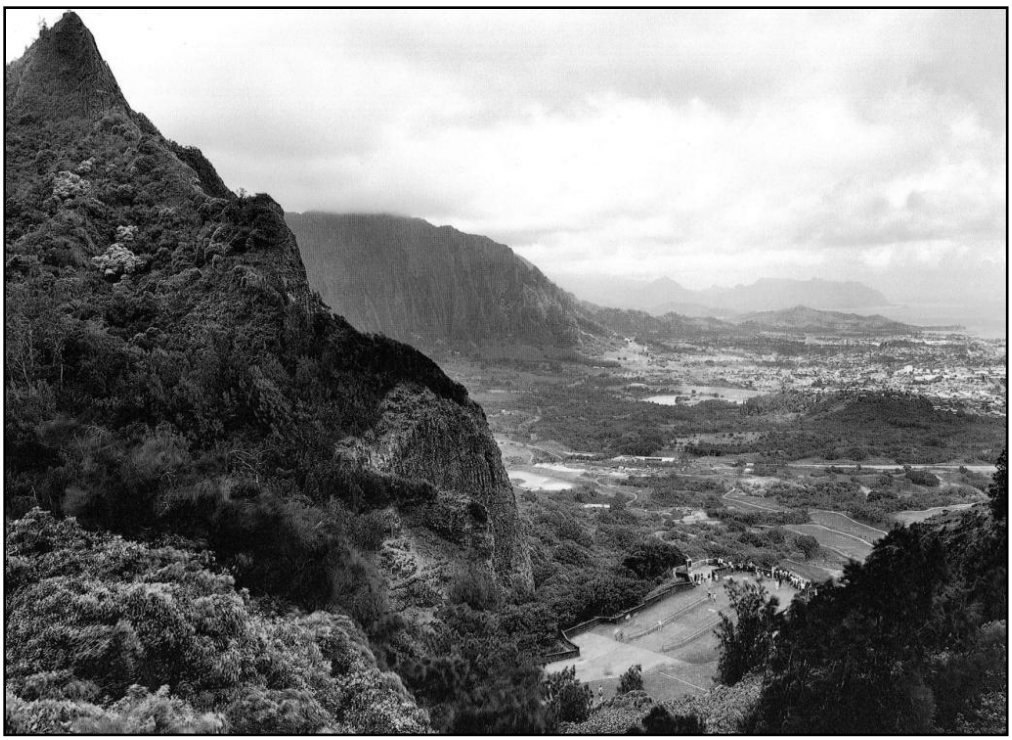

Figure 8. Ka Nuku (Landgraf 1994:99)

Figure 9. Kahapa‘akai (Becket and Singer 1999:22)

3.1.2.2 Heiau

According to Samuel Kamakau (1992:130), Wākea, an ancestor and possible progenitor of the Hawaiians, built the earliest *heiau* on the island in the valley of Waolani. Thrum (1906:44) mentions a *luakini* (sacrificial) *heiau* in Waolani called **Kawaluna** similarly constructed by Wākea and consecrated by the *mō‘ī* (ruler) of O‘ahu, Kū‘ali‘i, about 1685. According to a Hawaiian language newspaper, Kawaluna Heiau was located on the east ridge of Waolani Valley (*Ka Na‘i ‘Aupuni* 1906a, cited in Sterling and Summers 1978:304). Kawaluna Heiau appears to have been the prototypical *luakini heiau* that all subsequent *heiau* had to conform to (Beckwith 1970:26), and was also a *po‘ohonua*, a place of refuge for the sick, as well as a testing site for the validity of genealogical claimants to a particular line of chiefs (Taylor, cited in Sterling and Summers 1978:303). Gilbert McAllister (1933:86) recorded the approximate locations of two other *heiau* in lower Nu‘uanu Valley based on the testimonies of two informants. These and other *heiau* appear to be part of a complex of heiau in Waolani Valley (Dixon et al. 1994:20). Thrum (1906:44) also mentions a *heiau* in upper Nu‘uanu Valley called **Makuku** for bringing rain, although McAllister (1933:86) places it in Waolani. *Mo‘olelo* recount that this complex of *heiau* in Waolani Valley was the home of Mo‘oinanea, the primal *‘aumakua* (deified ancestor) who appeared as a *mo‘o* (lizard; Beckwith 1970:507). In addition, *mo‘olelo* recount that a *heiau* called **Kaheiki,** on the ridge between Nu‘uanu and Pauoa, was built by *menehune* (legendary race of small people; Westervelt 1915, cited in McAllister 1933:82; Figure 10).

Rayna Raphaelson (1925) recounts seven *heiau* that Kamehameha captured and destroyed during Kaleleka‘anae, or the last battle of Nu‘uanu in 1795. The first four *heiau* were **Elekoki**, near the spring Elekoki (‘Alekoki); **Koauananakoa**, near the Royal Mausoleum; **Ahipu‘u**; and **Puiua** (also spelled Puiaa), near **Hānaikamala** (Queen Emma’s Summer Palace), where Kamehameha’s warriors rested. The opposing force under the O‘ahu chiefs had been pushed back to a fifth *heiau* at the mouth of Waolani Valley. In ancient times, the wives of warriors often accompanied their husbands to the sites of the battles. While Kamehameha’s men were resting at Puiua, the women of the two forces met at a field on the east side of the Pali Highway, opposite to the entrance to Waolani, and had their own battle: “The women started to fight in true warrior fashion, and by the time the fighting was over, the entire field to the right was filled with the dead and the dying” (Raphaelson 1925).

The narrative continues with two *heiau* in Waolani Valley, **Kakanaiakeakea** and **Kawaluna**, and a final *heiau* called **Kaniakapūpū (**the singing of the land snails). According to Charles Kenn, this *heiau* was a place where people came for comfort and medical attention; the priests accepted tithes, and the guards were stationed at Kahaukomo, the sacred *hau* grove above the temple (Pacific Worlds 2003a). In one version of the Battle of Nu‘uanu, Kamehameha rested here while his men made the final assault on the O‘ahu forces, driving the last of the warriors over the Nu‘uanu Pali (Pacific Worlds 2003a). Kaniakapūpū was later used as a summer retreat for Kamehameha III, and some claim that it was mistakenly identified as a *heiau* in the historic period based on the old look of the ruins of the houses (Johnstone 1907:164)

Some of the seven structures mentioned by Raphaelson (1925) may have been hill forts rather than *heiau*. For example, John A. Cummins reported that Ha‘ipu and Ahipu‘u in lower Waolani Valley were small hills rather than *heiau*:

> Haipu was not a heiau, it was a beacon fortress where in case of a raid from the Pali way and heights above Waolani by natives from Koolau (Kailua), the Kona chiefs would from here be notified by a bonfire always ready to light. There was a guard of warriors at Ahipuu (hill of fire) where the house now is. This was a very large guard and was always maintained at war strength [Cummins, cited in Sterling and Summers 1978:300].

Figure 10. Kaheiki Heiau (Becket and Singer 1999:19)

3.1.2.3 Ala Hele

Ala hele once served to connect the various settlements throughout O‘ahu. A coastal route circled O‘ahu, and other trails traversed the mountain ranges and valleys, including the trail that wound up Nu‘uanu Valley toward the Pali and then traversed the sheer rock cliffs to reach windward O‘ahu (‘Ī‘ī 1959:92; Figure 11). According to the diary entry of Reverend R. Tinker in 1831, Hawaiians used the trail to transport taro, potatoes, *poi*, fowl, goats, and pigs between windward O‘ahu and Honolulu (Thrum 1901:89). Lord Byron, Commander of the *H.M.S. Blonde*, captured the descent of the Pali Trail in an entry in the ship’s log in 1825, in which he inscribed that “The descent to this plain…is the most fearful imaginable…where a false step would be inevitable destruction” (Byron 1826, quoted in Sterling and Summers 1978:225). Parts of this steep path later became incorporated into a stone-paved horse trail in 1845, the newly

constructed Pali Road in 1897, and recent improvements starting in 1952 that led to the existing Pali Highway (Devaney et al. 1982).

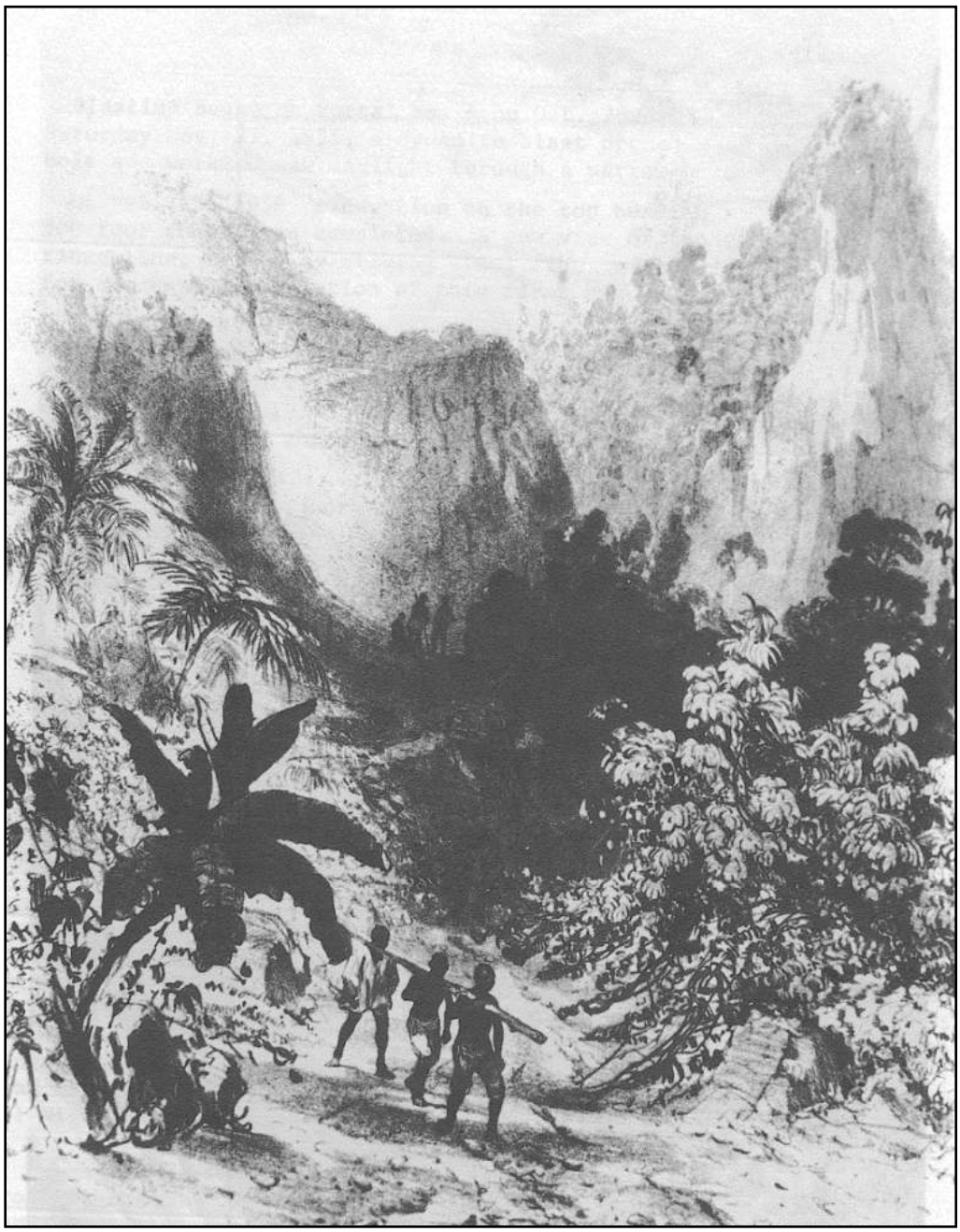

Figure 11. The old Pali Trail, 1836; lithograph of painting by Capt. V. B. Fisquet (R. J. Baker Collection and Bernice Pauahi Bishop Museum Collection, from Devaney 1982:174)

3.1.2.4 Ilina

McAllister (1993:86) mentions that there are many caves on both sides of Nu‘uanu Valley near Kaua‘i Street and below ‘Ālewa Heights, which is located *makai* of the project area. He personally examined five caves and discovered historic burials in four of them.

3.1.3 Mo‘olelo of Wahi Pana

The *wahi pana* of Nu‘uanu Valley are associated with numerous *mo‘olelo*. This section offers *mo‘olelo* of *wahi pana* in the vicinity of the project area in the forested *‘ili* of Luakaha near the Nu‘uanu Pali.

3.1.3.1 Kahaukomo

This *mo‘olelo* describes a battle between two noted men during the reign of Ka-lani-‘opu‘u (ca. 1770) that took place in the *hau* groves of Kahaukomo *mauka* of the project area:

> Na-maka was one of the noted men of Ka-lani-‘opu‘u’s time. He was a man skilled in politics, oratory, genealogies, spear-throwing (*lono ma ka ihe*), the conformation of the earth’s surfaces (*kulikuhi pu‘u one*), bone-breaking (*lua*), cliff-leaping (*lele pali*), and the interpretation of omens (*kilo*), all accomplishments which he had learned on Kaua‘i. He set out to find a *haku* (lord) to whom he might impart all his learning, and Ka-lani-‘opu‘u was the *haku* whom he selected. Arrived at O‘ahu, he heard that Pakua-nui was skilled in debate and in bone-breaking. This Pakua-nui was the father of Ka-‘ele-o-waipi‘o, a man of learning of Kamehameha’s day who lived at Kailua and composed the dirges of Jesus. Na-maka met Pakua-nui at Kahaukomo in Nu‘uanu, and after they had matched their skills, Pakua-nui realized the skill of the tentacle-breaking son of Kilohana and the *koai‘e* wood-breaking son of Kailila‘au. The shafts of wit flew, brilliant as the rainbow arching over the *hau* trees of Kahaukomo that lends its color to the *‘ulalena* rain blown by the *kiowao* breeze against the pali, bending the *kawelu* grasses of Lanihuli; swift as the gusts that lift the leaves of the tangled *lehua* of Malailua. There was no limit to his knowledge. He slipped out of the grasp of Pakua-nui like an eel or wormed his way through his fingers like a slim *‘opule* fish; a hard question he dodged like a blow aimed at the nose. Unable to defeat Na-maka at Kahaukomo Pakua-nui crowded Na-maka a little toward the edge of the path and with a shove of his foot sent him over the cliff. Those who saw this say that Na-maka flew like a hawk poised on the wind as he sailed above Lanihuli and whirled about like a kite as the wind turned, and as it struck the *pali* he descended upon it and lit on the top of a *kukui* tree directly below Kawaikilo [Kamakau 1992:111].

3.1.3.2 Hauola and Hapu‘u

This *mo‘olelo* portrays two *mo‘o* (goddesses), or “dragon-women,” Hauola and Hapu‘u, who lived *mauka* of the project area as guardians of the Pali (Westervelt 1915, cited in Sterling and Summers 1978:313). People once buried the naval cords of their children under these pōhaku to protect them from evil.

3.1.4 The Legend of Keaomelemele

Many Nu‘uanu place names are mentioned in the Legend of Keaomelemele, “the most beautiful blossom of Kealohilani, Kahiapaiole, Nuumealani, and Kuaihelani. The person who shook Konahuanui and set Waolani apart, the land where all the eepa people [supernatural race] lived” (Manu 1884, 2002; Pukui 2002:93). This story was written down by Moses Manu in serial form in the Hawaiian language newspaper *Ka Nūpepa Kū‘oko‘a* in 1884. A recent (2002) publication of these collected articles has an English translation by Mary Kawena Pukui.

The legend begins with the first *mo‘o*, a supernatural being that could take the form of a lizard, called Mo‘oinanea. She was the ancestress of the gods, the chiefs, the prophets, the priests, and the common people. From the godly line, were two males, Kū and Olopana, and two females, Hina and Hi‘ilei. The males and females were brought up in different places to preserve their high status. When they finally met, Kū fell in love with Hina and they were married. This couple had two children; a son named Kanaiakeakua and a daughter named Paliuli. The son was taken to Waolani to live with the gods Kāne and Kanaloa, and the daughter was taken to Ola‘a on Hawai‘i to live with an attendant named Waka (Manu 2002:104-107).

A third child of Hina and Kū was taken by the goddess Mo‘oinanea; she took the girl Keaomelemele, or “yellow cloud,” to a mythical land in the clouds. Now having given over three children to the goddess Mo‘oinanea, Kū and Hina begin to have troubles. Kū began to yearn for the other woman Hi‘ilei, and the couple agreed to live apart for a while. Kū and Hi‘ilei lived in Kuaihelani and had a son named Kaumailiula. Hina left to live in Nuumealani and took as her husband Olopana. They had a daughter named Kaulanaikapokii. This child was once again taken by Mo‘oinanea, who gave it to Kū and Hi‘ilei to rear at Kauihalani. The loss of her last child saddened Hina, and after a plea to Mo‘oinanea, the son of Kū and Hi‘ilei, Kaumailiula, was given to Hina to raise.

These five children met all together in one place for the first time in Waolani Valley when Keaomelemele gave an exhibition of her hula and chanting skills. The hula exhibition and Keaomelemele’s chanting was so powerful, the great mountain Konahuanui was cleft in two, separating it from Waolani, which is what caused the modern appearance of Nu‘uanu Valley.

Three sisters and two brothers were thus united, and Keaomelemele informed her siblings that she would take Kaumailiula as her husband, Kahanaiakeakua would remain with them to complete his duties as a priest, and Kaulanaikapokii would stay unmarried, become a healer, and join her sister Paliuli at Ola‘a on Hawai‘i.

> *I ka pau ana o k eia mau kukai olelo ana, ua k u ae la o Kaulanaikipokii—a hele mai la a hiki ma ka piina aku o ke alanui Nuuanu ma Maemae, ma uka iho o ke alanui Kauka e iho aku la i ke kahawai e kau la ka uwapo paipu wai ma kai ae o Alekoki, aia ma laila kekahi pohaku nui kahi i waiho ai a hiki i keia wa, ua kapa iho la oia ia pohaku o Alele, ma laila oia kahi i ku ai a hoomaka e lele a hiki ma luna pono Ihiihilauakea* [Manu 2002:68].
>
> After they had finished their conversation, Kaulanaikapokii stood up and went as far as the climb of Nuuanu Avenue at Maemae, just above Judd Street where it slopes toward the stream. There the water pipe bridges it just below Alekoki pool. A great rock lies there to this day, called Alele (Leaping-place). It was there she

> stood and began the leap that landed her directly on Ihiihilauakea (near Hanauma Bay) [Manu 2002:155].

After the wedding, Keaomelemele and her new husband lived on the mountain Ka‘ala and Mo‘oinanea moved her residence to Pu‘unui:

> There she lived and she became a goddess that was worshiped by the people of ancient times. While she lived there with her supernatural mana, a certain kind of palolo clay was found in this place. The clay pushed itself out of the ground and was greatly prized by those who cared for and worshipped her as a goddess. It was cherished by them and they imposed a kapu upon it. It was much liked by the chiefs as something to eat and to rub into the hair [Manu 2002:160].

3.1.5 The Goddess Haumea and Her Retainer Kali‘u

Another legend which mentions many place names in Nu‘uanu concerns stories about Haumea. The goddess Haumea is thought of as the progenitor of the Hawaiian *ali‘i* (chiefly class) and all Hawaiians (Malo 2002:5). She is a sister of the gods Kane and Kanaloa and the mother of the Hawaiian goddess Pele and her sisters and brothers. Kilohana Peak in Kalihi Valley was the first earthly residence of Papa, the human form of the goddess Haumea (Beckwith 1970:276).

There are many variations of the legend of Haumea living in a human form in the upland area of Kalihi Valley and saving her husband, Wākea, by escaping into a breadfruit tree at Waikahalu‘u Pond.

When Papa (Haumea) was running to rescue her husband, she was descending along Nu‘uanu Avenue towards Waikahalu‘u Pond:

> She found a man by the side of the stream Puehuehu, who said to her: “A man has been carried by who is to be baked in an oven this day. The fire is burning in the valley below.” Papa said, “Give me water to drink.” The man said, “I have none.” Then Papa took a stone and smashed it against the ground. It broke through into a pool of water. She drank and hastened on to the breadfruit tree at Nini, where she overtook her husband and the men who guarded them [Westervelt 1993:31].

In J. M. Poepoe’s account, there is additional information on the place Papa stopped to learn the news of her husband’s capture. In this version, Papa stopped near the bank of the stream, Pūehuehu (meaning “spray scattered”), an older name for Waolani Stream, and asked a farmer named Kali‘u, for news of her husband Wākea. He told her that Wākea had been taken to be burned, and she asked him for his help to rescue him. Kali‘u agreed, and Papa said that she needed to chew some *‘awa*. Kali‘u said he had *‘awa*, but no water. Papa lifted up a very large stone and threw it on the bare hillside next to the stream.

> She uttered a prayer…and a fork of lightning struck the side of the rock…loosening it.…Kali‘u watched in amazement as she lifted and tossed it. A gust of wind went by that almost knocked him off his feet….The rock struck and the earth trembled. He saw a spray of water rise up into the air from Waolani stream [Poepoe 1906a, translation in Sterling and Summers 1978:236].

> She sent him to fetch the water and he found a spring on this side of the river where the water fell into a deep pool below. That is the pool of Puehuehu to this day [Poepoe 1906b, translation in Sterling and Summers 1978:236].

Poepoe said the rock that Haumea (Papa) threw could still be seen behind a wooden building on the ‘*ewa* (west) side of the bridge at Kuakini Street. Mary Pukui notes that this story explains the meaning of the place name. “The spray-scattered [when Haumea threw the rock] and that’s why it is called Puehuehu” (Pukui, cited in Sterling and Summers 1978:296).

The story also provides a reference to Kali‘u, who is not only the name of a farmer, but the name of the ‘*ili* (small land division) where Haumea stopped to chew the ‘*awa*.

> Kaliu. Land makai of Kuakini Street. Upper part of Puehuehu. It was named for this man. Kaliu was the farmer (see Pūehuehu) and war leader of Haumea. She sent him with all his relatives to stay in Laiohana (land below) on Koolau side [*Ka Na‘i ‘Aupuni* 1906b, translation by Pukui in Sterling and Summers 1978:296].

3.1.6 Kaheiki Heiau and Kaupē, the Cannibal Chief

In a list of the *heiau* of O‘ahu, Thomas Thrum (1906) named Kaheiki Heiau in Pauoa Valley on or near Pacific Heights. Fornander says Kaheiki was built by the *menehune* and was on the ridge between Nu‘uanu and Pauoa Valleys in an area called Ka‘oehuehu. Westervelt (1993:91) places this *heiau* “on the road to Pauoa Valley, now Pacific Heights,” or “at the foot of the hill on the eastern side of Nu‘uanu Valley, the hill now known as Pacific Heights” (Westervelt, cited in Sterling and Summers 1978:297). Other historians have placed the *heiau* not in Pauoa Ahupua‘a but in Nu‘uanu Ahupua‘a. Robert Nui (Nui n.d., cited in Sterling and Summers 1978:297) claims the *heiau* was as far away as Waolani on the western side of Nu‘uanu Valley, in back of the old location of ‘Iolani School, on the corner of Nu‘uanu Avenue and Craigside Place.

Kamakau gives the location of Kaheiki when speaking of the building of Punchbowl Street:

> Early in 1829 Boki started work on a government road running from the west gate of the Beretania place at Kahehune (the Royal School) to ‘Auwaiolimu (where the Buddhist church stands on Punchbowl) and to the Pauoa stream, then on to the opposite side of Kalokohonu, down Kaheiki, rising to ‘Alekoki and then running straight to Kawanakoa [Kamakau 1992:291].

Kaheiki seems to be on or near the point of the ridge of Pacific Heights. The exact boundary between Pauoa and Nu‘uanu Ahupua‘a in the lower region is unknown, so it is difficult to say whether Pacific Heights was considered part of Nu‘uanu, Pauoa, or both. In Sterling and Summers’ “Sites of Oahu,” Kaheiki Heiau is placed in Nu‘uanu, but Pacific Heights is also discussed in the Pauoa section.

Some ethnologists believe that Kaheiki Heiau is the temple referred to in the legend of Kaupē, the cannibal dog. In this legend, Kahānai-a-ke-akua, a chief in Kona, ruled the land from “Nu‘uanu to the sea.” He was a friend to the *menehune*, and when they heard that he had decided to build a new *heiau*, they gathered together in one night, gathered flat and smooth stones from the seashore to the uplands, and finished the work in one night. At the *heiau*, Kahānai-a-ke-akua

placed his *kahu* (guardian) Kahilona, a wise *kahuna* (priest). Most versions of this legend (e.g., Kamakau 1991:26-27; Westervelt 1993:90-96) place this *heiau* in Pauoa, but Armitage and Judd (1944) state that the *heiau* was in Nu‘uanu.

A *kupua* (supernatural creature) named Kaupē, who could change into a dog, overthrew Kahānai. Kaupē was a cannibal and once captured the son of an important Hawai‘i island chief, taking the son to his *heiau* in Nu‘uanu. The Hawaiian chief traveled to O‘ahu, climbed to the *heiau*, and fell down outside, beseeching the gods to help him rescue his son. The guardian of the temple, Kahilona, found the man and decided to help him. He gave the chief a chant to rescue his son and ultimately defeat Kaupē. Kaupē survived as a ghost, who haunts the highest point in Nu‘uanu Ahupua‘a (Westervelt 1993:90-96).

> One of the best known and familiar ghosts is the Dog of Nuuanu. You may see his shadow trotting across the wet moon-lit lawns, or you may come across him standing quietly in the middle of the stone-paved highway as though he were listening for some one. Some legends say his ghost can be seen in the magnificent cloud effects at sunset, but the Hawaiians will tell you his favorite haunt is Nuuanu Pali. He used to stop the carriage and horseback riders before the day of automobiles. If a man met Kaupe first, he never made the descent of the steep mountain trail to the other side, but turned back. Kaupe was the dog of death and to see him was an omen of coming disaster [Armitage and Judd 1944:69].

3.1.7 Battles in Nu‘uanu

Nu‘uanu was the site of several battles in the late pre-contact period. The battles involved inter-island conflicts, usually between the leeward Kona chiefs and the windward Ko‘olau chiefs, who moved along the Pali trail and pass to conduct raids into each other’s territories. In the early post-contact period, it was the site of Kamehameha’s final battle in his conquest of the island of O‘ahu.

> Between Kahapa‘akai clear to the mouth of the valley were situated many celebrated heiaus (*luakini waihau*) where people went to worship. [These had been] erected in ancient days as war heiaus or heiaus for purifying the land; for Nu‘uanu had been a magnificent battleground in those old times. Here Pele-io-holani fought against Alapa‘i-nui, ruling chief of Hawaii, and so fought chiefs before and after his day [Kamakau 1991:291].

3.1.7.1 Kākuihihewa and Kū‘ali‘i, ca. 1720-1740

Kū‘ali‘i is a chief who, through a series of battles with the ‘Ewa and Kona chiefs, unified the island around A. D. 1720-1740. In the Legend of Kalelealuaka, Kū‘ali‘i is fighting to overcome the district chief, Kākuihiwewa.

The hero Kalelealuaka had the ability to fly from one point to another in the blink of an eye. He became a warrior for the O‘ahu chief, Kākuhihewa, during a series of battles with the O‘ahu chief Kūali‘i.

> In a few days again came a report that Kualii had an army at a place called Kahapaakai, in Nuuanu. Maliuhaaino [the war chief of Kākuihiwewa]

> immediately marshaled his forces and started for the scene of battle the same evening [Thrum 1998:102].

Kalelealuaka flew to the battlefield, slaying many of the warriors, including the captain of Kūali‘i’s forces. Kūali‘i sued for peace and agreed to live as a subject under the dominion of Kākuihiwewa (Thrum 1998:102).

In a second story of the battles in Nu‘uanu, it is Kūali‘i who is the victor.

> In the valley of Waolani, a side valley from the great Nuuanu, stood one of the sacred Heiaus called Kawaluna, which only the highest chief of the island was entitled to consecrate at the annual sacrifice. As Moi of Oahu the undoubted right to perform the ceremony was with Kualii, and he resolved to assert his prerogative and try conclusions with the Kona chiefs, who were preparing to resist what they considered an assumption of authority by the Koolaupoko chief. Crossing the mountain by the Nuuanu and Kalihi passes, Kualii assembled his men on the ridge of Keanakamano, overlooking the Waolani valley, descended to the Heiau, performed the customary ceremony on such occasions, and at the conclusion fought and routed the Kona forces that had ascended the valley to resist and prevent him. The Kona chiefs submitted themselves, and Kualii returned to Kailua [Fornander 1996:280].

3.1.7.2 Kahekili and Kahahana

In 1783, the Maui chief Kahekili invaded O‘ahu, landing at Waikīkī. Several Nu’uanu place names are mentioned in this history. The chief of O‘ahu, Kahahana, was in upland Nu‘uanu.

> In the beginning of 1783—some say it was in the month of January—Kahekili, dividing his forces in three columns, marched from Waikiki by Puowaina, Pauoa, and Kapena [in Nu‘uanu], and gave battle to Kahahana near the small stream of Kaheiki. Kahahana’s army was thoroughly routed, and he and his wife Kekua-poi-ula fled to the mountains [Fornander 1996:224-225].

Kahekili’s forces first moved towards Nu‘uanu Valley and reached Kulaokahu‘a, the arid coastal plain between Honolulu and Waikīkī. The great warrior, Pe‘ape‘a, a follower of Kahekili who lived in Mānoa, heard of the Maui chief’s movements and ran towards the battle (Fornander 1919:458-463).

> *A lohe o Peapea, haalele iho la ia i ka wahine a holo mai la ma uka mai o Ualakaa, a Makiki, Pauoa, Kaheiki, e pili la me Maemae. Ilaila loaa iaia ka maka mua o na kanaka o Kahekili. A o ko Kahahana aoao hoi, i Waolani ka poe, i Maemae ka maka mua e iho mai ana.*
>
> When Peapea heard this he left his wife and ran above Ualakaa [Roundtop], Makiki, Pauoa, and Kaheiki, which is adjacent to Maemae. There he met the van of the army of Kahekili. As to the forces of Kahahana, the main army was at Waolani, while the front was descending from Maemae [Fornander 1919:458-459].

At this point at Ma‘ema‘e, which Fornander (1919:460) places around Wyllie Street in Nu‘uanu, Pe‘ape‘a came between the two forces and began to single-handedly destroy Kahahana’s army.

> *Pela no kona hele luku ana a hiki i Luakaha, a Nuuanu. Hee o Kahahana ame kona mau alii a holo aku la, o ka nui ua pau i ka make ia Peapea. A puni ae la o Oahu nei ia Kahekili, lawe ae la o Peapea ia Kekuapoi, wahine a Kahahana i wahine nana, mamuli o kona koa ame ka ikaika, a noho iho la.*
>
> Thus he went slaughtering until reaching Luakaha [most *mauka ‘ili*] in Nuuanu. Kahahana and his chiefs were defeated and fled, the majority having been all slain by Peapea. Oahu being conquered by Kahekili, Peapea took Kekuapoi, Kahahana’s wife, as his own, on account of his courage and strength, and [they] lived together [Fornander 1919:460-461].

3.1.7.3 The Battle of Nu‘uanu

The most significant battle, called the Battle of Nu‘uanu, took place in 1795 (Fornander 1996:348), when the Hawaiian chief, Kamehameha, landed at Waikīkī to fight the forces of the O‘ahu district.

> In the meantime Kamehameha landed his fleet and disembarked his army on Oahu, extending from Waialae to Waikiki. Consuming but a few days in arranging and organizing, he marched up the Nuuanu valley, where Kalanikupule had posted his forces, from Puiwa upwards, occupying Kaumuohena, Kapaeli, Kaukahoku, Kawananakoa, Luakaha, Kahapaakai, Kamoniakapueo, and Nuuanu. At Puiwa the hostile forces met, and for a while the victory was hotly contested; but the superiority of Kamehameha's artillery, the number of his guns, and the better practice of his soldiers, soon- turned the day in his favour, and the defeat of the Oahu forces became an accelerated rout and a promiscuous slaughter. Of those who were not killed, some escaped up the sides of the mountains that enclose the valley on either side, while a large number were driven over the pali of Nuuanu, a precipice of several hundred feet in height, and perished miserably [Fornander 1996:347-348].
>
> …the position of the Oahu army was on the steep side of the hill, about three miles in the rear of the town of Honolulu. A stone wall protected them in front, and the steepness of the ground availed them against an assault. Believing themselves secure, they defied their enemies with insulting gestures and bravados. A field piece, which Young had brought to bear upon them, knocking the stones about their heads, disordered their ranks and they broke and fled. Its most fatal result was the death of Kaiana, who was killed by this ball. His loss spread consternation among his troops and rendered the victory comparatively easy. The forces of Kamehameha charged; in the onslaught many of the Oahuans were slain, and the rest pursued with great slaughter until they were driven to the end of the valley, which terminates in a precipice of six hundred feet, nearly perpendicular height, forming a bold and narrow gorge between the two forest-clad mountains. A few made their escape; some were driven headlong over its brink, and tumbled,

> mangled and lifeless corpses, on the rocks and trees beneath; others fought with desperation and met a warrior's death… [Thrum 1897:111].

3.2 Historic Background

Based on the distribution of sites in the most arid and marginal lands, virtually all of O‘ahu was territorially claimed and possibly occupied by A.D. 1650 (Kirch 1992:15). O‘ahu was divided into six *moku*—Kona, ‘Ewa, Wai‘anae, Waialua, Ko‘olauloa, and Ko‘olaupoko—that were further divided into 86 *ahupua‘a* (Kame‘eleihiwa 1992:330). These lands, in turn, were further divided as private property during the Māhele of 1848, but modern maps and land boundaries still generally follow the ancient system of land division. The project area lies in the *‘ili* of Luakaha in Nu‘uanu Valley in Nu‘uanu Ahupua‘a in the central portion of Kona (Honolulu) District. Nu‘uanu Valley contains archaeological sites indicative of ancient habitation and subsistence (see Section 3.3, Previous Archaeological Research, below), as well as numerous other *wahi pana* (refer to Figure 7).

3.2.1 Habitation and Subsistence

Nu‘uanu Valley was an important region for taro cultivation. The following *‘ōlelo no‘eau* indicates that Nu‘uanu provided much of the food for the residents of the traditional village of Kou (Honolulu):

> *Ho‘a ke ahi, kō‘ala ke ola. O na hale wale no ka i Honolulu; o ka ‘ai a me ka i‘a i Nu‘uanu.*
>
> Light the fire for there is life-giving substance. Only the houses stand in Honolulu; the vegetable food and meat are in Nu‘uanu.
>
> This proverb shows an evident expression of affection for Nu‘uanu. In olden days, much of the taro lands were found in Nu‘uanu, which supplied Honolulu with poi [pounded taro], taro greens, *‘o‘opu* [goby], and freshwater shrimp. So it is said that only houses stand in Honolulu; it is the food that comes from Nu’uanu [Pukui 1983:109].

Substantial populations and permanent settlements were likely located close to the mouth of Nu‘uanu Stream at the coastal Kou village, as coastal residents constructed fishponds in Honolulu Bay and developed wetland agriculture (Dixon et al. 1994:7). John Papa ‘Ī‘ī (1959:68-69), a chief and retainer in the royal courts of Kamehameha I and Liholiho (Kamehameha II), recalled a visit to lower Nu‘uanu Valley as a child and described the construction and use of irrigated pondfields for taro. The Russian explorer Otto von Kotzebue also recorded large taro patches and *‘auwai* in the lower valley near the coast in 1817 (Kotzebue 1967:339-342).

Modest permanent habitation may have been located downstream of the project area (Dixon et al. 1994:7). Archaeological surveys have documented remnants of *‘auwai* (canals and ditches), terraces, and walls (Yent and Ota 1980) *makai* of Hānaiakamalama (Queen Emma’s Summer Palace) and in lower Nu‘uanu Valley (Leidemann 1989, 1991) . Handy (1940:78-79) also observed remnants of ancient terraces on the gentle sloping land between Nu‘uanu and Waolani Streams in the lower valley and along the streams in the upper valley, as well as gardens. In addition, Kotzebue (1967:339-342) noted extensive taro cultivation that extended toward the

mountains of Nu‘uanu Valley during his visit in 1817. However, it appears that irrigated, pondfield cultivation of taro with *‘auwai* did not extend as far *mauka* as the project area; terraces in the region would have likely been used for dryland taro or sweet potato (Dixen et al. 1994:12). The early nineteenth century residents of Nu‘uanu Valley also cultivated bananas, *‘awa* (kava), *wauke* (paper mulberry), *olonā* (a native shrub), and sugarcane (Kamakau 1992:291).

Handy describes the upper part of Nu‘uanu Valley as follows:

> In upper Nuuanu 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 [‘Ili] doubtless had many inland gardens; but there were not wet terraces that far up. From Waolani to Kapalama the terraces were continuous on the level and gently sloping land between the Nuuanu and Waolani streams, down what is now Liliha Street. In many vacant lots, yards, and gardens above and below Judd Street traces of terraces may still be seen.
>
> Hanai-a-ka-malama [Queen Emma’s place] and the area inland from Puiwa road, which runs north and south off Nuuanu Avenue, were formerly all in terraces, watered by ditches. Terraces were common from Mr. Wight’s place on the seaward side of Dowsett Tract, along the hillside and stream below Puiwa Land (which runs at right angles to Puiwa road), and on the south side of Nuuanu Stream as far as Laimi road, and extended all the way down the valley from the stream [Handy 1940:78-79].

The density of these taro fields, surrounding the *makai* areas of Nu‘uanu Valley around both Nu‘uanu and Waolani Streams can be seen on an early map of the south coast of O‘ahu in 1817 by Otto von Kotzebue (Figure 12). Kotzebue’s map is especially interesting as it not only shows the large rectangular taro patches, but also shows the ‘*auwai* (irrigation ditches) that connect the patches to the river and to each other.

Kotzebue (1967:339-341) described the taro fields of Nu‘uanu as follows:

> …a beautifully cultivated valley, which is bounded towards the north by romantic scenery of woody mountains, and on the south by the sea. The artificial taro fields, which may justly be called taro lakes, excited my attention. Each of them forms a regular square of 160 feet, and is enclosed with stone all round like our basins. This field, or rather this pond…contains two feet of water. In the spaces between the fields, which are from three to six feet broad, there are very pleasant shady avenues, and on both sides bananas and sugar cane are planted…. [T]he fish which are caught in distant streams thrive admirably when put into them. In the same manner as they here keep river-fish, they manage in the sea with sea-fish, where they sometimes take advantage of the outward coral reefs, and draw from them to the shore a wall of coral stone. Such a reservoir costs much labor, but not so much skill as the taro fields, where both are united, I have seen whole

Figure 12. 1817 map of South O‘ahu by Otto von Kotzebue showing dense concentrations of taro *lo‘i* in lower Nu‘uanu Valley and the current project area to the northeast

> mountains covered with such fields, through which the water gradually flowed; each sluice formed a small cascade, which ran through avenues of sugarcane, or banana into the next pond, and afforded an extremely picturesque prospect [Kotzebue 1967:339-341].

Taro farming continued in Nu‘uanu into the mid-nineteenth century when, in 1850, the *ali‘i* Pākī built a famous irrigation ditch *(‘auwai*) that extended from above Luakaha down the west side of the valley (Figure 13). Antonio Perry, a Hawaiian judge who dealt with water rights, gave information on these nineteenth century ditches.

> Each large *auwai* was given the name of the chief or of the land most prominently connected with the undertaking. In the digging of one of the more recent ditches, the Paki auwai, extending from a point above Luakaha to the vicinity of the present cemetery in Nuuanu Valley, and so named because the chief Paki planned it and directed its construction, 700 men were employed, 300 being furnished by Paki, 300 by the chief Kehikili and 50 each by Kuakini and Dr. Rooke. The work was completed in three days [Perry 1912:93].

Figure 13. Pākī' ‘Auwai at Luakaha

An 1855 map (Figure 14) by Joseph de la Passe from the French ship *Eurydice* shows that many *lo‘i* still existed in Nu‘uanu by the mid-nineteenth century, but also indicates that the alignments of Liliha, Judd, and Nu‘uanu Streets (the present Nu‘uanu Avenue) have been superimposed on the traditional Hawaiian landscape. Where Kotzebue’s 1817 map (see Figure 12) had shown only a few grass huts hugging Nu‘uanu Stream or scattered along the western fringe of the *lo‘i*, de la Passe depicted many more buildings, most of which were clustered along

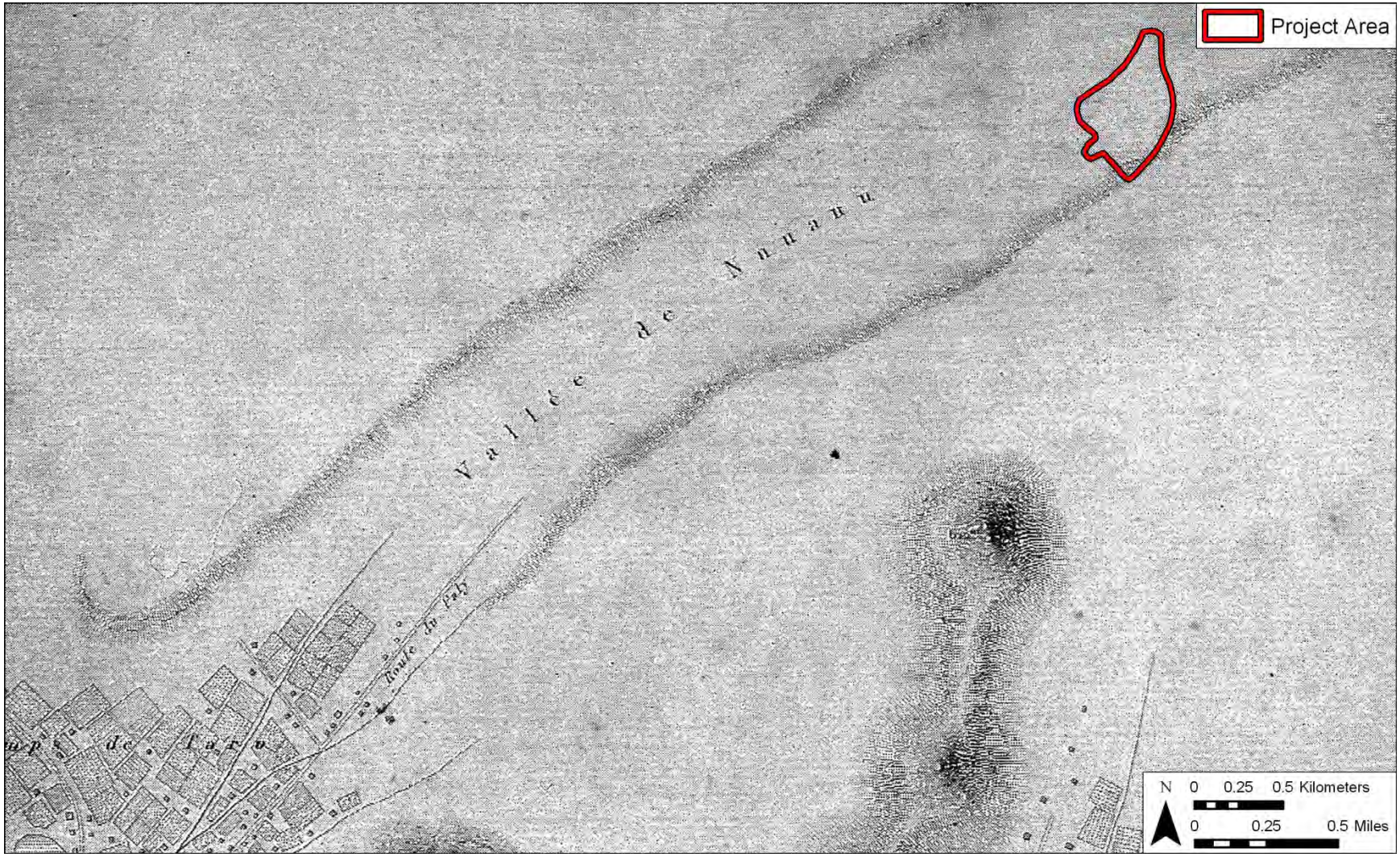

Figure 14. 1855 map of Honolulu by Joseph de la Passe showing taro *lo‘i* on both Nu‘uanu and Waolani Streams and the current project area to the northeast. Houses line Nu‘uanu Avenue (marked as the ‘Route du Paly’)

the roads. Dr. Hugo Stangenwald’s 1853 photograph, “Nuuanu, looking toward the Pali” (Figure 15) shows that many of these buildings were large residences.

An 1853 sketch (Figure 16) of Honolulu by Paul Emmert shows houses clustered on each side of Nu‘uanu Avenue. The catholic church from which Emmert made his sketch is visible at the bottom left of de la Passe’s 1855 map (refer to Figure 14), on what is now Bishop Street. An undated photograph (Figure 17) of taro patches in Nu‘uanu Valley illustrates the size and shape of these lower valley patches.

As seen in the 1897 Monsarrat map of Honolulu (Figure 18), by the end of the nineteenth century residential parcels along Judd and Nu‘uanu Streets had displaced the traditional Hawaiian house sites and taro *lo‘i* in Nu‘uanu. A 1919 U.S. War Department map (Figure 19) shows Nu‘uanu fully incorporated in the grid of commercial and residential Honolulu streets by the first decades of the twentieth century.

Figure 15. Dr. Hugo Stangenwald's photograph, “Nuuanu, looking toward the Pali.” Nu‘uanu Avenue runs up the center of the image

Figure 16. 1853 sketch of Nu‘uanu Valley from the tower of the catholic church by Paul Emmert; Pacific Heights is in right background and Lanihuli Peak is in left background

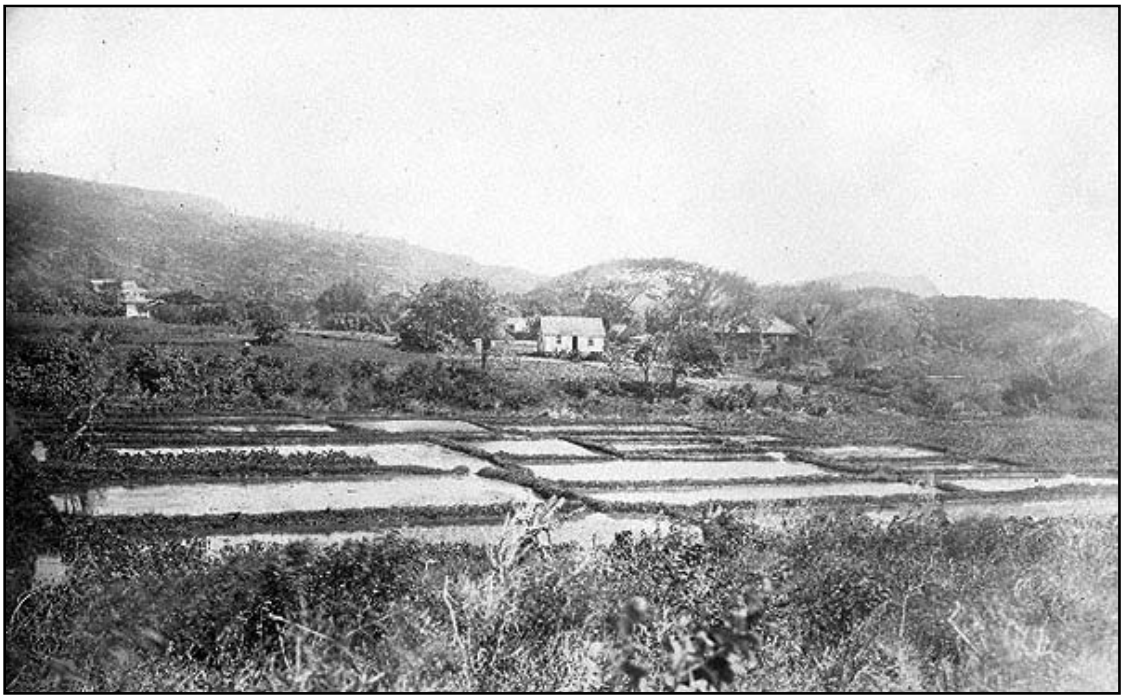

Figure 17. Undated photograph labeled, “Taro Patches in Nuuanu Valley, Honolulu Hawaii” (Bernice Pauahi Bishop Museum Collection)

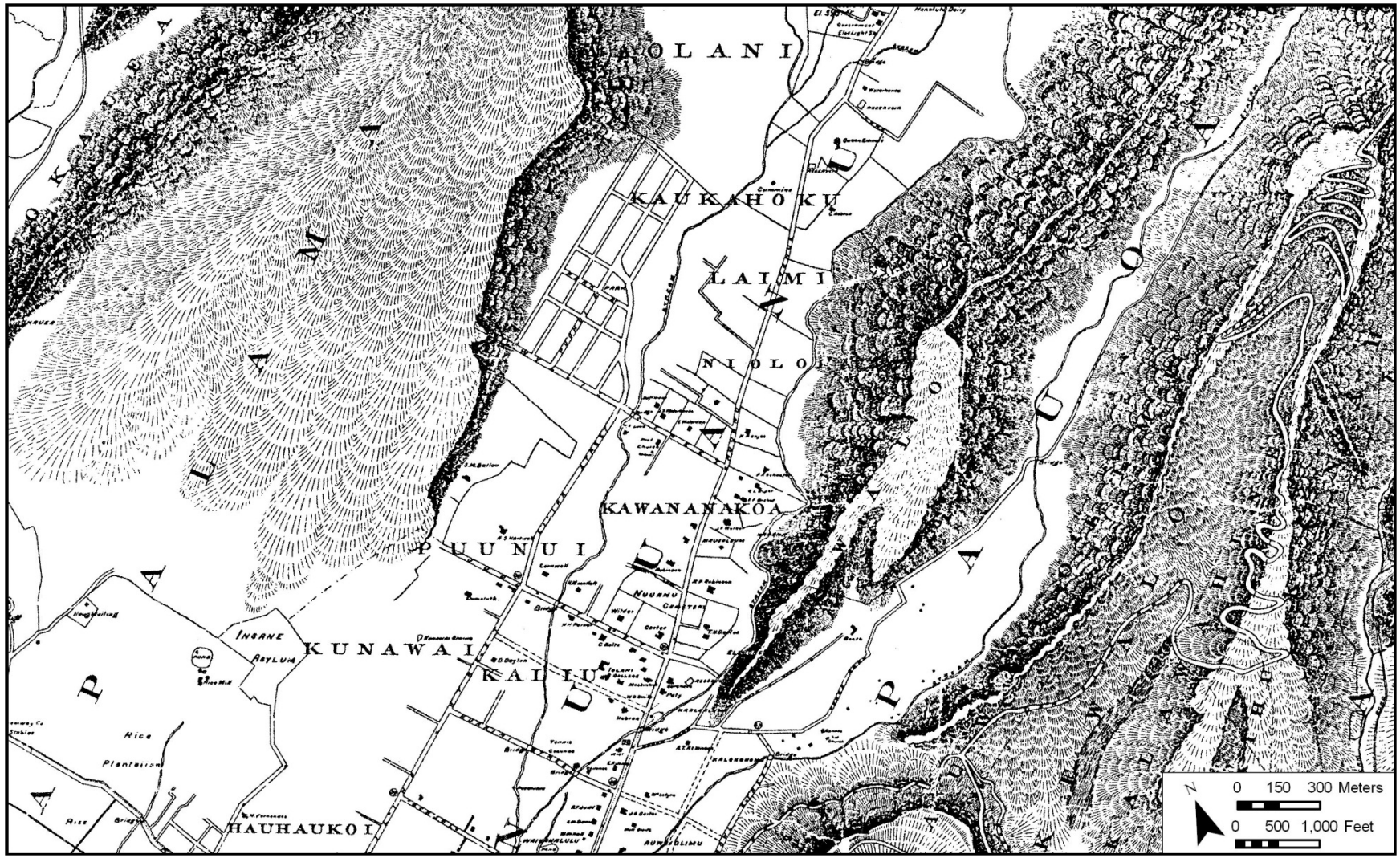

Figure 18. 1897 map of Honolulu by M. D. Monsarrat, showing street grid across lower Nu‘uanu Valley and the disappearance of *lo‘i* and ‘*auwai*. Note: the current project area is farther to the northeast, off the map

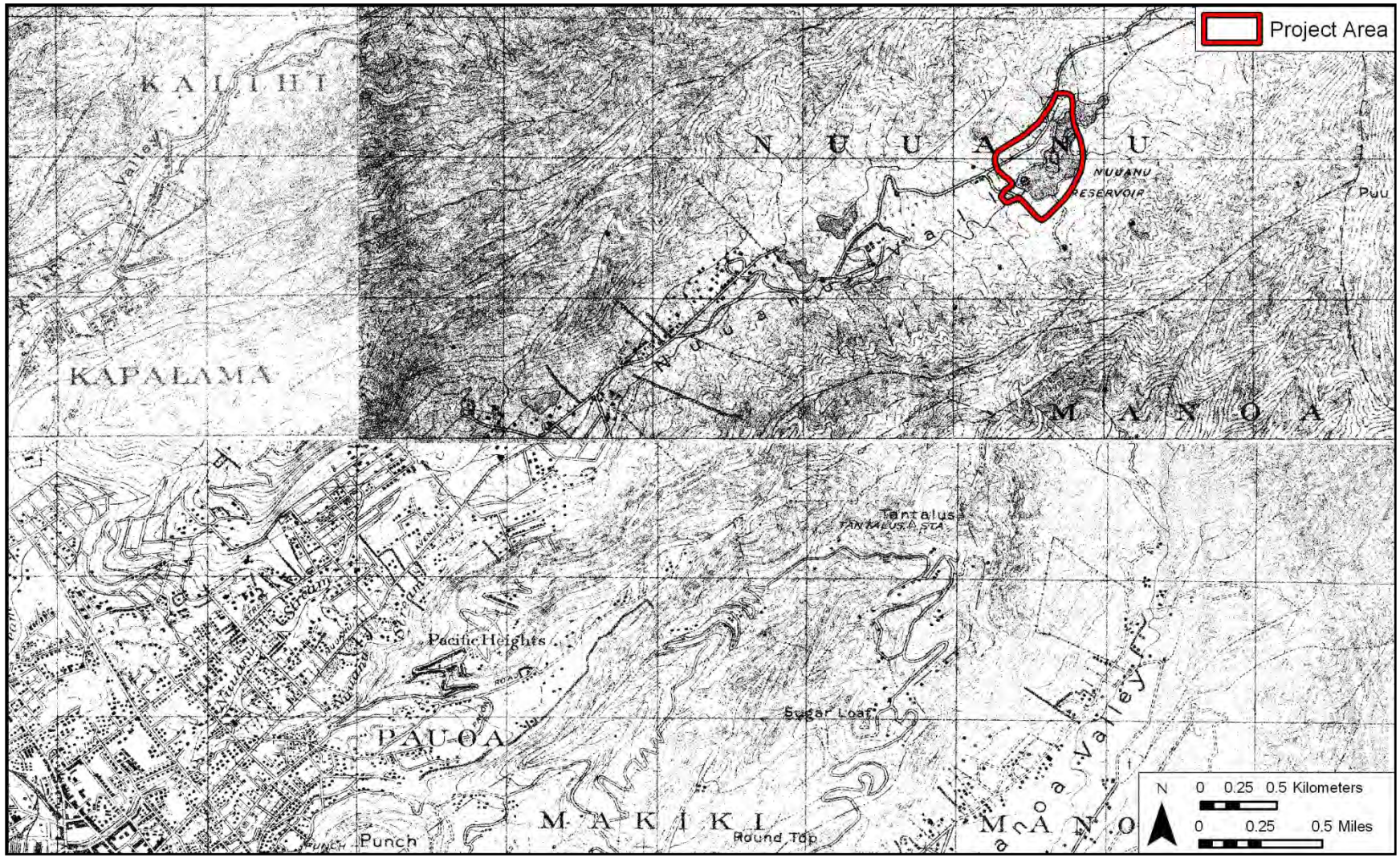

Figure 19. 1919 U.S. War Department map of Honolulu showing lower Nu‘uanu Valley fully integrated into the Honolulu street grid

3.2.2 Pali Trail and Pali Road

The *ala hele* that once wound through Nu‘uanu Valley and traversed the sheer cliff rocks of the Nu‘uanu Pali has undergone several dramatic changes since the mid-nineteenth century. According to a letter written by Reverend R. Tinker in 1840, an American merchant named Hinckley first proposed making the old Pali Trail more passable, but a blacksmith named Beers first supervised cutting steps into the steepest sections and building an iron railing (Thrum 1901:89). In response to agricultural development in Kāne‘ohe and other *ahupua‘a* in windward O‘ahu, Kamehameha III secured funds in 1845 to make the old Pali Trail accessible to horses. Sections of the path were paved with stones that enabled Kamehameha III, John Young, and Dr. Gerritt P. Judd to traverse it on June 28, 1845. In 1861, Dr. Judd and Reverend E. Corwin made the first descent in a horse-drawn carriage (*Island Call* 1953). The Pali Trail was then widened to six feet, paved with stones, and the grade was lessened in most areas to 15% (Bishop 1898, cited in Devaney et al. 1982:165; Figure 20). In 1882, construction began to further widen the road to twenty feet and reduce the grade to 8%, which forced the road to wind back and forth on the side of the Nu‘uanu Pali rather than straight down, but delays due to rain damage and high costs prevented the new Pali Road from opening until 1897 (Thurston 1890:265; Figure 21). Johnny Wilson, a young engineer with the Public Works Department, spent months surveying the steep terrain and forest of the Pali, but there were difficulties, such as “workers getting dynamited to oblivion and tumbling over the precipice…” (Chiddix and Simpson 2004:78). Construction workers found an estimated 800 skulls, along with other bones, at the bottom of the Nu‘uanu Pali—the remains of the warriors defeated by Kamehameha (*Island Call* 1953). The road was declared open in 1897 and was maintained for 55 years with occasional improvements (Figure 22) until work began in 1952 to construct a new four-lane highway with two tunnels running under the *nuku* where Kalanikupule fought Kamehameha’s forces (Devaney et al. 1982:172).

Overall, subsequent changes to the traditional path facilitated transportation across the Ko‘olau mountains and made Nu‘uanu Valley more accessible to Honolulu, which consequently led to the development of Nu‘uanu Valley as a residential area for people of royalty, politics, and business (Pacific Worlds 2003a). In fact, the only two remaining royal residences in Hawai‘i—Kaniakapūpū and Hānaiakamalama—are located *makai* of the project area.

3.2.3 Kaniakapūpū

In ancient times, the forested *‘ili* of Luakaha in the upper valley of Nu‘uanu had been set aside as a relaxation spot for the high *ali‘i* and royalty (Cooke 1938, cited in Sterling and Summers 1978:307). In the Battle of Nu‘uanu in 1795, this is one of the places that Kamehameha I rested before he began the final push to victory at the Nu‘uanu Pali. Then Kamehameha III built Kaniakapūpū into his Summer Palace, one of several places of refuge from the politics taking place in Honolulu, as well as from the heat of the plain of Honolulu: “Here he was able to think with those who surrounded him, away from the pressures of the foreigners. It was a cool place, and they could take off their western clothes, sit down and discuss the government” (Pacific Worlds 2003a). Kamehameha III may have resided at the estate as early as 1835, but the present ruins date to 1843-1845 (Mason 1989). The building consisted of a large living room and two bedrooms and was surrounded by a *lānai* and a low fence. Some sources claim the Summer

Figure 20. The stone-paved Pali Trail with horses in the background, 1887 (Wood, in Devaney et al. 1982:177)

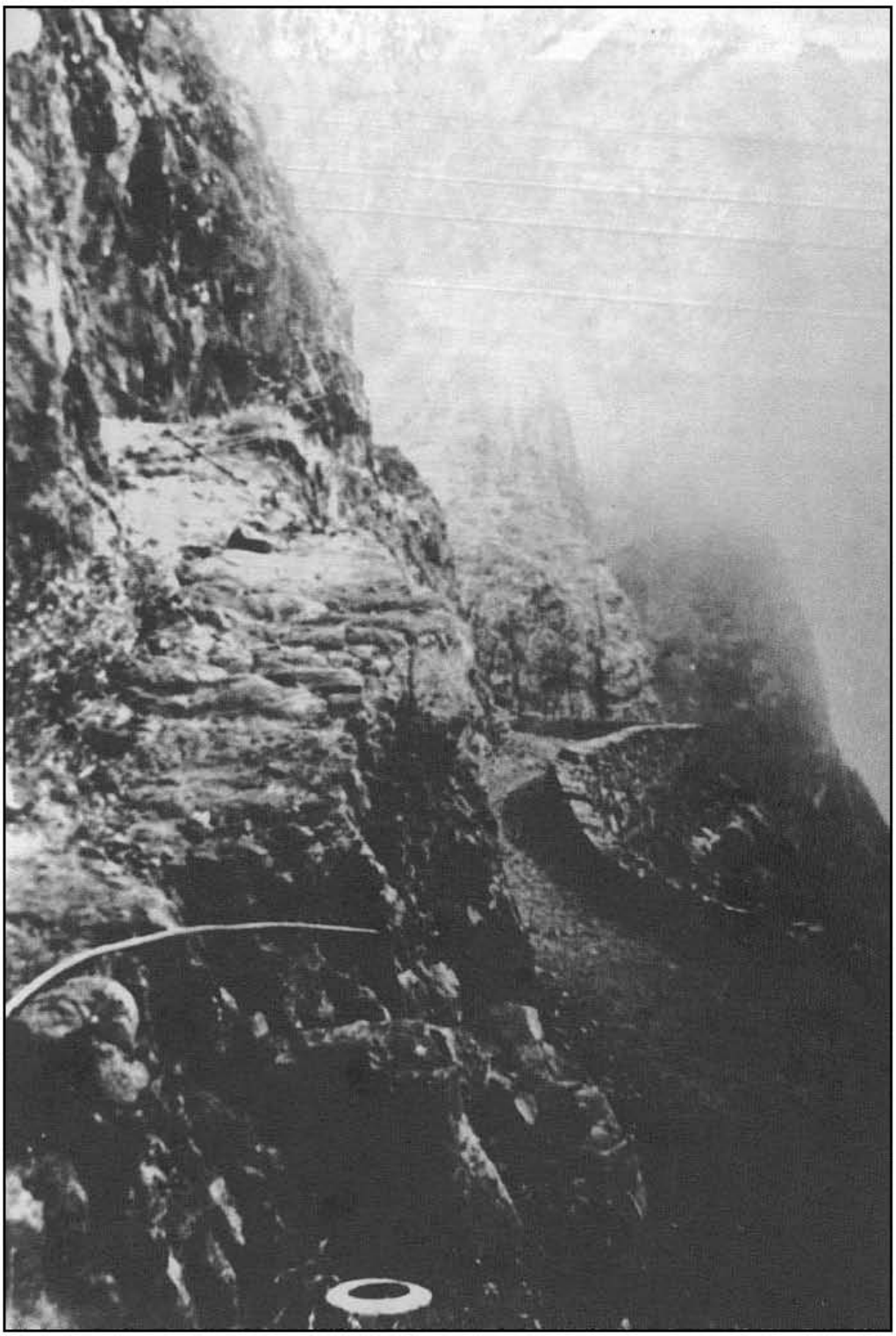

Figure 21. Old Pali Trail (left) and the newly constructed Pali Road with stone wall (right), 1880s (Bernice Pauahi Bishop Museum Collection, in Devaney et al. 1982:175)

Figure 22. Old Pali Road, 1946 (Hawaiian Aviation Preservation Society 2009)

Palace was constructed over a *heiau* of Kaniakapūpū (Raphaelson n.d., cited in Sterling and Summers 1978:307), while others place the *heiau* next to the palace (Pacific Worlds 2003a). While the site has not yet been excavated by archaeologists, an archaeological survey (Neller 1984) and a background study (Mason 1989) do not indicate that the house was formerly a *heiau*.

An archaeology field school mapped the immediate grounds of Kaniakapūpū, showing a perimeter wall, a garden area, a possible house or *heiau*, a retaining wall, and a detached kitchen surrounding the main structure (University of Hawai‘i 1999, cited in Pacific Worlds 2003a; Figure 23). Other archaeologists recorded two historic sites *mauka* of the main structure, including a wall that may be associated with Kaniakapūpū (Moore and Kennedy 1999).

Kaniakapūpū was the scene of a historic feast on July 31, 1847 that celebrated the fourth anniversary of Lā Ho‘iho‘i Ea (Restoration Day), in which Admiral Thomas restored the sovereignty of the Kingdom of Hawai‘i after a forced cession to the British. Kamehameha III, Queen Kalama, and other royalty left ‘Iolani Palace in the state carriage, followed processions of three hundred infantry, officers on horseback, 1,000 “horse-women, five abreast…wearing palm-leaf hats and Spanish ponchos, gay with ribbons and wreaths of flowers,” and 2,500 horsemen (Hawaiian Annual 1930:102-105, cited in Sterling and Summers 1978:308). The guests were first entertained with games, including *lua*, *hākōkō* (wrestling), and spear-fighting, of which John Papa ‘Ī‘ī excelled:

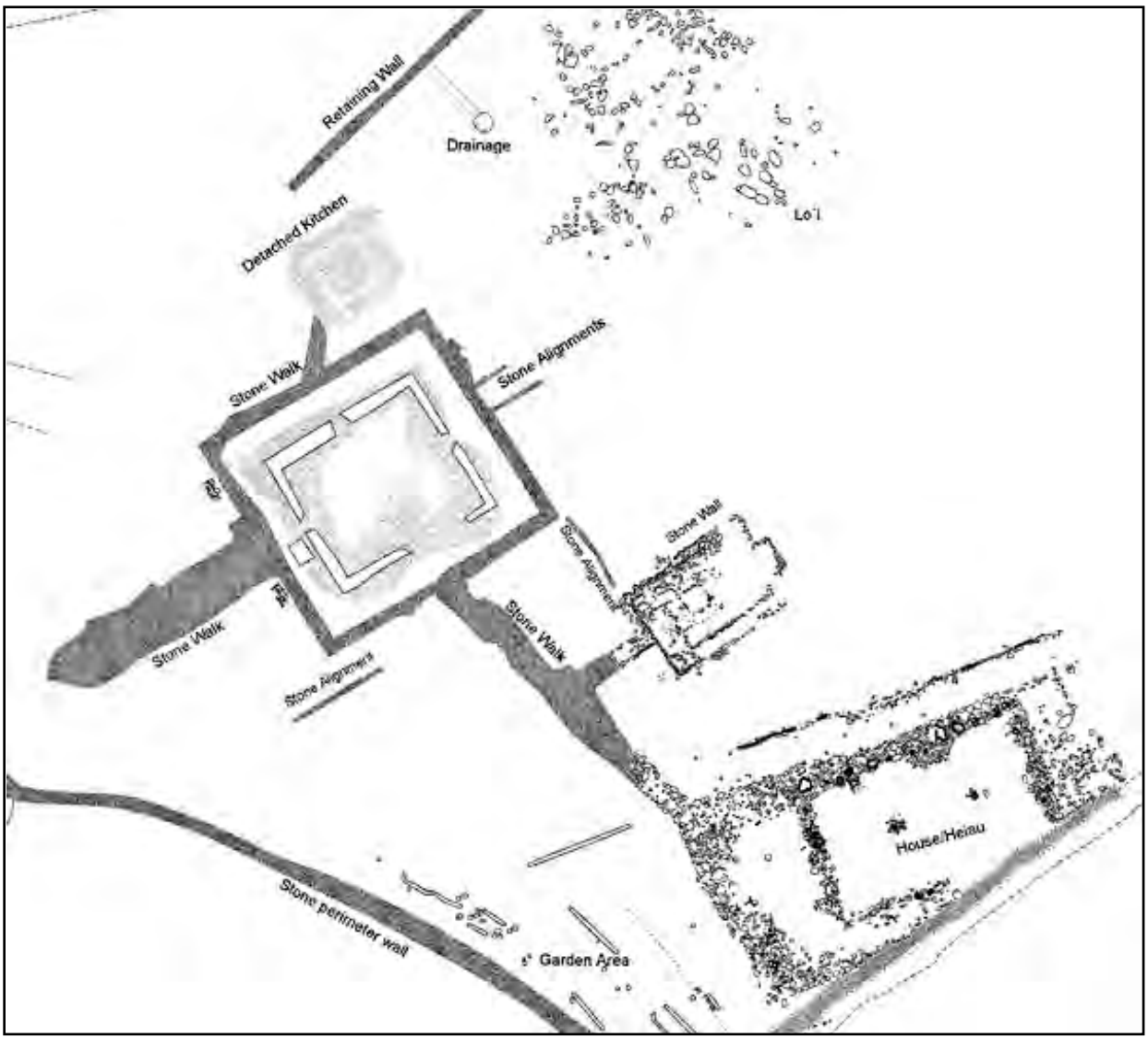

Figure 23. Site map of Kaniakapūpū (University of Hawai‘i 1999, cited in Pacific Worlds 2003a)

> …In the spear exercise the most expert performer was John Ii, then one of the king's counselors and the year following appointed a judge of the supreme court. He was tall, clean limbed, and exceedingly lithe in all his movements, and it was a rare sight when he stood alone, unarmed, opposed to twenty spearsmen each of whom endeavored to hit him. Dexterously catching the first spear that was darted, with this he successfully parried all the rest that seemed to come in a crown and were aimed with furious force at all parts of his person. And when the missiles of his assailants had been all exhausted, he in turn picked up their spears and rapidly darted them back at his opponents, driving them from the field, amid the wild applause of the native spectators… [Hawaiian Annual 1930:102-105, cited in Sterling and Summers 1978:308].

An estimated 10,000 people attended the feast, which was provisioned with “271 hogs, 482 large calabashes of poi, 602 chickens, 3 whole oxen, 2 barrels salt pork, 2 barrels biscuit, 3,125 salt fish, 1,820 fresh fish, 12 barrels luau and cabbages, 4 barrels onions, 80 bunches bananas, 55 pineapples, 10 barrels potatoes, 55 ducks, 82 turkeys, 2,245 coconuts, 4,000 heads of taro, 180 squid, oranges, limes, grapes and various fruit” (Hawaiian Annual 1930:102-105, cited in Sterling and Summers 1978:308). Women also sang *mele* throughout the feast and danced hula in the evening after most of the party had departed (Hawaiian Annual 1930:102-105, cited in Sterling and Summers 1978:308).

The following year the Chief’s Children School held a picnic at Kaniakapūpū (Helen Judd manuscript, cited in Anderson and Williams 1993), but it remains unclear what happened to Kaniakapūpū (Pacific Worlds 2003a). A map produced by C. J. Lyons in 1874 (Figure 24) locates the site as an “old ruin,” the only remaining structure associated with Kamehameha III (Pacific Worlds 2003a). Now, Ahahui Malama o Kaniakapūpū is quietly working to restore Kaniakapūpū (Pacific Worlds 2003a).

3.2.4 Hānaiakamālama

During the reign of Kamehameha IV, a summer palace was built for his wife, Queen Emma. She had inherited the property from her father, John Young II, the son of the John Young who had helped Kamehameha during his conquest of the Hawaiian Islands. John Young fought with Kamehameha during the battle of Nu‘uanu. At one point they rested on land in Pū‘iwa. It was this land that John Young II purchased in 1851 and later willed to his daughter, Emma, at his death in 1857. He called the estate and house Hānaiakamālama (the foster child of the moon, or the night), after his home in Kawaihae on the island of Hawai‘i. After Queen Emma’s death in 1884, the Hawaiian government purchased and rented out Hānaiakamālama, also known as Queen Emma’s Summer Palace. The property was taken over in 1915 by the Daughters of Hawai‘i, a group of women that have since preserved the property as the Queen Emma Museum (*Honolulu Advertiser* 1953, cited in Sterling and Summers 1978:300-301*).*

3.2.5 The Māhele

The Organic Acts of 1845 and 1846 initiated the process of the Māhele—the division of Hawaiian lands—that introduced private property into Hawaiian society. In 1848, the Crown and the *ali‘i* received their land titles. *Kuleana* (Native land rights) awards to commoners for individual parcels within the *ahupua‘a* were subsequently granted in 1850. The Crown Lands were considered the private lands of the monarch, and many lands were sold or mortgaged during the reigns of Kamehameha III and IV to settle debts to foreigners. To end this practice, the Crown lands were made inalienable in 1865, and their dispensation was regulated by the Board of Commissioners of Crown Lands, which effectively put them under the administrative control of foreign-born residents (Kame‘eleihiwa 1992:310). Before the passage of the Act of January 3, 1865, which made Crown Lands inalienable, Kamehameha III and his successors did as they pleased with the Crown Lands, selling, leasing, and mortgaging them at will (Chinen 1958:27).

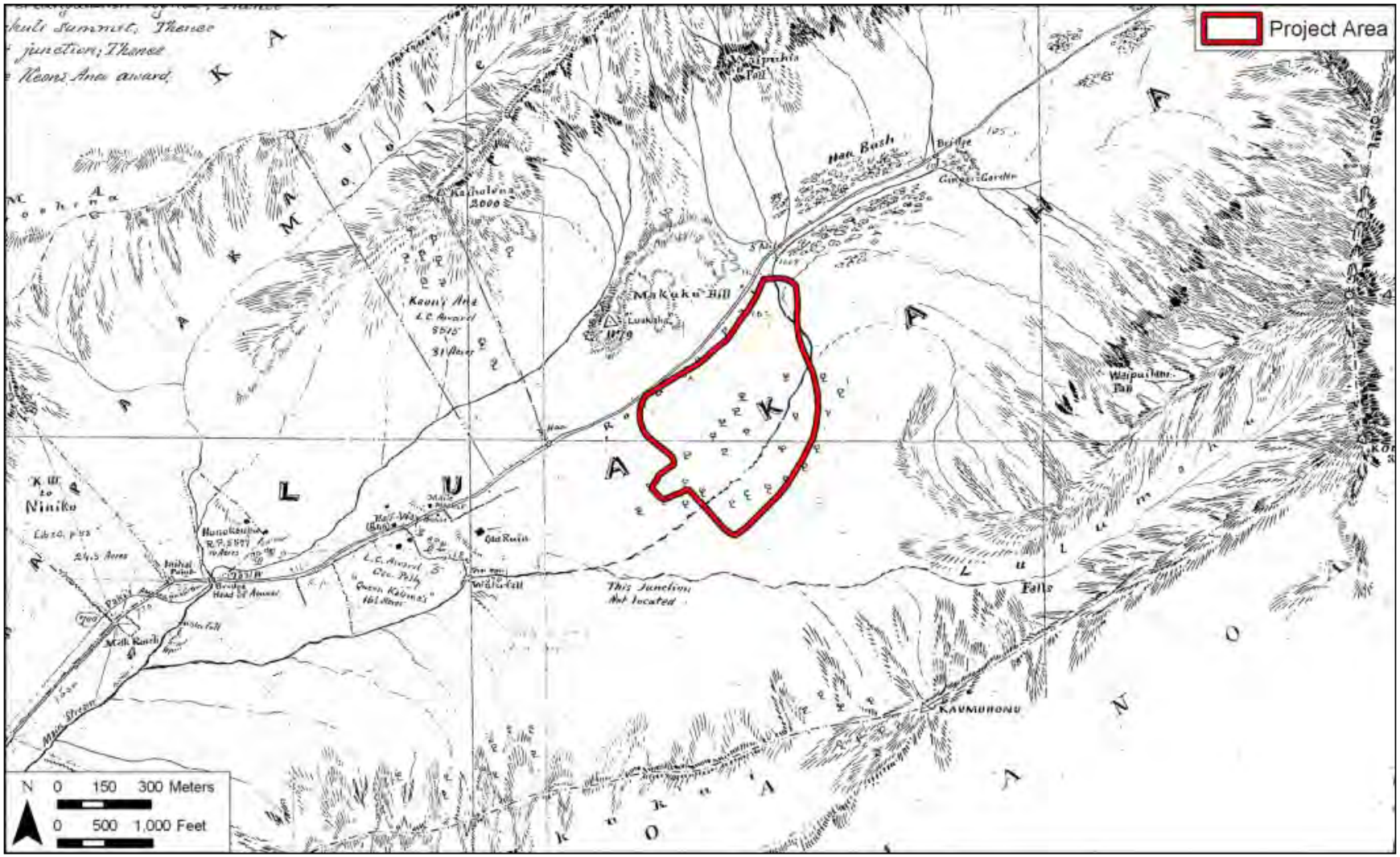

Figure 24. The *‘ili* of Luakaha, showing Kaniakapūpū as an “old ruin,” as well as LCAs in the vicinity of the project area (Lyons 1874)

In 1850, the Privy Council passed resolutions that would affirm the rights of the commoners or native tenants. To apply for fee-simple title to their lands, native tenants were required to file their claim with the Land Commission within the specified time period of February 1846 to February 14, 1848. T he Kuleana Act of 1850 confirmed and protected the rights of native tenants. Under this act, the claimant was required to have two witnesses who could testify they knew the claimant and the boundaries of the land, knew that the claimant had lived on the land for a minimum of two years, and knew that no one had challenged the claim. The land also had to be surveyed.

Not everyone who was eligible to apply for *kuleana* lands did so and, likewise, not all claims were awarded. Some claimants failed to follow through and come before the Land Commission, some did not produce two witnesses, and some did not get their land surveyed. Out of the potential 2,500,000 acres of Crown and Government lands, less than 30,000 acres of land were awarded to the Native Hawaiian tenants (Chinen 1958:31).

Among the first written descriptions of Nu‘uanu Ahupua‘a by Hawaiians are the testimonies recorded during the 1840s and 1850s in documents associated with LCAs and awardees of the Māhele. There were 1,399 LCA claims filed within Nu‘uanu Ahupua‘a for properties in the lower valley (Pacific Worlds 2003b), but no *kuleana* LCAs were located in the current project area. Most of the *‘ili* of Luakaha became Crown Lands, including the royal residence of Kaniakapūpū, *makai* of the project area (refer to Figure 24). The claims, testimonies, and awards reveal that Hawaiians used the land in Luakaha ‘Ili in the upper valley of Nu‘uanu primarily to cultivate taro (Waihona ‘Aina 2000).

3.2.6 Nu‘uanu Watershed

There was very limited development in the *‘ili* of Luakaha in the upper valley of Nu‘uanu during the twentieth century. Historic maps indicate the locations of four open reservoirs (numbered one through four) that line the main road (the Pali Highway), with residential development in Alewa Heights in the vicinity of Nu‘uanu Reservoirs Nos. 2 and 3 (Figure 25 to Figure 29). The progression of images does not show any development near Nu‘uanu Reservoir No. 4.

The four reservoirs in Nu‘uanu Valley were constructed between 1890 and 1910 for hydropower, flood control, and domestic water (Hawai‘i DLNR 2010b). Nu‘uanu Reservoir No. 4, the largest of the four reservoirs, was originally built to provide water for the burgeoning city of Honolulu, with several small streams feeding it. Construction of the earthen dam began in 1905 and was completed in 1910 (Durkee 2008:ES-1). Drawings of the original reservoir plans (1907, supplied by R. M. Towill Corporation) show the original topography before dam construction, including the location of Keiliohia Spring and early water ditches (located within the present reservoir; Figure 30). After the discovery of artesian wells that could provide a safer supply of water for Honolulu, water from the reservoir was used to produce electricity (Townscape, Inc. and Dashiell 2003:18). From 1919 until 1930, water flowed to downstream turbines that generated enough power to run the city lights throughout the night as well as to operate sewage stations during the day (Durkee 2008:ES-1). Then, leakages in the dam structure forced its reconstruction. Drawings from the reconstruction plans show the general locations of the borrow pit, rip-rap quarry, and engineers’ house (1932, supplied by R. M. Towill Corporation; Figure 31). After widening the crest of the dam and other modifications in 1934,

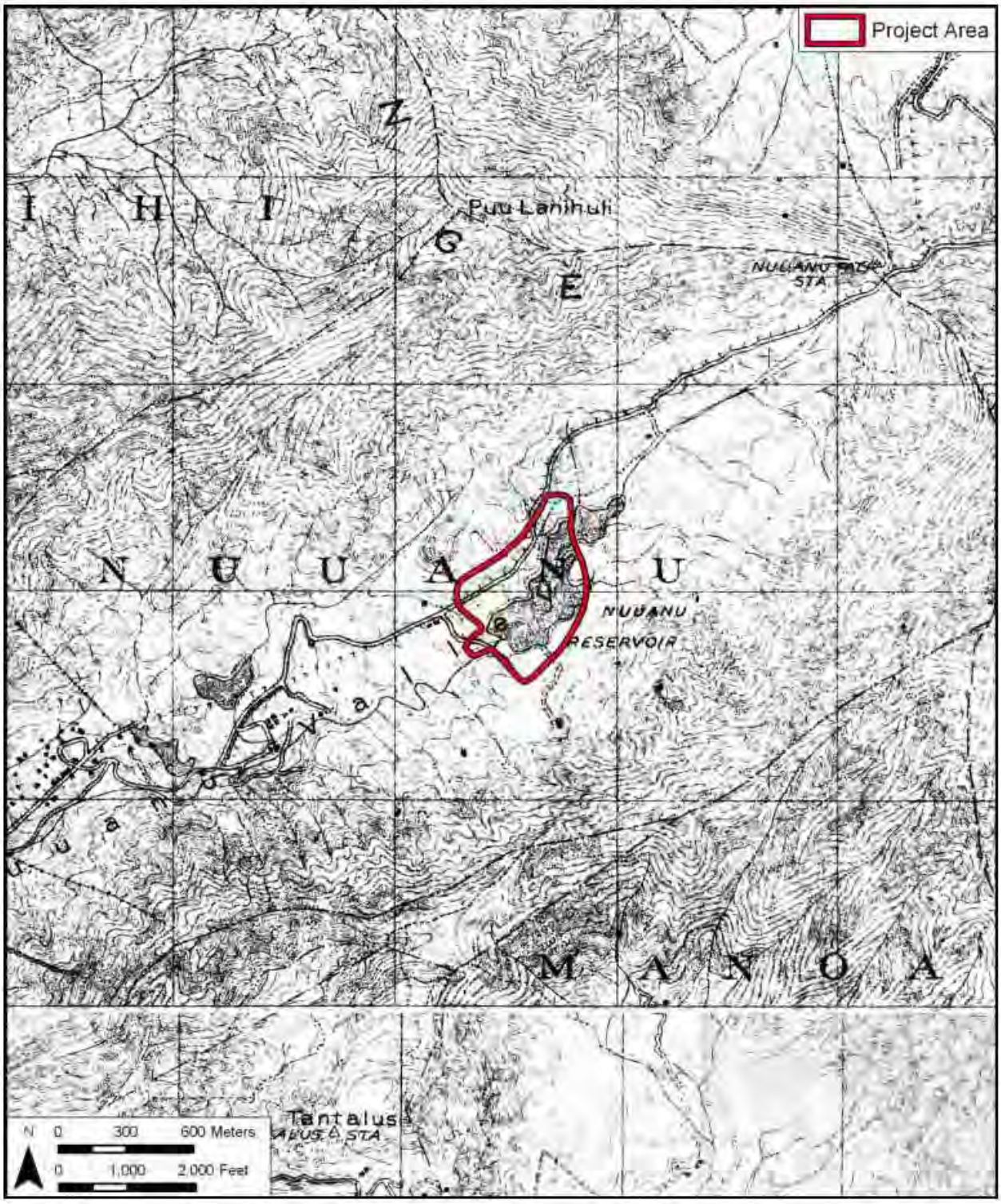

Figure 25. Portion of 1919 U.S. War Department map showing the project area

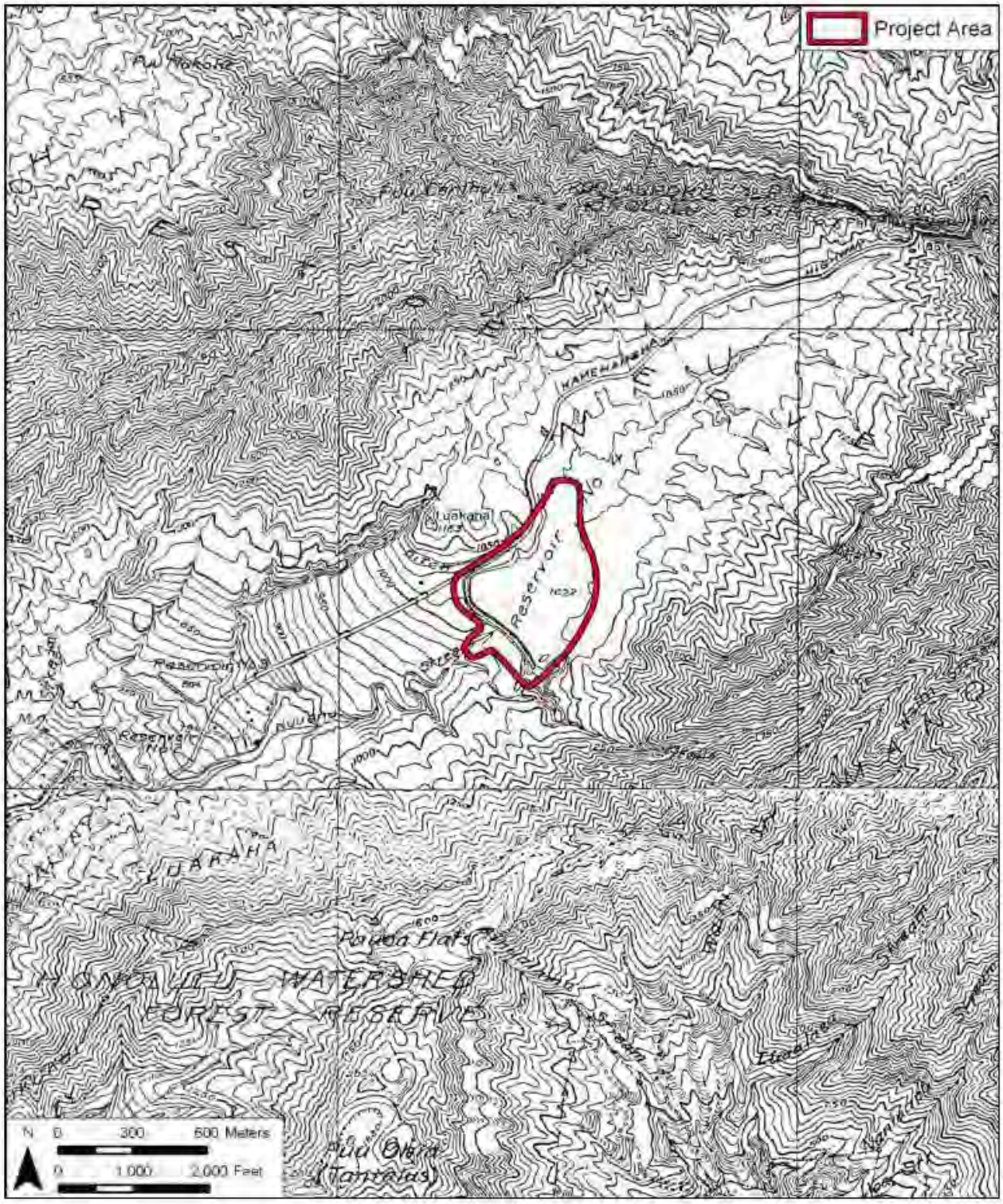

Figure 26. Portion of 1927-1928 Honolulu U.S.G.S. 7.5-minute topographic quadrangle showing the project area

Figure 27. Portion of 1943 U.S. War Department map showing the project area

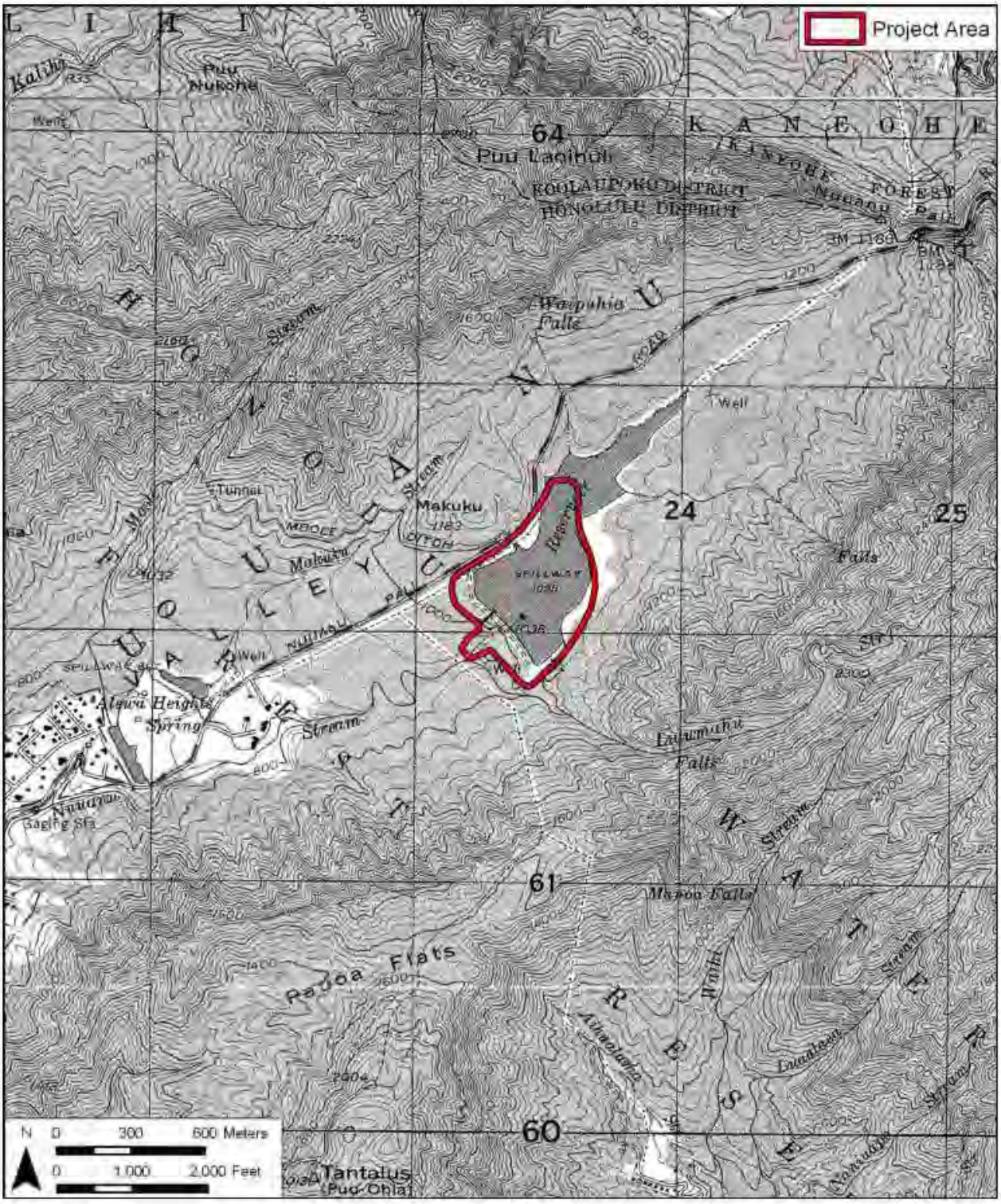

Figure 28. Portion of 1953-1954 U.S. Army Mapping Service map showing the project area

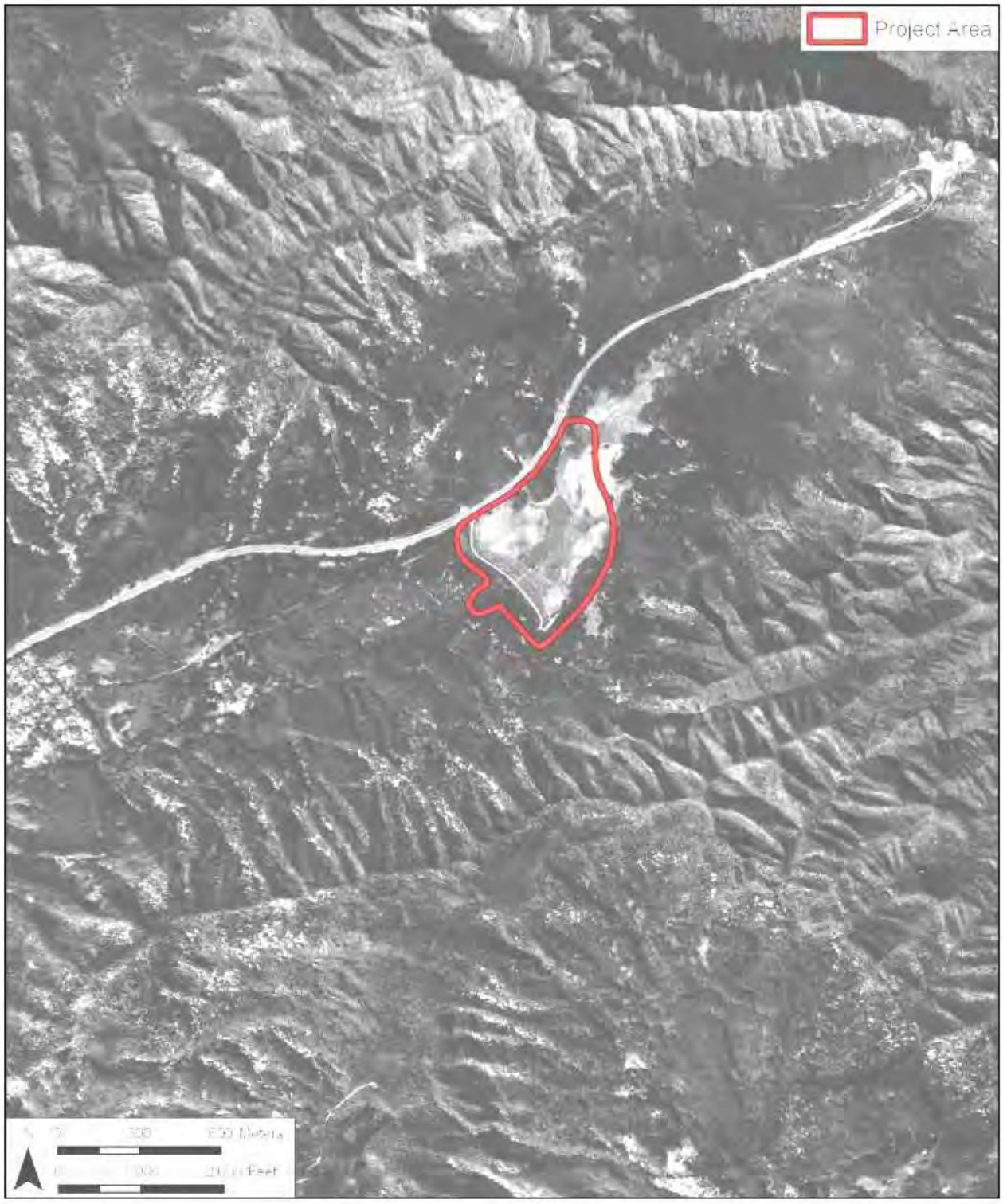

Figure 29. Portion of the orthoimagery of the 1977-1978 Honolulu U.S.G.S. 7.5-minute topographic quadrangle showing the project area

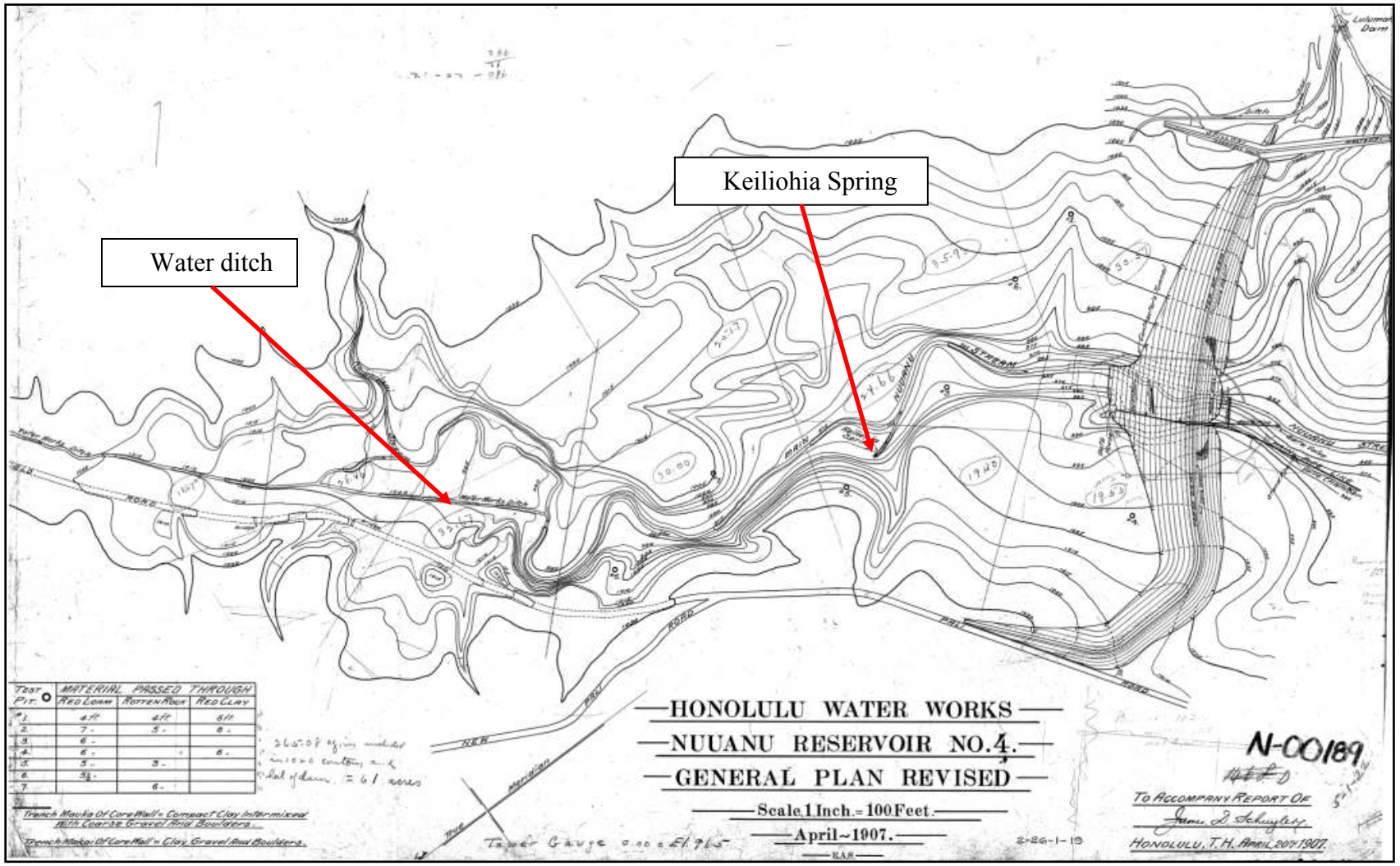

Figure 30. Original construction plans for Nu‘uanu Reservoir No. 4, indicating the location of Keiliohia Spring and early water ditches (1907, supplied by R. M. Towill Corporation)

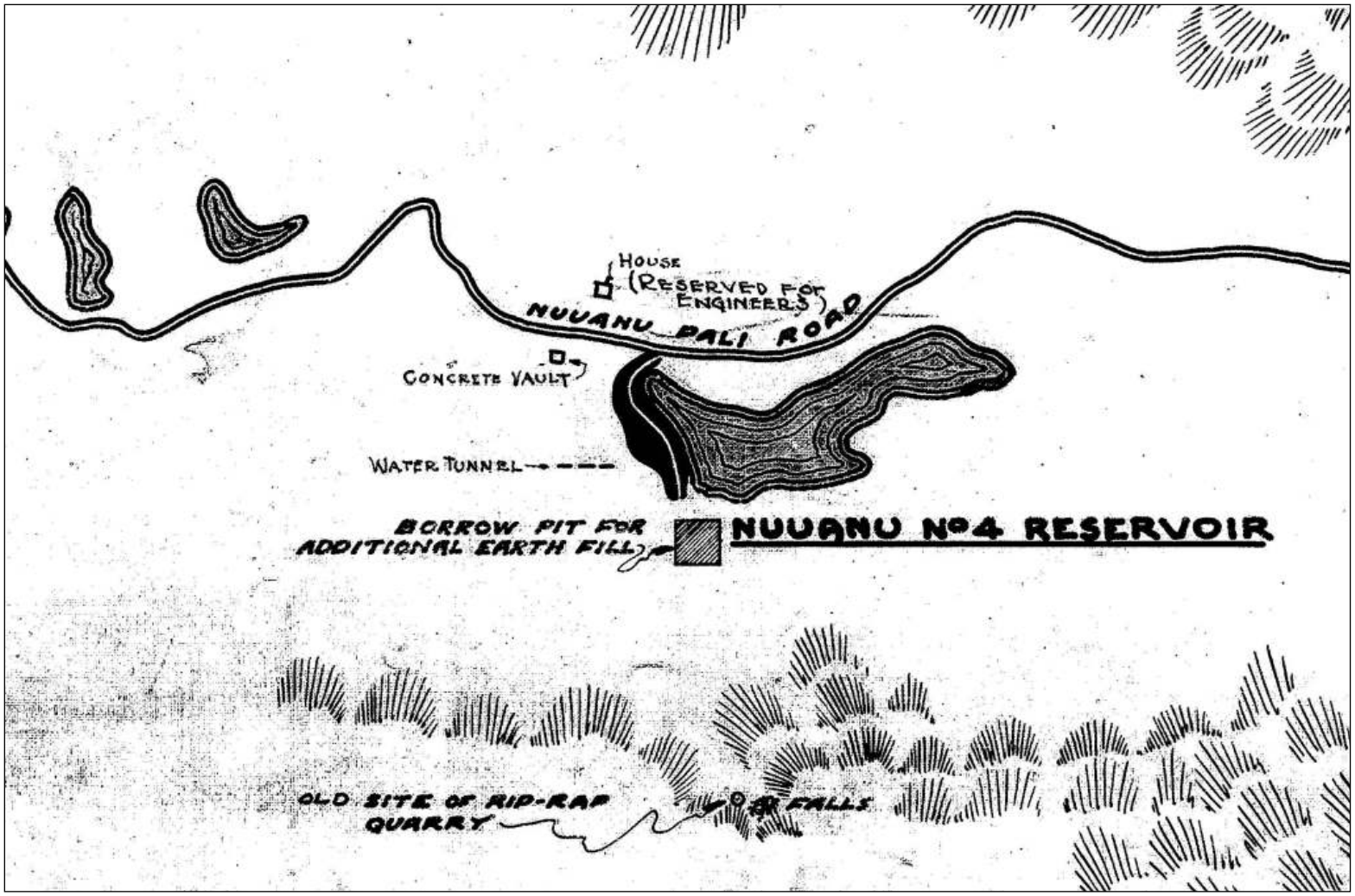

Figure 31. Reconstruction plans for Nu‘uanu Reservoir No. 4, indicating general locations of borrow pit for earth fill, rip-rap quarry, and the engineers’ house (1932, supplied by R. M. Towill Corporation)

the reservoir has since been used as a flood control structure by regulating the flow of Nu‘uanu Stream, which flows four miles to Honolulu Harbor (Durkee 2008:ES-1; Townscape, Inc. and Dashiell 2003:18). The reservoir has also been used for seasonal recreational fishing. Shortly after World War II, the Territorial government introduced freshwater sport fish in Hawai‘i, and the reservoir was utilized as a refuge and research site (Hawai‘i DLNR 2010b). Since the first public opening in 1969, the reservoir continues to be stocked with channel catfish, which spawn during the late spring in Nu‘uanu (Hawai‘i DLNR 2010b), as well as freshwater clams, tilapia, and cichlids (Hollier 2007; Kawanami 2010).

3.3 Previous Archaeological Research

3.3.1 Recent Archaeological Surveys in Nu‘uanu

There have been a small number of archaeological investigations conducted in the lower portion of Nu‘uanu, above Vineyard Street; however, very few studies have been conducted in the upper portion of Nu‘uanu, near the current project area. Archaeological investigations have focused on studies of historic residences on the eastern side of Nu‘uanu Valley, with possible pre-contact features. The archaeological study locations are shown on Figure 32 and listed in Table 1.

3.3.1.1 Hānaiakamālama, Queen Emma’s Summer Palace

Excavations were carried out at Queen Emma’s Summer Palace, Hānaiakamālama (SIHP # 50-80-14-9904), before 1970 when it was nominated to the National Register (Gould 1970). Subsequently, the State Parks Division excavated several trash pits near the “Fern House” at Hānaiakamālama (Smith 1980). In 1980, several features were recorded during a reconnaissance survey of a new parking lot *makai* of the Summer Palace. The remains of an ‘*auwai* (irrigation ditch), terraces, and walls were recorded (Yent and Ota 1980).

3.3.1.2 The Royal Mausoleum

Trenching at the Royal Mausoleum, Mauna Ala (SIHP # 50-80-14-9909), was monitored by the State Parks Division in 1979 (Ota 1980). Several additional small projects have been monitored at the Mausoleum up to the present time (Abad 1997; Beggerly 1977; Nagata 2000; Silva 1980, 1984; Yent 1985). Human remains, traditional Hawaiian artifacts, and historic artifacts were recovered from the excavated trenches along the exterior wall of the chapel.

3.3.1.3 Clent Heath Estate

The Division of State Parks (Yent 1983) conducted historic research and a reconnaissance survey of the Clent Heath estate (SIHP # 50-80-14-0016), built in 1910 by Jack Waldron and his wife Else Schaefer Waldron (the daughter of George Schaefer—the man who built the nearby Rosebank House). Else Waldron (1967), in her book on her childhood and early married life, talks about the extensive landscaping of the estate carried out by the couple. Yent found evidence of these landscaping features on the property.

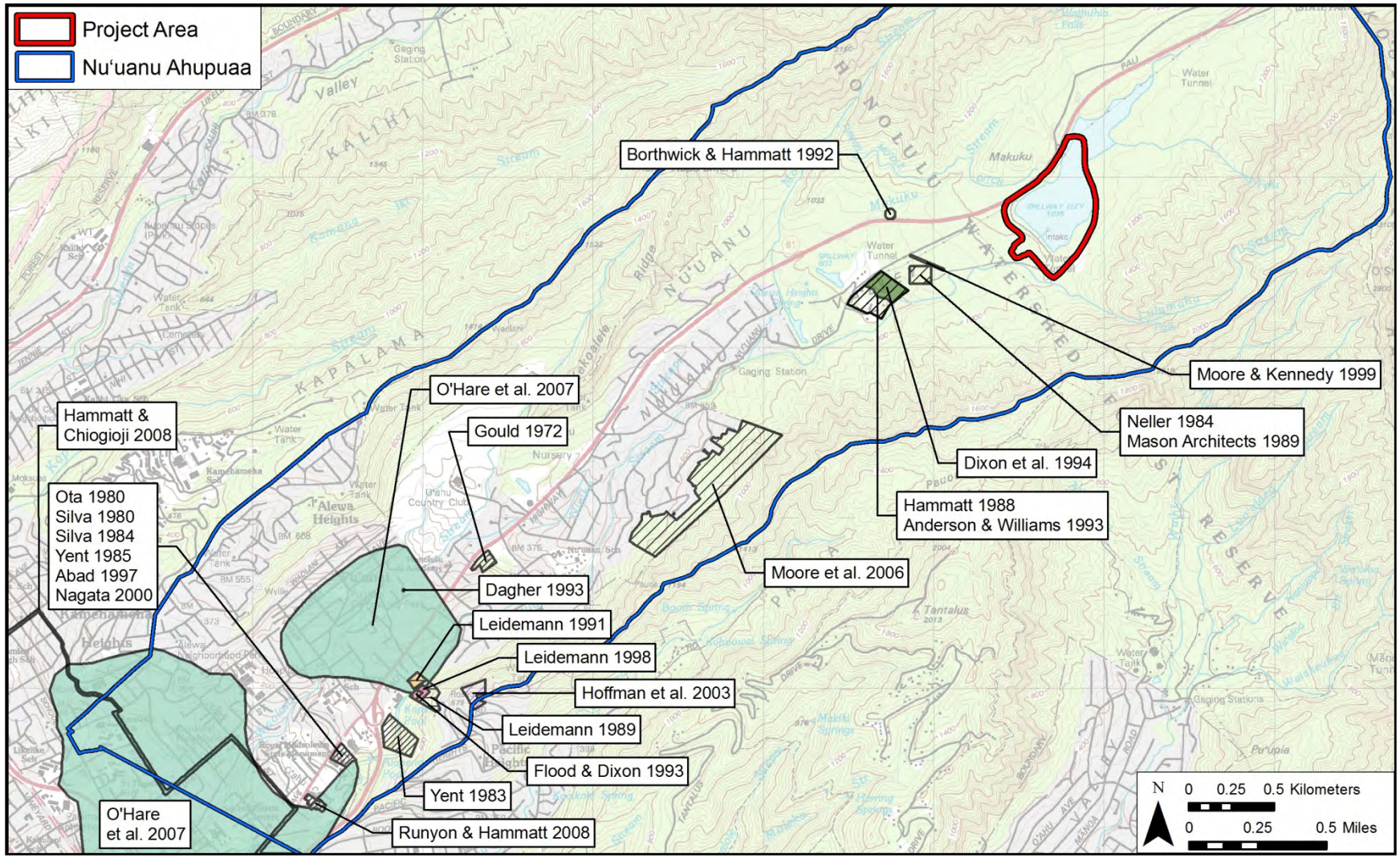

Figure 32. Previous archaeological projects in Nu‘uanu (U.S.G.S. Honolulu Quad 1998)

Table 1. Previous archaeology in Nu‘uanu Ahupua‘a

Reference	Location	Description and Results
Thrum 1906	Kawaluna and Makuku Heiau	Two *heiau*, one in Waolani Valley and one in Nu‘uanu Valley.
McAllister 1933	2290 Liliha Street and 2712 Nu‘uanu Street	Two *heiau* based on local informants; one *hōlua* slide; several caves, some of which contain historic burials; SIHP # 50-80-14-70. Petroglyphs near Alapena Pool; mainly human figures and some animal figures, probably dogs; SIHP # 50-80-14-1161.
Gould 1970; Smith 1980; Yent & Ota 1980	Hānaiakamālama, Queen Emma’s Summer Palace	SIHP # 50-80-14-9904. Nominated to the National Register in 1970. The Bishop Museum excavated several trash pits in 1980. Ground features were recorded in the new parking lot in 1980 by the State Parks Division, including remains of an ‘*auwai*, stone terraces, and walls (SIHP # 50-80-14-9916).
Beggerly 1977; Ota 1980; Silva 1980, 1984; Yent 1985; Abad 1997; Nagata 2000	Royal Mausoleum, Mauna Ala	SIHP # 50-80-14-9909. Human remains and traditional and historic artifacts were found in trenches along the exterior walls.
Yent 1983	Clent Heath, Waldron Home	SIHP # 50-80-14-9916. Exotic plants noted around house built by Jack Waldron in 1910-1911.
Neller 1984; Mason Architects 1989	Kaniakapūpū, Summer Palace of Kamehameha III	SIHP # 50-80-14-409. Survey of grounds of summer palace; remains unexcavated. Said to be built on top of a *heiau*. An architectural description was prepared in 1989.
Hammatt 1988; Anderson & Williams 1993; Dixon et al. 1994	LCA 5 to George Pelly in Luakaha ‘Ili; TMK: 1-2-2-055:002, 004	SIHP # 50-80-14-4928. A reconnaissance survey in 1988 recorded only twentieth century features and artifacts. Additional historic background was presented in a 1993 report. During a 1994 inventory survey of a portion of the project area, 20 features were recorded. Features dating to nineteenth century occupation include three retention walls, one possible boundary wall, one house foundation, one trash dump, and one stone bathhouse. Twentieth century landscaping features include fragments of seven terraces,

Reference	Location	Description and Results
		one drainage system, two bridges, two trails, one wall and associated stone alignments, and one low wall.
Leidemann 1989, 1991	West bank of Nu‘uanu Stream; TMK: 1-2-2-031:011	The Bishop Museum conducted a reconnaissance surveys of parcels along the Nu‘uanu Stream. They recorded an ‘*auwai* and rock walls.
Borthwick and Hammatt 1992	Proposed Nu‘uanu Tunnel 3A; TMK: 1-1-9-007	No surface sites were found.
Dagher 1993	620 Jack Lane	Property owner notified the SHPD that there was a historic burial on his property (SIHP # 50-80-14-4656); grave was surrounded by a concrete wall and had a headstone dated to 1894.
Flood and Dixon 1993	East bank of Nu‘uanu Stream; TMK: 1-2-2-031:032	Terraces, a nineteenth century habitation, and features associated with a twentieth century plant nursery were recorded; SIHP # 50-80-14-2464.
Leidemann et al. 1998	East bank of Nu‘uanu stream; TMK: 1-2-2-013:011, 012	Ground survey and test excavations. Dryland agricultural terraces, post-contact habitation; SIHP # 50-80-14-2464.
Moore & Kennedy 1999	Proposed water line corridor; TMK: 1-1-1-954:001	Two historic sites were recorded including a wall (SIHP # 50-80-14-5969) and a metal pipe with associated cobble and earthen berm and ditch (SIHP # 50-80-14-5697).
Hoffman et al. 2003	Farrington Residence, Pacific Heights, Nu‘uanu; TMK: 1-2-2-032:007	Assessment of 3-acre parcel with twentieth century house and extensive landscaping.
McElroy 2005	600 ft from north end of Nu‘uanu Pali Dr. in Luakaha ‘Ili; TMK: 1-2-2-054:001	Survey of 0.8 acre parcel SIHP # 50-80-14-5697, a ditch that houses the remains of a water line; SIHP # 50-80-14-6675, a rough bolder terrace.
Moore et al. 2006	Eastern ridge of Nu‘uanu Ahupua‘a; TMK: 1-2-2-047:005	Approximately 46-acre parcel, 450-1025 ft elevation. Two boundary walls recorded; SIHP # 50-80-14-6767.
O’Hare et al. 2007	Kalihi/Nu‘uanu Sewer Rehabilitation Project	No new archaeological sites observed.
Runyon and Hammatt 2008	15 Craigside Place	No historic properties observed.

3.3.1.4 Kaniakapūpū, the Summer Palace of King Kamehameha III

Neller (1984) wrote about the Summer Palace of King Kamehameha III, Kaniakapūpū. A description of the site was recorded by an architectural firm (Mason 1989). Kamehameha III may have resided at the estate as early as 1835, but the present ruins date to 1843-1845 (Mason 1989). The building consisted of a large living room and two bedrooms and was surrounded by a *lānai* and a low fence. Some sources claim the Summer Palace was constructed over a *heiau* of Kaniakapūpū (Raphaelson n.d., cited in Sterling and Summers 1978:307), while others place the *heiau* next to the palace (Pacific Worlds 2003a). While the site has not yet been excavated by archaeologists (although it appears to have been looted by treasure hunters), an archaeological survey (Neller 1984) and a background study (Mason 1989) do not indicate that the house was formerly a *heiau*.

In 1999, Archaeological Consultants of the Pacific (Moore and Kennedy 1999) conducted an inventory survey for a proposed waterline corridor *mauka* of Kamehameha III's Summer Palace, Kaniakapūpū. The archaeologists recorded two historic sites, including a wall (SIHP # 50-80-14-5969) that may be associated with Kaniakapūpū, and a ditch, the remains of a metal pipe, and an associated cobble and earthen berm (SIHP # 50-80-14-5697).

3.3.1.5 Luakaha ‘Ili

Two parcels (approximately 9.9 acres) in the ‘*ili* of Luakaha (TMK: 1-2-2-055:002, 004), above ‘Ālewa Heights, were surveyed in 1988 by CSH (Hammatt 1988). These parcels are part of LCA 5, awarded to George Pelly. Two terraces, probably built for twentieth century landscaping, were recorded, and historic artifacts were found in test pits. A later assessment of the project gave additional historic background information on the Luakaha ‘Ili parcels (Anderson and Williams 1993). In 1994, Bishop Museum archaeologists (Dixon et al. 1994) conducted an inventory survey of a 4.8 acre parcel (TMK: 1-2-2-055:004) of the Luakaha ‘Ili first surveyed in 1988 (Hammatt 1988). Twenty features were recorded, including a boundary wall, a house foundation, a trash dump, and a stone bathhouse. All of the features seemed to be associated with a nineteenth century residence (SIHP # 50-80-4928). Historic artifacts were found around the site and in the trash dump. Twelve test units were excavated around the features, but no early pre-contact material was found.

A 0.8-acre parcel in the ‘*ili* of Luakaha (TMK: 1-2-2-054:001), located approximately 600 ft southeast of the north end of Nu‘uanu Pal Drive, was surveyed in 2006 by T. S. Dye & Colleagues, Archaeologists, Inc. (McElroy 2005). Two historic properties were observed during the survey: SIHP # 50-80-14-5697, a ditch, the remains of a metal pipe, and an associated cobble and earthen berm; and SIHP # 50-80-14-6675, a rough bolder terrace, which likely served as a habitation area. SIHP # -5697 was previously documented by Moore and Kennedy (1999).

3.3.1.6 Nu‘uanu Stream

The Bishop Museum (Leidemann 1989, 1991) conducted a reconnaissance survey and subsurface testing at a parcel (TMK: 1-2-2-031:011) on the west bank of Nu‘uanu Stream in 1989 and 1990. An ‘*auwai* and rock walls were recorded during the ground survey, and historic artifacts were collected from the ground surface and from subsurface testing. A parcel on the east bank of the stream (TMK: 1-2-2-031:032) was also surveyed (Flood and Dixon 1993). Ground

features included terraces, a nineteenth-century house platform, and features associated with a twentieth-century plant nursery.

Leidemann et al. (1998) documented the remains of an historic house site on the east side of Nu‘uanu Stream on the western slopes of the ridge that leads up to Pacific Heights (SIHP # 50-80-14-2464). The majority of features at this site indicate use as a post-contact habitation site. Eight features were recorded, including Lapalapakea ‘Auwai, a stone foundation, a C-shaped structure, a boulder alignment, three walls, and a mound. Traces of possible late pre-contact activities were also discovered in the form of lithic debris and agricultural terracing.

3.3.1.7 Proposed Nu‘uanu Tunnel 3A

An archaeological survey of a 1-acre parcel for the proposed Nu‘uanu Tunnel 3A was conducted by CSH in 1992 (Borthwick and Hammatt 1992). This project area is within the *‘ili* of Luakaha at an elevation of 900 feet. No archaeological sites were observed.

3.3.1.8 Jack Lane Burial

In 1993, the owner of an orchid nursery on Jack Lane notified the SHPD that there was an historic grave on his property. The grave was surrounded by a concrete wall. A headstone had a Hawaiian inscription and a date of May 31, 1894. The SHPD took photographs of the grave stone and filed a report on the grave location (Dagher 1993).

3.3.1.9 Pacific Heights Road

In 2003, CSH (Hoffman et al. 2003) presented an assessment of a 3-acre parcel at 3180 Pacific Heights Road. The property had a house and many landscape features, including rock walls, terrace retaining walls, walkways, stairs, and a fishpond. Historic background research indicated that the area was awarded during the Māhele (LCA 273) to Joseph Booth, who used this area for cattle pasture. In the early 1900s, this area was developed as part of the Nu‘uanu Hillside Lots. This particular parcel was developed in 1926 by Wallace R. Farrington, a governor of Hawaii Territory, and his son, a delegate to the U.S. Congress. It was later occupied by John Dominis Holt, a native Hawaiian writer and landscaper.

3.3.1.10 Eastern Ridge of Nu‘uanu Ahupua‘a

In 2005, Archaeological Consultants of the Pacific (Moore et al. 2006) surveyed a 45.883-acre parcel at TMK: 1-2-2-047:005 on the ridge separating Nu‘uanu and Pauoa Valleys. Two rock walls, designated SIHP # 50-80-14-6767, were recorded “along the crests of narrow finger ridges” on the subject property. They were interpreted as probably post-contact ranching walls.

3.3.2 *Heiau* and Other Early Recorded Sites

Samuel Kamakau says the very first *heiau* in the Hawaiian Islands were built by Wākea, who is said by some to be the progenitor of the Hawaiian race:

> In Waolani, Wākea built the first *heiau* houses for the gods. These were Kupuanu‘u, Kupualani, Pāka‘a-lana-lalo, and Pāka‘a-lana-luna. They were in the valley of Waolani. On the ridge that joins Waolani and Kapālama were two *heiau*, one overlooking the valley of Ke‘ana-o-ka manō and the other overlooking Nu‘uanu valley. These were the *heiau* where, it was said, most of the *‘e‘epa*

> people lived and most of the people of wondrous fame who lived at Waolani lived [Kamakau 1992:130].

Thomas Thrum mentions two *heiau* in Nu‘uanu, one being in Waolani:

> Kawaluna.....Waolani, Nuuanu.-Of heiau and luakini class, consecrated by Kualii about 1685. Tradition credits the construction of several in this locality to the time of Wakea.
>
> Makuku.....Upper Nuuanu.-Heiau to propitiate rain. Site not located [Thrum 1906:44].

In the 1930s, Gilbert J. McAllister conducted an O‘ahu-wide survey. He gave just one site number (now SIHP # 50-80-14-70) for all of upper Nu‘uanu Valley and upper Waolani Valley. He noted:

> …only two heiau sites in Nuuanu Valley remembered now, and their names are not known. According to Pahu there was a heiau in the vicinity of 2290 Liliha St. …Kapena, another informant, remembers having heard that there was a heiau at 2712 Nuuanu Street [McAllister 1933:86].

The two locations for *heiau* in Nu‘uanu Valley on Liliha Street (near ‘Ekekela Place, *mauka* of St. Francis Hospital) and Nu‘uanu Avenue (near Moana Wai Place) are located within the Lanakila in Upper Nu‘uanu. Their approximate locations have been added to the previous archaeology map (refer to Figure 32) based on the street names and numbers given by McAllister in 1933. The street numbers may have changed since 1933, so these are only a very rough approximation of their location.

In all, Kamakau mentions seven *heiau*, all in Waolani Valley. Thrum mentions two *heiau*, one in Waolani Valley and one in Nu‘uanu Valley called Makuku. There is a peak and a stream called Makuku near Nu‘uanu Reservoir No. 4, and this may be the general location for Makuku Heiau. McAllister mentions two *heiau*, both in lower Nu‘uanu Valley, *makai* of Wyllie Street. This could mean that there were a total of eleven *heiau* in Nu‘uanu and Waolani, but it is more likely that Kawaluna, an important *heiau*, was known to Kamakau and is one of the *heiau* that he mentioned in Waolani Valley:

> Tradition credits the Heiau of Kawaluna at this place (better known as Rooke's Valley [Waolani Valley], to the time of Kualii, about 1685, and its consecration by him by right as Moi of Oahu, following which, he routed the Kona forces that had ascended the valley to resist and prevent him [Thrum 1906:56].

Another source, in a Hawaiian language newspaper, places Kawaluna Heiau on the east ridge of Waolani Valley, “The heiau was built on the pali-shelf of Nuumealani. That shelf is on the right side of Waiolani [*sic*]” (*Ka Nai Aupuni* 1906, cited in Sterling and Summers 1978:304). In the Legend of Pupuhuluana, the bird man Kula-uka dropped a stone to deceive the goddess Haumea. This stone was called Kawa-luna (Thrum 1925:92). The legend does not say exactly where this occurs, but it may be a reference to a famed *pōhaku* at Kawaluna Heiau in Nu‘uanu.

There are two small hills called Ha‘ipu and Ahipu‘u, south (*makai*) of the O‘ahu Country Club, that some mistake for *heiau*. An old-time resident of the area said:

> Haipu was not a heiau, it was a beacon fortress where in case of a raid from the Pali way and heights above Waolani by natives from Koolau (Kailua), the Kona chiefs would from here be notified by a bonfire always ready to light. There was a guard of warriors at Ahipuu (hill of fire) where the house now is. This was a very large guard and was always maintained at war strength [Cummins, cited in Sterling and Summers 1978:300].

This clarification may also explain the number of temples mentioned in Rayna Raphaelson's (1925) account of the *heiau* that Kamehameha captured and destroyed during the battle of Nu‘uanu. Some of the seven structures that he mentions may have been hill forts rather than *heiau*.

> Up the valley he [Kamehameha] came with his troops, driving before him the warriors of Oahu. At Elekoki there was a battle. Kamehameha advanced upon the *heiau*, captured it, destroyed it, and went on. So all the way along, at each temple, he attacked and conquered.

The first four *heiau* were (1) Elekoki, near the spring Elekoki (Alekoki); (2) Koauananakoa, near the Royal Mausoleum; (3) Ahipu‘u, near the "Sherman Place"; and, (4) Puiua (also spelled Puiaa; probably should be Pu‘iwa, the name of the surrounding *‘ili*), near Queen Emma's Summer Palace "Hānaiakamālama", where Kamehameha's warriors rested. The opposing force under the O‘ahu chiefs, had been pushed back to a fifth *heiau*, at the mouth of Waolani Valley. In ancient times, the wives of warriors often accompanied their husbands to the sites of the battles. While Kamehameha's men were resting at Puiua, the women of the two forces met at a field on the east side of the Pali Highway, opposite to the entrance to Waolani, and had their own battle.

> The women started to fight in true warrior fashion, and by the time the fighting was over, the entire field to the right was filled with the dead and the dying [Raphaelson 1925].

Raphaelson says there were at least two *heiau* in Waolani. The first (5) was Kakanaiakeakea Heiau, which was named for the *ali‘i* for whom it was built. It's caretaker was the god Kahano, who brought the *menehune* to Hawai‘i. The other (6) was Kawaluna, which was consecrated by Kūali‘i around 1685. The seventh and last *heiau* (7) in the account was Kaniakapūpū, later used as the home for Kamehameha III. In one version of the Battle of Nu‘uanu, Kamehameha again rested here while his men made the final assault on the O‘ahu forces, driving the last of the warriors over the Nu‘uanu Pali. Again, all of these mentioned *heiau*, except the two in Waolani Valley, may have been hill forts rather than ceremonial *heiau*.

McAllister (1933:86) mentions another site in Waolani, a *hōlua* slide. He was told that is was "at the end of the ridge dividing Waolani and Nuuanu valleys," but nothing remained of it. There is a hill on the east ridge of Waolani called "Kapoholua," shown on a 1910 map of Waolani Valley. If this place name does refer to a *hōlua* slide, the name could be translated as Kapo-*hōlua*, the "*hōlua* of Kapo". Kapo, the sister of the Hawaiian goddess Pele, was said to have lived in nearby Kalihi Valley. An alternate translation could be Ka-pō-hōlua, "the *hōlua* of night" or "the *hōlua* of the gods." The place name may not refer to a *hōlua* slide at all; one

alternate translation would be Kapoho-lua, “the depression, or the pit,” an unusual name for a peak, but not an impossible one.

In the early 1930s, Kenneth Emory noted some petroglyphs on a large rock, below Alapena pool. McAllister (1933:83-34) found additional figures on the rock and adjacent stones and on rock “several hundred feet downstream.” McAllister records these as Site 67. Additional figures south and west of Alapena Pool were listed as Site 68 and a third cluster on the west bank of Alapena Pool were designated Site 69. These sites were combined to form the National Register Nomination site 50-80-14-1161. Most of the petroglyphs are human figures and some animals, probably dogs. Although not given a site designation, McAllister (1933:86) also mentions that there are many caves on either side of Nu‘uanu Valley, near Kauai Street, and below ‘Ālewa Heights. He personally examined five caves, of which four contained historic burials.

3.4 Background Summary and Predictive Model

Mythological and traditional accounts indicate that Nu’uanu was an important area in pre-contact times and was known to contain valuable agricultural and water resources. Substantial populations and permanent settlements were likely located close to the mouth of Nu‘uanu Stream at the coastal village of Kou, as coastal residents constructed fishponds in Honolulu Bay and developed wetland agriculture (Dixon et al. 1994:7).

Archaeological surveys, historic observations, *mo‘olelo*, and *‘ōlelo no‘eau* indicate that Nu‘uanu Valley was an important region for cultivation, especially taro, as well as bananas, *‘awa*, *wauke*, sugarcane, and *olonā*. The site of Kaniakapūpū, located about half a mile *makai* of the project area, contains remnant and still flowing *‘auwai* (interview with Mr. Baron Ching in Genz and Hammatt 2011:83); however, a previous archaeological assessment immediately *makai* of Kaniakapūpū indicated that irrigated pondfield cultivation of taro with *‘auwai* did not extend as far *mauka* as the current project area. Terraces in the region would have likely been used for dryland taro or sweet potato cultivation (Dixen et al. 1994:12).

The closest documented site to the project area, Kaniakapūpū, transcends several time periods and may extend geographically *mauka* towards Nu‘uanu Reservoir No. 4. In ancient times, the forested *‘ili* of Luakaha in the upper valley of Nu‘uanu had been set aside as a relaxation spot for the high *ali‘i* and royalty (Cooke 1938, cited in Sterling and Summers 1978:307). In the Battle of Nu‘uanu in 1795, this area is one of the places that Kamehameha I rested before he began the final push to victory at the Nu‘uanu Pali (Pacific Worlds 2003a). Subsequently, Kamehameha III built Kaniakapūpū into his summer retreat, at which he commemorated the fourth anniversary of Lā Ho‘iho‘i Ea (Hawaiian Annual 1930:102-105, cited in Sterling and Summers 1978:308) and began to train his and other noble children for their future leadership roles (Pacific Worlds 2003a).

McAllister (1933:86) mentions that there are many caves on both sides of Nu‘uanu Valley, but there is no documented evidence from archaeological surveys, historical records or oral traditions of *ilina*, burial caves, or *iwi kūpuna* within the project area.

Previously documented *mo‘olelo* indicate that Nu‘uanu Valley is a place with deep ancestral and historical significance. Nu‘uanu Valley was a place of godly residence and travel, the location of the birth of the first human and the construction of the first *heiau* (Thrum 1906:44), the main passage between the *moku* of Kona and Ko‘olaupoko (‘Ī‘ī 1959:92), and the site of

several historic battles (e.g., Fornander 1996; Kamakau 1992:111, 138, 172-173; Thrum 1998:102).

A review of background research and previous archaeological studies indicates that upper Nu‘uanu, where the current project area is located, was not heavily utilized in prehistoric or historic times. It is likely that any historic properties encountered will relate to the building of Nu‘uanu Reservoir No. 4. Additionally, it is possible that the metal pipe and associated ditch and earthen bank (SIHP # 50 -80-14-5697) noted by Moore and Kennedy (1999) and again by McElroy (2005) may be encountered within or near the southern boundary of the project area. Any possible sites related to Kaniakapūpū will be south of the current project area boundary.

Section 4 Results of Fieldwork

4.1 Cultural Impact Assessment Field Findings

A tour of the forested region just *makai* of the project area on January 9, 2011 by CSH cultural anthropologist Joseph Genz, Ph.D. along with members of ‘Ahahui Malama o Kaniakapūpū identified a number of possible historic sites (Figure 33) that they believe may be connected culturally to Kaniakapūpū, which is located approximately half of a mile to the southwest of the project area. Community members identified concentrations of *pōhaku* (stones), *laua‘e* (fragrant ferns), ti plants, and *‘ie‘ie* (endemic woody, branching climbers) near the reservoir’s spillway that they believe indicate possible former habitation sites. In the dense bamboo forest farther *makai*, one community member identified *‘ie‘ie*, a network of ‘*auwai*, and a rock structure indicative of former habitation. This community member also identified a three- to five-foot high, dry-stacked stone wall that extends approximately 1000 feet from an area near the western portion of the reservoir’s access road to the trailhead leading toward Kaniakapūpū, and noted a possible shrine at the wall and described terraces and enclosures that abut the wall. The community member also identified several large *pōhaku* in the dense forest that he believes are indicative of former human activity, and based on previous excursions, he suggested that the entire region contains similar cultural features. Another community member indicated several other cultural features *mauka* of the main site of Kaniakapūpū (and *makai* of the current project area), including a carriage road, a guard station, and a wall. Cultural sites may also continue farther *makai* of Kaniakapūpū. A third community member remembered that a series of five stone terraces lined the properties adjacent to her grandmother’s house (the second residence *makai* of Kaniakapūpū) and that cobbled stone trails traversed the region.

The original construction plans for the reservoir indicate that a spring called Keiliohia was located in the project area, but was covered when the reservoir was filled (R. M. Towill Corporation 1907). A community member indicates that an unidentified spring inside the reservoir—possibly Keiliohia—still flows at low water levels. Keiliohia Spring may have been associated with agricultural and cultural practices; a community member describes a trail that connected this spring to the medicinal gardens of Kaniakapūpū.

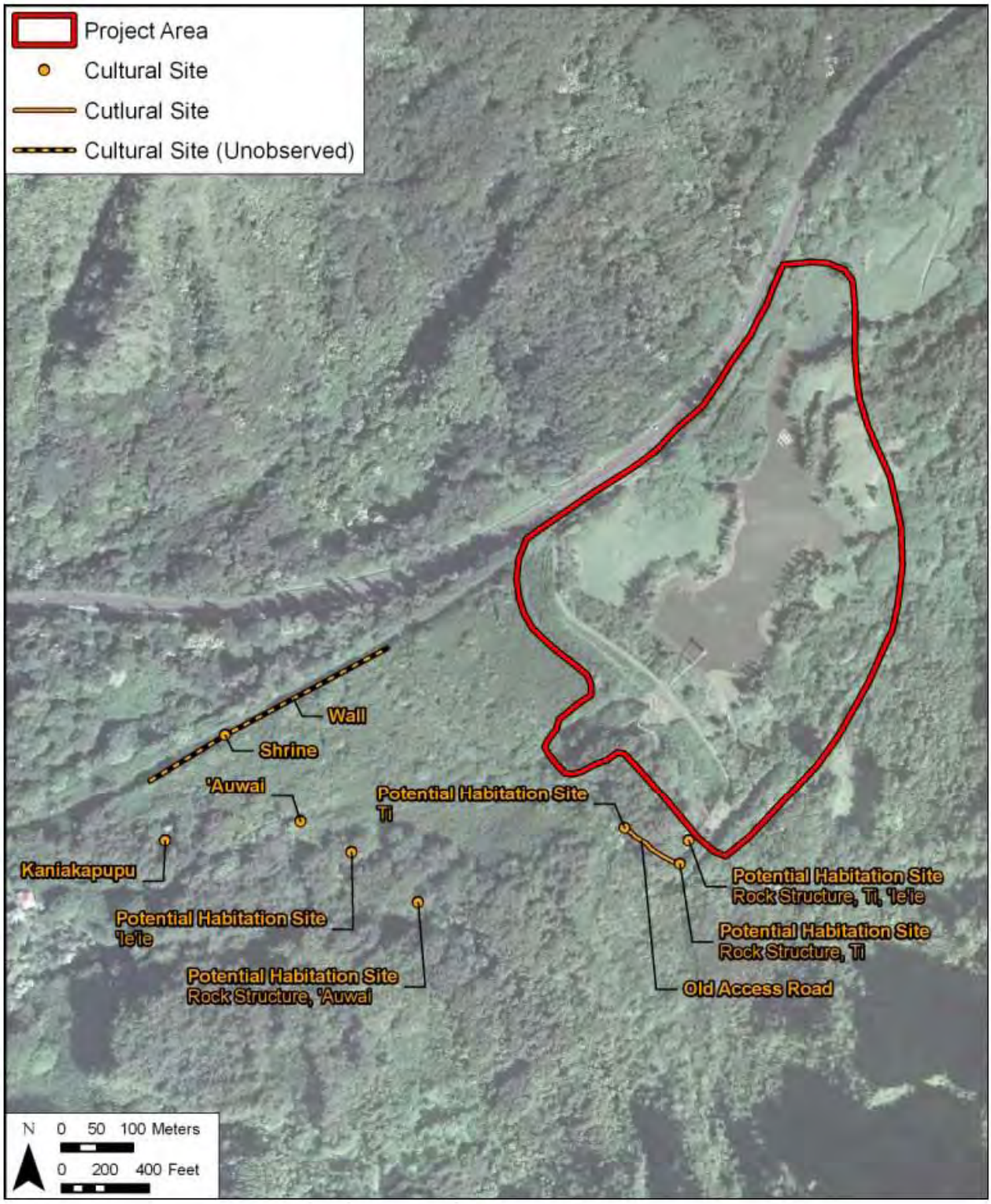

Figure 33. Cultural sites identified by community members (base map: 1998 U.S.G.S. orthoimagery)

4.2 Archaeological Inventory Survey Findings

CSH conducted fieldwork on two separate occasions, on January 5, 2011 and March 31, 2011. The fieldwork conducted on January 5, 2011 included a tour of Nu‘uanu Reservoir No. 4 by project engineer Mr. Jim Nierman and documentation of the reservoir. The fieldwork conducted on March 31, 2011, included the examination of three of the possible cultural sites pointed out by members of ‘Ahahui Malama o Kaniakapūpū during their visit on January 9, 2011.

On March 31, 2011, CSH archaeologists examined three of the possible cultural sites pointed out by members of ‘Ahahui Malama o Kaniakapūpū during their visit on January 9, 2011. It should be noted that all three of these possible sites lie outside of (although near) the current project area boundary, to the south. The possible sites were noted to be comprised of rock structures, ti plants, and/or *‘ie‘ie* and are thought by community members to represent habitation sites. CSH observed ti plants throughout the forested area to the south of the project area; the plants did not appear to represent sites of former habitation as proposed by members of ‘Ahahui Malama o Kaniakapūpū. Natural collections of boulders were also seen throughout the area.

After viewing the three possible sites, CSH determined that two of the possible sites appear to be natural collections of boulders and plants (Figure 34), while the third possible site (Figure 35) represents a mound of basalt boulders that show evidence of mechanical rock quarrying (Figure 36).

While surveying to the south of the project area boundary on March 31, 2011, CSH observed a narrow ditch cut into the natural ground surface (Figure 37). At times, the ditch leveled out to match the ground surface. A partially-buried metal pipe was observed running down the center of sections of the ditch (Figure 38). Near the easternmost beginning of the ditch, several boulders were seen that displayed definite dozer scarring (Figure 39). A possible old access road or trail is observed just north and alongside of the ditch on the natural ground surface (Figure 40). It is possible that this metal pipe is the old water line that connected to the water valve located in the project area. It is also possible that the observed pipe and ditch represent the continuation of the old water pipe and associated ditch and cobble and earthen berm (SIHP # 50-80-14-5697) reported by Moore and Kennedy (1999) farther to the west. SIHP # 50-80-14-5697 was previously determined Hawai‘i Register eligible under criteria A and D, but subsequently considered “no longer significant” as sufficient information was collected and documented during AIS fieldwork (Moore and Kennedy 1999:21).

A single historic property (the entire Nu‘uanu Reservoir No. 4 with appurtenances) was identified within the project area and was designated SIHP # 50-80-14-7380. A detailed description of this historic property is presented in Section 4.3 below.

Figure 34. Natural collection of boulders and ti plants

Figure 35. Mound of boulders that represent rock quarrying activities

Figure 36. Boulder with mechanically-drilled hole representing quarrying activities

Figure 37. Ditch cut into the natural ground surface

Figure 38. Partially-buried metal pipe within level area of ditch

Figure 39. Dozer scarring on a boulder near the ditch

Figure 40. Possible old access road or trail alongside the ditch

4.3 Historic Property Description

4.3.1 SIHP # 50-80-14-7380

Formal Type: Reservoir System
Functional Interpretation: Water Supply/Flood Control/Recreation
No. of Features: 1
Age: Historic
Current Dimensions: Approximately 64 acres
Shape: Irregular
Location: Nu‘uanu Valley
Tax Map Key: [1] 2-2-054:001
Land Jurisdiction: Honolulu Board of Water Supply
Description:

SIHP # 50-80-14-7380 includes Nu‘uanu Reservoir No. 4 and appurtenances. Nu‘uanu Reservoir No. 4 consists of a 65-foot high earthen embankment dam with a 1,750-foot crest length and partial rip-rap on the upstream face. The reservoir has a normal pool storage capacity of 120 acre-feet with a surface area of 10 acres. Discharges from the dam flow into Nu‘uanu Stream and through the city of Honolulu before entering the Pacific Ocean at Honolulu Harbor. An intake tower is set within the reservoir and a tower footbridge leads from the intake tower to the top of the embankment dam (Figure 41). The upstream side of the embankment dam consists of a partial rip-rap surface (Figure 42). To the southeast of the reservoir itself, a spillway leads to the south and down the valley (Figure 43 and Figure 44). An outlet receiving area with a 24-inch pipe (Figure 46 and Figure 47) is located at the bottom of a paved trail on the downstream slope of the embankment dam (Figure 48). Several seepage points and monitoring wells (Figure 49) are also located on the downstream slope of the embankment dam. Access to the reservoir complex is by the reservoir access road that leads off of the Pali Highway and travels along the top of the embankment dam (Figure 50). An old access road is located partway down the downstream side of the embankment dam (Figure 51).

To the southeast of the reservoir, in a paved parking area, is a water valve protruding from the side of a small concrete-lined embankment (Figure 52). This water valve supplied the whole of Honolulu with water during the middle of the nineteenth century, until the discovery of a vast underground source of water (Daws 2006:269-273). Following this discovery, artesian wells were drilled throughout Honolulu and became the main source of supplied water for the city (Board of Water Supply 2004; Daws 2006:273). Farther to the southeast of the paved parking area and along a trail through the woods that starts at the water valve, is an area for water filtration (Figure 53 through Figure 55). Two large concrete-lined vats are situated in the ground and would have been filled with sand. Water would have been placed into the vats and filtered through the sand to purify it. Further along the trail into the woods, lies a concrete and rock wall alongside a stream (Figure 56). It appears to function as a dam for the stream.

The primary function of the existing Nu‘uanu No. 4 Reservoir Dam is to provide flood control from the 1.4 square mile watershed on the heavily vegetated leeward slopes of the Ko‘olau Mountains for Nu‘uanu Valley and part of downtown Honolulu that lies within the Nu‘uanu

Stream corridor. The reservoir is also used for recreation and as a fresh water fish refuge by the Department of Land and Natural Resources, Division of Aquatic Resources. Nu‘uanu Reservoir No. 4 was originally built to provide water for the burgeoning city of Honolulu, with several small streams feeding it. After the discovery of artesian wells that could provide a safer supply of water for Honolulu, water from the reservoir was used to produce electricity. From 1919 until the 1930s, water flowed to downstream turbines that generated enough power to run the city lights throughout the night as well as operate sewage stations during the day.

SIHP # 50-80-14-7380 possesses integrity of design, setting, materials, workmanship, feeling, and association and is recommended eligible to the Hawai‘i Register of Historic Places under criteria A, B, and D.

Figure 41. Intake tower and tower footbridge

Figure 42. Partial rip-rap surface on the side of the embankment dam

Figure 43. Beginning of spillway to the southeast of the reservoir

Figure 44. Continuation of spillway to the east of the reservoir

Figure 45. Continuation of spillway to the south

Figure 46. Outlet receiving area with 24-inch pipe coming out of the downstream slope of the embankment dam

Figure 47. End of 24-inch outlet pipe draining into a shallow stream

Figure 48. Paved trail leading up the embankment dam from the outlet receiving area

Figure 49. Monitoring well

Figure 50. Portion of reservoir access road, view to the northwest (towards the Pali Highway)

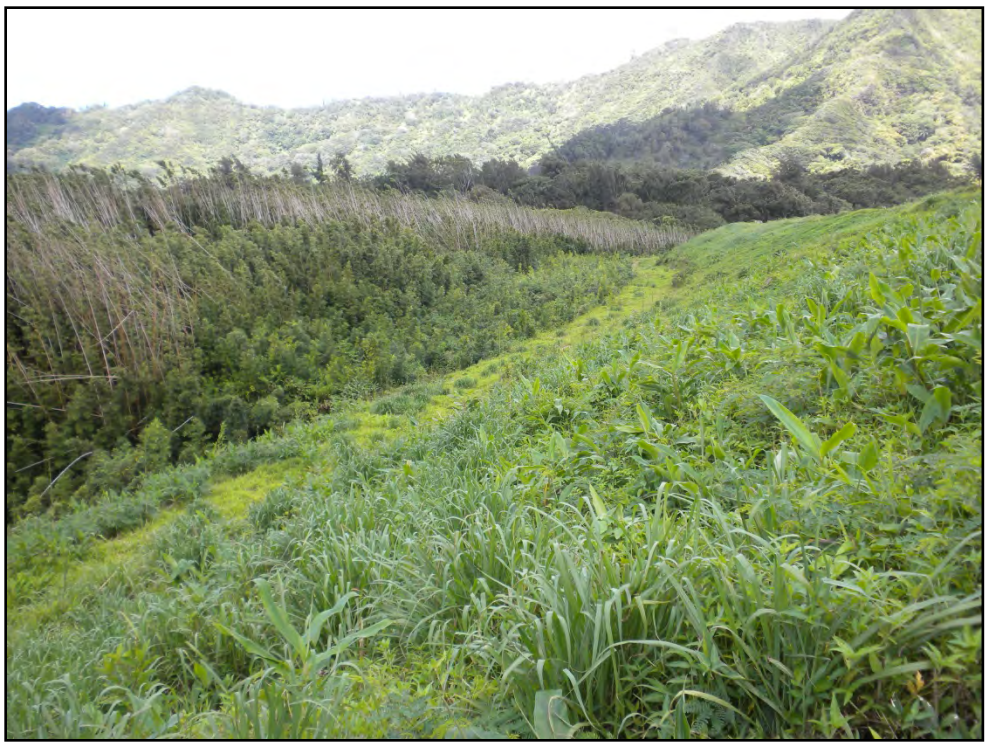

Figure 51. Old access road on downstream side of embankment dam

Figure 52. Water valve

Figure 53. Part of water filtering system

Figure 54. Large vats used for water filtering

Figure 55. Close-up of water filtering vats, showing valves in the side walls of each vat

Figure 56. Concrete and rock wall/dam alongside a stream

Section 5 Summary and Interpretation

At the request of R. M. Towill Corporation, CSH conducted an archaeological inventory survey for the Nu‘uanu Reservoir No. 4 Project, Nu‘uanu Ahupua‘a, Honolulu District, Island of O‘ahu (TMK: [1] 2-2-054:001).

There was very limited development in the *‘ili* of Luakaha in the upper valley of Nu‘uanu during the twentieth century. Historic maps indicate the locations of four open reservoirs (numbered one through four) that line the main road (the Pali Highway), with residential development in Alewa Heights in the vicinity of Nu‘uanu Reservoir Nos. 2 and 3. Historic maps do not show any development near Nu‘uanu Reservoir No. 4.

The four reservoirs in Nu‘uanu Valley were constructed between 1890 and 1910 for hydropower, flood control, and domestic water (Hawai‘i DLNR 2010b). Nu‘uanu Reservoir No. 4, the largest of the four reservoirs, was originally built to provide water for the burgeoning city of Honolulu, with several small streams feeding it. Construction of the earthen dam began in 1905 and was completed in 1910 (Durkee 2008:2). Drawings of the original reservoir plans (1907, supplied by R. M. Towill Corporation) show the original topography before dam construction, including the location of Keiliohia Spring and early water ditches (located within the present reservoir). After the discovery of artesian wells that could provide a safer supply of water for Honolulu, water from the reservoir was used to produce electricity (Townscape, Inc. and Dashiell 2003:18). From 1919 until the 1930s, water flowed to downstream turbines that generated enough power to run the city lights throughout the night as well as operate sewage stations during the day (Durkee 2008:2). Then, leakages in the dam structure forced its reconstruction. After widening the crest of the dam and other modifications in 1934, the reservoir has since been used as a flood control structure by regulating the flow of Nu‘uanu Stream, which flows four miles to Honolulu Harbor (Durkee 2008:2; Townscape, Inc. and Dashiell 2003:18). The reservoir has also been used for seasonal recreational fishing. Shortly after World War II, the Territorial Government introduced freshwater sport fish in Hawai‘i, and the reservoir was utilized as a refuge and research site (Hawai‘i DLNR 2010b). Since the first public opening in 1969, the reservoir continues to be stocked with channel catfish, which spawn during the late spring in Nu‘uanu (Hawai‘i DLNR 2010b), as well as freshwater clams, tilapia, and cichlids (Hollier 2007; Kawanami 2010).

The fieldwork component of this archaeological inventory survey was accomplished on two separate occasions, on January 5, 2011 and March 31, 2011. The fieldwork conducted on January 5, 2011 included a tour of Nu‘uanu Reservoir No. 4 by project engineer Mr. Jim Nierman and documentation of the reservoir. The fieldwork conducted on March 31, 2011, included examination of three of the possible cultural sites pointed out by members of ‘Ahahui Malama o Kaniakapūpū during their visit on January 9, 2011. CSH determined that two of the possible sites appear to be natural collections of boulders and plants, while the third possible site represents a mound of basalt boulders that show evidence of mechanical rock quarrying.

Also on March 31, 2011, while surveying to the south of the project area boundary, CSH observed a narrow ditch cut into the natural ground surface with an intermittent partially-buried metal pipe. This appears to represent the continuation of the old water pipe and associated ditch and cobble and earthen berm (SIHP # 50-80-14-5697) reported by Moore and Kennedy (1999)

farther to the west. SIHP # 50-80-14-5697 was previously determined Hawai‘i Register eligible under criteria A and D, but subsequently considered “no longer significant” as sufficient information was collected and documented during AIS fieldwork (Moore and Kennedy 1999:21).

A single historic property (the entire Nu‘uanu Reservoir No. 4 with appurtenances) was identified within the project area during the AIS investigation and was designated SIHP #50-80-14-7380. SIHP 50-80-14-7380 is recommended eligible to the Hawai‘i Register of Historic Places under criteria A, B, and D.

Section 6 Significance Assessments

One historic property was identified within the current project area. To be considered eligible for listing on the Hawai‘i Register of Historic Places, a historic property must possess one or more of the following: integrity of location, design, setting, materials, workmanship, feeling, and/or association, and meet one or more of the following broad cultural/historic significance criteria:

A Historic property reflects major trends or events in the history of the state or nation.

B Historic property is associated with the lives of persons significant in our past.

C Historic property is an excellent example of a site type.

D Historic property has yielded or may be likely to yield information important in prehistory or history.

E Historic property has cultural significance to an ethnic group, including, but not limited to, religious structures, burials, and traditional cultural properties.

6.1 SIHP 50-80-14-7380

SIHP 50-80-14-7380 is the Nu‘uanu No. 4 Reservoir system, which includes the dam itself and several appurtenances. SIHP 50-80-14-7380 is recommended eligible to the Hawai‘i Register of Historic Places under criteria A, B, and D.

Section 7 Project Effect and Mitigation Recommendations

7.1 Project Effect

CSH's project-specific effect recommendation is "effect, with proposed mitigation commitments" (in accordance with HAR 13-284-7). The project will potentially adversely affect SIHP 50-80-14-7380. The recommended mitigation measure detailed below will reduce the project's effect on SIHP 50-80-14-7380.

7.2 Mitigation Recommendations

To reduce the proposed project's potential adverse effect on SIHP 50-80-14-7380, architectural recordation, in the form of a Historic American Engineering Record, is recommended as a mitigation measure.

Additionally, as a part of the AIS, CSH, with the help of Mr. Jim Niermann from R. M. Towill, completed a National Register of Historic Places Registration Form for Nu‘uanu Reservoir No. 4 (Appendix A). The Registration Form should be considered preliminary in nature and should be used only as a guide for future nomination of Nu‘uanu Reservoir No. 4. Additionally, as Nu‘uanu Reservoir No. 4 is part of a larger system of reservoirs, a full study of the whole Nu‘uanu Reservoir System at some point in the future is recommended.

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Appendix A National Register of Historic Places Registration Form

NPS Form 10-900 OMB No. 1024-0018 (Expires 5/31/2012)

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in National Register Bulletin, *How to Complete the National Register of Historic Places Registration Form*. If any item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. **Place additional certification comments, entries, and narrative items on continuation sheets if needed (NPS Form 10-900a).**

1. Name of Property

historic name Nu'uanu Reservoir No. 4

other names/site number

2. Location

street & number Located adjacent to and east of Pali Hwy, about 4 mi NE of downtown N/A not for publication

Honolulu

city or town Honolulu X vicinity

state Hawaii code HI county Honolulu code 003 zip code

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended,

I hereby certify that this ___ nomination ___ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60.

In my opinion, the property ___ meets ___ does not meet the National Register Criteria. I recommend that this property be considered significant at the following level(s) of significance:

___ national ___ statewide ___local

Signature of certifying official/Title Date

State or Federal agency/bureau or Tribal Government

In my opinion, the property ___ meets ___ does not meet the National Register criteria

Signature of commenting official Date

Title State or Federal agency/bureau or Tribal Government

4. National Park Service Certification

I hereby certify that this property is:

___ entered in the National Register ___ determined eligible for the National Register

___ determined not eligible for the National Register ___ removed from the National Register

___ other (explain:)

Signature of the Keeper Date of Action

United States Department of the Interior
National Park Service / National Register of Historic Places Registration Form
NPS Form 10-900 OMB No. 1024-0018 (Expires 5/31/2012)

Nu'uanu Reservoir No. 4 — Name of Property
Honolulu, Hawaii — County and State

5. Classification

Ownership of Property (Check as many boxes as apply.)

- [ ] private
- [ ] public - Local
- [ ] public - State
- [ ] public - Federal

Category of Property (Check only one box.)

- [ ] building(s)
- [ ] district
- [ ] site
- [X] structure
- [ ] object

Number of Resources within Property (Do not include previously listed resources in the count.)

Contributing	Noncontributing	
0	0	buildings
0	0	sites
2	0	structures
0	0	objects
2	0	**Total**

Name of related multiple property listing (Enter "N/A" if property is not part of a multiple property listing)

N/A

Number of contributing resources previously listed in the National Register

N/A

6. Function or Use

Historic Functions (Enter categories from instructions.)

PROCESSING/waterworks
AGRICULTURE/irrigation facility

Current Functions (Enter categories from instructions.)

PROCESSING/waterworks
RECREATION/outdoor recreation
AGRICULTURE/fishing facility or site
WORK IN PROGRESS

7. Description

Architectural Classification (Enter categories from instructions.)

NO STYLE

Materials (Enter categories from instructions.)

foundation: Earth
walls: N/A
roof: N/A
other: Concrete, metal, stone

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Nu'uanu Reservoir No. 4 — Name of Property
Honolulu, Hawaii — County and State

Narrative Description

(Describe the historic and current physical appearance of the property. Explain contributing and noncontributing resources if necessary. Begin with **a summary paragraph** that briefly describes the general characteristics of the property, such as its location, setting, size, and significant features.)

Summary Paragraph

Nu'uanu Reservoir No. 4 is a 64-acre reservoir located in Nu'uanu Valley, on the leeward side of the Ko'olau Mountain Range and adjacent to (east of) the Pali Highway (State Route 61), approximately four miles northeast of downtown Honolulu. Nu'uanu Reservoir No. 4 consists of a 65-foot high earthen embankment dam and several appurtenances. The reservoir was originally built to provide water for the burgeoning city of Honolulu; the location of the reservoir was chosen to take advantage of several small streams and the larger Nu'uanu Stream. The reservoir was designed by S. G. Walker, civil engineer. Construction of the earthen dam began in 1905 and continued until 1907, when construction was halted for contractual reasons. Construction began again in 1908 and was completed in 1910 (Durkee 2008:ES-1; Lao 1988:1). Reconstruction and modifications to the dam were made between 1933 and 1934, after leakage was observed (Durkee 2008:2-3). Upcoming repair work is planned for the dam in order to meet safety requirements.

Narrative Description

At present, Nu'uanu Reservoir No. 4 consists of a 65-foot high earthen embankment dam with a 1,750-foot crest length. The reservoir has a normal pool storage capacity of 120 acre-feet with a surface area of 10 acres. The upstream face of the dam has a partial rip-rap surface. An intake tower is set within the reservoir and a tower footbridge leads from the intake tower to the top of the embankment dam. To the southeast of the reservoir itself, a spillway leads to the south and down the valley. An outlet receiving area with a 24-inch pipe is located at the bottom of a paved trail on the downstream slope of the embankment dam. Several seepage points and monitoring wells are also located on the downstream slope of the embankment dam. Access to the reservoir complex is by the reservoir access road that leads off of the Pali Highway and travels along the top of the embankment dam. An old access road is located partway down the downstream side of the embankment dam. To the southeast of the reservoir, in a paved parking area, is a water valve protruding from the side of a small concrete-lined embankment. Farther to the southeast of the paved parking area and along a trail through the woods that starts at the water valve, is an area for water filtration, involving two large concrete-lined vats situated in the ground. Further along the trail into the woods, lies a concrete and rock wall alongside a stream. It appears to function as a dam for the stream.

Nu'uanu Reservoir No. 4 was constructed on Nu'uanu Stream. As Nu'uanu Stream was used by traditional Hawaiians as a main source of water (for drinking, bathing, and taro irrigation), it was natural to develop the stream into the reservoir (Durkee 2008:2; Lao 1988:1). This location was proposed by Major A. S. Bender in a report on the City of Honolulu's water supply during 1882-1884.

For the purposes of this registration form, the earthen dam and appurtenances set into the dam are considered one contributing resource (structure) within this property; the second contributing resource (structure) is considered to be the water filtration area located to the southeast of the earthen embankment dam.

An overview of Nu'uanu Reservoir No. 4 was given by Chester Lao (1988) during the Conference on Dam Safety at the Ala Moana Hotel from November 17-18, 1988. In 2008, Dean Durkee, of Gannett Fleming, conducted a Phase I Investigation of Nu'uanu Reservoir No. 4 to assess the general physical condition of the dam with respect to safety. Much of the information provided in this section is taken from Lau (1988) and Durkee (2008).

According to Lao (1988:3-4):

> The original dam is a gravity structure consisting of a concrete and timber cutoff, partly hand-laid rockfill for the toe and hydraulic fill for the heel. ... The rockfill was laid up with a vertical upstream face and a downslope of 1:1.... Some 1,700 cubic yards of rock was used across the channel for a top length of 170 feet. For the concrete cutoff, a trench 15 to 45 feet deeper than the original surface was excavated across the streambed. The concrete extended 150 feet across the streambed. Oregon pine 2-inch plants were spiked to 4 x 4 uprights. Concrete was poured to a height of 72 feet. A redwood diaphragm was continued to the top of the dam 10 feet away from the rockfill. The hydraulic fill consists of material sluiced from the reservoir site to fill the space between the diaphragm and the rockfill and also to form the heel portion at a

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Nu'uanu Reservoir No. 4 Honolulu, Hawaii
Name of Property County and State

1:3 slope. The fines were directed to the core and the coarser material to the outside. A steam pump rated at 1,500 gpm was used to power a hydraulic giant that washed soil into a wood flume. As originally completed in 1910, the dam was 2,100 feet in length, extended 77 feet above the streambed, utilized a side channel spillway, had 6 feet of freeboard, a crest width of 10 feet, maximum pool depth of 60 feet, and a maximum storage capacity of 470+ MG.

Leakages in the dam structure forced its reconstruction in the 1930s. Extensive reconstruction began in 1933 and ended in 1934 (Durkee 2008:2-3). Lao (1988:5-6) describes the substantial changes made to the dam:

> Freeboard was revised to 10 feet while the crest was thickened an additional 10 feet. A trench 10 feet deep was excavated along the heel of the dam and a continuous wall of interlocking sheetpile of ½-inch web thickness was driven 45 feet or to refusal. The upstream slope was flattened to a slope of 1:4 with 80,000 cubic yards of rolled earth fill. Hand laid riprap of basalt provided protection against wave wash. The old outlet pipes were sealed and the control tower knocked over. A new control tower and outlet piping were installed.

The purpose of the upcoming repair work is to meet dam safety requirements listed in the State of Hawai'i DLNR Dam Safety Program Inspection Report (Hawai'i DLNR 2010a) and the Phase I Investigation Report (Durkee 2008) on Nu'uanu Reservoir No. 4. Planned repair work includes the following:

1. Removal and disposal of accumulated sediments at the base of the existing reservoir intake tower structure and repair and rehabilitation of the existing lower level sluice gate and operational controls.
2. Repair of three existing debris cages (trash racks) and lower level sluice gate on the intake tower.
3. Construction of measuring weirs at three existing seepage points on the downstream slope and outlet structure.
4. Dredging of outlet receiving area and installation of extension of outlet pipe.
5. Removal of the temporary access road located on the downstream face of the dam embankment and restoration of the embankment slope.
6. Repair and repaving of the existing reservoir access road on the top of the dam.
7. Inspection of the downstream slope and repair of the upstream slope rip-rap deficiencies and depressions.
8. Inspection and cleaning of the existing outlet tunnel structure.
9. Recalibration/repainting of water level markings on the existing intake tower.
10. Creation of subdivision map for Nu'uanu No. 4 reservoir.

The primary function of the existing Nu'uanu Reservoir No. 4 is to provide flood control from the 1.4 square mile watershed on the heavily vegetated leeward slopes of the Ko'olau Mountains for Nu'uanu Valley and part of downtown Honolulu that lies within the Nu'uanu Stream corridor. The reservoir is also used for recreation and as a fresh water fish refuge by the Department of Land and Natural Resources (DLNR), Division of Aquatic Resources (Durkee 2008:3).

Originally, the reservoir was constructed to provide hydropower, flood control, and domestic water for the burgeoning city of Honolulu. It was situated to take advantage of Nu'uanu Stream, which flowed through the city of Honolulu and out into the harbor. Shortly after construction of the dam, it was discovered that artesian wells could provide a safer supply of water for Honolulu (Durkee 2008:2). This led to use of the reservoir for hydropower (Townscape, Inc. and Dashiell 2003:18). From 1919 until 1930, water flowed to downstream turbines that generated enough power to run the city lights throughout the night as well as to operate sewage stations during the day (Durkee 2008:ES-1).

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Nu'uanu Reservoir No. 4 — Name of Property
Honolulu, Hawaii — County and State

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

- [X] A Property is associated with events that have made a significant contribution to the broad patterns of our history.
- [ ] B Property is associated with the lives of persons significant in our past.
- [X] C Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- [X] D Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations
(Mark "x" in all the boxes that apply.)

Property is:

- [ ] A Owned by a religious institution or used for religious purposes.
- [ ] B removed from its original location.
- [ ] C a birthplace or grave.
- [ ] D a cemetery.
- [ ] E a reconstructed building, object, or structure.
- [ ] F a commemorative property.
- [ ] G less than 50 years old or achieving significance within the past 50 years.

Areas of Significance
(Enter categories from instructions.)

Engineering
Community Planning and Development
Industry

Period of Significance

1905-1930
1905-1962

Significant Dates

1910
1919

Significant Person
(Complete only if Criterion B is marked above.)

N/A

Cultural Affiliation

Historic Hawaiian

Architect/Builder

Walker, S. G.

Period of Significance (justification)

Two periods of significance are associated with Nu'uanu Reservoir No. 4: 1905-1930 and 1905-1962. 1905 is the year construction of the reservoir began; construction ended in 1910. Beginning in 1910, the reservoir began being used for flood control and as a supply of water. The reservoir supplied water for the whole of Honolulu until 1919. At this time and up until 1930, the reservoir was used for hydropower for the city of Honolulu. From 1905 until 1962, the reservoir was used to provide flood control for Nu'uanu Valley and part of downtown Honolulu. 1962 is used as the closing date for the period

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of significance, based on the 50 year minimum age requirement for a historic property at the time this report was written (2012).

Criteria Considerations (explanation, if necessary)
N/A

Statement of Significance Summary Paragraph (Provide a summary paragraph that includes level of significance and applicable criteria.)

Nu'uanu Reservoir No. 4 is significant under Criteria A, C, and D. The reservoir is considered significant under Criterion A for its association with supplying the burgeoning city of Honolulu with needed utilities from 1910 until 1930. The reservoir was constructed in order to not only provide flood control, but to supply Honolulu first with water, and later with electricity. Nu'uanu Reservoir No. 4 is considered significant under Criterion C as a good example of an earthen embankment dam and reservoir constructed in Hawai'i in the early 20th century (1905-1910). The reservoir is also considered significant under Criterion D, as it is has yielded important information pertaining to engineering in early 20th century Hawai'i and the needs of early 20th century inhabitants of the Honolulu and Nu'uanu areas.

Narrative Statement of Significance (Provide at least **one** paragraph for each area of significance.)

Nu'uanu Reservoir No. 4 is a 64-acre reservoir located in Nu'uanu Valley, on the leeward side of the Ko'olau Mountain Range and adjacent to (east of) the Pali Highway (State Route 61), approximately four miles northeast of downtown Honolulu. Nu'uanu Reservoir No. 4 consists of a 65-foot high earthen embankment dam and several appurtenances.

Nu'uanu Reservoir No. 4 was constructed on Nu'uanu Stream. As Nu'uanu Stream was used by traditional Hawaiians as a main source of water (for drinking, bathing, and taro irrigation), it was natural to develop the stream into the reservoir (Durkee 2008:2; Lao 1988:1). This location was proposed by Major A. S. Bender in a report on the City of Honolulu's water supply during 1882-1884.

The reservoir was then designed by S. G. Walker, civil engineer. Construction of the earthen dam began in 1905 and continued until 1907, when construction was halted for contractual reasons. Construction began again in 1908 and was completed in 1910 (Durkee 2008:ES-1; Lao 1988:1). Reconstruction and modifications to the dam were made between 1933 and 1934, after leakage was observed (Durkee 2008:2-3). Upcoming repair work is planned for the dam in order to meet safety requirements listed in the State of Hawai'i DLNR Dam Safety Program Inspection Report (Hawai'i DLNR 2010a) and the Phase I Investigation Report (Durkee 2008) on Nu'uanu Reservoir No. 4.

The reservoir was originally constructed to provide hydropower, flood control, and domestic water for the burgeoning city of Honolulu. It was situated to take advantage of Nu'uanu Stream, which flowed through the city of Honolulu and out into the harbor. From 1910 until 1919, this reservoir was used to supply all of Honolulu with water. Shortly after construction of the dam, it was discovered that artesian wells could provide a safer supply of water for Honolulu (Durkee 2008:2). This led to use of the reservoir for hydropower (Townscape, Inc. and Dashiell 2003:18). From 1919 until 1930, water flowed to downstream turbines that generated enough power to run the city lights throughout the night as well as to operate sewage stations during the day (Durkee 2008:ES-1). Throughout this whole period (1910-1930), the reservoir was used to provide flood control for downstream areas of Nu'uanu Valley and parts of downtown Honolulu.

The primary function of Nu'uanu Reservoir No. 4 today is to provide flood control from the 1.4 square mile watershed on the heavily vegetated leeward slopes of the Ko'olau Mountains for Nu'uanu Valley and part of downtown Honolulu that lies within the Nu'uanu Stream corridor. The reservoir is also used for recreation and as a fresh water fish refuge by the Department of Land and Natural Resources (DLNR), Division of Aquatic Resources (Durkee 2008:3). The reservoir is no longer used as a source of water or for hydropower.

United States Department of the Interior
National Park Service / National Register of Historic Places Registration Form
NPS Form 10-900 OMB No. 1024-0018 (Expires 5/31/2012)

Nu'uanu Reservoir No. 4 — Name of Property
Honolulu, Hawaii — County and State

Developmental history/additional historic context information (if appropriate)
N/A

9. Major Bibliographical References

Bibliography (Cite the books, articles, and other sources used in preparing this form.)

Durkee, Dean B.

2008 *Phase I Investigation, Nu'uanu Dam No. 4, Honolulu, O'ahu, Hawai'i, National Inventory of Dams No. HI0001.* Gannett Fleming, Phoenix.

Lao, Chester

1988 *A History of Nuuanu Reservoir No. 4 Dam.* Presented at the Conference on Dam Safety, Ala Moana Hotel, Honolulu, November 17-18, 1988.

Townscape, Inc. and Eugene P. Dashiell

2003 *West Honolulu Watershed Study.* Townscape, Inc, Honolulu.

Previous documentation on file (NPS):
___ preliminary determination of individual listing (36 CFR 67 has been requested)
___ previously listed in the National Register
___ previously determined eligible by the National Register
___ designated a National Historic Landmark
___ recorded by Historic American Buildings Survey #
___ recorded by Historic American Engineering Record #
___ recorded by Historic American Landscape Survey #

Primary location of additional data:
X State Historic Preservation Office
___ Other State agency
___ Federal agency
___ Local government
___ University
X Other
Name of repository: **Honolulu Board of Water Supply (owner)**

Historic Resources Survey Number (if assigned):

10. Geographical Data

Acreage of Property 64 acres
(Do not include previously listed resource acreage.)

UTM References
(Place additional UTM references on a continuation sheet.)

	Zone	Easting	Northing		Zone	Easting	Northing
1				3			
2				4			

United States Department of the Interior
National Park Service / National Register of Historic Places Registration Form
NPS Form 10-900 OMB No. 1024-0018 (Expires 5/31/2012)

Nu'uanu Reservoir No. 4 Honolulu, Hawaii
Name of Property County and State

Verbal Boundary Description (Describe the boundaries of the property.)

The boundary of Nu'uanu Reservoir No. 4 is shown as the red outline on the accompanying Tax Map Key map for TMK: [1] 2-2-054.

Boundary Justification (Explain why the boundaries were selected.)

11. Form Prepared By

name/title Kelly Burke, Archaeologist
organization Cultural Surveys Hawai'i, Inc. date June 19, 2012
street & number P.O. Box 1114 telephone 808-262-9972
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name/title James Niermann, AICP, LEED AP
organization R. M. Towill Corporation date June 19, 2012
street & number 2024 N King St, Suite 200 telephone 808-842-1133
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e-mail JimN@rmtowill.com

Additional Documentation

Submit the following items with the completed form:

- **Maps:** A **USGS map** (7.5 or 15 minute series) indicating the property's location.

  A **Sketch map** for historic districts and properties having large acreage or numerous resources. Key all photographs to this map.
- **Continuation Sheets**
- **Additional items:** (Check with the SHPO or FPO for any additional items.)

Photographs:

Submit clear and descriptive photographs. The size of each image must be 1600x1200 pixels at 300 ppi (pixels per inch) or larger. Key all photographs to the sketch map.

Name of Property:

United States Department of the Interior
National Park Service / National Register of Historic Places Registration Form
NPS Form 10-900 OMB No. 1024-0018 (Expires 5/31/2012)

Nu'uanu Reservoir No. 4 Honolulu, Hawaii
Name of Property County and State

City or Vicinity:

County: State:

Photographer:

Date Photographed:

Description of Photograph(s) and number:

1 of ___.

Property Owner:

(Complete this item at the request of the SHPO or FPO.)

name Honolulu Board of Water Supply

street & number 630 South Beretania St telephone 808-748-5900

city or town Honolulu state Hawaii zip code 96843

Paperwork Reduction Act Statement: This information is being collected for applications to the National Register of Historic Places to nominate properties for listing or determine eligibility for listing, to list properties, and to amend existing listings. Response to this request is required to obtain a benefit in accordance with the National Historic Preservation Act, as amended (16 U.S.C.460 et seq.).
Estimated Burden Statement: Public reporting burden for this form is estimated to average 18 hours per response including time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding this burden estimate or any aspect of this form to the Office of Planning and Performance Management, U.S. Dept. of the Interior, 1849 C. Street, NW, Washington, DC.

Appendix C

Cultural Impact Assessment

Draft for Review

Cultural Impact Assessment for the Nu‘uanu Reservoir No. 4 Project, Nu‘uanu Ahupua‘a, Honolulu District, O‘ahu Island TMK: [1] 2-2-054:001

Prepared for

R.M. Towill Corporation

Prepared by

Joseph H. Genz, Ph.D.

and

Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai‘i, Inc.

Kailua, Hawai‘i

(Job Code: NUUANU 7)

February 2011

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Prefatory Remarks on Language and Style

A Note about Hawaiian and other non-English Words:

Cultural Surveys Hawai‘i (CSH) recognizes that the Hawaiian language is an official language of the State of Hawai‘i, it is important to daily life, and using it is essential to conveying a sense of place and identity. In consideration of a broad range of readers, CSH follows the conventional use of italics to identify and highlight all non-English (i.e., Hawaiian and foreign language) words in this report unless citing from a previous document that does not italicize them. CSH parenthetically translates or defines in the text the non-English words at first mention, and the commonly-used non-English words and their translations are also listed in the *Glossary* (Appendix A) for reference. However, translations of Hawaiian and other non-English words for plants and animals mentioned by community participants are referenced separately (see explanation below).

A Note about Plant and Animal Names:

When community participants mention specific plants and animals by Hawaiian, other non-English or common names, CSH provides their possible scientific names (Genus and species) in the *Common and Scientific Names of Plants and Animals Mentioned by Community Participants* (Appendix B). CSH derives these possible names from authoritative sources, but since the community participants only name the organisms and do not taxonomically identify them, CSH cannot positively ascertain their scientific identifications. CSH does not attempt in this report to verify the possible scientific names of plants and animals in previously published documents; however, citations of previously published works that include both common and scientific names of plants and animals appear as in the original texts.

Abbreviations

APE	Area of Potential Effect
CIA	Cultural Impact Assessment
CSH	Cultural Surveys Hawai‘i
DAR	Division of Aquatic Resources
DLNR	Department of Land and Natural Resources
DOH	Department of Health
HAR	Hawai‘i Administrative Rules
HRS	Hawai‘i Revised Statutes
LCA	Land Commission Award
OEQC	Office of Environmental Quality Control
OHA	Office of Hawaiian Affairs
OIBC	O‘ahu Island Burial Council
SHPD	State Historic Preservation Division
TCP	Traditional Cultural Property
TMK	Tax Map Key
USGS	United States Geological Survey

Management Summary

Reference	Cultural Impact Assessment for the Nu‘uanu Reservoir No. 4 Project, Nu‘uanu Ahupua‘a, Honolulu District, O‘ahu Island (TMK: [1] 2-2-054:001) (Genz and Hammatt 2011)
Date	February 2011
Project Number	CSH Job Code: NUUANU 7
Agencies	State of Hawai‘i Department of Health/Office of Environmental Quality Control (DOH/OEQC)
Project Location	The Nu‘uanu Reservoir No. 4 is located in the Ko‘olau Mountain range approximately four miles northeast of downtown Honolulu adjacent to the Pali Highway, State Route 61.
Land Jurisdiction	Honolulu Board of Water Supply
Project Description	The Nu‘uanu Reservoir No. 4 Dam consists of a 65-foot high earthen embankment dam with a 1,750-foot crest length and partial rip-rap on the upstream face. Appurtenances to the dam include an intake tower, outlet access tunnel, spillway, tower footbridge, access road, and monitoring wells. The reservoir has a normal pool storage capacity of 120 acre-feet with a surface area of 10 acres. Discharges from the dam flow into Nu‘uanu Stream and through the city of Honolulu before entering the Pacific Ocean at Honolulu Harbor. The primary function of the existing Nu‘uanu Reservoir No. 4 Dam is to provide flood control from the 1.4 square mile watershed on the heavily vegetated leeward slopes of the Ko‘olau Mountains for Nu‘uanu Valley and part of downtown Honolulu that lies within the Nu‘uanu Stream corridor. The reservoir is also used for recreation and as a fresh water fish refuge by the Department of Land and Natural Resources (DLNR), Division of Aquatic Resources (DAR). The purpose of the planned repair work is to meet dam safety requirements listed in the State of Hawai‘i DLNR Dam Safety Program inspection report (2010a) and the Phase 1 Investigation Report (Durkee 2008) on the Nu‘uanu Reservoir No.4.
Project Acreage	Approximately ten acres

Area of Potential Effect (APE) and Survey Acreage	For the purposes of this Cultural Impact Assessment (CIA), the APE is defined as the approximately ten-acre Project area. While this investigation focused on the Project APE, the study area included the entire *ahupua‘a* (land division usually extending from the uplands to the sea) of Nu‘uanu.
Document Purpose	The Project requires compliance with the State of Hawai‘i environmental review process (Hawai‘i Revised Statutes [HRS] Chapter 343), which requires consideration of a proposed project’s effect on cultural practices and resources. SEY Engineers requested CSH conduct this CIA. Through document research and ongoing cultural consultation efforts, this report provides information pertinent to the assessment of the proposed Project’s impacts to cultural practices and resources (per the *Office of Environmental Quality Control’s Guidelines for Assessing Cultural Impacts*) which may include Traditional Cultural Properties (TCPs) of ongoing cultural significance that may be eligible for inclusion on the State Register of Historic Places, in accordance with Hawai‘i State Historic Preservation Statute (Chapter 6E) guidelines for significance criteria according to Hawai‘i Administrative Rules (HAR) §13-275 under Criterion E. The document is intended to support the Project’s environmental review and may also serve to support the Project’s historic preservation review under HRS Chapter 6E and HAR Chapter 13-275.
Consultation Effort	Hawaiian organizations, agencies and community members were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the Project area and the vicinity. The organizations consulted included the State Historic Preservation Division (SHPD), the Office of Hawaiian Affairs (OHA), the O‘ahu Island Burial Council (OIBC), ‘Ahahui Mālama I Nā Kūpuna o Hawai‘i Nei, Hui Malama o Kaniakapūpū, and community members of Nu‘uanu Ahupua‘a.
Results of Background Research	Background research for this Project yielded the following results (presented in approximate chronological order): 1. Coastal settlers in the traditional village of Kou (Honolulu) likely constructed fishponds in Honolulu Bay and developed wetland agriculture close to the mouth of Nu‘uanu Stream (Dixon et al. 1994:7). Irrigated, pondfield cultivation of taro with stone-lined *‘auwai* (ditches) extended *mauka* (inland) to the lower valley of Nu‘uanu (Handy 1940:78–79; Handy and Handy 1972:475; Leidemann 1989, 1991; Yent and Ota 1980), while terraces in the vicinity of the Project area in the upper

	valley would have likely been used for dryland taro or sweet potato cultivation (Dixen et al. 1994:12). 2. Nu‘uanu Ahupua‘a contains numerous *wahi pana* (storied places) and associated *mo‘olelo* (stories, oral traditions) that place the specific Project area within a broad cultural context. Two waterfalls, Waipuilani and Waipuhia, feed the upper tributaries of Nu‘uanu Stream that flow into the Nu‘uanu Reservoir No. 4. The original construction plans (1907) for the reservoir indicate that a spring called Keiliohia was located in the Project area, but was covered with the filling of the water for the reservoir (plans supplied by R.M. Towill Corporation). 3. The Project area is located in the cool, forested *‘ili* (land division smaller than an *ahupua‘a*) of Luakaha (Lyons 1874), which means “a place for relaxation” and neatly captures how Hawaiians during various time periods have similarly used the land for rest and respite. In ancient times, Luakaha ‘Ili had been set aside as a relaxation spot for the high *ali‘i* (chiefs) and royalty (C.H. Cooke 1938, cited in Sterling and Summers 1978:307). According to Charles Kenn, a *heiau* (sacred place of worship, temple) called Kaniakapūpū *makai* (seaward) of the Project area was a place where people came for comfort and medical attention, with guards stationed at a sacred *hau* (hibiscus) grove *mauka* of the Project area (Pacific Worlds 2003a). In one version of the Battle of Nu‘uanu in 1795, Kamehameha I rested at Kaniakapūpū while his men made the final assault on the remaining O‘ahu forces, 300 of which made a final stand in Luakaha ‘Ili in an attempt to allow the others to escape down the *pali* (cliffs) or over the mountains (Pacific Worlds 2003a). Then, Kamehameha III built Kaniakapūpū into his summer palace, one of several places of refuge from the politics taking place in Honolulu, as well as from the heat of the plain of Honolulu. Kaniakapūpū was the scene of a historic feast on July 31, 1847, in which 10,000 people celebrated the fourth anniversary of Lā Ho‘iho‘i Ea (Restoration Day) (Hawaiian Annual 1930:102–105, cited in Sterling and Summers 1978:308). The following year the Chief’s Children School held a picnic at Kaniakapūpū (Helen Judd manuscript, cited in Anderson and Williams 1993), but afterwards the site fell into disuse (Pacific Worlds 2003a). 4. A trail once wound up Nu‘uanu Valley toward the Nu‘uanu Pali and then traversed the sheer rock cliffs to reach windward O‘ahu (‘Ī‘ī 1959:92). Parts of this steep path later became

	incorporated into the stone-paved horse trail in 1845, the newly constructed Pali Road in 1897, and recent improvements starting in 1952 that led to the existing Pali Highway that runs next to the Project area (Devaney et al. 1982). 5. The middle nineteenth century marked the introduction of private and public land ownership laws to Hawaiian society during the Māhele (division of Hawaiian lands). Most of the *‘ili* of Luakaha became Crown Lands, including the royal residence of Kaniakapūpū *makai* of the Project area. No Land Commision Awards were awarded in the current Project area (Waihona ‘Aina 2000). 6. There has been very limited development in the *‘ili* of Luakaha in the upper valley of Nu‘uanu during the twentieth century. The four reservoirs in Nu‘uanu Valley were constructed from 1890 to 1910 for hydropower, flood control, and domestic water (Hawai‘i DLNR 2010b). The Nu‘uanu Reservoir No. 4 was constructed between 1905 and 1910, and after modifications in 1934, it has since been used as a flood control structure by regulating the flow of Nu‘uanu Stream (Durkee 2008:2; Townscape, Inc. and Dashiell 2003:18). The reservoir has also been used for seasonal recreational fishing since 1969 for introduced channel catfish (Hawai‘i DLNR 2010b), and also supports freshwater clams, tilapia, and cichlids (Hollier 2007; Kawanami 2010). 7. A previously recorded oral history indicates that children in the early twentieth century swam in streams and went *ti*-leaf sliding in the lower valley *makai* of the Project area (Pacific Worlds 2003d).
Results of Community Consultation	CSH attempted to contact 28 community members and government agency and community organization representatives. Of the 16 people that responded, seven *kūpuna* (elders) and/or *kama‘āina* (Native-born) participated in formal interviews for more in-depth contributions to the CIA. This community consultation indicates: 1. *Mo‘olelo* (oral traditions) demonstrate that Nu‘uanu Valley is a place with deep ancestral and historical significance. From his reading of documented sources, Mr. Ching relates that Nu‘uanu Valley was a place of godly residence and travel, the location of the birth of the first human and the construction of the first *heiau*, the main passage between the *moku* (district) of Kona and Ko‘olaupoko, and the site of several historic battles.

	2. The site of Kaniakapūpū spans several time periods. Mr. Ching and Mr. Kalahiki share *mo‘olelo* of a *heiau* dedicated to Lono (the god of agriculture) and medicinal gardens maintained by *kahūna* (priests), and Mr. Ching identifies rock-lined *‘auwai* that once channeled water to *lo‘i kalo* (irrigated taro fields). Mr. Kalahiki narrates how Kamehameha I’s army rested at a waterfall near Kaniakapūpū during their ascent to their final battle at the Nu‘uanu Pali while the O‘ahu forces fatalistically fled toward a s ide valley *mauka* of Kaniakapūpū and the Nu‘uanu Reservoir No. 4 (likely Lulumahu Valley). Mr. Ching describes the construction of Kamehameha III’s summer palace at Kaniakapūpū, the elaborate commemoration of the fourth anniversary of Lā Ho‘iho‘i Ea, and the training of noble children for their future leadership roles. Now, the vision of ‘Ahahui Malama o Kaniakapūpū is to restore the site, document any features and artifacts outside the currently known boundary, and develop a cultural preservation and education center, including the cultivation of medicinal plants for *lā‘au lapa‘au* (traditional plant medicine). Mrs. Douglass recounts that Val Ching, another expert of Nu‘uanu Valley, previously mentioned to her that medicinal gardens were once maintained in the region, and that the spores of these plants most likely have survived and could be collected to restore the gardens. 3. Numerous archaeological and cultural sites are located in the forested region *makai* of the Nu‘uanu Reservoir No. 4 that may be connected culturally to Kaniakapūpū (see Figure 43). Mr. Ching, Ms. Cruz, Ms. Leinweber, and Ms. Hassager identify concentrations of *pōhaku* (stones), *laua‘e* (fragrant ferns), ti, and *‘ie‘ie* (endemic woody, branching climbers) near the reservoir’s spillway that indicate possible former habitation sites. In the dense bamboo forest farther *makai*, Mr. Ching identifies *‘ie‘ie*, a network of *‘auwai*, and a rock structure indicative of former habitation. Mr. Ching also identifies a three-to-five-foot high dry-stacked stone wall that extends from an area near the western portion of the reservoir’s access road approximately 1,000 feet to the trailhead leading toward Kaniakapūpū, noting a possible shrine at the wall and describing terraces and enclosures that abut the wall. Mr. Ching also identifies several large *pōhaku* in the dense forest that are indicative of former human activity, and based on pr evious excursions, he suggests that the entire region contains similar cultural features. Mr. Bayman is aware of other cultural features *mauka* of the main site of Kaniakapūpū, including a

	carriage road, a guard station, and a wall. Cultural sites may also continue farther *makai* of Kaniakapūpū. Mrs. Douglass remembers that a series of five stone terraces lined the properties adjacent to her grandmother's house (the second residence *makai* of Kaniakapūpū) and that cobbled stone trails traversed the region. 4. A cultural resource may still be located underneath the Nu‘uanu Reservoir No. 4. Mrs. Douglass notes that a freshwater spring was once located in the area now covered by the water of the reservoir. She describes how travelers had to provide a tithe for safe passage from the medicinal gardens of Kaniakapūpū to this *mauka* spring. 5. Childhood memories of Nu‘uanu Valley shared by Mrs. Douglass include playing with other missionary children in the gulch and shallow waters of Nu‘uanu Stream as well as climbing Luakaha Falls, and discovering the ruins of Kaniakapūpū. Ms. Falemei laments how development has impacted the landscape of Nu‘uanu since her childhood, especially the once freely flowing *wailele* (waterfalls), ever-present mist, and lush vegetation. 6. According to R.M. Towill Corporation, the proposed Project involves substantially draining the reservoir levels, which would result in approximately three acres of exposed sediment. Complimenting the vision of ‘Ahahui Malama o Kaniakapūpū to restore Kaniakapūpū and the surrounding area to former conditions of extensive irrigated taro cultivation, Mr. Ching recommends that the fertile sediment should be left in place and utilized as the base for *lo‘i kalo*. 7. Mr. Kāne is concerned that the Project may restrict the already diminished flow of Nu‘uanu Stream, while Ms. Leinweber is concerned that any overflow will directly impact the site of Kaniakapūpū. 8. To improve access to Kaniakapūpū in order to restore the structures and re-cultivate the land, Mr. Ching requests that the Honolulu Board of Water Supply grant ‘Ahahui Malama o Kaniakapūpū access to the gate and reservoir access road, and to grant permission to use the old water pipe access road that leads toward Kaniakapūpū from the spillway.

Impacts and Recommendations	Based on t he information gathered for the cultural and historic background and community consultation detailed in this CIA report, CSH foresees potential impacts of the proposed Project on N ative Hawaiian or other ethnic groups' cultural practices customarily and traditionally exercised for subsistence, cultural or religious purposes, and on cultural, historic, and natural resources, and makes the following recommendations: 1. Land- and water-disturbing activities may uncover cultural resources. The original construction plans for the reservoir indicate that a spring called Keiliohia was located in the Project area but was covered with the filling of the water for reservoir. An undated photograph indicates that an unidentified spring (possibly Keiliohia) inside the reservoir still flows at low water levels (see Figure 49). Keiliohia Spring may have been associated with agricultural and cultural practices; community participant Mrs. Douglass describes a trail that connected the medicinal gardens of Kaniakapūpū to this spring. Should historic, cultural or burial sites or artifacts be identified during ground disturbance, the construction contractor should immediately cease all work and the appropriate agencies notified pursuant to applicable law. 2. The Project may impact sites of cultural, historical, archaeological, and botanical interest. Kaniakapūpū is located about half a mile south of the Project area. Community participants Ms. Leinweber and Mr. Kāne are concerned that an increase or decrease in the flow of the Nu‘uanu Stream may adversely impact Kaniakapūpū. In addition, an exploratory excursion with members of ‘Ahahui Malama o Kaniakapūpū into the forested region immediately *makai* of the reservoir's spillway uncovered four potential habitation sites based on a combination of rock concentrations and nearby endemic plants used for cultural practices (*ti*, *‘ie‘ie*, *laua‘e*), and Mr. Ching described a stone wall near the western portion of the dam (see Figure 43). It is thus likely that other cultural sites are located *makai* of the dam in the dense bamboo forest, possibly within the extreme southern portion of the Project area, that could be connected culturally to Kaniakapūpū. If construction work extends into the forested region *makai* of the dam, a monitor should be present with particular botanical expertise in identifying vegetation indicative of former habitation. If such potential habitation sites are discovered, the construction contractor should implement best management practices to

	avoid impacting these cultural sites. 3. R.M. Towill Corporation should brief and consult with ‘Ahahui Malama o Kaniakapūpū, as well as other community members and organizations, as the Project design progresses. This on-going consultation should keep the community informed of any changes that could result in unanticipated adverse cultural impacts, and it could provide insights into alternative uses of the potential exposed sediment, particularly Mr. Ching’s recommendation to convert the area to *lo‘i kalo*.

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Section 1 Introduction

1.1 Project Background

At the request of R.M. Towill Corporation, Cultural Surveys Hawai‘i (CSH) is conducting a Cultural Impact Assessment (CIA) for the Nu‘uanu Reservoir No. 4 Project, Nu‘uanu Ahupua‘a, Honolulu District, O‘ahu Island (TMK: [1] 2-2-054:001) (Figure 1 to Figure 3). The ten-acre reservoir is located in Nu‘uanu Valley adjacent to the Pali Highway, State Route 61, approximately four miles northeast of downtown Honolulu.

The Nu‘uanu Reservoir No. 4 Dam consists of a 65-foot high earthen embankment dam with a 1,750-foot crest length and partial rip-rap on the upstream face. Appurtenances to the dam include an intake tower, outlet access tunnel, spillway, tower footbridge, access road, and monitoring wells (Figure 4). The reservoir has a normal pool storage capacity of 120 acre-feet with a surface area of 10 acres (Figure 5). Discharges from the dam flow into Nu‘uanu Stream and through the city of Honolulu before entering the Pacific Ocean at Honolulu Harbor.

The primary function of the existing Nu‘uanu Reservoir No. 4 Dam is to provide flood control from the 1.4 square mile watershed on the heavily vegetated leeward slopes of the Ko‘olau Mountains for Nu‘uanu Valley and part of downtown Honolulu that lies within the Nu‘uanu Stream corridor. The reservoir is also used for recreation and as a fresh water fish refuge by the Department of Land and Natural Resources (DLNR), Division of Aquatic Resources (DAR).

The purpose of the planned repair work is to meet dam safety requirements listed in the State of Hawai‘i DLNR Dam Safety Program inspection report (2010a) and the Phase 1 Investigation Report (Durkee 2008) on the Nu‘uanu Reservoir No.4. Planned repair work includes the following:

1. Removal and disposal of accumulated sediments at the base of the existing reservoir intake tower structure and repair and rehabilitation of the existing lower level sluice gate and operational controls;
2. Repair of three existing debris cages (trash racks) and lower level sluice gate on the intake tower;
3. Construction of measuring weirs at three existing seepage points on the downstream slope and outlet structure;
4. Dredging of outlet receiving area and installation of extension of outlet pipe;
5. Removal of the temporary access road located on the downstream face of the dam embankment and restoration of the embankment slope;
6. Repair and repaving of the existing reservoir access road on the top of the dam;
7. Inspection of the downstream slope and repair of the upstream slope rip-rap deficiencies and depressions;
8. Inspection and cleaning of the existing outlet tunnel structure;
9. Recalibrate/repaint water level markings on the existing intake tower; and
10. Creation of subdivision map for Nu‘uanu Reservoir No. 4.

Figure 1. Portion of the orthoimagery of the 1998 U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle showing the Project area

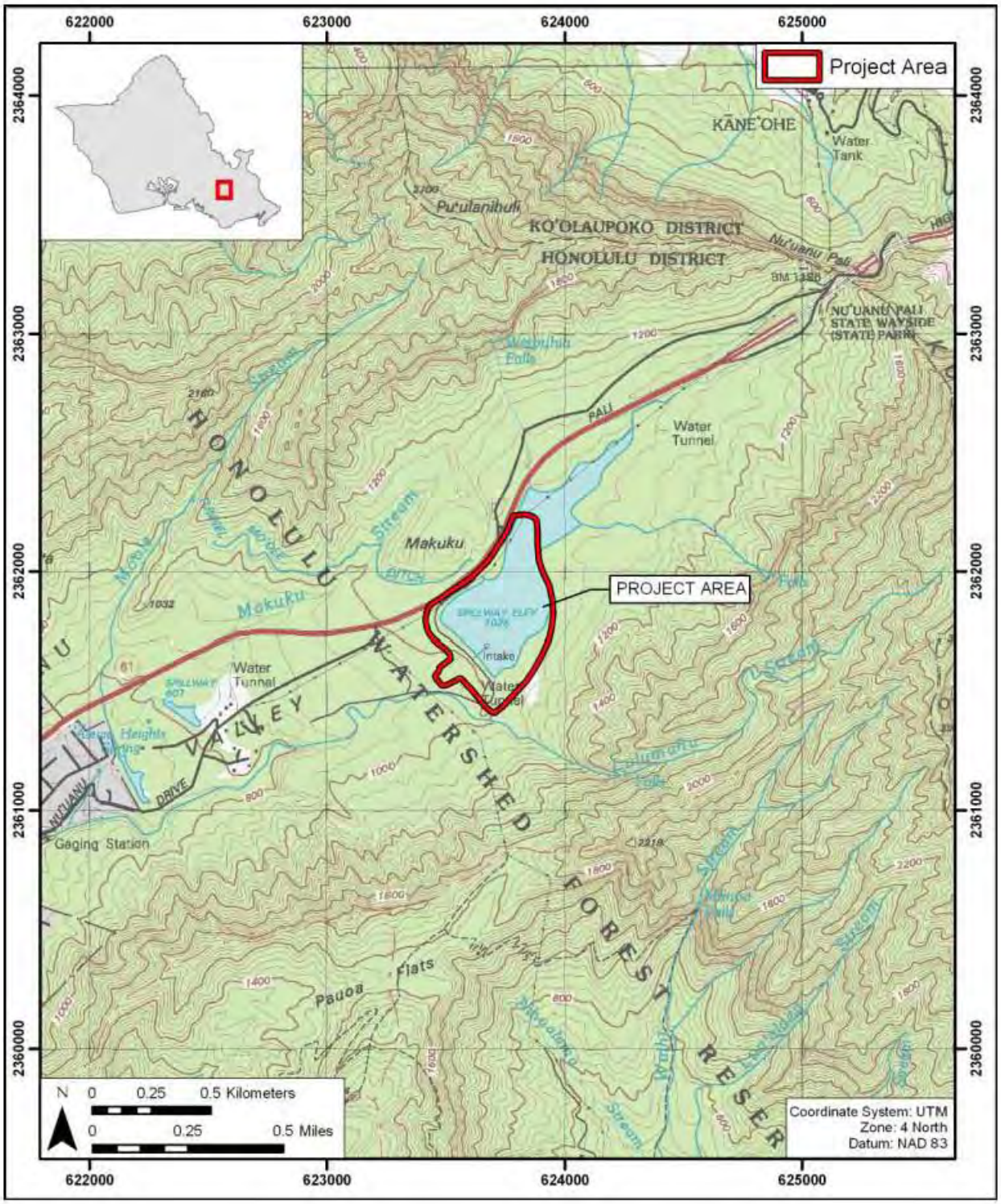

Figure 2. Portion of the 1998 USGS 7.5 minute topographic quadrangle showing the Project area

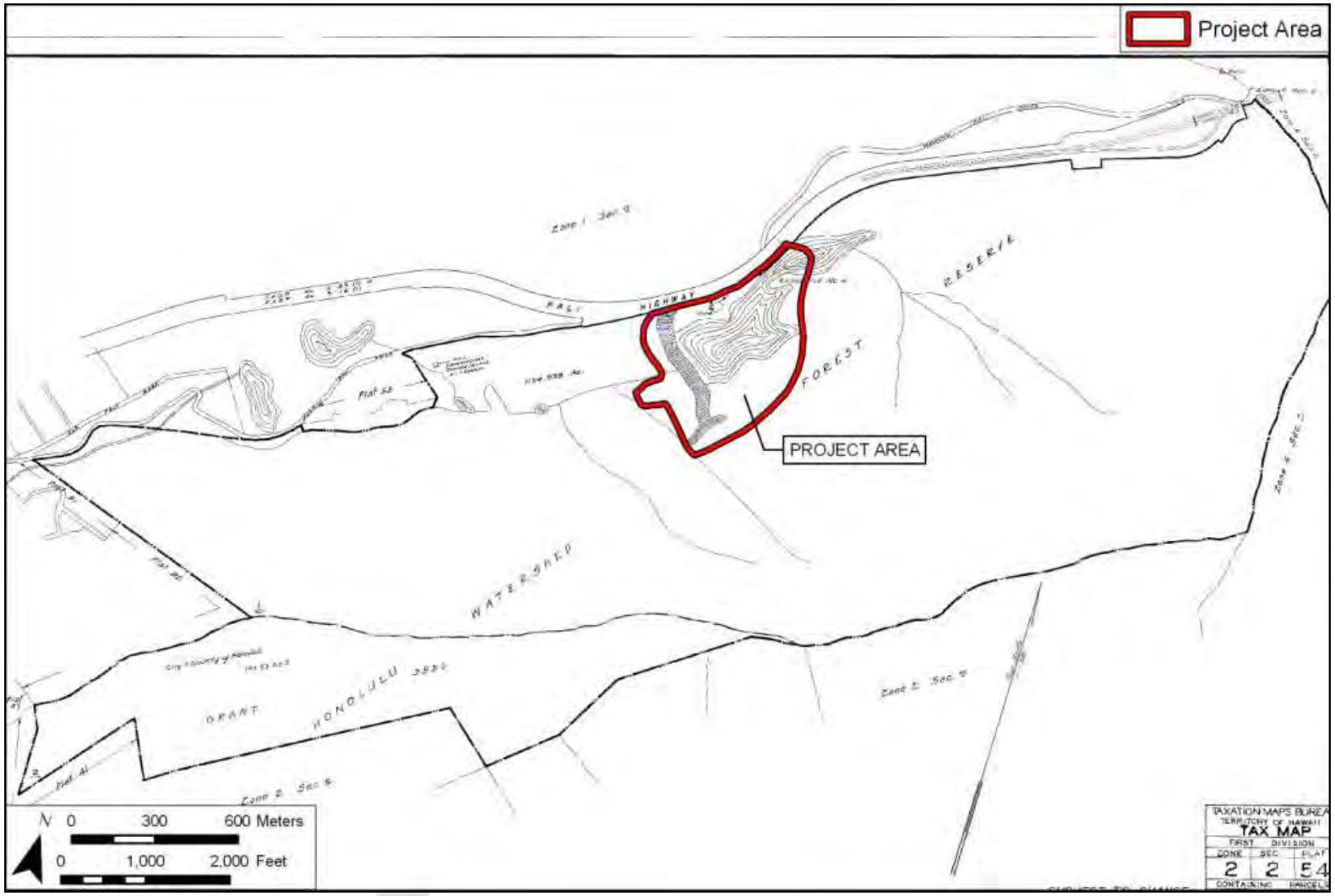

Figure 3. Tax Map Key (TMK): [1] 2-2-054 showing the Project area (Hawai‘i TMK Service 2010)

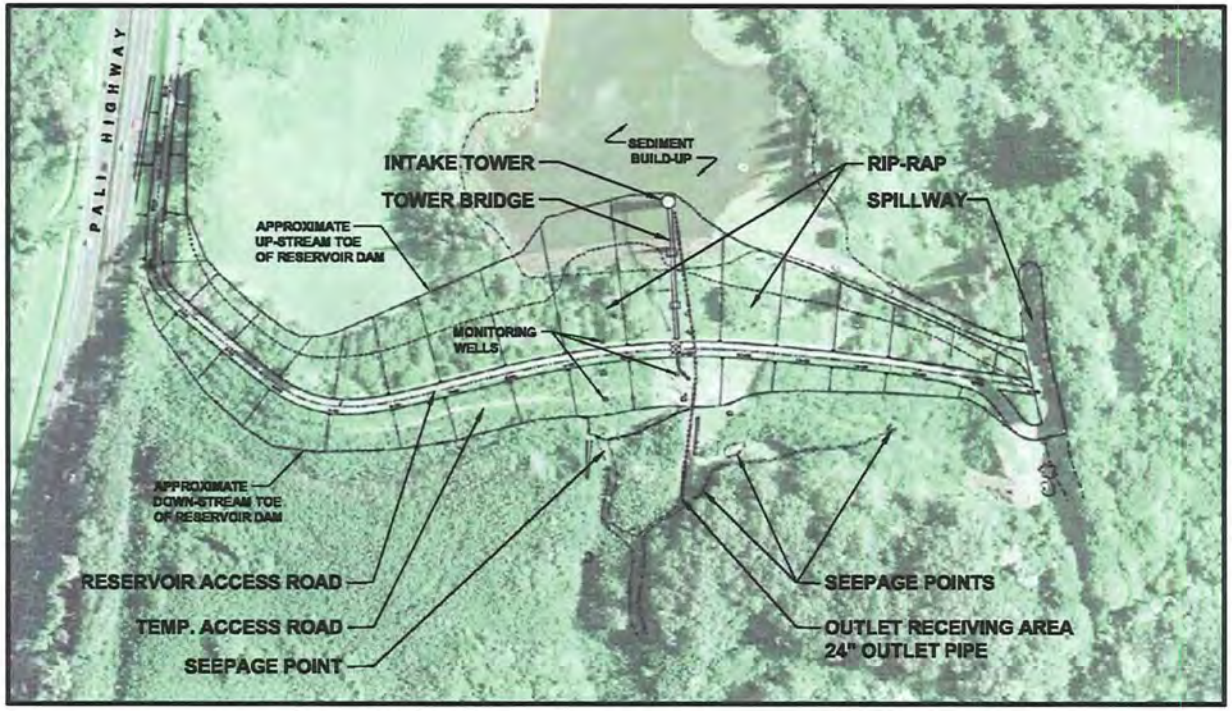

Figure 4. Existing Reservoir Dam Site (R.M. Towill Corporation 2010a)

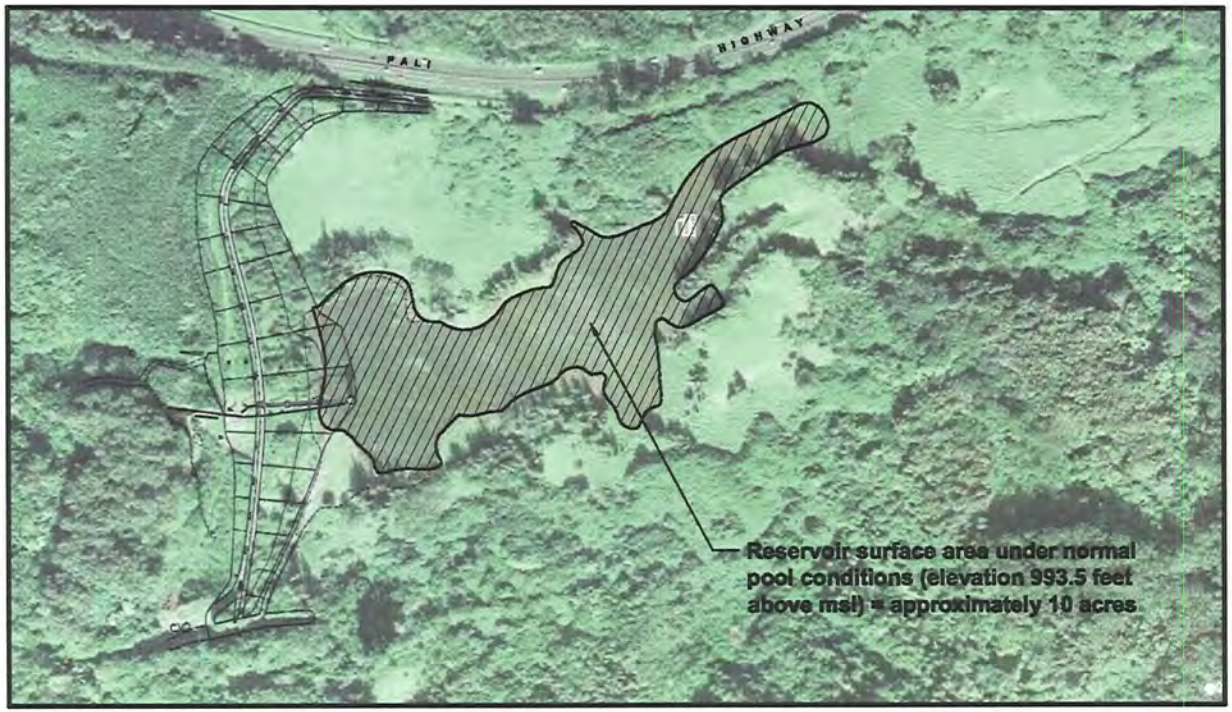

Figure 5. Reservoir Area (R.M. Towill Corporation 2010b)

1.2 Document Purpose

The Project requires compliance with the State of Hawai‘i environmental review process (Hawai‘i Revised Statutes [HRS] Chapter 343), which requires consideration of a proposed project’s effect on cultural practices. CSH is conducting this CIA at the request of R.M. Towill Corporation. Through document research and ongoing cultural consultation efforts, this report provides information pertinent to the assessment of the proposed Project’s impacts to cultural practices and resources (per the *Office of Environmental Quality Control’s Guidelines for Assessing Cultural Impacts*), which may include Traditional Cultural Properties (TCPs) of ongoing cultural significance that may be eligible for inclusion on the State Register of Historic Places, in accordance with Hawai‘i State Historic Preservation Statute (Chapter 6E) guidelines for significance criteria in Hawai‘i Administrative Rules (HAR) §13-275 under Criterion E, which states to be significant an historic property shall:

> Have an important value to the Native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group’s history and cultural identity.

This document is intended to support the Project’s environmental review and may also serve to support the Project’s historic preservation review under HRS Chapter 6E and HAR Chapter 13-275.

1.3 Scope of Work

The scope of work for this CIA includes:

1. Examination of cultural and historical resources, including Land Commission documents, historic maps, and previous research reports, with the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal, and other resources or agricultural pursuits as may be indicated in the historic record.
2. Review of previous archaeological work at and near the subject parcel that may be relevant to reconstructions of traditional land use activities; and to the identification and description of cultural resources, practices, and beliefs associated with the parcel.
3. Consultation and interviews with knowledgeable parties regarding cultural and natural resources and practices at or near the parcel; present and past uses of the parcel; and/or other practices, uses, or traditions associated with the parcel and environs.
4. Preparation of a report that summarizes the results of these research activities and provides recommendations based on findings.

1.4 Environmental Setting

1.4.1 Natural Setting

The amphitheater-shaped valley of Nu‘uanu on the leeward side of the Ko‘olau Mountain range is fronted by the coastal Honolulu Plain. The Project area is located in the upper portion of Nu‘uanu Valley.

1.4.2 Rainfall, Soil, and Vegetation

The upper portion of Nu‘uanu Valley receives heavy rainfall annually (1500 millimeters or 60 inches) (Giambelluca et al. 1986:73). The soil of the Project area consists of Lolekaa silty clay, with three to eight percent slopes (LoB) and 25 to 40 percent slopes (LoE) (Foote et al. 1972) (Figure 6). Lolekaa silty clay is well-drained soil on fans and terraces that developed in old colluviums and alluvium. For the lesser slopes, soil permeability is moderately rapid, runoff is slow, and the erosion hazard is slight (Foote et al. 1972:83). For the greater slopes, runoff is medium to rapid, and the erosion hazard is moderate to severe (Foote et al. 1972:84). Typical vegetation includes guava, Christmas berry, California grass, Hilo grass, and rice grass (Foote et al. 1972:83).

1.4.3 Built Environment

The Nu‘uanu Reservoir No. 4 Dam consists of a 65-foot high earthen embankment dam, an intake tower, outlet access tunnel, spillway, tower footbridge, access road, and monitoring wells.

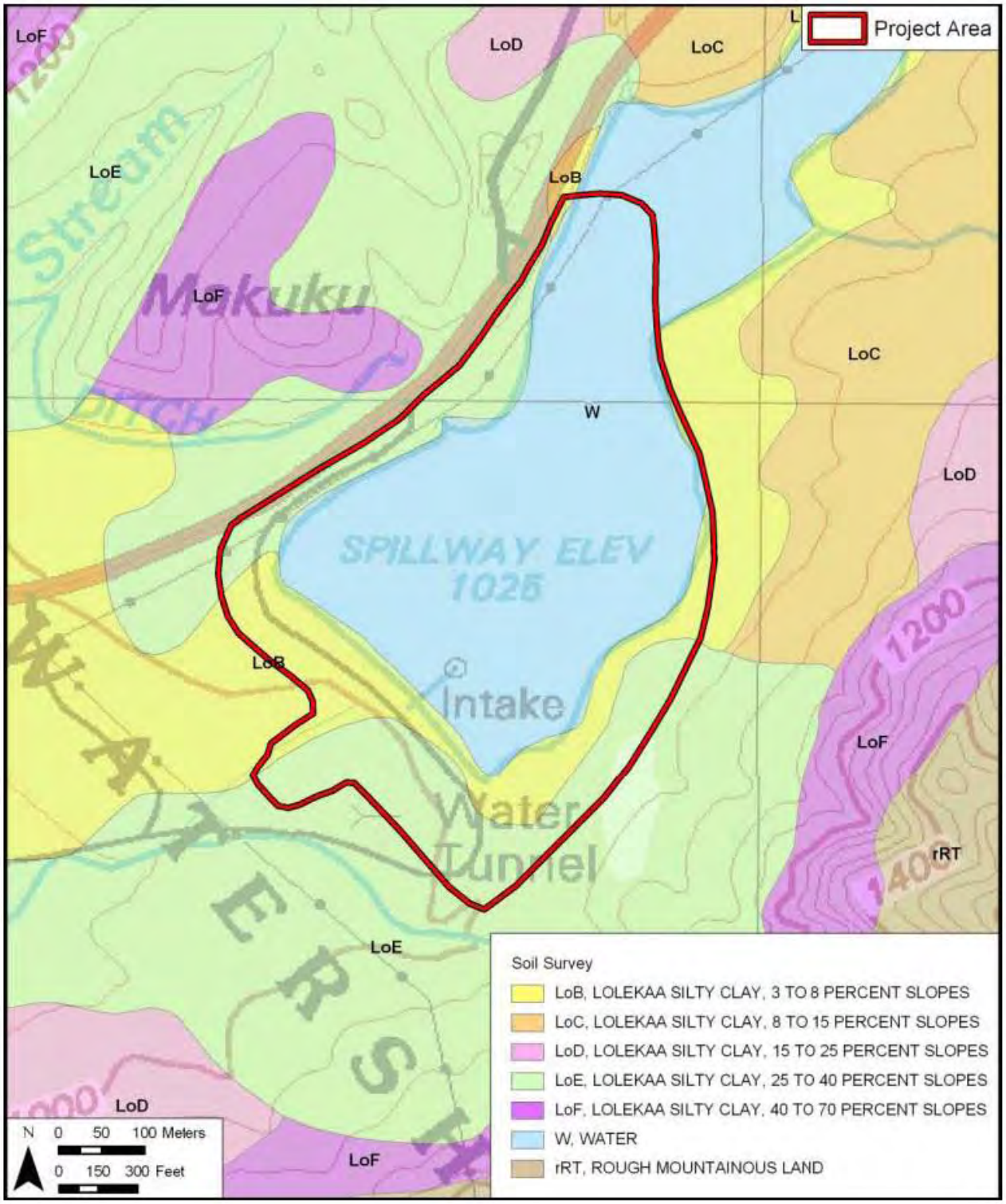

Figure 6. Portion of 1998 USGS 7.5-minute series topographic quadrangle showing the Project area with soil overlay (Foote el al. 1972)

Section 2 Methods

2.1 Archival Research

Historical documents, maps and existing archaeological information pertaining to Nu‘uanu were researched at the CSH library and other archives including the University of Hawai‘i at Mānoa’s Hamilton Library, the State Historic Preservation Division (SHPD) library, the Hawai‘i State Archives, the State Land Survey Division, and the archives of the Bishop Museum. Previous archaeological reports for the area were reviewed, as were historic maps and photographs and primary and secondary historical sources. Information on Land Commission Awards (LCAs) was accessed through Waihona ‘Aina Corporation’s Māhele Data Base (www.waihona.com) as well as a selection of CSH library references. Research for the Cultural and Historical Background section centered on the following cultural and historic resources, practices, and beliefs: religious and ceremonial knowledge and practices; traditional subsistence land use and settlement patterns; gathering practices and agricultural pursuits; *wahi pana* (storied places) and associated *mo‘olelo* (stories, oral traditions), *mele* (songs), *oli* (chants), and *‘ōlelo no‘eau* (proverbs); and historic land transformation, development, and population changes (see Scope of Work above).

2.2 Community Consultation

2.2.1 Sampling and Recruitment

A combination of qualitative methods, including purposive, snowball, and expert (or judgment) sampling, were used to identify and invite potential participants to the study. These methods are used for intensive case studies, such as CIAs, to recruit people that are hard to identify, or are members of elite groups (Bernard 2006:190). Our purpose is not to establish a representative or random sample. It is to “identify specific groups of people who either possess characteristics or live in circumstances relevant to the social phenomenon being studied….This approach to sampling allows the researcher deliberately to include a wide range of types of informants and also to select key informants with access to important sources of knowledge” (Mays and Pope 1995:110).

We began with purposive sampling informed by referrals from known specialists and relevant agencies. For example, we contacted the SHPD, Office of Hawaiian Affairs (OHA), O‘ahu Island Burial Council (OIBC), and community and cultural organizations in Nu‘uanu for their brief response/review of the Project and to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the project area and vicinity, cultural and lineal descendants of Nu‘uanu, and other appropriate community representatives and members. Based on their in-depth knowledge and experiences, these key respondents then referred CSH to additional potential participants who were added to the pool of invited participants. This is snowball sampling, a chain referral method that entails asking a few key individuals (including agency and organization representatives) to provide their comments and referrals to other locally recognized experts or stakeholders who would be likely candidates for the study (Bernard 2006:192). CSH also employs expert or judgment sampling which involves assembling a group

of people with recognized experience and expertise in a specific area (Bernard 2006:189–191). CSH maintains a database that draws on over two decades of established relationships with community consultants: cultural practitioners and specialists, community representatives and cultural and lineal descendants. The names of new potential contacts were also provided by colleagues at CSH and from the researchers' familiarity with people who live in or around the study area. Researchers often attend public forums (e.g., Neighborhood Board, Burial Council and Civic Club meetings) in (or near) the study area to scope for participants. Please refer to Table 1, Section 4, for a complete list of individuals and organizations contacted for this CIA.

CSH focuses on obtaining in-depth information with a high level of validity from a targeted group of relevant stakeholders and local experts. Our qualitative methods do not aim to survey an entire population or subgroup. A depth of understanding about complex issues cannot be gained through comprehensive surveying. Our qualitative methodologies do not include quantitative (statistical) analyses, yet they are recognized as rigorous and thorough. Bernard (2006:25) describes the qualitative methods as "a kind of measurement, an integral part of the complex whole that comprises scientific research." Depending on the size and complexity of the project, CSH reports include in-depth contributions from about one-third of all participating respondents. Typically this means three to twelve interviews.

2.2.2 Informed Consent Protocol

An informed consent process was conducted as follows: (1) before beginning the interview the CSH researcher explained to the participant how the consent process works, the Project purpose, the intent of the study and how his/her information will be used; (2) the researcher gave him/her a copy of the Authorization and Release Form to read and sign (Appendix C); (3) if the person agreed to participate by way of signing the consent form or providing oral consent, the researcher started the interview; (4) the interviewee received a copy of the Authorization and Release Form for his/her records, while the original is stored at CSH; (5) after the interview was summarized at CSH (and possibly transcribed in full), the study participant was afforded an opportunity to review the interview notes (or transcription) and summary and to make any corrections, deletions or additions to the substance of their testimony/oral history interview; this was accomplished either via phone, post or email or through a follow-up visit with the participant; (6) the participant received the final approved interview and any photographs taken for the study for record. If the participant was interested in receiving a copy of the full transcript of the interview (if there is one as not all interviews are audio-recorded and transcribed), a copy was provided. Participants were also given information on how to view the report on the OEQC website and offered a hardcopy of the report once the report is a public document.

2.2.3 Interview Techniques

To assist in discussion of natural and cultural resources and cultural practices specific to the study area, CSH initiated semi-structured interviews (as described by Bernard 2006) asking questions from the following broad categories: cultivation, gathering practices and *mauka* (inland) and *makai* (seaward) resources, burials, trails, historic properties, and *wahi pana*. The interview protocol is tailored to the specific natural and cultural features of the landscape in the study area identified through archival research and community consultation. For example, for

this study, cultivation, fishing, and gathering practices were emphasized over other categories less salient to Project participants. These interviews and oral histories supplement and provide depth to consultations from government agencies and community organizations that may provide brief responses, reviews and/or referrals gathered via phone, email and occasionally face-to-face commentary.

2.2.3.1 In-depth Interviews and Oral Histories

Interviews were conducted initially at a place of the study participant's choosing (usually at the participant's home or at a public meeting place) and/or—whenever feasible—during site visits to the Project area. Generally, CSH's preference is to interview a participant individually or in small groups (two–four); occasionally participants are interviewed in focus groups (six–eight). Following the consent protocol outlined above, interviews may be recorded on tape and in handwritten notes, and the participant photographed. The interview typically lasts one to four hours, and records the—who, what, when and where of the interview. In addition to questions outlined above, the interviewee is asked to provide biographical information (e.g., connection to the study area, genealogy, professional and volunteer affiliations, etc.).

2.2.3.2 Field Interviews

Field interviews are conducted with individuals or in focus groups comprised of *kūpuna* (elder) and *kama‘āina* (Native-born) who have a similar experience or background (e.g., the members of an area club, elders, fishermen, *hula* dancers) and who are physically able and interested in visiting the Project area. In some cases, field visits are preceded with an off-site interview to gather basic biographical, affiliation and other information about the participant. Initially, CSH researchers usually visit the project area to become familiar with the land and recognized (or potential) cultural places and historic properties in preparation for field interviews. All field activities are performed in a manner so as to minimize impact to the natural and cultural environment in the project area. Where appropriate, Hawaiian protocol may be used before going on to the study area and may include the *ho‘okupu* (offering) of *pule* (blessing), and *oli*. All participants on field visits are asked to respect the integrity of natural and cultural features of the landscape and not remove any cultural artifacts or other resources from the area. In this study, CSH used a Garmin Global Positiong Sytem (GPS) handheld unit during the site visits to record the locations of various cultural sites.

2.3 Compensation and Contributions to Community

Many individuals and communities have generously worked with CSH over the years to identify and document the rich natural and cultural resources of these islands for cultural impact, ethno-historical and, more recently, TCP studies. CSH makes every effort to provide some form of compensation to individuals and communities who contribute to cultural studies. This is done in a variety of ways: individual interview participants are compensated for their time in the form of a small honorarium and/or other *makana* (gift); community organization representatives (who may not be allowed to receive a gift) are asked if they would like a donation to a Hawaiian charter school or nonprofit of their choice to be made anonymously or in the name of the individual or organization participating in the study; contributors are provided their transcripts,

interview summaries, photographs and—when possible—a copy of the CIA report; CSH is working to identify a public repository for all cultural studies that will allow easy access to current and past reports; CSH staff do volunteer work for community initiatives that serve to preserve and protect historic and cultural resources (for example in, Lāna‘i and Kaho‘olawe). Generally our goal is to provide educational opportunities to students through internships, share our knowledge of historic preservation and cultural resources and the State and Federal laws that guide the historic preservation process, and through involvement in an ongoing working group of public and private stakeholders collaborating to improve and strengthen the Chapter 343 environmental review process.

Section 3 Cultural and Historical Background

This section draws from archaeology, ethnography, and an archive of historic documents and images to present a portrait of Hawaiian culture and history as it relates to the specific Project area. Focusing in on geographic and temporal scales, this section first traces the exploration of the Pacific Ocean and the subsequent discovery, settlement, and expansion of the Hawaiian archipelago. This broad overview of Hawaiian history introduces key concepts and terms used throughout the report and leads to a focused history of Nu‘uanu Ahupua‘a with emphasis on the Project area, including the earliest known settlement and subsistence patterns, a compilation of *wahi pana* and associated *mo‘olelo*, successions of chiefly rule, the introduction of private property, and contemporary land use.

3.1 Discovery, Settlement, and Expansion of the Hawaiian Islands

By 10,000 years ago, humans had migrated to occupy nearly all the habitable land on the planet. Aside from crossing a series of short water gaps to reach Australia and New Guinea, they had reached it all by walking. The remaining unexplored region was the vast Pacific Ocean. Approximately 4,500 years ago, coastal dwellers of southeast China began a wave of migration through the closely-spaced, inter-visible islands of Southeast Asia. Advances in sailing strategies, canoe technology, and navigation techniques enabled their descendents to sail past the familiar insular waters a millennium later. These precocious seafarers systematically explored the remote, uninhabited regions of the Pacific Ocean to the east, as well as the Indian Ocean to the west. This led to the eventual discovery and colonization of virtually every habitable island in the Pacific Ocean, as well as coastal trading along the Indian sub-continent and settlement as far west as Madagascar (Howe 2007; Irwin 2007).

The ancient wayfinders most likely employed an expansionary strategy of first staging a series of exploratory probes to find likely islands, followed by returns to the homeland, and then launching colonizing expeditions (Irwin 1992). To do so, they sailed their double-hulled voyaging canoes eastward against the direction of the dominant trade winds by waiting for westerly wind shifts. After mentally mapping the positions of newly discovered islands in terms of celestial referents, they returned to their homelands to share the sailing directions for future voyages of colonization (Finney 1996). As most of the Pacific Islands are volcanic in origin, the exploratory seafarers, also horticulturalists, necessarily transported a landscape of plants. They brought with them taro, yams, breadfruit, bananas, and coconuts, as well as domesticated pigs, dogs, and chickens, and, possibly with intention, rats (Irwin 2007; Kirch 2000).

Later voyagers discovered and settled the distant archipelagoes of western Polynesia (e.g., Samoa, Tonga, and Fiji), the northwestern archipelagoes of Micronesia (e.g., Marshall Islands and Caroline Islands), and eastern Polynesia (e.g. Tahiti and Marquesas), and from there settled the widely-separated archipelagoes of Hawai‘i and Aotearoa as well as the solitary island of Rapa Nui (Irwin 2007; Kirch 2000). Finney (2007:145) suggests that a waxing and waning rhythm of voyaging characterized the large, high-island archipelagoes of eastern Polynesia: “a flurry of back and forth sailings as the islands are being discovered, settled and supplied; then

some continued long-range travel for personal, religious or other reasons; and then by a contraction of voyaging as populations grew and rival chiefdoms fought over land and power."

Archeological excavations, linguistic reconstructions, and genetic studies suggest that the initial settlement of Hawai‘i came from eastern Polynesia (Kirch 2000) around A.D. 700–800 (Athens et al. 2002). *Mo‘olelo* link Hawai‘i to Kahiki—the generic word for the ancestral homeland of Hawaiians, not a specific island—through accounts of the discovery of certain Hawaiian islands and subsequent inter-archipelago return trips (Beckwith 1970). The first settlers of Hawai‘i from within the region of Kahiki were probably from the Marquesas Islands (Kirch 2000:291). The archaeological record suggests that early Hawaiians formed settlements of hamlets along the coasts, interred the dead, ate domesticated pigs, dogs, and chickens, and began to clear tracts of forest between A.D. 600–1100 (Kirch 2000:293).

The early settlers of the Hawaiian archipelago would have been especially attracted to windward O‘ahu with its coral reefs, bays, and sheltered inlets for fishing, dense basalt dikes for the production of stone adzes and other tools, and amphitheatre-headed valleys and broad alluvial floodplains that contained fertile soils, numerous permanently flowing streams, and abundant rainfall for the cultivation of crops (Kirch 1985:69). Excavation data from the coastal region of Waimānalo provide a glimpse into the life of the settlers' descendants. The Bellows Beach sand dune occupation site (O18) reveals a particularly rich cultural stratigraphy that has recently been radiocarbon dated after 40 years of dispute (e.g., Dye 2000; Kirch 1985:71; Pearson et al. 1971; Tuggle and Spriggs 2001) to A.D. 1040–1219 (Dye and Pantaleo 2010), several centuries after the current estimates of first settlement. Archaeological excavation data from this site indicate that the settlers' descendants, like their east Polynesian ancestors, lived in pole-and-thatch dwellings, interred the dead beneath these structures, cooked in small hearths, and manufactured stone tools as well as bone and shell fishhooks, and supported themselves by cultivating inland crops, raising domesticated animals, hunting seabirds on of fshore islets, fishing, and gathering shellfish (Kirch 1985:71–74). As they adapted to local conditions, they invented distinctive Hawaiian artifacts, including two-piece fishhooks and the *lei niho palaoa* (*lei* of rock oyster shell), which, in addition to other ornaments interred with individuals, suggests a degree of social stratification (Kirch 1985:71–74). Hawaiians also cared for the dead with a variety of *ilina* (burials, graves) depending on the social status of the deceased, including cremation burials, burial caves, burials in the sand and earth, burials directly underneath house floors, burials in the platforms of *heiau* (sacred place of worship, temple), and burials marked on the surface by stone terraces, mounds, platforms, and other monuments (Kirch 1985:238–242).

New fishhook styles discovered in Hawaiian archaeological sites and Tahitian words entering into the Hawaiian language suggest contact with Tahiti around A.D. 1200 (Kirch 2000:291). In addition, numerous *mo‘olelo* chronicle the era of two-way voyaging between the archipelagoes of Tahiti and Hawai‘i by detailing the feats of specific navigators (Cachola-Abad 1993). The Hawai‘i-Tahiti voyaging corridor eventually ceased as Hawaiians and Tahitians began to focus more on local initiatives, such as building, maintaining, and deploying fleets of war canoes rather than guiding them on overseas adventures (Finney 2007:145). According to Fornander's (1878:168–169) synthesis of *mo‘olelo*, the *ali‘i* (chief) La‘amaikahiki closed the era of voyaging between Tahiti and Hawai‘i when he returned to his ancestral homeland 21 generations before

the 1870s. With an average of 20 years between generations, that places the cessation of Hawaiian long-distance voyaging at about A.D. 1450 (Fornander 1878:168–169).

The archaeological record suggests that Hawaiians experienced exponential population growth, intensification of production, and increased social stratification around A.D. 1100–1650. Hawaiians converted valley floors and hillsides to *lo‘i* (terraced fields) with *‘auwai* (canals and ditches) that diverted stream water to irrigate *kalo* (taro) and other crops in flooded pond fields, developed dryland field systems for the cultivation of *‘uala* (sweet potato) and other crops, and constructed stone-walled *loko i‘a* (fishponds) on shallow reef flats to grow and harvest fish (Kirch 2000:293–295). By A.D. 1600, the population, which had burgeoned to at least several hundred thousand people, expanded from the fertile windward regions into the most arid and marginal regions of the archipelago—the leeward valleys and coasts (Kirch 2007). This agricultural and aquacultural intensification supported emerging classes of *ali‘i* and *maka‘āinana* (commoners), whose labor created enduring *heiau* and other monumental architecture that survive in the archaeological record (Kirch 2000:295–296).

The original settlers and their descendents had likely organized themselves into kin-based social groups. The necessity of defining territorial boundaries increased as the population rapidly grew, the amount of available land diminished, voyaging spheres contracted, and the society became more differentiated, hierarchical, and competitive (Kirch 1985:306). The original lineage territories and associated chiefdoms were most likely *moku‘āina*, or *moku*, (districts) that were sequentially divided (Ladefoged and Graves 2006). Between A.D. 1400–1500, Hawaiians developed a hierarchically nested system of land tenure that centered on the *ahupua‘a*, a territorial unit that typically extended from the peaks of the mountains down to the sea, encompassing the entire ecology of an island and incorporating its main resource zones, including interior uplands and mountains, coastal lowlands, and fringing reefs (Kirch 2000:296). The *maka‘āinana* remained on the land they cultivated, but *ali‘i* governed this *ahupua‘a* pattern of territorial units. These *ahupua‘a* territories changed through time; the regions in a *moku* with greater predictability of resources were most likely settled first and defined according to topographic features, and later divided into separate communities if increases in production could support larger populations (Ladefoged and Graves 2006). Then, on the eve of European contact (1778), critical transformations in the social structure took place that shifted Hawai‘i from a chiefdom to an emerging state-level society, especially the rise of divine kingship legitimated in new religious ideologies (the state cults of the gods Kū and Lono) with a formal priesthood (including human sacrifice) and maintained by a monopoly of force (Kirch 2010).

3.2 Nu‘uanu Ahupua‘a

Based on the distribution of sites in the most arid and marginal lands, virtually all of O‘ahu was territorially claimed and possibly occupied by A.D. 1650 (Kirch 1992:15). O‘ahu was divided into six *moku*—Kona, ‘Ewa, Wai‘anae, Waialua, Ko‘olauloa, and Ko‘olaupoko—that were further divided into 86 *ahupua‘a* (Kame‘eleihiwa 1992:330). These lands, in turn, were further divided as private property during the Māhele of 1848, but modern maps and land boundaries still generally follow the ancient system of land division. The Project area lies in the *‘ili* (land division smaller than an *ahupua‘a*) of Luakaha in Nu‘uanu Valley in Nu‘uanu Ahupua‘a in the central portion of Honolulu (Kona) District on the island of O‘ahu. Nu‘uanu

Valley contains archaeological sites indicative of ancient habitation and subsistence, as well as numerous other *wahi pana* (Figure 7).

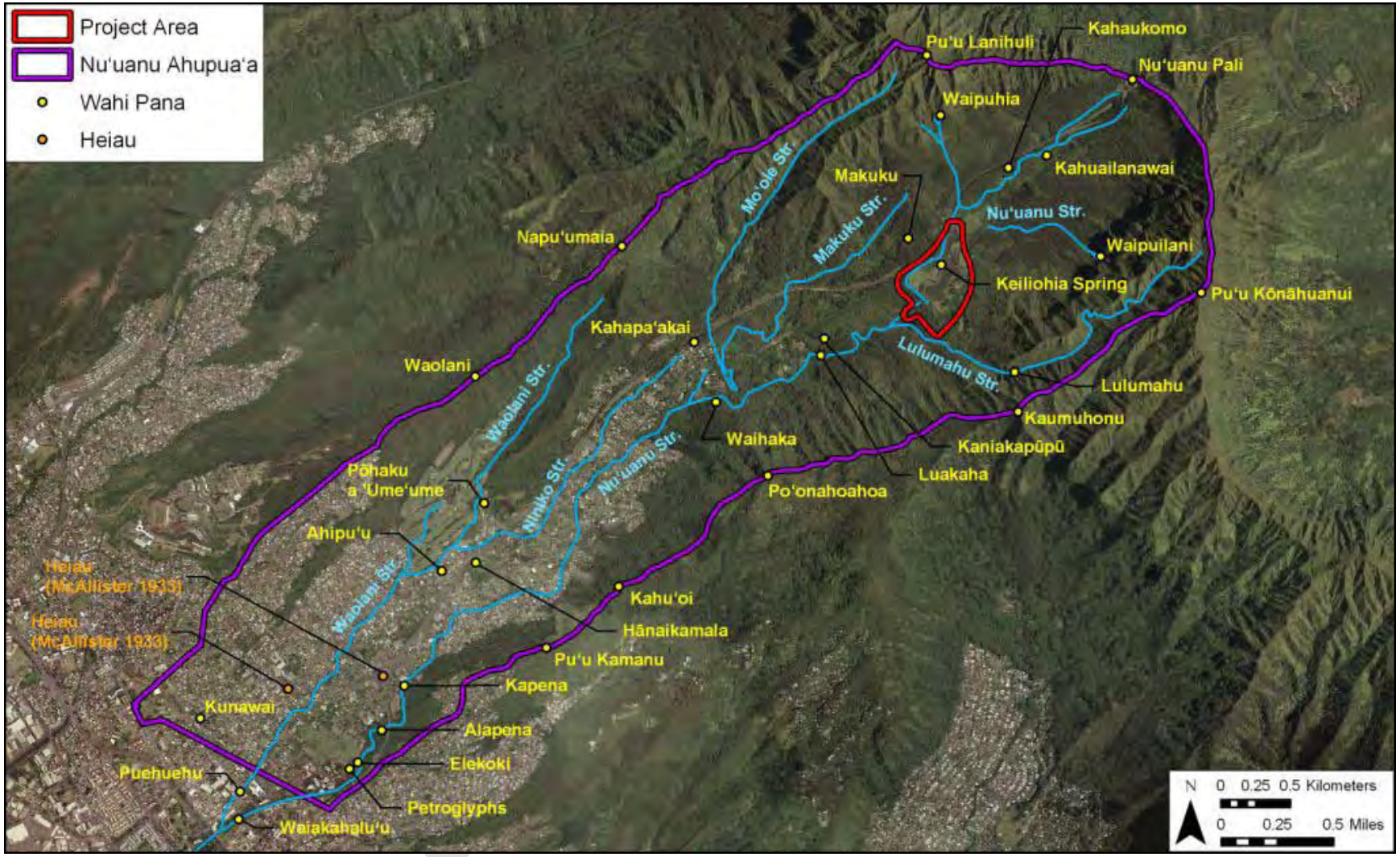

Figure 7. *Wahi pana* of Nu‘uanu Ahupua‘a (base image, orthoimagery of the 2004–2005 USGS 7.5-minute topographic quadrangle)

3.2.1 Habitation and Subsistence

Substantial populations and permanent settlements were likely located close to the mouth of Nu‘uanu Stream at the coastal Kou village, as coastal residents constructed fishponds in Honolulu Bay and developed wetland agriculture, while more modest permanent habitation may have been located downstream of the Project area (Dixon et al. 1994:7). Archaeological surveys, historic observations, *mo‘olelo*, and *‘ōlelo no‘eau* converge on the notion that Nu‘uanu Valley was an important region for cultivation, especially taro. The following *‘ōlelo no‘eau* indicates that Nu‘uanu provided much of the food for the residents of the traditional village of Kou (Honolulu):

> *Ho‘a ke ahi, kō‘ala ke ola. O na hale wale no ka i Honolulu; o ka ‘ai a me ka i‘a i Nu‘uanu.*
>
> Light the fire for there is life-giving substance. Only the houses stand in Honolulu; the vegetable food and meat are in Nu‘uanu.
>
> This proverb shows an evident expression of affection for Nu‘uanu. In olden days, much of the taro lands were found in Nu‘uanu, which supplied Honolulu with poi [pounded taro], taro greens, ‘o‘opu [goby], and freshwater shrimp. So it is said that only houses stand in Honolulu; it is the food that comes from Nu’uanu. (Pukui 1983:109)

Archaeoalogical surveys have documented remnants of *‘auwai*, terraces, and walls (SIHP No. 50-80-14-9916; Yent and Ota 1980) *makai* of Hānaiakamalama (Queen Emma’s Summer Palace) and in lower Nu‘uanu Valley (Leidemann 1989, 1991). John Papa ‘Ī‘ī (1959:68–69), a chief and retainer in the royal court of Kamehameha I and Liholiho (Kamehameha II), recalled a visit to lower Nu‘uanu Valley as a child, and describes the construction and use of irrigated pondfields for taro. The Russian explorer Otto von Kotzebue (1967:339–342) also recorded large taro patches and *‘auwai* in the lower valley near the coast and that extended toward the mountains in 1817. The early nineteenth century residents of Nu‘uanu Valley also cultivated bananas, *‘awa* (kava), *wauke* (paper mulberry), sugarcane, and *olonā* (a native shrub) (Kamakau 1992:291), and E.S. Craighill Handy (1940:78–79) and his wife (Handy and Handy 1972:475) observed remnants of ancient terraces on the gentle sloping land between Nu‘uanu and Waolani Streams in the lower valley and along the streams in the upper valley, as well as gardens. It appears that irrigated, pondfield cultivation of taro with *‘auwai* did not extend as far *mauka* as the Project area; terraces in the region would have likely been used for dryland taro or sweet potato (Dixen et al. 1994:12).

3.2.2 Wahi Pana

A Hawaiian *wahi pana* “physically and poetically describes an area while revealing its historical or legendary significance” (Landgraf 1994:v). *Wahi pana* are sacred places that include such cultural properties as *heiau*, *loko i‘a*, *ala hele* (trails), *ilina* and *iwi kūpuna* (ancestral bone remains), land divisions, and natural geographic locations, such as streams, peaks, rock formations, ridges, and offshore islands and reefs that are associated with culturally significant

beliefs or events. A *wahi pana* leaves an imprint on the landscape even if its tangible properties no longer exist, as the *mana* (divine power) of previous people and events associated with this space continues to manifest itself. For example, the stereotypical *heiau* is composed of terraces, enclosures, walls, mounds, or upright stones, but *heiau* can also be sacred places on a landscape that lack built structures, natural landscape features such as rock outrcoppings, and earthworks where *mana* is concentrated and transferred between the deities and worshippers (Becket and Singer 1999:xix–xx).

The *wahi pana* of Nu‘uanu link the *kama‘āina* and *kūpuna* to their past. This section traces the *wahi pana* from the mountain peaks to the lowland valley. The following measures clarify these *wahi pana*: the locations of the cultural properties are bolded in the text and labeled (see Figure 7) if their locations are known; all *wahi pana* meanings are cited from Pukui et al. (1974) unless otherwise noted; and spelling and use of diacriticals follow Pukui et al. (1974).

3.2.2.1 Place Names

The name **Nu‘uanu** (cool height) may derive from the contraction of *nuku* (mountain pass) to reference the cold wind near the summit at the Pali (Lyons 1901:181). The lower portion of Nu‘uanu Valley is comprised of the *‘ili* of **Kunawai** (pool of the eel), **Kaliu**, **Pu‘unui** (big hill), **Kaukahoku**, **Kawānanakoa** (the fearless prophecy), **Niolopa**, **La‘imi** (day [of] seeking), **Pū‘iwa** (the startled), **Waolani** (heavenly mountain area), and **Kahapa‘akai** (salt place), and the upper part of Nu‘uanu Valley is comprised of the forested *‘ili* of **Luakaha** (place for relaxation) (Lyons 1874). The Project area is located within the *‘ili* of Luakaha.

Nu‘uanu Valley is watered by two main streams, the **Nu‘uanu Stream** and the **Waolani Stream** (once called Pūehuehu Stream), and by several tributaries streams, including **Lulumahu**, **Makuku**, **Mo‘ole**, **Niniko**, and **Kauhipuna**. In the vicinity of the Project area, two waterfalls, **Waipuilani** (water spout) and **Waipuhia** (blown water; now called “Upside Down Falls”), feed Nu‘uanu Stream, which leads to another waterfall, **Luakaha**, downstream of the Project area, and another waterfall, **Lulumahu**, feeds Lulumahu Stream. Pools along the various streams include **Kahuailanawai** (site of tranquil water), **Pueheuhu** (spray scattered), **Waihi**, **Waihaka**, **Kapena** (the package), **Alapena**, **‘Alekoki** (Elekoke; short ripples), **Kunawai**, **Waiakahalu‘u**, and **Kamanuwai** (the water bird). The original construction plans (1907) for the Nu‘uanu Reservoir No. 4 indicate that a spring called **Keiliohia** was located in the Project area, but was covered with the filling of the water for the reservoir (image supplied by R.M. Towill Corporation).

The mountainous sections of Nu‘uanu Valley contain *wahi pana* connected to the stunning landscape, with towering *pu‘u* (peaks) overlooking the upland forests, as well as smaller hills and valleys. Towering above the northern *mauka* section of Nu‘uanu Valley are the peaks of **Pu‘u Kōnāhuanui** (large fat innards) and **Pu‘u Lanihulu** (where the heavens change), which describes the abrupt changes in the winds at the peak (Raphaelson 1925). Nestled between these two peaks is **Ka Nuku** (Figure 8), the *nuku* (pass) that leads to the **Nu‘uanu Pali**. Smaller peaks and ridges include **Napu‘umaia** (the banana hills) and **Waolani** (heavenly mountain area) on the west side of the valley; **Kaumuhonu**, **Po‘onahoahoa**, **Kahu‘oi**, and **Pu‘u Kamanu** (bird hill) on the east side; and **Makuku** and **Ahipu‘u** (hill fire) in the central area.

A ***hōlua*** (slide) was located at the end of the ridge dividing the valleys of Waolani and Nu‘uanu (McAllister 1933:86). Several *pōhaku* (rocks) with **petroglyphs** of human figures and animals are located near the pool called Alapena (McAllister (1933:83–34). *Mo‘olelo* describe how *menehune* (legendary race of small people) contended for the possession of a *pōhaku* called **Pōhaku a ‘Ume‘ume** (stone of contention), which was hurled back and forth between Waolani and Kupanihi (Pacific Heights) (Notes from John A. Cummins, Hawaiian Ethnological Notes, Vol. II:204, cited in Sterling and Summers 1978:303).

Mauka of the Project area is a region called **Kahaukomo** (the *hau* [Hibiscus] trees begin). In these *hau* groves awaited bandits who ambushed and sometimes killed travelers heading to and from the Nu‘uanu Pali (Raphaelson 1929:11). Two *pōhaku* named **Hapu‘u** and **Kala‘iola** located in Kahaumoko *mauka* of the *hau* grove and *makai* of the pool Kahuailanawai were female guardians of the *nuku* of the Nu‘uanu Pali that could grant safe passage to travelers scaling the precipice (Hawaiian Ethnological Notes, Volume I:820, cited in Sterling and Summers 1978:313). In addition, **Kahapa‘akai** (salt place) is the name of a place with a *ko‘a* (shrine) and associated petroglyphs, as well as a nearby spring, in the upper valley (Becket and Singer 1999:22) (Figure 9).

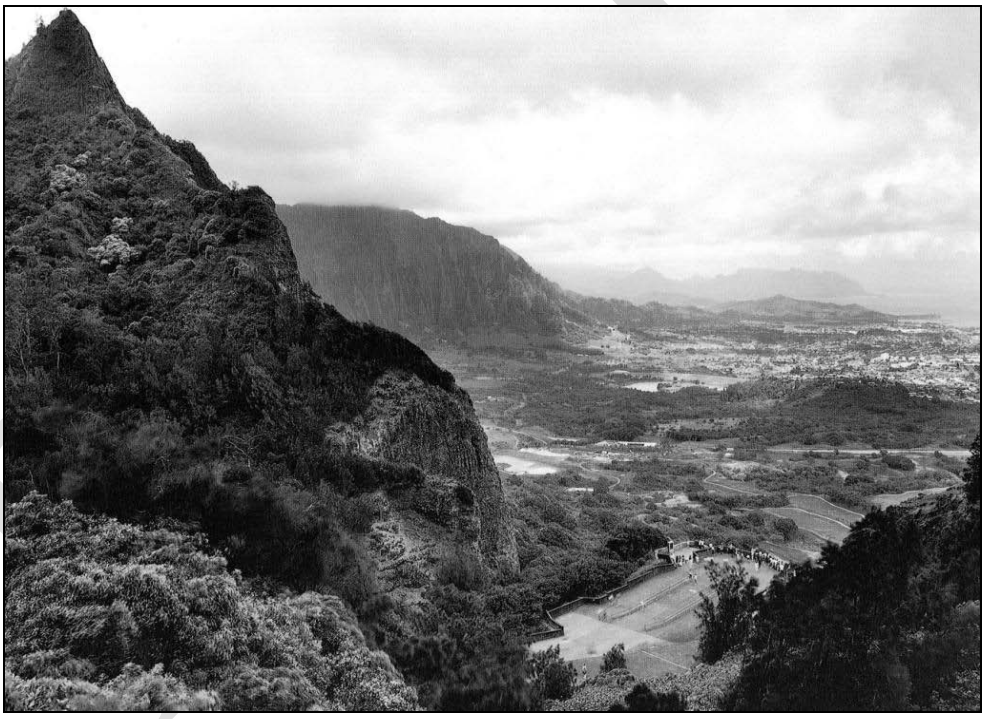

Figure 8. Ka Nuku (Landgraf 1994:99)

Figure 9. Kahapa‘akai (Becket and Singer 1999:22)

3.2.2.2 Heiau

According to Samuel Kamakau (1992:130), Wākea, an ancestor and possible progenitor of the Hawaiians, built the earliest *heiau* on the island in the valley of Waolani. Thrum (1906:44) mentions a *luakini*-class (human sacrificial) *heiau* in Waolani called **Kawaluna** similarly constructed by Wākea and consecrated by the *mō‘ī* (ruler) of O‘ahu, Kū‘ali‘i, about 1685. According to a Hawaiian language newspaper, Kawaluna Heiau was located on the east ridge of Waolani Valley (*Ka Nai Aupuni* 1906, cited in Sterling and Summers 1978:304). Kawaluna Heiau appears to have been the prototypical *luakini heiau* that all subsequent *heiau* had to conform to (Beckwith 1970:26), and was also a *po‘ohonua*, a place of refuge for the sick (Tucker 1916). J. Gilbert McAllister (1933:86) recorded the approximate locations of two other *heiau* in lower Nu‘uanu Valley based on the testimonies of two informants. These and other *heiau* appear to be part a complex of heiau in Waolani Valley (Dixon et al. 1994:20). Thrum (1906:44) also mentions a *heiau* in upper Nu‘uanu Valley called **Makuku** for bringing rain, although McAllister (1933:86) places it in Waolani. *Mo‘olelo* recount that this complex of *heiau* in Waolani Valley was the home of Mo‘oinanea, the primal *‘aumakua* (deified ancestor) who appeared as a *mo‘o* (lizard) (Beckwith 1970:507). In addition, *mo‘olelo* recount that a *heiau* called **Kaheiki** on the ridge between Nu‘uanu and Pauoa was built by *menehune* (legendary race of small people) (Westervelt 1915, cited in McAllister 1933:82) (Figure 10).

Rayna Raphaelson (1925) recounts seven *heiau* that Kamehameha captured and destroyed during Kaleleka‘anae, or the last battle of Nu‘uanu in 1795 (see Section 3.3.5). The first four *heiau* were **Elekoki**, near the spring Elekoki (Alekoki); **Koauananakoa**, near the Royal Mausoleum; **Ahipu‘u**; **Puiua** (also spelled Puiaa), near **Hānaiakamalama** (Queen Emma’s Summer Palace), where Kamehameha’s warriors rested. The opposing force under the O‘ahu chiefs had been pushed back to a fifth *heiau* at the mouth of Waolani Valley. In ancient times, the wives of warriors often accompanied their husbands to the sites of the battles. While Kamehameha’s men were resting at Puiua, the women of the two forces met at a field on the east side of the Pali Highway, opposite to the entrance to Waolani, and had their own battle:

> The women started to fight in true warrior fashion, and by the time the fighting was over, the entire field to the right was filled with the dead and the dying. (Raphaelson 1925)

The narrative continues with two *heiau* in Waolani Valley, **Kakanaiakeakea** and **Kawaluna**, and a final *heiau* called **Kaniakapūpū (**the singing of the land snails). According to Charles Kenn, this *heiau* was a place where people came for comfort and medical attention; the priests accepted tithes and the guards were stationed at Kahaukomo, the sacred *hau* (beach hibiscus) grove above the temple (Pacific Worlds 2003a). In one version of the Battle of Nu‘uanu, Kamehameha rested here while his men made the final assault on the O‘ahu forces, driving the last of the warriors over the Nu‘uanu Pali (Pacific Worlds 2003a). Kaniakapūpū was later used as a summer retreat for Kamehameha III (see Section 3.2.7), and some claim that it was mistakenly identified as a *heiau* in the historic period based on the old look of the ruins of the houses (Johnstone 1907:164)

Some of the seven structures mentioned by Raphaelson (1925) may have been hill forts rather than *heiau*. For example, John A. Cummins reported that Ha‘ipu and Ahipu‘u in lower Waolani Valley were small hills rather than *heiau*:

> Haipu was not a heiau, it was a beacon fortress where in case of a raid from the Pali way and heights above Waolani by natives from Koolau (Kailua), the Kona chiefs would from here be notified by a bonfire always ready to light. There was a guard of warriors at Ahipuu (hill of fire) where the house now is. This was a very large guard and was always maintained at war strength. (John A. Cummins, Hawaiian Ethnological Notes, Vol. II:205, cited in Sterling and Summers 1978:300)

Figure 10. Kaheiki Heiau (Becket and Singer 1999:19)

3.2.2.3 Ala Hele

Ala hele once served to connect the various settlements throughout O‘ahu. A coastal route circled O‘ahu and other trails traversed the mountain ranges and valleys, including the trail that wound up Nu‘uanu Valley toward the Pali and then traversed the sheer rock cliffs to reach windward O‘ahu (‘Ī‘ī 1959:92) (Figure 11). According to the diary entry of Reverend R. Tinker in 1831, Hawaiians used the trail to transport taro, potatoes, *poi*, fowl, goats, and pigs between windward O‘ahu and Honolulu (Thrum 1901:89). Lord Byron, Commander of the *H.M.S. Blonde*, captured the descent of the Pali Trail in an entry in the ship’s log in 1825, in which he inscribed that “The descent to this plain…is the most fearful imaginable…where a false step would be inevitable destruction” (Byron 1826, cited in Sterling and Summers 1978:225). Parts of this steep path later became incorporated into the stone-paved horse trail in 1845, the newly constructed Pali Road in 1897, and recent improvements starting in 1952 that led to the existing Pali Highway (Devaney et al. 1982) (see Section 3.2.6).

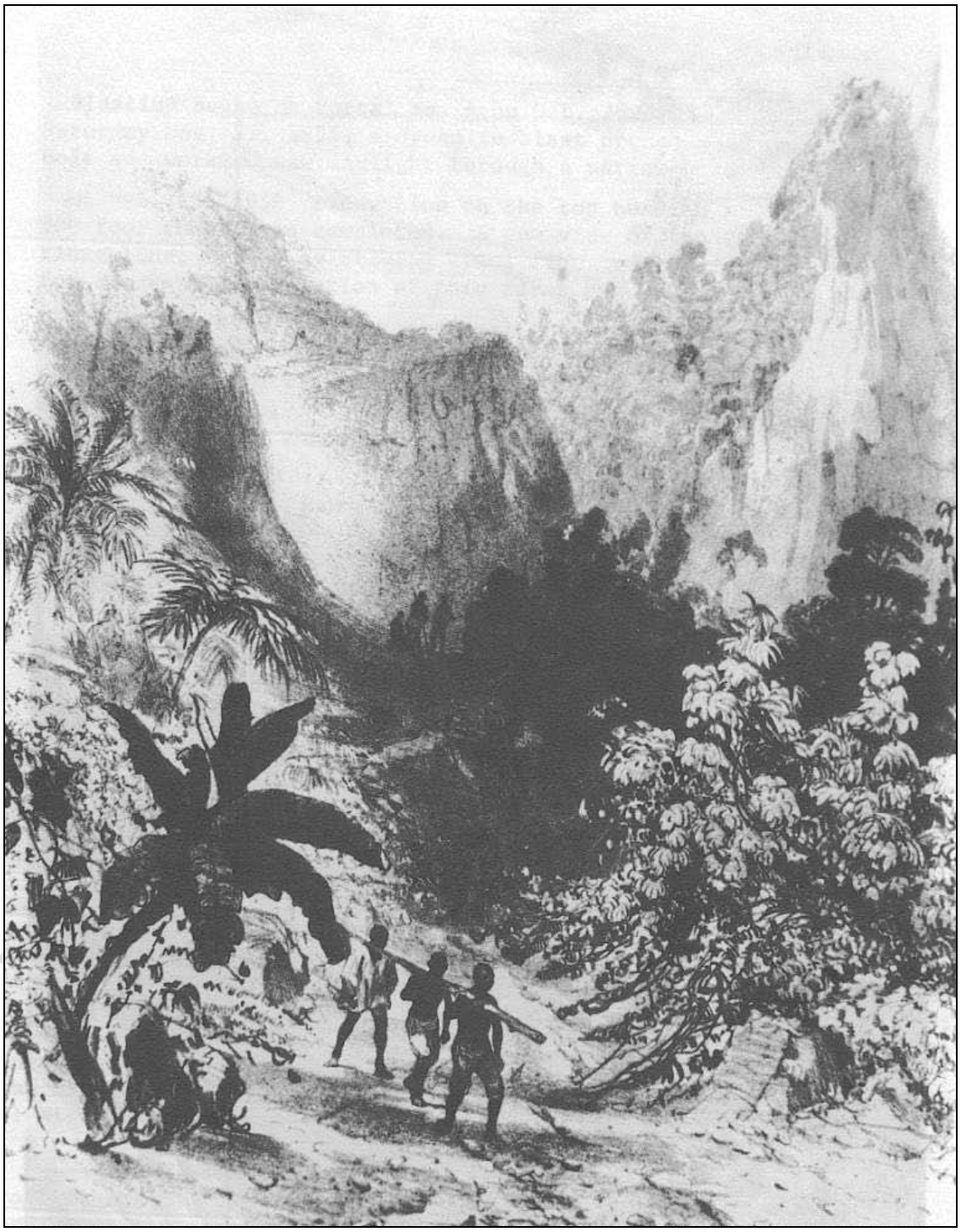

Figure 11. The old Pali Trail, 1836, view toward the Nu‘uanu Pali from Kāne‘ohe; lithograph of painting by Capt. V. B. Fisquet (Bernice Pauahi Bishop Museum Collection and R. J. Baker Collection, in Devaney 1982:174)

3.2.2.4 Ilina

McAllister (193:86) mentions that there are many caves on both sides of Nu‘uanu Valley near Kauai Street and below ‘Ālewa Heights, which is located *makai* of the Project area. He personally examined five caves and discovered historic burials in four of them. There is no documented evidence from archaeological surveys, historical records or oral traditions of *ilina*, burial caves or *iwi kūpuna* within the Project area.

3.2.3 Mo‘olelo of Wahi Pana

The *wahi pana* of Nu‘uanu Valley are associated with numerous *mo‘olelo*. This section offers *mo‘olelo* of *wahi pana* in the vicinity of the Project area in the forested *‘ili* of Luakaha near the Nu‘uanu Pali.

3.2.3.1 Kahaukomo

A *mo‘olelo* describes a battle between two noted men during the reign of Ka-lani-‘opu‘u (ca. 1770) that took place in the *hau* groves of Kahaukomo *mauka* of the Project area (Kamakau 1992:111). Skilled in *lua* (type of hand-to-hand fighting) and debate, these two dueled physically and mentally such that “shafts of wit flew.” Realizing that he was outmatched, Pakua-nui forced Na-maka off the Pali, but as Na-maka was also gifted in *lele pali* (cliff-jumping), he sailed on the breeze and landed farther down on the *pali* (see Appendix D for the expanded *mo‘olelo*).

3.2.3.2 Hauola and Hapu‘u

A *mo‘olelo* portrays two *mo‘o* (goddesses), or “dragon-women,” Hauola and Hapu‘u, who lived *mauka* of the Project area as guardians of the Pali (Westervelt 1915, cited in Sterling and Summers 1978:313). People once buried the naval cords of their children under these *pōhaku* to protect them from evil.

3.2.4 ‘Ōlelo No‘eau of Winds and Rains

Several *‘ōlelo no‘eau* poetically describe the winds and rains of Nu‘uanu Valley:

> *Ako Nu‘unau i ka hālau loa a ka makani; ‘āko Mānoa i ka hale a ke ehu.*
> Gathered in Nu‘unau is the longhouse of the wind; gathered in Mānoa is the house of rainy sprays. (Pukui 1983:13)
>
> *Ka makani kā‘ili kapa o Nu‘anu.*
> The garment-snatching wind of Nu‘uanu.
> The gale that blows at Nu‘unau Pali, O‘ahu, could whisk away the top garment of a traveler there. (Pukui 1983:#1464:158–159]
>
> *Ka makani kula‘i kanaka o Nu‘uanu*.
> The wind of Nu‘uanu that pushes people over.
> The strong gales at Nu‘uanu were known to make travelers fall down. (Pukui 1983:159)

Ku ka liki o Nu‘uanu i ka makani.
Nu‘unau draws her shoulders up in the wind.
Said of a show-off (Pukui 1983:203)

Kāhiko i Nu‘uanu ka ua Wa‘ahila.
Adorned in Nu‘unau by the Wa‘ahila rain.
The Wa‘ahila rain makes Nu‘uanu grow green and beautiful (Pukui 1983:143)

Ka ua Pōpōkapa o Nu‘uanu.
The Tapa-bundling rain of Nu‘uanu.
The Popokapa rain is so called because anyone who came up Nu‘uanu Pali from the windward side had to bundle his garments and hold his arms against his chest to keep from getting wet. (Pukui 1983:173)

Ola ke awa o Kou i ka ua Wa‘ahila.
Life comes to the harbor of Kou because of the Wa‘ahila rain.
It is the rain of Nu‘uanu that gives water to Kou (now central Honolulu). (Pukui 1983:272)

3.2.5 The Reigns of Kū‘ali‘i, Kahekili, and Kamehameha and the Battles of Nu‘uanu

Kū‘ali‘i, a *mō‘ī* from Maui, unified O‘ahu around A. D. 1720–1740 through a series of battles in Nu‘uanu. In one *mo‘olelo*, Kalelealuaka, who had the ability to fly from one point to another in the blink of an eye, became a warrior for the O‘ahu chief, Kākuhihewa, and killed the captain of Kūali‘i’s forces in Nu‘uanu, forcing Kūali‘i to agree to live as a subject under the dominion of Kākuhihewa (Thrum 1998:102). In another *mo‘olelo*, Kū‘ali‘i assembled his forces on the ridge of Keanakamano overlooking Waolani Valley and descended to Kawaluna Heiau, where they defeated the forces of the Kona chiefs to maintain his status of *mō‘ī* of O‘ahu (Fornander 1996:280).

The earliest historic accounts relate major battles of conquest during the late 1700s. The feeding of such amassed armies necessitated procuring valuable food supplies and highly productive locales. In 1783, Kahekili, the *mō‘ī* of Maui, fought for control of O‘ahu from Kahahana, the *mō‘ī* of O‘ahu. Kahekili marched from Waikīkī to the valley of Nu‘uanu and met Kahahana near the small stream of Kaheiki (Fornander 1996; Kamakau 1992:138). One of Kahekili’s great warriors, Peapea, ran toward the developing battle and reportedly single handedly defeated Kahahana’s army (Fornander 1919:458–461). According to Marion Kelly, the stream adjacent to Kaheiki Heiau was dammed by corpses from the onslaught and the waters ran red with blood (Becket and Singer 1999:18).

Kamehameha followed much the same route as Kahekili some ten years later. When Kamehameha’s fleet landed on the beaches of Waikīkī in 1795 to start his invasion of O‘ahu, Kalanikupule and his chiefs were positioned strategically in the valley of Nu‘uanu. They could have fought at Kalanikupule’s home in Waikīkī but Kalanikupule took his men to Nu‘uanu Valley (Kamakau 1992:172–173). The O‘ahu forces suffered heavy casualties and were forced higher into the valley. The battle culminated in the *‘ili* of Luakaha just *mauka* of the Project area, where 300 individuals made a final stand to allow the remaining troops to escape by descending

the Nu‘uanu Pali or climbing over the mountains to adjacent valleys (Pacific Worlds 2003a) (Figure 12). Kalanikupule had positioned cannon fortifications above the Nu‘uanu Pali in two notches on the ridge of the towering Kōnāhuanui peak at the upper boundary of the *ahupua‘a* of Nu‘uanu (James 2004). Two of these cannon fortifications remain as visible evidence of the historic clash that ensued (James 2004). The battle is called Kaleleka‘anae, which means “leaping *‘anae*” (mullet), and refers to the way many O‘ahu armies of Kalanikupule and some of their families chose to or were forced to jump to their deaths from the *nuku* of the steep Nu‘uanu Pali rather than accept defeat from the warriors of Kamehameha (James 2004). At least 300 warriors from both sides died (Kamakau 1992:172–173).

After the battle of Nu‘uanu, Kamehameha became the sole ruler of O‘ahu, Moloka‘i, Lāna‘i, Hawai‘i and Maui (Kamakau 1992:172–173). He divided the conquered lands of O‘ahu to his warrior chiefs and counselors (‘Ī‘ī 1959:69–70). In 1809, Kamehameha moved his court from Waikīkī to the fishing village of Kou at the mouth of Nu‘uanu Stream, where a natural break in the fringing reef permitted the passage and berthing of foreign ships. To escape the burgeoning town of Honolulu, royalty built retreats in the cool valley of Nu‘uanu, which coincided with improvements to the traditional *ala hele* that wound through the valley.

Figure 12. The “Last Stand” of the O‘ahu forces during the Battle of Nu‘uanu, looking from the Nu‘uanu Reservoir No. 4 toward the Nu‘uanu Pali (Photograph by R.D. K. Herman, Pacific Worlds 2003b)

3.2.6 Pali Trail and Pali Road

The *ala hele* that once wound through Nu‘uanu Valley and traversed the sheer cliff rocks of the Nu‘uanu Pali (see Section 3.2.2.3) has undergone several dramatic changes since the mid-nineteenth century. According to a letter written by Reverend R. Tinker in 1840, an American merchant named Hinckley first proposed making the old Pali Trail more passable, but a

blacksmith named Beers first supervised cutting steps into the steepest sections and building an iron railing (Thrum 1901:89). In response to agricultural development in Kāne‘ohe and other *ahupua‘a* in windward O‘ahu, Kamehameha III secured funds in 1845 to make the old Pali Trail accessible to horses. Sections of the path were paved with stones that enabled Kamehameha III, John Young, and Dr. Gerritt P. Judd to traverse it on June 28, 1845. In 1861, Dr. Judd and Reverend E. Corwin made the first descent in a horse-drawn carriage (*Island Call* 1953). The Pali Trail was then widened to six feet, paved with stones, and the grade was lessened in most areas to 15% (Bishop 1898, cited in Devaney et al. 1982:165 (Figure 13). In 1882, construction began to further widen the road to twenty feet and reduced the grade to 8%, which forced the road to wind back and forth on the side of the Nu‘uanu Pali rather than straight down, but delays due to rain damage and high costs prevented the new Pali Road from opening until 1897 (Thurston 1890:265) (Figure 14). Johnny Wilson, a young engineer with the Public Works Department, spent months surveying the steep terrain and forest of the Pali, but there were difficulties, such as “workers getting dynamited to oblivion and tumbling over the precipice…” (Chiddix and Simpson 2004:78). Construction workers found an estimated 800 skulls, along with other bones at the bottom of the Nu‘uanu Pali—the remains of the warriors defeated by Kamehameha (*Island Call* 1953). The road was declared open in 1897 and was maintained for 55 years with occasional improvements (Figure 15) until work began in 1952 to construct a new four-lane highway with two tunnels running under the *nuku* where Kalanikupule fought Kamehameha’s forces (Devaney et al. 1982:172).

Overall, subsequent changes to the traditional path facilitated transportation across the Ko‘olau mountains and made Nu‘uanu Valley more accessible to Honolulu, which consequently led to the development of Nu‘uanu Valley as a residential area for people of royalty, politics, and business (Pacific Worlds 2003a). In fact, the only two remaining royal residences in Hawai‘i—Kaniakapūpū and Hānaiakamalama—are located *makai* of the Project area.

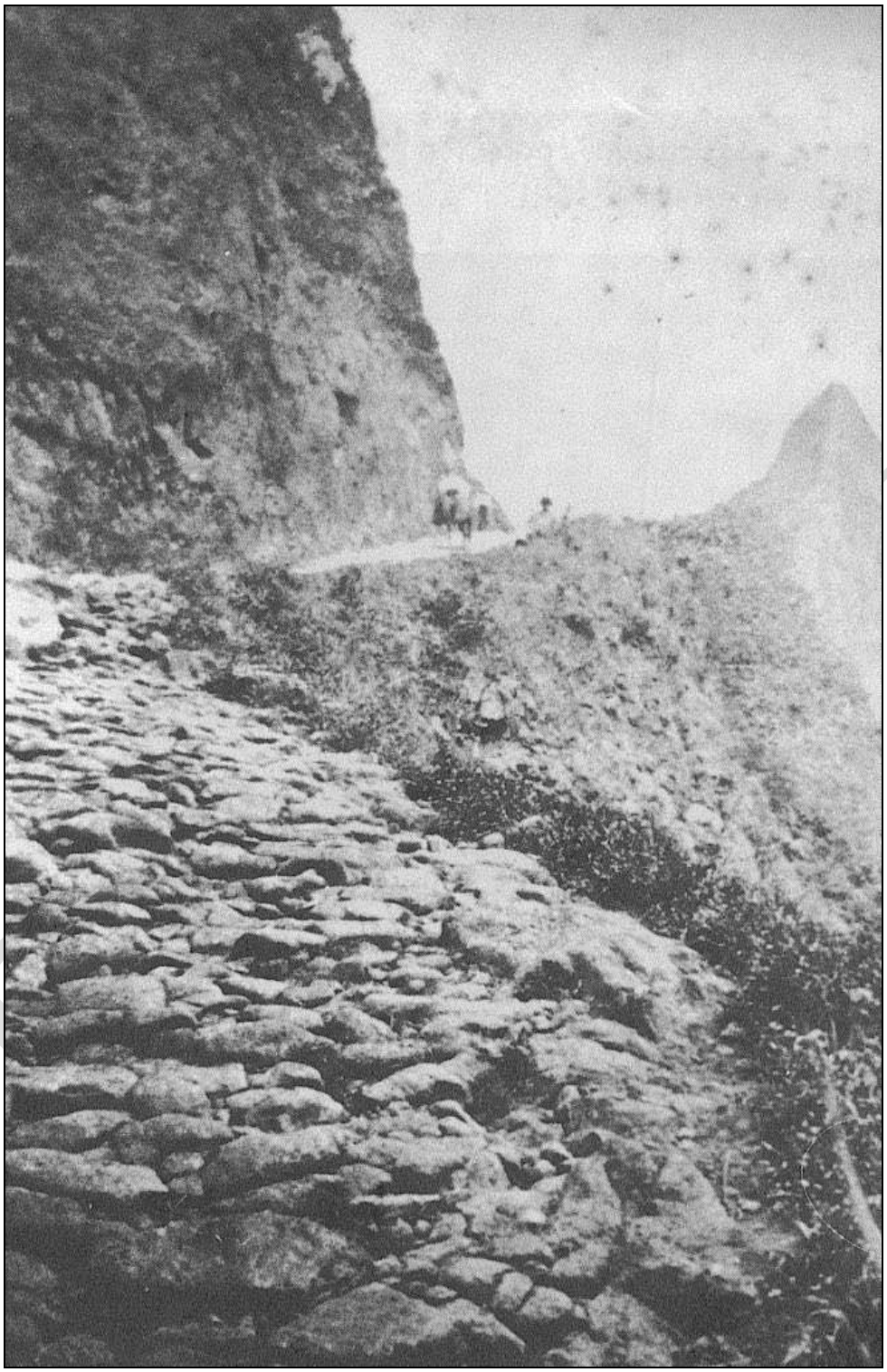

Figure 13. The stone-paved Pali Trail with horses in the background, 1887, view toward the Nu‘uanu Pali from Kāne‘ohe (Hawai‘i State Archives, in Devaney et al. 1982:177)

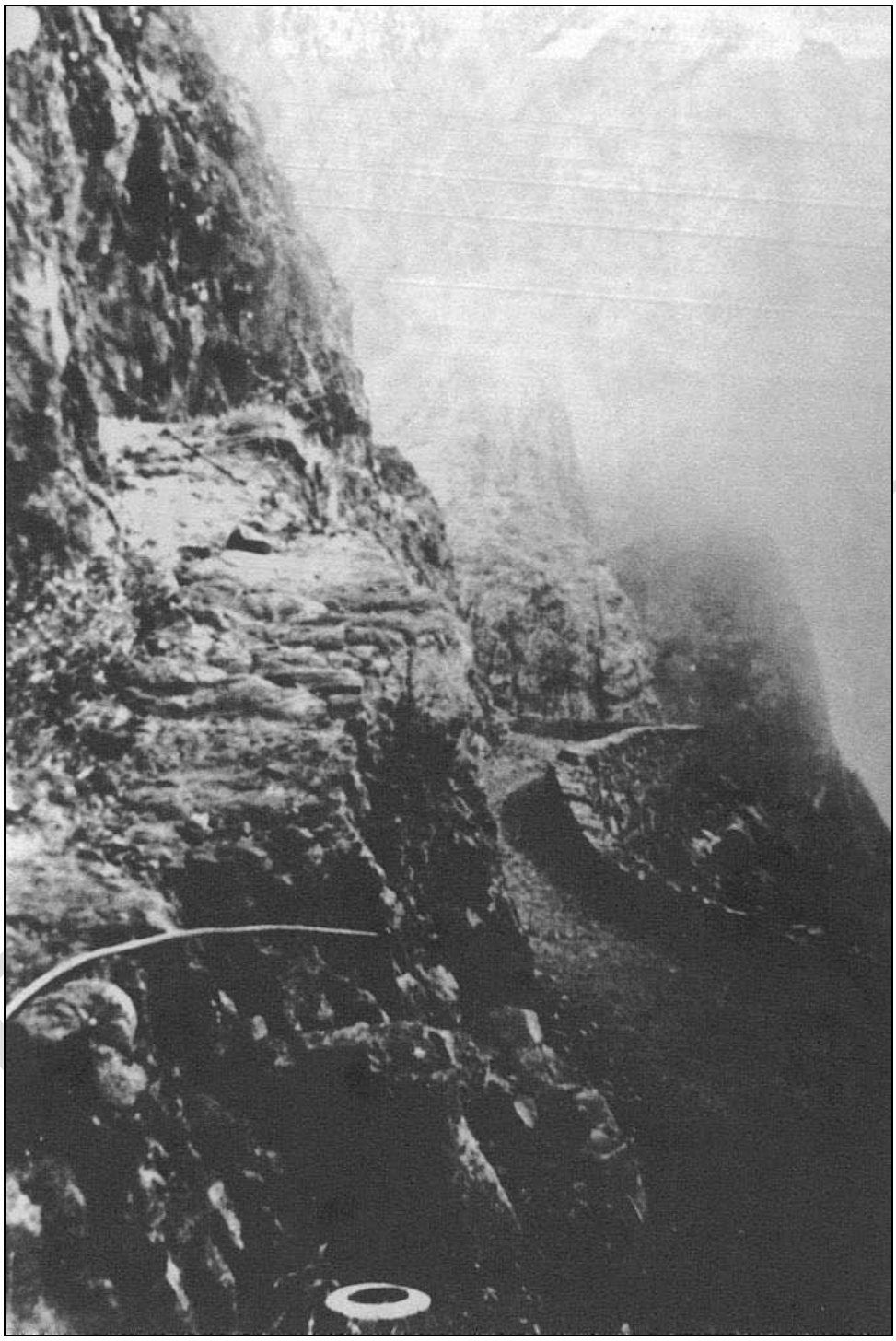

Figure 14. Old Pali Trail (left) and the newly constructed Pali Road with stone wall (right), 1880s, view toward the Nu‘uanu Pali from Kāne‘ohe (Bernice Pauahi Bishop Museum Collection, in Devaney et al. 1982:175)

Figure 15. Old Pali Road, 1946 (Hawaiian Aviation Preservation Society 2009)

3.2.7 Kaniakapūpū

In ancient times, the forested *‘ili* of Luakaha (Figure 16) in the upper valley of Nu‘uanu had been set aside as a relaxation spot for the high *ali‘i* and royalty (C.H. Cooke 1938, cited in Sterling and Summers 1978:307). In the Battle of Nu‘uanu in 1795, this is one of the places that Kamehameha I rested before he began the final push to victory at the Nu‘uanu Pali. Then, Kamehameha III built Kaniakapūpū into his Summer Palace, one of several places of refuge from the politics taking place in Honolulu, as well as from the heat of the plain of Honolulu: “Here he was able to think with those who surrounded him, away from the pressures of the foreigners. It was a cool place, and they could take off their western clothes, sit down and discuss the government” (Pacific Worlds 2003a). Kamehameha III may have resided at the estate as early as 1835, but the present ruins date to 1843–1845 (Mason 1989). The building consisted of a large living room and two bedrooms, and was surrounded by a *lānai* and low fence. Some sources claim the Summer Palace was constructed over a *heiau* of Kaniakapūpū (Raphaelson Ms., cited in Sterling and Summers 1978:307) and others place the *heiau* next to the palace (Pacific Worlds 2003a). While the site has not yet been excavated by archaeologists, an archaeology survey (Neller 1984) and background study (Mason 1989) do not indicate that the house was formerly a *heiau*. An archaeology field school mapped the immediate grounds of Kaniakapūpū, showing a perimeter wall, a garden area, a possible house or *heiau*, a retaining wall, and a detached kitchen surrounding the main structure (University of Hawai‘i 1999, cited in Pacific Worlds 2003a) (Figure 17). Other archaeologists recorded two historic sites *mauka* of the main structure, including a wall that may be associated with Kaniakapūpū (Moore and Kennedy 1999).

Kaniakapūpū was the scene of a historic feast on July 31, 1847 that celebrated the fourth anniversary of Lā Ho‘iho‘i Ea (Restoration Day), in which Admiral Thomas restored the sovereignty of the Kingdom of Hawai‘i after a forced cession to the British captain, Lord George Paulet. Kamehameha III, Queen Kalama, and other royalty left the palace in the state carriage, followed processions of three hundred infantry, officers on horseback, 1,000 “horse-women, five abreast…wearing palm-leaf hats and Spanish ponchos, gay with ribbons and wreaths of flowers,” and 2,500 horsemen (Hawaiian Annual 1930:102–105, cited in Sterling and Summers 1978:308). The guests were first entertained with games, including *lua*, *hākōkō* (wrestling), and spear-fighting, of which John Papa ‘Ī‘ī excelled:

> …In the spear exercise the most expert performer was John Ii, then one of the king’s counselors and the year following appointed a judge of the supreme court. He was tall, clean limbed, and exceedingly lithe in all his movements, and it was a rare sight when he stood alone, unarmed, opposed to twenty spearsmen each of whom endeavored to hit him. Dexterously catching the first spear that was darted, with this he successfully parried all the rest that seemed to come in a crown and were aimed with furious force at all parts of his person. And when the missiles of his assailants had been all exhausted, he in turn picked up their spears and rapidly darted them back at his opponents, driving them from the field, amid the wild applause of the native spectators… (Hawaiian Annual 1930:102–105, cited in Sterling and Summers 1978:308)

An estimated 10,000 people attended the feast, which was provisioned with “271 hogs, 482 large calabashes of poi, 602 chickens, 3 whole oxen, 2 barrels salt pork, 2 barrels biscuit, 3,125 salt fish, 1,820 fresh fish, 12 barrels luau and cabbages, 4 barrels onions, 80 bunches bananas, 55 pineapples, 10 barrels potatoes, 55 ducks, 82 turkeys, 2,245 coconuts, 4,000 heads of taro, 180 squid, oranges, limes, grapes and various fruit” (Hawaiian Annual 1930:102–105, cited in Sterling and Summers 1978:308). Women also sang *mele* throughout the feast and danced hula in the evening after most of the party had departed (Hawaiian Annual 1930:102–105, cited in Sterling and Summers 1978:308).

The following year the Chief’s Children School held a picnic at Kaniakapūpū (Helen Judd manuscript, cited in Anderson and Williams 1993), but it remains unclear what happened to Kaniakapūpū (Pacific Worlds 2003a). A map produced by C.J. Lyons in 1874 (see Figure 18) locates the site as an “old ruin,” the only remaining structure associated with Kamehameha III (Pacific Worlds 2003a). Now, ‘Ahahui Malama o Kaniakapūpū is quietly working to restore Kaniakapūpū (Pacific Worlds 2003a).

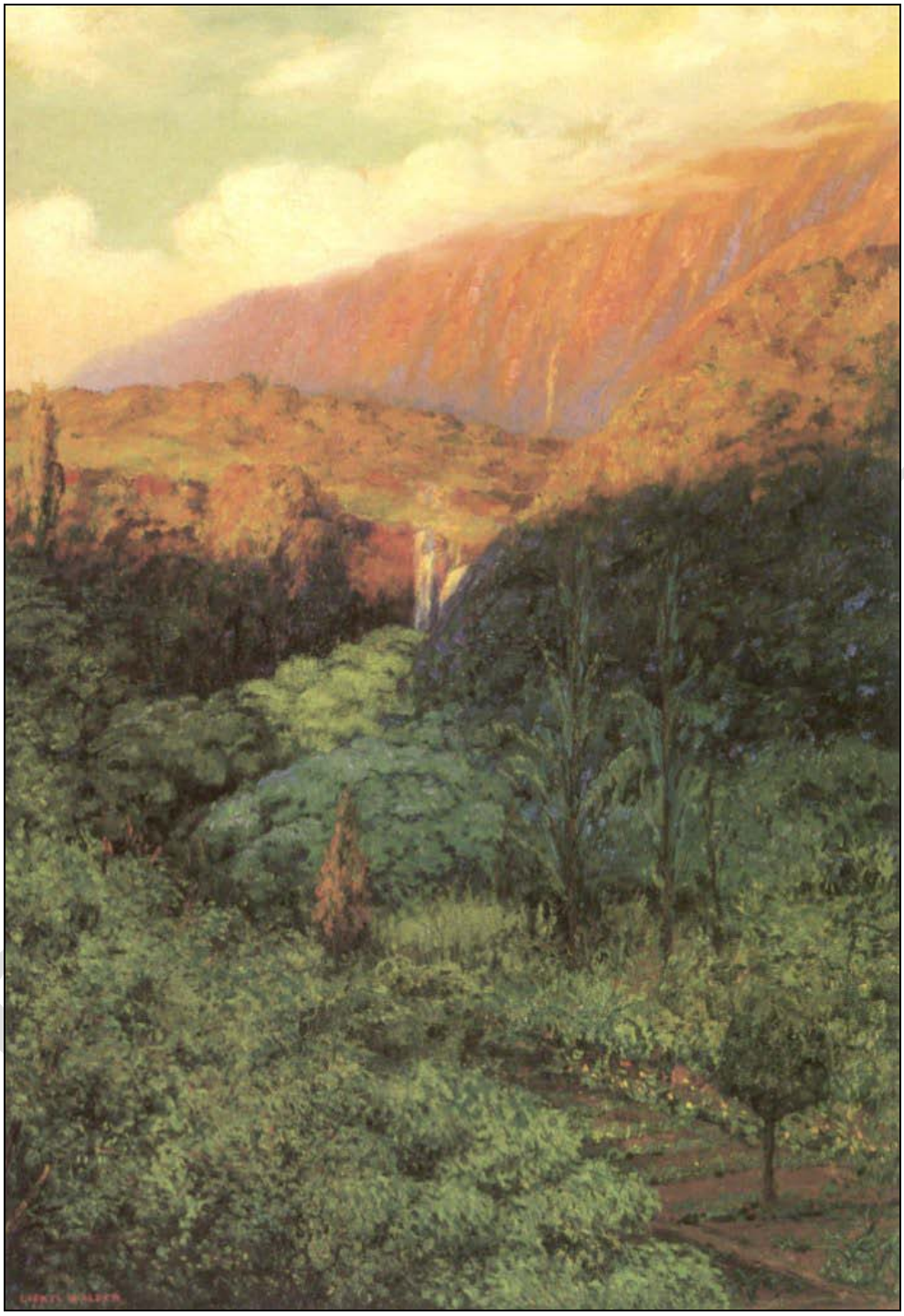

Figure 16. *Luakaha: Evening*, oil on canvas painting by Lionel Walden in 1916 (Honolulu Academy of Arts), showing gardens along Nu‘uanu Stream, Luakaha Falls, and Lulumahu Falls (background)

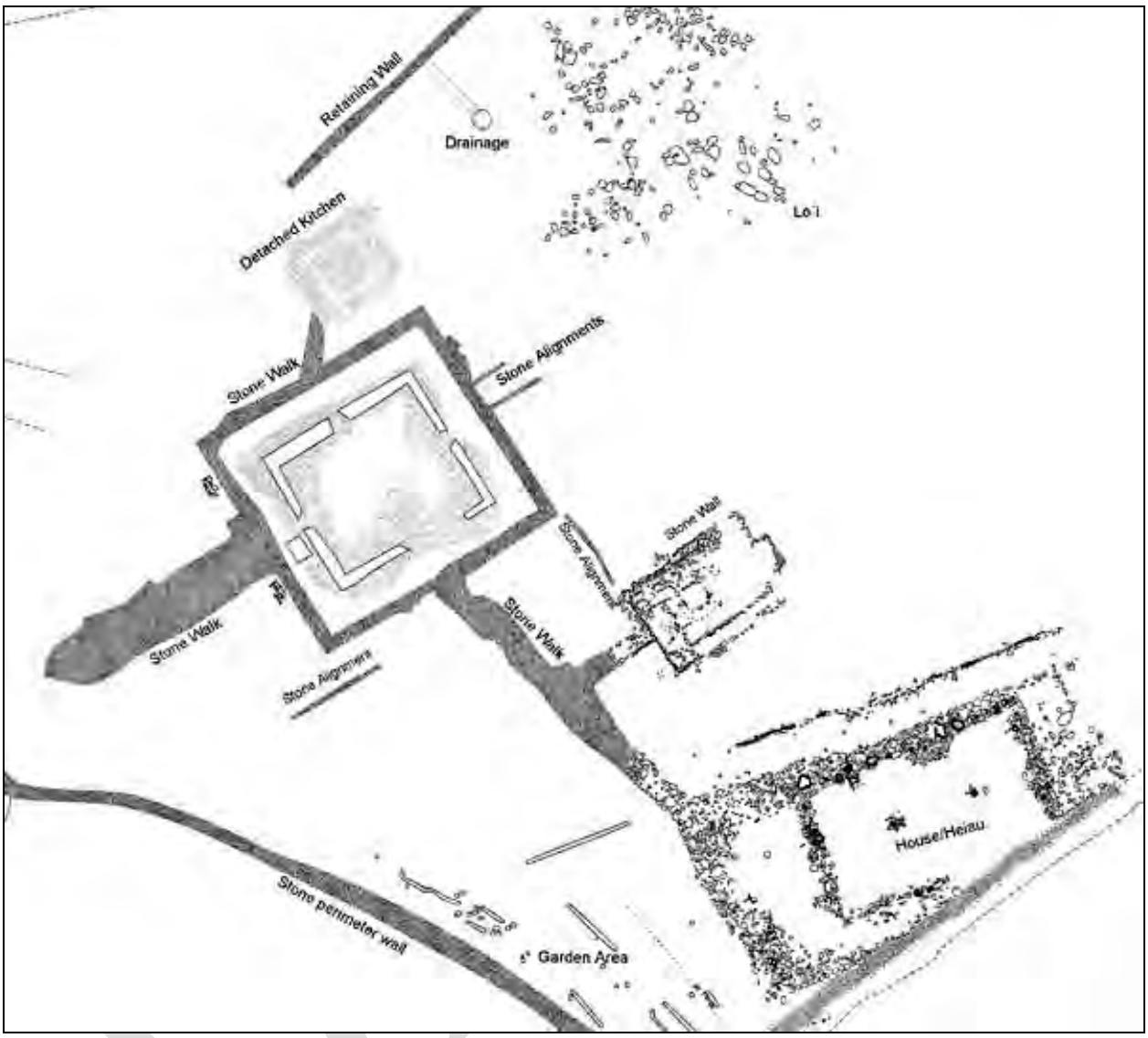

Figure 17. Site map of Kaniakapūpū (University of Hawai‘i 1999)

3.2.8 Hānaiakamālama

During the reign of Kamehameha IV, a summer palace was built for his wife, Queen Emma. She had inherited the property from her father, John Young II, the son of John Young who had helped Kamehameha during his conquest of the Hawaiian Islands. John Young fought with Kamehameha during the battle of Nu‘uanu. At one point they rested on land in Pū‘iwa. It was this land that John Young II purchased in 1851 and later willed to his daughter, Emma at his death in 1857. He called the estate and house Hānaiakamalama (the foster child of the moon, or the night), after his home in Kawaihae on the island of Hawai‘i. After her death in 1884, the Hawaiian government purchased and rented out Hānaiakamalama, also known as Queen Emma's Summer Palace. The property was taken over by the Daughters of Hawai‘i in 1915, a group of women that have since preserved the property as the Queen Emma Museum (*Honolulu Advertiser*, 1953, cited in Sterling and Summers 1978:300–301).

3.2.9 The Māhele

The Organic Acts of 1845 and 1846 initiated the process of the Māhele—the division of Hawaiian lands—that introduced private property into Hawaiian society. In 1848, the Crown and the *ali‘i* received their land titles. *Kuleana* (Native land rights) awards to commoners for individual parcels within the *ahupua‘a* were subsequently granted in 1850. The Crown Lands were considered the private lands of the monarch, and many lands were sold or mortgaged during the reigns of Kamehameha III and IV to settle debts to foreigners. To end this practice, the Crown lands were made inalienable in 1865, and their dispensation was regulated by a Board of Commissioners of Crown Lands, which effectively put them under the administrative control of foreign-born residents (Kame‘eleihiwa 1992:310). Before the passage of the Act of January 3, 1865, which made Crown Lands inalienable, Kamehameha III and his successors did as they pleased with the Crown Lands, selling, leasing, and mortgaging them at will (Chinen 1958:27).

In 1850, the Privy Council passed resolutions that would affirm the rights of the commoners or native tenants. To apply for fee-simple title to their lands, native tenants were required to file their claim with the Land Commission within the specified time period of February 1846 and February 14, 1848. The Kuleana Act of 1850 confirmed and protected the rights of native tenants. Under this act, the claimant was required to have two witnesses who could testify they knew the claimant and the boundaries of the land, knew that the claimant had lived on the land for a minimum of two years, and knew that no one had challenged the claim. The land also had to be surveyed.

Not everyone who was eligible to apply for *kuleana* lands did so and, likewise, not all claims were awarded. Some claimants failed to follow through and come before the Land Commission, some did not produce two witnesses, and some did not get their land surveyed. Out of the potential 2,500,000 acres of Crown and Government lands, less than 30,000 acres of land were awarded to the Native-Hawaiian tenants (Chinen 1958:31).

Among the first written descriptions of Nu‘uanu Ahupua‘a by Hawaiians are the testimonies recorded during the 1840s and 1850s in documents associated with LCAs and awardees of the Māhele. There were 1,399 LCA claims filed within the Nu‘uanu Ahupua‘a for properties in the lower valley (Pacific Worlds 2003c), but no *kuleana* LCAs were located in the current Project

area. Most of the *‘ili* of Luakaha became Crown Lands, including the royal residence of Kaniakapūpū *makai* of the Project area (Figure 18). The claims, testimonies, and awards reveal that Hawaiians used the land in Luakaha ‘Ili in the upper valley of Nu‘uanu primarily to cultivate taro (Waihona ‘Aina 2000).

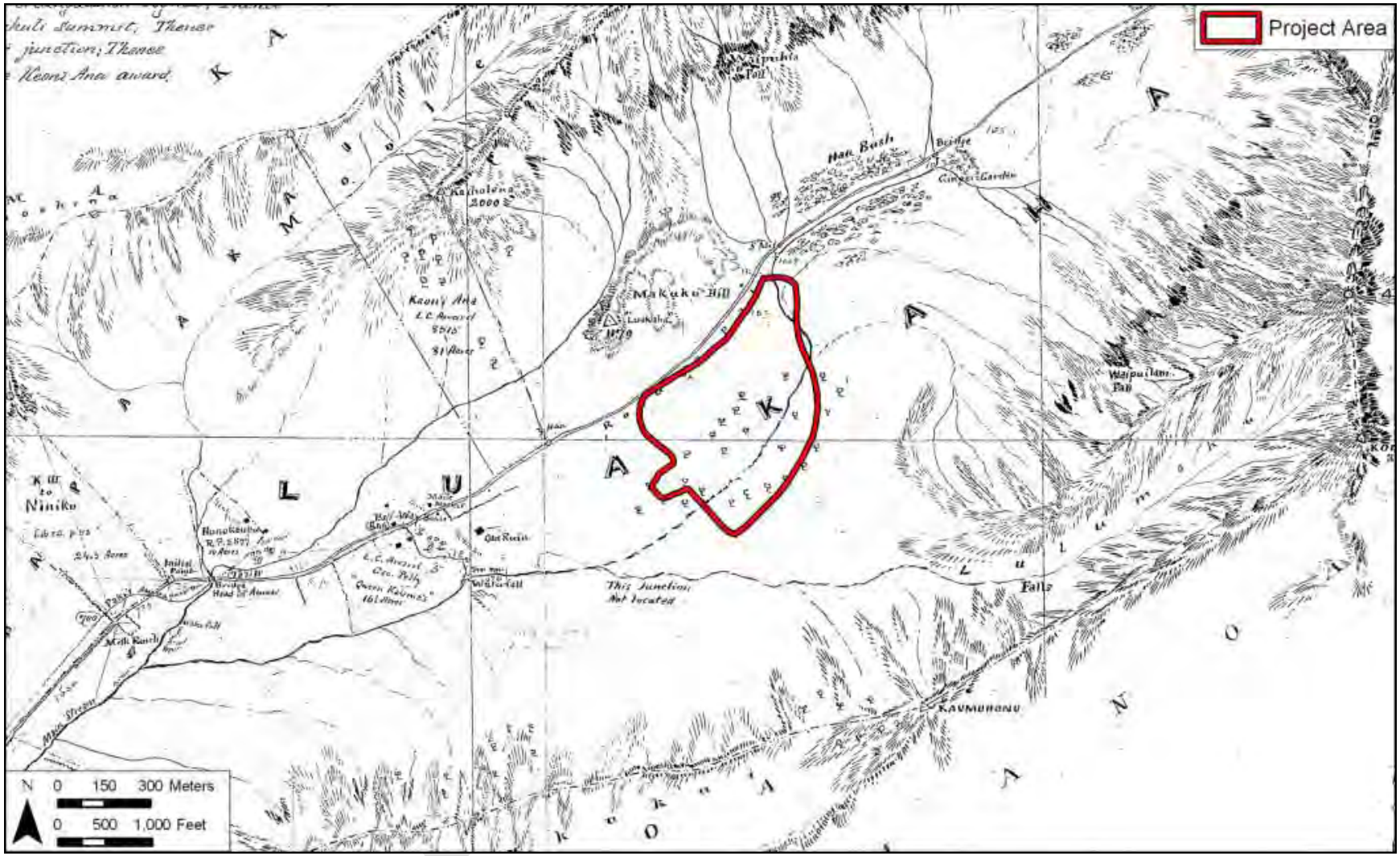

Figure 18. The *‘ili* of Luakaha, showing LCAs in the vicinity of the Project area (Lyons 1874)

3.2.10 Nu‘uanu Watershed and Nu‘uanu Reservoir No. 4

There has been very limited development in the *‘ili* of Luakaha in the upper valley of Nu‘uanu during the twentieth century. Historic maps indicate the locations of four open reservoirs that line the main road (numbered one through four), with residential development in Alewa Heights in the vicinity of Nu‘uanu Reservoir Nos. 2 and 3 (Figure 19 to Figure 23). The progression of images does not show any development near Nu‘uanu Reservoir No. 4.

The four reservoirs in Nu‘uanu Valley were constructed from 1890 to 1910 for hydropower, flood control, and domestic water (Hawai‘i DLNR 2010b). The Nu‘uanu Reservoir No. 4, the largest of the four reservoirs, was originally built to provide water for the burgeoning city of Honolulu, with several small streams feeding it. Construction of the earthen dam began in 1905 and was completed in 1910 (Durkee 2008:2). Drawings of the original reservoir plans show the original topography before dam construction, including the location of Keiliohia Spring and early water ditches (in the present reservoir) (1907, supplied by R.M. Towill Corporation) (Figure 24). After the discovery of artesian wells that could provide a safer supply of water for Honolulu, water from the reservoir was used to produce electricity (Townscape, Inc. and Dashiell 2003:18). From 1919 unt il the 1930, water flowed to downstream turbines that generated enough power to run the city lights throughout the night as well as to operate sewage stations during the day (Durkee 2008:2). Then, leakages in the dam structure forced its reconstruction. Drawings from the reconstruction plans show the general locations of the borrow pit, rip-rap quarry, and engineers’ houses (1932, supplied by R.M. Towill Corporation) (Figure 25). After widening the crest of the dam and other modifications in 1934, the reservoir has since been used as a flood control structure by regulating the flow of Nu‘uanu Stream, which flows four miles to Honolulu Harbor (Durkee 2008:2; Townscape, Inc. and Dashiell 2003:18). The reservoir has also been used for seasonal recreational fishing. Shortly after World War II, the Territorial government introduced freshwater sport fish in Hawai‘i and the reservoir was utilized as a refuge and research site (Hawai‘i DLNR 2010b). Since the first public opening in 1969, the reservoir continues to be stocked with channel catfish, which spawn during the late spring in Nu‘uanu (Hawai‘i DLNR 2010b), as well as freshwater clams, tilapia, and cichlids (Hollier 2007; Kawanami 2010).

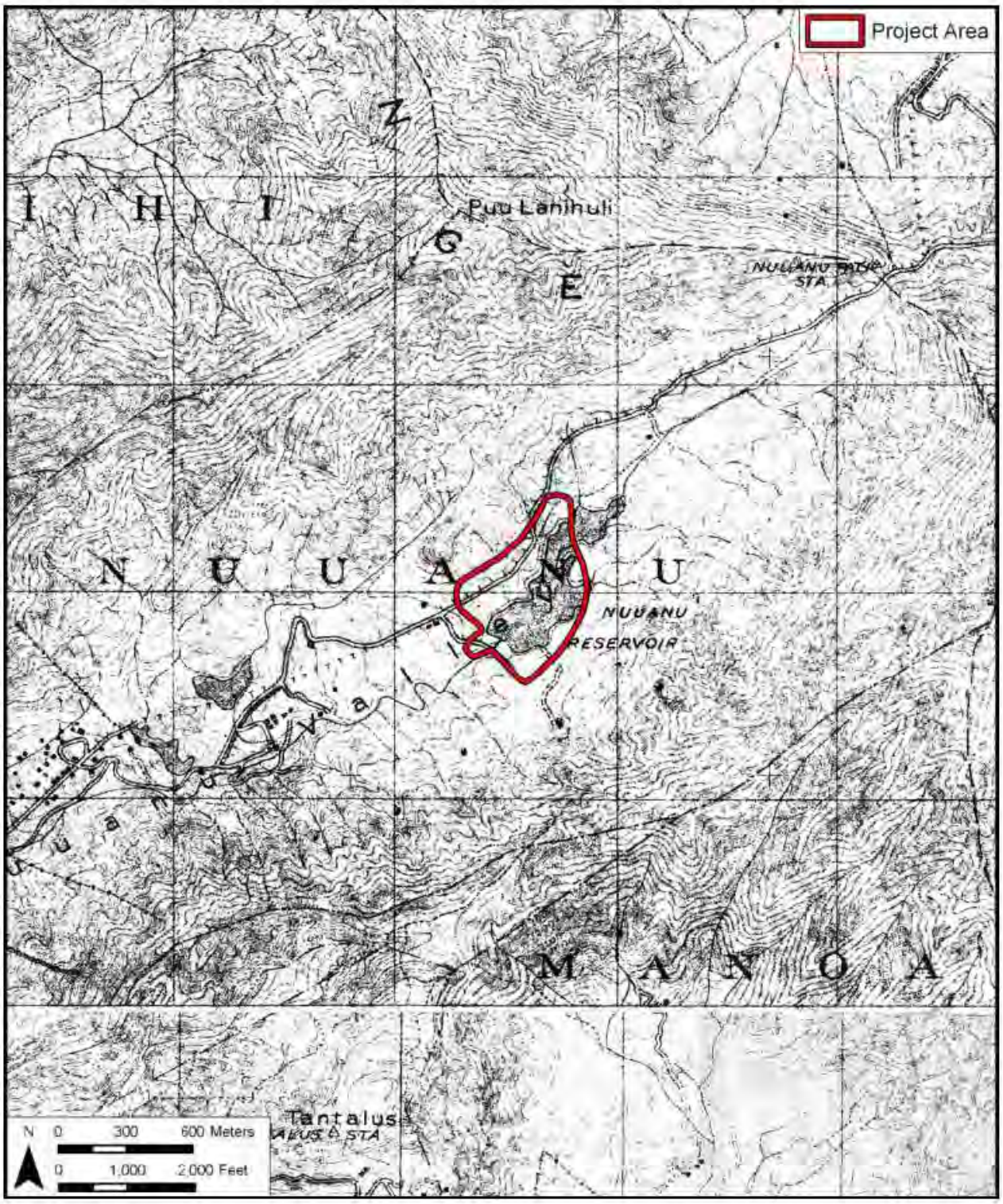

Figure 19. Portion of 1919 U.S. War Department map showing the Project area

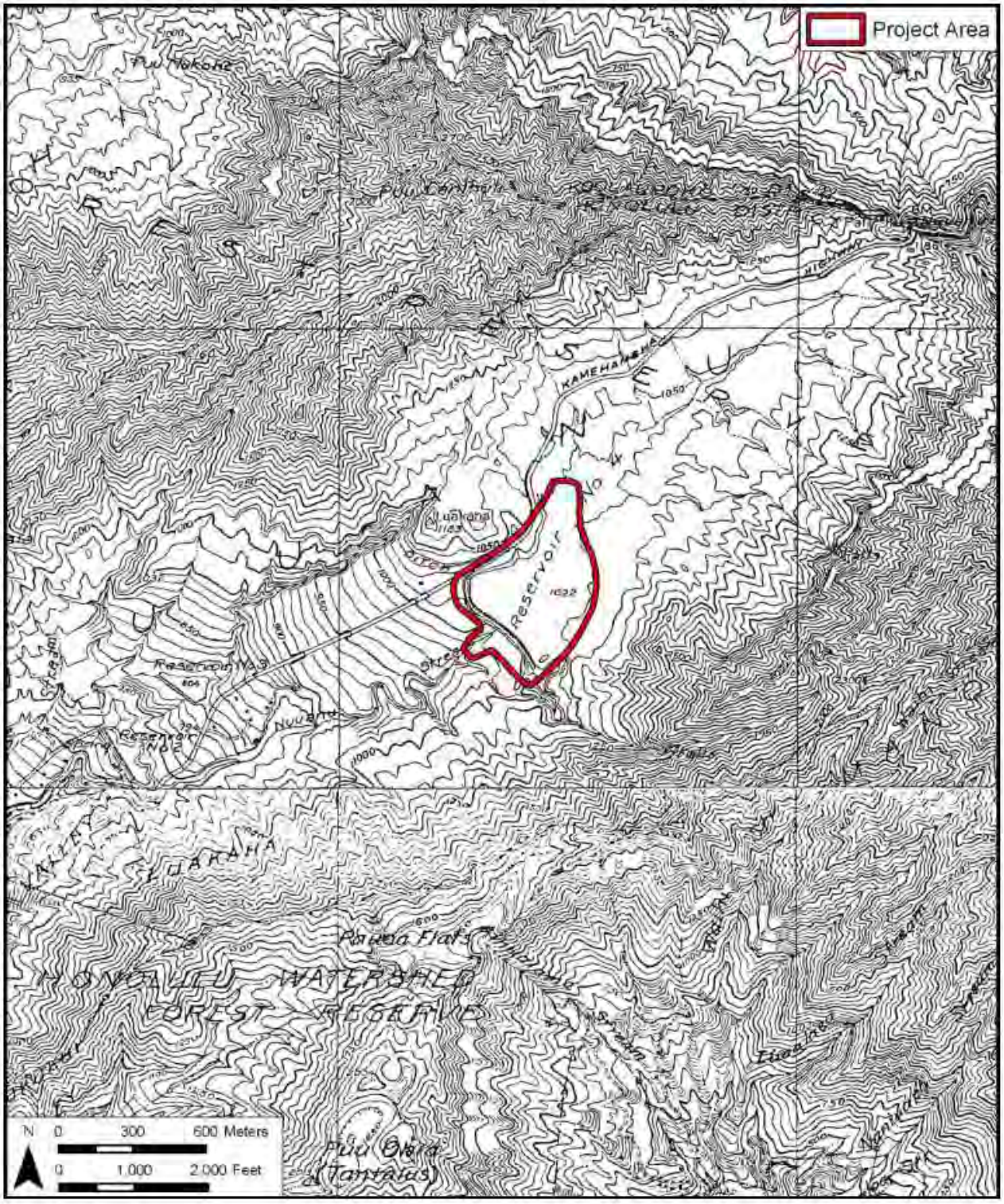

Figure 20. Portion of 1927–1928 USGS 7.5-minute topographic quadrangle showing the Project area

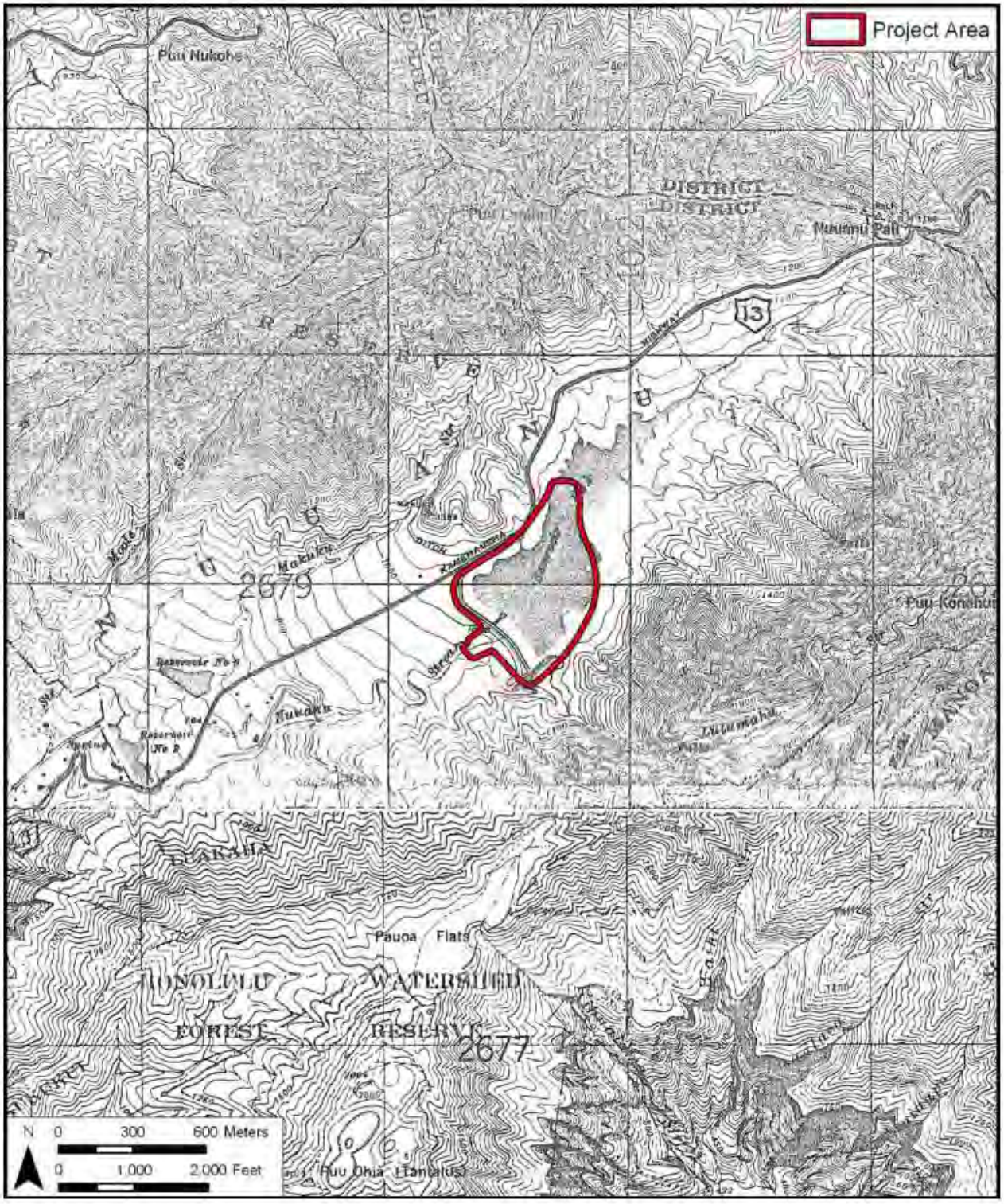

Figure 21. Portion of 1943 U.S. War Department map showing the Project area

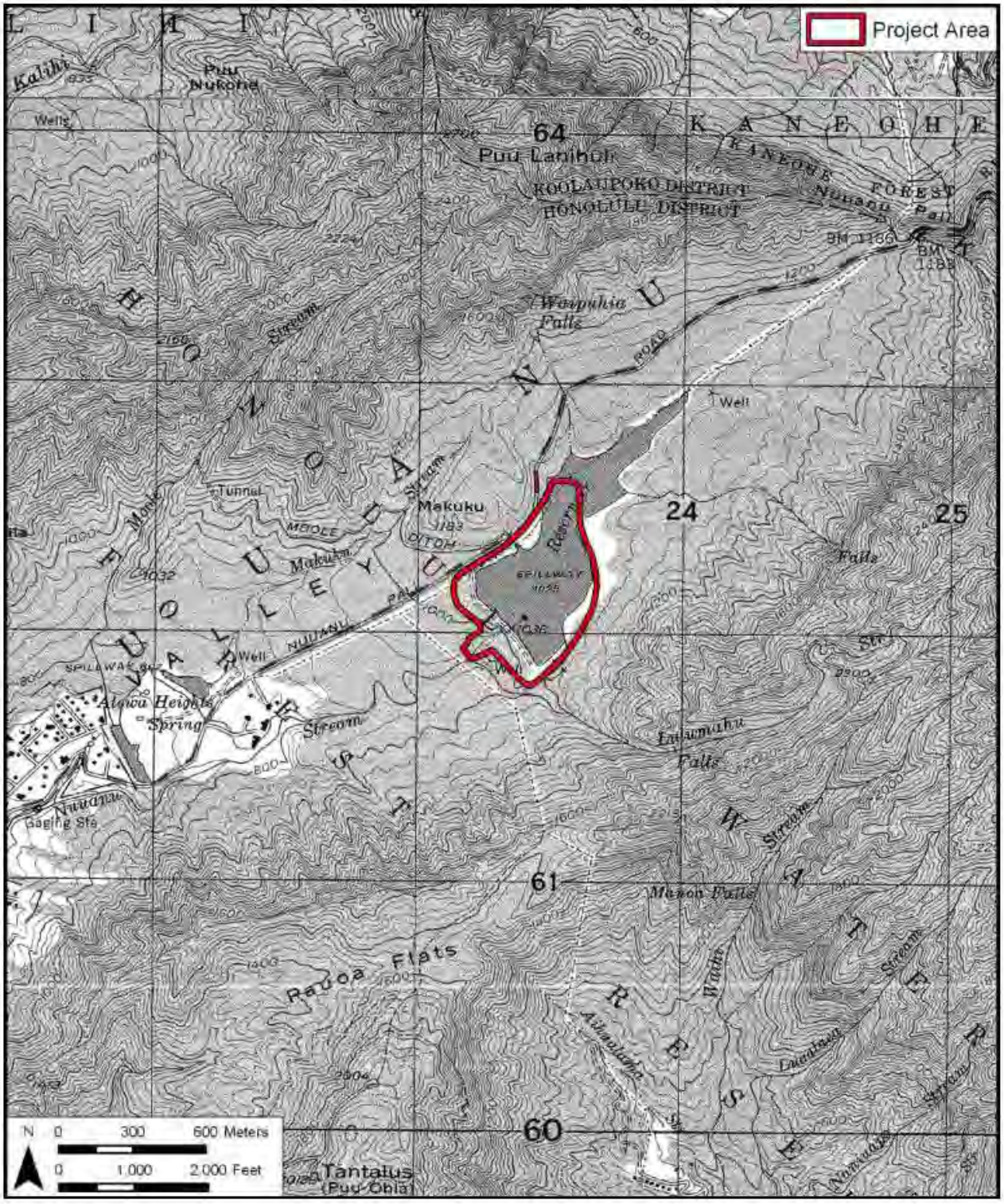

Figure 22. Portion of 1953–1954 U.S. Army Mapping Service map showing the Project area

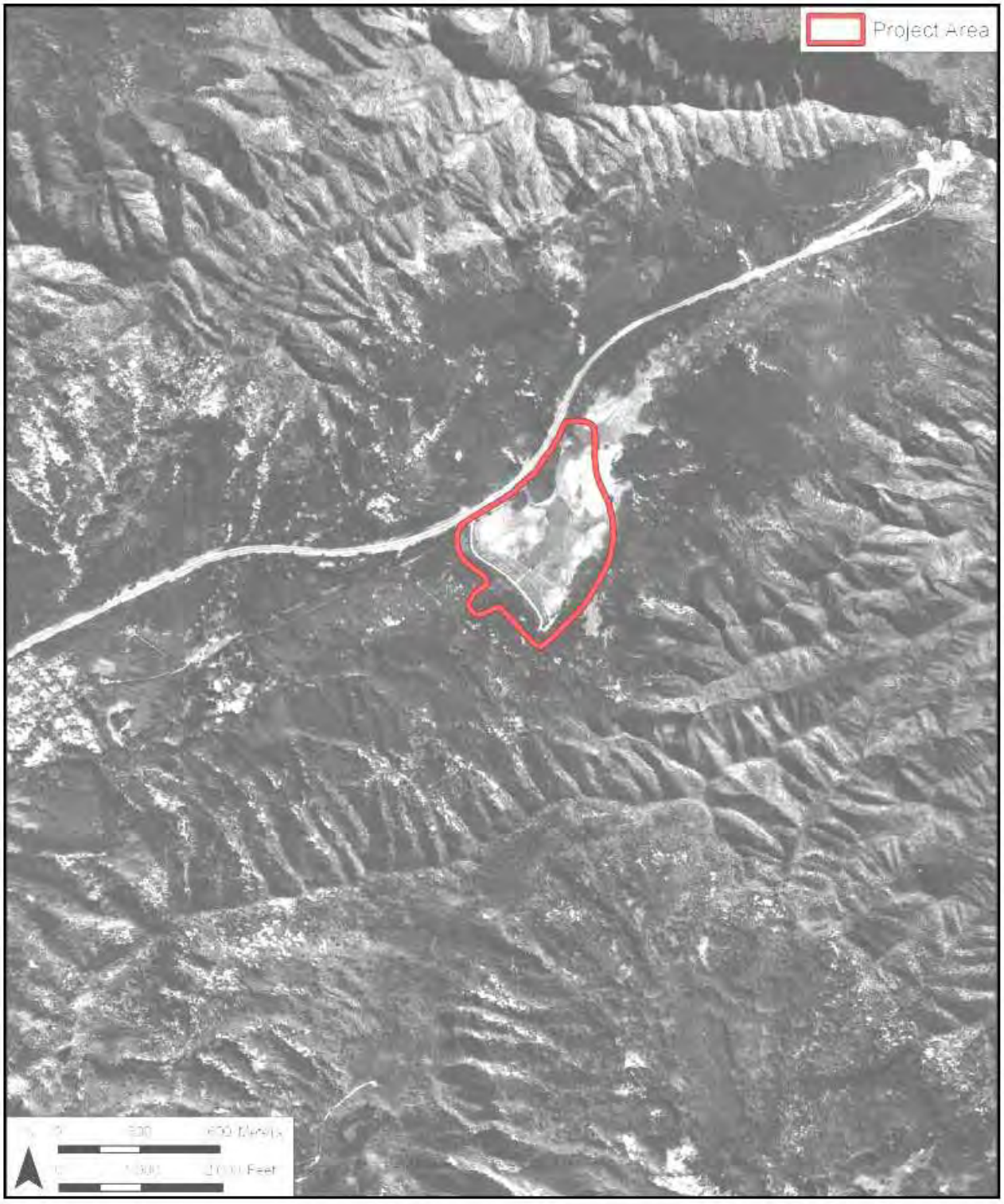

Figure 23. Portion of the orthoimagery of the 1977–1978 USGS 7.5-minute topographic quadrangle showing the Project area

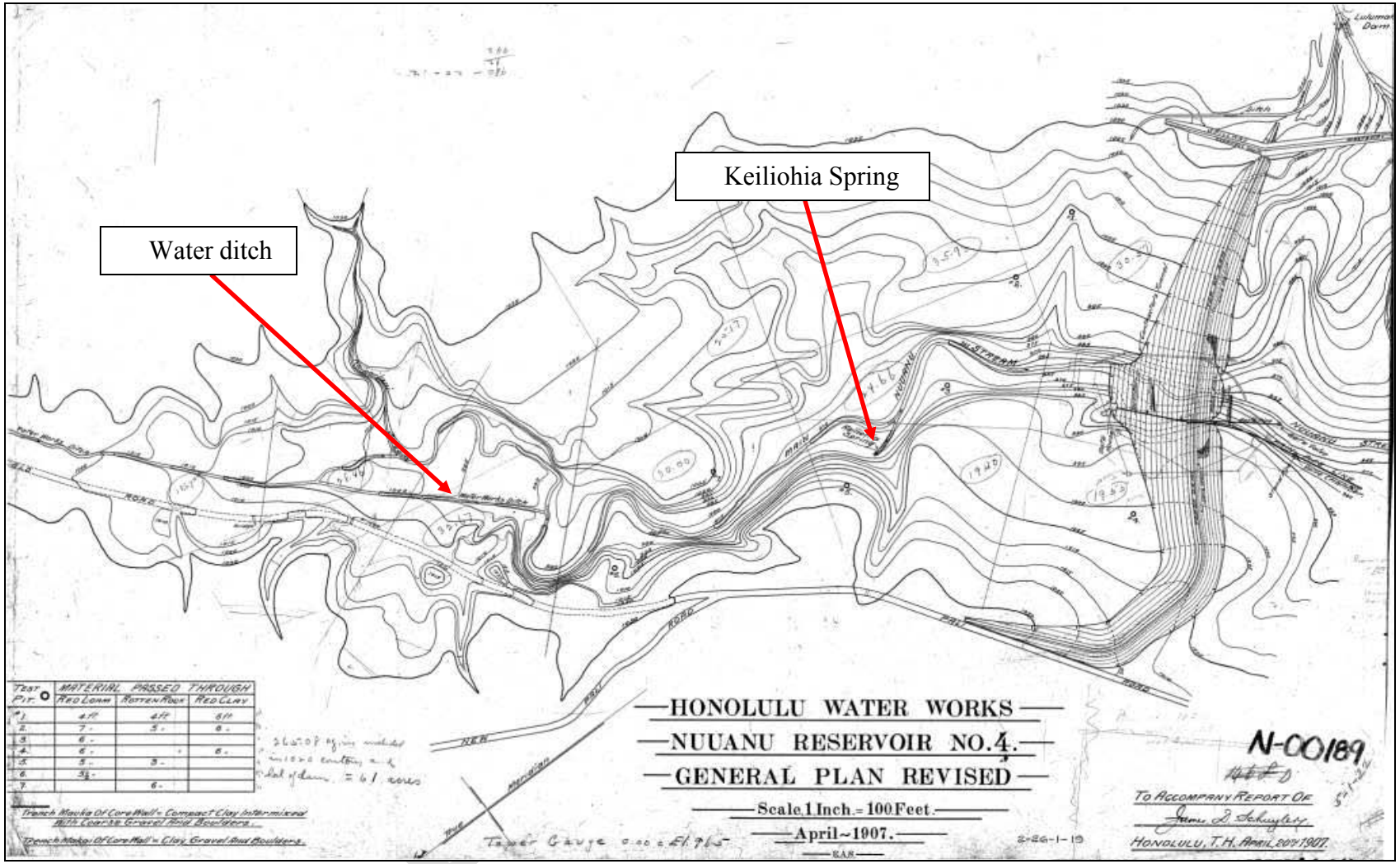

Figure 24. Original construction plans for the Nu‘uanu Reservoir No. 4, indicating the location of Keiliohia Spring (now covered by the reservoir’s water) and early water ditches (1907, supplied by R.M. Towill Corporation)

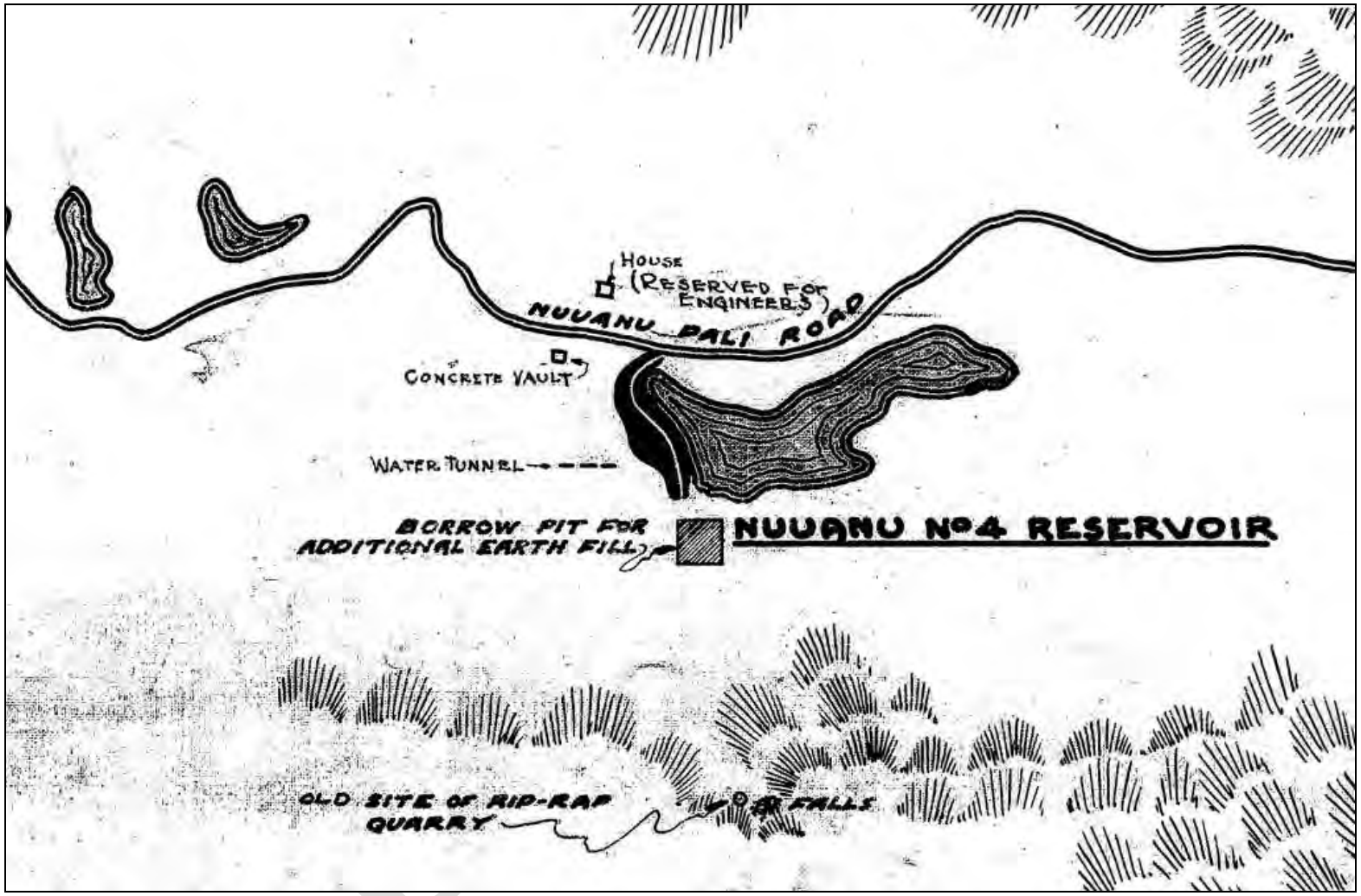

Figure 25. Reconstruction plans for the Nu‘uanu Reservoir No. 4, indicating general locations of borrow pit for earth fill, rip-rap quarry, and the engineers’ house (1932, supplied by R.M. Towill Corporation)

3.2.11 Previous Oral History Research

This section builds on the previous cultural and historical background by highlighting the voices of *kama‘āina* of Nu‘uanu Valley, including Kalani (no last name given) (Pacific Worlds 2003d). Her *mo‘olelo* from a past generation colors the cultural and historical background of Nu‘uanu with nuanced recollections and add a depth to the information provided by living *kūpuna* and *kama‘āina* who were recently interviewed by CSH (detailed in Section 5).

3.2.11.1 Kalani

Kalani shared her childhood memories of growing up in Nu‘uanu Valley:

> There are many stories connected with the Pali. Stories about seeing Pele on the highway there, or a white dog which is another image or vision associated with Pele. Kamapua‘a in stories of not to carry pig over the Pali. All of which I grew up with and we all followed. We never went over the Pali with any pork in the car. We still don’t—that I can tell you.
>
> I know that there is a story that Kamapua‘a—the famous pig god—was there, and that he would frequent the Nu‘uana area. He was known as a trickster. He would make a human appearance or a *pua‘a* [pig] appearance and you needed to be on your guard or wary so you did not do anything that was going to cause him to do any mischief with you in the area.
>
> The area is secluded. People go there to be alone and have things happen to them, noises in the night. I think they are doing mischief and it brings on the mischief. It depends on what type of business you are doing. If it’s not totally up-and-up, then you probably shouldn’t be there anyway.
>
> I have found that it is a very basic rule in our Hawaiian culture: if you are doing something that is not your business to do, or that is inappropriate, there will be mischief or an undoing come of it, so you probably shouldn’t be doing it anyway.
>
> Nu‘uanu is a different environment to grow up in. So many today have neighborhoods and they have parks, and they have tennis courts, or basketball courts, or volleyball courts. Whereas, if you grew up in Nuuanu Valley, you played in the backyard, which was the forest and the stream. You went swimming in the streams first before the ocean. We learned where all the ponds were coming down through the streams.
>
> We spent our weekends or afternoons running through the forest picking guava, mountain apple and floating down the streams in tubes or stream hopping. Swimming all the way down. There are different ponds with different falls. We would go there and spend the day just playing in the ponds.

We always went through the forest simply by following the stream. We never came out on the road from any of our ‘playground’ areas, which were basically from Queen Emma’s on up. The homes all slope down and border on the river, and every homeowner took care of those pond areas. All of us as kids knew this, and they knew who we were. If we misbehaved they certainly knew how to get a hold of our parents because we didn’t really have many people who lived up in this area, and the Nu‘uanu families that had lived here for many generations knew each other.

Ti leaf siding was further up the mountain at the Dowsett highland area, where there was tall grass after the pineapple, and now that there are more homes built there you’d have to go further up. But the ti-leaf sliding was in that area.

You needed that tall grass, when it was wet, to go ti leaf sliding. You would go up, find your favorite spot, and usually there were ti leaf plants all along the way. Everyone would gather 6 or 8 or 10 bunches of ti leaves that might make a good cushion, and they were wet.

You start at the top. You sit on them and you push, holding the stems in front of you between the legs. And you’d push, and it might be rough going for the first one, but as soon as there was a trail laid, it would get damp, and then it would get very slippery. And at the bottom, when we were all tired, then we’d go swimming.

When I was little, I used to get perplexed about, you go to First or Second Grade, you would read these readers, ‘see Spot run, see Dick and Jane chase Spot…’ And I really had a reader like that in First Grade, and I was puzzled by it. I sat there, listened to teacher who was from America—called ’the Mainland’—and read these things.

Then we would come home and we’d do our valley things with my cousins who lived next door. We were very family-oriented. I would walk to their house, two or three houses up the road, they’d come down, we’d go out and gather guava so my mother could make fresh guava juice, when it was season… (Pacific Worlds 2003d)

Section 4 Community Consultation

Throughout the course of this assessment, an effort was made to contact and consult with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge of and/or concerns about traditional cultural practices specifically related to the Project area. This effort was made by letter, email, telephone and in-person contact. The initial outreach effort was started in October 2010. Community consultation was completed in January 2011. In the majority of cases, a letter (Appendix E), an aerial photograph (see Figure 1), and a map (See Figure 2) of the Project area were mailed.

In most cases, two to three attempts were made to contact individuals, organizations, and agencies apposite to the CIA for this Project. The results of the community consultation process are presented in Table 1. Excerpts from more extensive interviews specifically related to Nu‘uanu Ahupua‘a and the Project area are presented in Section 6 below.

Table 1. Results of Community Consultation

Name	Affiliation, Background	Comments
Ailā, William	Hui Mālama I Nā Kūpuna o Hawai‘i Nei	October 20, 2010 CSH sent letter by email December 8, 2010 CSH sent letter by email
Apaka, Jeff	Director of Community Relations, Waikīkī Community Center	November 1, 2010 CSH sent letter by email December 8, 2010 CSH sent letter by email
Ayau, Halealoha	Hui Mālama I Nā Kūpuna o Hawai‘i Nei	October 20, 2010 CSH sent letter by email December 8, 2010 CSH sent letter by email
Bayman, Jim	Archaeologist, University of Hawai‘i	November 12, 2010 CSH sent letter by email November 12, 2010 Mr. Bayman called CSH, stating that he worked on a 1999 field study of Kaniakapūpū in 1999, and is aware of numerous associated cultural features *mauka* of the main site, including a carriage road, a guard station, and a wall
Blaisdell, Kekuni	Resident	November 1, 2010 CSH sent letter by email December 8, 2010 CSH sent letter by email

Name	Affiliation, Background	Comments
Burrows, Chuck	OHA Native Hawaiian Historic Preservation Council	October 20, 2010 CSH sent letter by email December 8, 2010 CSH sent letter by email December 9, 2010 Mr. Burrows replied by email, stating that is concerned if there are any archaeological sites within the Project area, he recommends an archaeological monitor and a cultural monitor; and requested that CSH present the Project information to the OHA Native Hawaiian Historic Preservation Council December 10, 2010 Mr. Burrows replied by email, stating that it may be questionable if archaeological sites mauka of Kaniakapūpū, are associated culturally, but that claims can be made as it being part of the "Kaniakapūpū *Heiau* Complex."
Cayan, Coochie	History and Culture Branch Chief, SHPD	October 20, 2010 CSH sent letter October 27, 2010 Ms. Cayan sent letter, expressing concern for access to cultural and natural sites, and referred the following organizations and individuals: long-time families of Nu‘uanu, *kūpuna* at Waikīkī Community Center and Lanakila Senior Center, neighborhood boards in Kalihi, Downtown, Ala Moana, and Waikīkī, special interest groups such as the Sierra Club, hiking and trail clubs, and fishermen of the reservoir, OHA Native Hawaiian Historic Preservation Council, Lynette Cruz, Mel Kalahiki, and Kekuni Blaisdell.

Name	Affiliation, Background	Comments
Ching, Baron	‘Ahahui Malama o Kaniakapūpū	October 20, 2010 CSH sent letter by email October 20, 2010 Mr. Ching replied by email, stating that the dam improvements need to be done properly and that there are a lot of features nearby November 7, Mr. Ching led a walking tour of Kaniakapūpū (see Section 5.2) November 10, 2010 CSH sent interview summary (1) to Mr. Ching for approval November 15, 2010 CSH met with Mr. Ching and other members of ‘Ahahui Malama o Kaniakapūpū at Zippy’s in Kāne’ohe to discuss the Project, and Mr. Ching stated that there are structures *makai* of the Project area, as well as an old road that leads from the Project area toward Kaniakapūpū January 9, 2011 CSH met with Mr. Ching and other members of ‘Ahahui Malama o Kaniakapūpū for a site visit to the Nu‘uanu Reservoir No. 4 and forested area *makai* of the Project area and *mauka* of Kaniakapūpū (see Section 5.3) January 13, 2011 CSH sent interview summary (2) to Mr. Ching for approval Januart 27, 2011 Mr. Ching approved interview summaries (1 and 2)
Ching, Clarence Ku	Former resident	October 20, 2010 CSH sent letter by email December 8, 2010 CSH sent letter by email

Name	Affiliation, Background	Comments
Cruz, Lynette	‘Ahahui Malama o Kaniakapūpū	October 18, 2010 C SH sent email to Ms. Cruz, requesting community contact information for Nu‘uanu October 18, 2010 M s. Cruz referred Beadie Dawson, Bob Midkiff, Laurel Seeti Douglass, Clarence Ku Ching, Mel Kalahiki, Charles Burrows, and Mike Sheehan (who was not contacted due to time constraints) November 15, 2010 CSH met with Ms. Cruz and other members of ‘Ahahui Malama o Kaniakapūpū at Zippy’s in Kāne’ohe to discuss the Project, and Ms. Cruz referred Bob Midkiff, who used to live *makai* of Kaniakapūpū, and suggested to ask Seeti Douglass about Queen Kalama’s bathhouse January 9, 2011 CSH met with Ms. Cruz and other members of ‘Ahahui Malama o Kaniakapūpū for a site visit to the Nu‘uanu Reservoir No. 4 and forested area *makai* of the Project area and *mauka* of Kaniakapūpū (see Section 5.3) January 13, 2011 CSH sent interview summary to Ms. Cruz for approval January 13, 2011 M s. Cruz approved interview summary
Daughter’s of Hawaii Queen Emma Summer Palace		November 9, 2010 CSH sent letter by email December 8, 2010 CSH sent letter by email

Name	Affiliation, Background	Comments
Dawson, Beadie	Resident	October 20, 2010 CSH sent letter by email December 8, 2010 CSH called and left message December 14, 2010 CSH called and left message
Douglass, Laurel “Seeti”	Former resident	October 20, 2010 CSH sent letter by email December 1, 2010 CSH interviewed Mrs. Douglas (see Section 5.4) December 9, 2010 CSH sent interview summary for approval January 3, 2010 CSH sent interview summary for approval by email January 31, 2011 Mrs. Douglass approved interview summary
Falemei, Hinaleimoana	OIBC, Resident	October 26, 2010 Ms. Falemei replied to Kawika McKeague, who forwarded response to CSH, stating that she is happy that this well-known and long-used area will be undergoing some major repair work, and that she has no immediate concerns since the work will be in an area already impacted (see Section 4.3)
Finley, Robert J.	Chair, Waikīkī Neighborhood Board	November 1, 2010 CSH sent letter by email December 8, 2010 CSH sent letter by email December 8, 2010 Mr. Finley responded by email that he does not have any expertise to contribute
Guerrero, Donald	Chair, Kalihi-Palama Neighborhood Board	November 1, 2010 CSH sent letter by email December 8, 2010 CSH sent letter by email

Name	Affiliation, Background	Comments
Hassager, Ulla	‘Ahahui Malama o Kaniakapūpū	October 20, 2010 CSH sent letter by email November 15, 2010 CSH met with Ms. Hassager and other members of ‘Ahahui Malama o Kaniakapūpū at Zippy’s in Kāne’ohe to discuss the Project January 9, 2011 CSH met with Ms. Hassager and other members of ‘Ahahui Malama o Kaniakapūpū for a site visit to the Nu‘uanu Reservoir No. 4 and forested area *makai* of the Project area and *mauka* of Kaniakapūpū (see Section 5.3) January 13, 2011 CSH sent interview summary to Ms. Hassager for approval February 28, 2011 Ms. Hassager approved interview summary
Hori, Nicole	Secretary/Treasurer, Nu‘uanu/Punchbowl Neighborhood Board	November 1, 2010 CSH sent letter by email December 8, 2010 CSH sent letter by email
Hurst, Larry	Chair, Ala Moana/Kaka‘ako Neighborhood Board	November 3, 2010 CSH sent letter December 8, 2010 CSH sent letter

Name	Affiliation, Background	Comments
Kalahiki, Mel	‘Ahahui Malama o Kaniakapūpū	October 20, 2010 CSH sent letter by email November 15, 2010 CSH met with Mr. Kalihiki and other members of ‘Ahahui Malama o Kaniakapūpū at Zippy’s in Kāne’ohe to discuss the Project, and Mr. Kalahiki shared a *mo’olelo* from the Battle of Nu’uanu concerning the defeated O‘ahu forces, who were buried *mauka* of the Project area. November 16, 2010 C SH interviewed Mr. Kalihiki (see Section 5.5) December 8, 2010 C SH sent interview summary for approval by email. January 3, 2010 C SH sent interview summary for approval by email January 18, 2011 M r. Kalahiki approved interview summary
Kāne, Uncle Shad	OIBC, Nā Koa o Pālehua, OHA Native Hawaiian Historic Preservation Council	November 1, 2010 CSH sent letter by email November 3, 2010 M r. Kāne responded by email, referring Seeti Douglas and stating that there is substantial disturbance in the immediate area of the reservoir, but that the flow of the stream should not be restricted more than it already is, as it flows past many culturally historic places on its way to Honolulu
Lanikila Multi-Purpose Senior Center		November 1, 2010 CSH sent letter December 8, 2010 CSH sent letter
Lavoie, Frank	Chair, Downtown Neighborhood Board	November 1, 2010 CSH sent letter by email November 3, 2010 Mr. Lavoie responded by email, stating that he will mention the Project during the November 4, 2010 meeting

Name	Affiliation, Background	Comments
Leinweber, Spencer	‘Ahahui Malama o Kaniakapūpū	November 15, 2010 CSH met with Ms. Spencer and other members of ‘Ahahui Malama o Kaniakapūpū at Zippy’s in Kāne’ohe to discuss the Project, and Ms. Spencer wants to obtain the proposed Project engineering details, and states that any overflow will flow directly to the site of Kaniakapūpū January 9, 2011 CSH met with Ms. Leinweber and other members of ‘Ahahui Malama o Kaniakapūpū for a site visit to the Nuuanu Reservoir No. 4 and forested area *makai* of the Project area and *mauka* of Kaniakapūpū (see Section 5.3) January 13, 2011 CSH sent interview summary to Mr. Leinweber for approval February 28, 2011 Ms. Leinweber approved interview summary
McKeague, Kawika	OIBC	October 20, 2010 CSH sent letter by email December 8, 2010 CSH sent letter by email December 10, 2010 Mr. McKeague forwarded response by Hinaleimoana Falemei
Midkiff, Bob	Former resident	January 3, 2010 CSH called Mr. Midkiff at the Kahala Nui retirement home, but he was leaving for the mainland, and could not comment on the proposed Project
Morgan, Lydi	Secretary, Sierra Club Hawai‘i Chapter O‘ahu Group	November 1, 2010 CSH sent letter by email December 8, 2010 CSH sent letter by email

Name	Affiliation, Background	Comments
Nāmu‘o, Clyde	Administrator, OHA	October 20, 2010 CSH sent letter October 27, 2010 M r. Nāmu‘o replied in a written statement and recommended that consultation be initiated with Chuck Burrows and the Queen Emma Summer Palace (Hānaiakamālama)

4.1 State Historic Preservation Division

CSH contacted Phyllis “Coochie” Cayan, History and Culture Branch Chief of SHPD, on October 20, 2010. In a written response sent to CSH on October 22, 2010 (Figure 26), Ms. Cayan emphasizes the rich traditional cultural resources and history of Nu‘uanu, including significant sites (e.g., Kaniakapūpū, the Pali, Mauna Ala) and *mo‘olelo* of specific places that link the deities and the *ali‘i* from mythical to historic times. SHPD is concerned that public access to cultural and natural resources remain unrestricted and also raises the possibility of disturbing cultural and archaeological sites with ground disturbance. SHPD suggests community outreach with long-time families of Nu‘uanu, *kūpuna* at Waikīkī Community Center and Lanakila Senior Center, neighborhood boards in Kalihi, Downtown, Ala Moana, and Waikīkī, special interest groups such as the Sierra Club, hiking and trail clubs, and fishermen of the reservoir, the Association of Hawaiian Civic Club’s Historic Preservation Committee, Lynette Cruz, Mel Kalahiki, and Kekuni Blaisdell.

4.2 Office of Hawaiian Affairs

CSH contacted Clyde Nāmu‘o, Administrator of OHA, on October 20, 2010. In a written response sent to CSH on October 20, 2010 (Figure 27), Mr. Nāmu‘o recommends initiating consultation with Chuck Burrows and the Queen Emma Summer Palace, Hānaiakamālama.

4.3 Hinaleimoana K.K. Wong Falemei

CSH contacted Hinaleimoana K.K. Wong Falemei, Vice-Chair of the OIBC on October 20, 2010. In a written response sent to CSH on October 26 by email, Mrs. Falemei states her family connection to Nu‘uanu Ahupua‘a and describes severe changes to the valley in the last quarter century:

> My name is Hinaleimoana K.K. Wong Falemei and I am a native of this *ahupua‘a* of Nu‘uanu. At least four generations on both my Hawaiian and Chinese sides of the family have called this *ahupua‘a* home, and prior to that, their families migrated not only from China, but also the various other islands of Hawai‘i that we still have great connection to. I, however continue to live and work here in this *ahupua‘a* and I am thankful to have been contacted re: this work in Nu‘uanu. At this point in time I have no new information to add upon what might already be

found in the most cited and familiar of reference resources i.e. *Sites of Oahu* to mention one of the primary ones.

Of the *mo‘olelo* and the histories associated with Nu‘uanu, again one need not proffer those that have already been told and retold, however I am happy to know that this well-known and long used area will be undergoing some major repair work. Given that the work is going to be performed in already existing areas that have been impacted previously by man I have no immediate concerns as there are already mechanisms in place in the event that a discovery of any sort of “new” or previously undiscovered items turn up.

The *mo‘olelo* that I have of Nu‘uanu are not the historical ones but more that of growing up i n Nu‘uanu and the kinds of gathering I have done here in my *ahupua‘a* as well as the personal stories of life and love in this valley. I have fond memories of this place.

I do know however that the impact of the growth of our island has severely changed the face and the climate of this valley. The shortage of water on this island due to all of the growth we have seen in the last 25 years has truly impacted Nu‘uanu. No longer is Nu‘uanu the cool, and back then oh so often chilly lofty heights. No longer do the *wailele* or waterfalls that were the claim to fame of this *‘āina* [land] flow so freely from the valley’s mountainsides. Only in times of great rain do they ever appear and never do they really appear so robust as they did in my childhood. No longer do I drive through the ever present mist of Nu‘uanu as we did when I was a small child. No longer do the lands of Nu‘uanu from mountain to ocean look ever so green and verdant. I remember a be autiful Nu‘uanu that always was so lush and alive. Now it is obvious that our island’s growth has truly taken its toll, and over a period of only 25 years. I miss the Nu‘uanu of former times. Perhaps one day I may live to see the return of the true nature and meaning of the name Nu‘uanu.

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

PAUL J. CONRY
ACTING FIRST DEPUTY

LENORE N. OHYE
ACTING DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

October 22, 2010

LOG NO: 2010.3252
DOC. NO: 1010PC001

MEMORANDUM

TO: Joe Genz
Cultural Surveys Hawai'i, P.O. Box 1114, Kailua, Hawai'i 96734

FROM: Phyllis Coochie Cayan, History and Culture Branch Chief

Subject: **Cultural Impact Assessment (CIA) for the Nu'uanu Reservoir No. 4 Project, Nu'uanu Ahupua'a, Honolulu District, O'ahu Island. TMK: [1] 2-2-054:001.**

Mahalo for the opportunity to comment on the CIA for the Nu'uanau Reservoir No.4 project at TMK:[1] 2-2-054:001. As you all are aware the ahupua'a of Nu'uanu is rich in traditional cultural resources and history - both pre-contact and historic that range from the first peoples to settle in this ahupua'a to the historic times that include the ali'i and their presence in the valley. Nu'uanu remains rich in culture and history with significant sites (i.e. Kaniakapupu, the Pali, Mauna Ala) as well as many legends of specific places in the ahupua'a that link with the deities and the ali'i from mythical to historic times. This ahupua'a is rich in natural resources that attracted the monarchy and later many other peoples to settle there as food production was easily enhanced with the ample water resources and access to the shoreline at Kou (Honolulu) harbor was within reach. Nu'uanu Valley has all the natural resources for food production (especially water), for habitation and for access to significant sites for religious protocols necessary to the people. The valley today remains abundant in natural resources despite modern development and more people.

The department recommends you all bring this project's information to as many public and community forums as possible to reach the deep community users in the ahupua'a especially long-time families who continue to live in the ahupua'a. This will entail strategic outreach to gather mana'o on traditional cultural practices in venues such as:

1. Using the OHA newspaper "Ka Wai Ola" to reach the old-time families and others in the ahupua'a and/or requesting contacts from the OHA Native Hawaiian Historic Preservation Council.
2. Talk story with kupuna at senior centers (i.e., Waikiki Community Center, Lanakila Senior Center).
3. Talk story with Neighborhood Boards in Kalihi, Downtown, Ala Moana, Waikiki – all in the ahupua'a.
4. Talk story with special interest groups like the Sierra Club, the hiking and trail clubs, the fisher folk who use the reservoir in open season, the fisher folk along the shoreline of the ahupua'a and so on.
5. The Association of Hawaiian Civic Clubs' *Historic Preservation Committee* (see AHCC website).

Some folks who may be helpful in your outreach include the following:

- Ms. Lynette Cruz /Sacred Sites, Sacred Places (contact at UH Manoa Anthropology Dept.)
- Uncle Mel Kalahiki no contact info available –ask Lynette or Kekuni
- Dr. Kekuni Blaisdell, kupuna resident Phone: 808.595.6691

SHPD also has concerns that public access to cultural and natural resources are not blocked by the project and/or there is access in a safe manner. Also, if there is any ground disturbances the possibility of disturbing cultural and/or archaeological sites due to the history of this valley by the people of old.

Hopefully you will talk story with community groups and old-timers who may have recollections of any traditional cultural practices in the project area. Any questions, please call me at 808-692-8025 or via email to me at Phyllis.L.Cayan@hawaii.gov #

Figure 26. SHPD response letter

PHONE (808) 594-1888 FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD10/5340

October 27, 2010

Joe Genz
Cultural Surveys Hawai'i
P.O. Box 1114
Kailua, HI 96734

RE: Cultural Impact Assessment consultation
Nu'uanu Reservoir Repair Project - Honolulu, Island of O'ahu
Tax Map Key: (1) 2-2-054:001

Aloha e Mr. Genz,

The Office of Hawaiian Affairs (OHA) is in receipt of your October 20, 2010 letter initiating consultation and seeking comments ahead of a cultural impact assessment (assessment) to conduct repair work on the Nu'uanu Reservoir No. 4 project. It is our understanding the Honolulu Board of Water Supply is undertaking repair work on this project that will entail removal and disposal of sediments, repair debris cages, dredging, construction of measuring weirs, improvement of access road to damn, and other improvements.

OHA recommends that consultation be initiated with the following individuals and community organizations that may be willing to share their mana'o regarding the assessment: conservationist Chuck Burrows and the Queen Emma Summer Palace, Hānaiakamālama. Please remember that this list is not all encompassing and we are sure additional individuals will be identified as you move forward with your consultation process.

We applaud your efforts to perform a cultural impact assessment. OHA does request assurances that should iwi kūpuna or Native Hawaiian cultural or traditional deposits be identified during ground altering activities related to this project, all work will immediately cease and the appropriate agencies will be contacted pursuant to applicable law. OHA would also like to be notified and consulted if burials are found.

Please forward Kathryn Keala a copy of the draft assessment to review and provide additional comments. Thank you for initiating consultation at this early stage. Should you have any questions, please contact Kathryn Keala, at (808) 594-0272 or kathyk@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Chief Executive Officer

Figure 27. OHA response letter

Section 5 Interviews

Kama‘āina and *kūpuna* with knowledge of the proposed Project and study area participated in semi-structured interviews from October 2010 to January 2011 for this CIA. CSH attempted to contact 28 individuals for this draft CIA report; of those, 16 responded and seven participated in formal interviews. CSH initiated the interviews with questions from the following five broad categories: *wahi pana* and *mo‘olelo*, agriculture and gathering practices, freshwater and marine resources, cultural and historic properties, and burials. Participants' biographical backgrounds, comments, and concerns about the proposed development and Project area are presented below.

5.1 Acknowledgements

The authors and researchers of this report extend our deep appreciation to everyone who took time to speak and share their *mana‘o* (thoughts, opinions) with CSH whether in interviews or brief consultations. We request that if these interviews are used in future documents, the words of contributors are reproduced accurately and not in any way altered, and that if large excerpts from interviews are used, report preparers obtain the express written consent of the interviewee/s.

5.2 Baron Ching

CSH accompanied Baron Ching on a walking tour of Kaniakapūpū on November 7, 2010. Mr. Ching provided a detailed history of Kaniakapūpū in relation to Luakaha ‘Ili, Nu‘uanu Valley and Honolulu Ahupua‘a [an alternate name for Nu‘uanu Ahupua‘a, depending on the source and time period]. Overall, the site of Kaniakapūpū transcends several time periods, with religious, political, and economic significance extending into the ancient past, during the reigns of Kamehameha and his successors, and continuing today. Mr. Ching shared the following information during his walking tour:

The *ahupua‘a* of Honolulu and the valley of Nu‘uanu have always been important locations for several gods. *Mo‘olelo* describe that Haumea and her daughter, the volcano goddess Pele, lived in the *ahupua‘a*, and that the gods Kū, Kāne, and Kanaloa "have always walked here."

Mo‘olelo also describe that Hawai‘iloa, the discover of the Hawaiian archipelago, voyaged back to Tahiti in order to bring Kunuiakeakua (Tu-nui-a-te-atua) to Hawai‘i. Kunuiakeakua constructed a *heiau* called Kawaluna in the valley of Waolani in Nu‘uanu under the supervision of the god Kū. This was the first *heiau* to be constructed under the supervison of a god. All subsequent *heiau* had to conform to the components of this first *heiau*. Other *mo‘olelo* explain that Papa and Wākea, ancestors of the Hawaiians, gave birth to the first people in Nu‘uanu. The Nu‘uanu corridor also served as the main passage between the *moku* of Kona and Ko‘olaupoko, as well the site of several battles.

Kū‘ali‘i, a *mō‘ī* from Maui, staged a major battle in Nu‘uanu in the 1500–1600s to become the sole ruler of O‘ahu. In 1783, Kahekili fought for control of O‘ahu, Maui, and Moloka‘i by emgaging the O‘ahu forces at Pauoa, where the river "ran with blood." Then, in 1795, Kamehameha invaded O‘ahu and led his final victorious battle at the Nu‘uanu Pali. Some reports

indicate that Kamehameha rested at Kaniakapūpū during the final battle and did not go to the battle at the precipice.

In ancient times, Kaniakapūpū was the site of a *heiau* dedicated to Lono, the god of agriculture. Remnants of the vast *lo‘i kalo* in the vicinity of Kaniakapūpū can still be seen today in the form of rock-lined *‘auwai* that still function to channel water from the main flow of Nu‘uanu Stream (Figure 28). *Kahūna* (priests) also cultivated medicinal plants in gardens at Kaniakapūpū.

Around 1835, K amehameha III ordered the construction of the Summer Palace at Kaniakapūpū (Figure 29), the first government building in Hawai‘i that incorporated a foreign architectural style. The main building is composed of basalt rocks cemented together with mortar. Other features are more modern: a wooden lanai used to run in front of the main entrance; the floor was made of wood; the windows were beveled to allow more light to enter; plaster decorated the interior, and the house is divided into a large living room and two bedrooms. Yet, distinctive Hawaiian elements of house construction were also built into the palace. The thatched roof was made of *pili* (a type of native grass) and the doors were purposively misaligned to prevent nightmarchers from entering. In addition, the surrounding area contains numerous other distinctive Hawaiian architectural features, including a stone pavement leading up to the main entrance (Figure 30), terraced stone walls along the perimeter of the area (Figure 31), a stone cookhouse (Figure 32), stone bridges (Figure 33and Figure 34), stone-lined *‘auwai* (Figure 35) and an adze sharpening stone (Figure 36). The area also contains a three-tiered stone terrace that outlines an area that may have been a *heiau* or a platform for *lua* training in ancient times (Figure 37), but that was converted to a roofed structure, as indicated by rock-lined post holes along its perimeter (Figure 38).

The Summer Palace was a pl ace of relaxation and retreat for Kamehameha III. He met with his chiefs at Kaniakapūpū to make decisions that led to fundamental changes to Hawaiian society. According to *mo‘olelo* previously shared by Mel Kalahiki of ‘Ahahui Malama o Kaniakapūpū, Kamehameha III partially wrote at Kaniakapūpū a declaration of rights in 1839, the first constitution in 1840, and a new system of land ownership under the Māhele of 1847.

Five months after Lord George Paulet declared Hawai‘i to be a British colony on February 15, 1843, Admiral Thomas informed Kamehameha III that Britain respected the sovereignty of the Kindgdom of Hawai‘i. Kamehameha III commemorated this day, July 31, as Lā Ho‘iho‘i Ea (Restoration Day), with a speech that included the phrase, *ua ma ke ea o ka ‘āina i ka pono* (the life of the land is perpetuated in righteousness), now the state motto. A party also took place at Kaniakapūpū. In 1847, the fourth anniversary of this day was celebrated at Kaniakapūpū, which 10,000 visitors reportedly attended. Walking along a path (Figure 39), they came to a long stone pavement, where the dignitaries met Kamehameha III on the lanai in front of the main building. The party was located 60 rods (1000 feet) away and a table 20 rods (350 feet) in length was full of food. Perhaps the abandoned structure with rock-lined post holes (see Figure 38) was used to prepare food for two these two great *pā‘ina* (feast, meal) of 1843 an 1847. *Mauka* of the cleared vegetation behind Kaniakapūpū is a bottle (Figure 40) that most likely was manufactured between 1820–1870. Mr. Ching speculates this bottle may have been associated with the Lā Ho‘iho‘i Ea party. According to Mr. Ching, a previous archaeological survey did not extend farther *mauka* into the dense forest of bamboo. Acknowledging that the placement of most stones

on the landscape was intentional and pointing out several stones in the limited visibility of the bamboo, Mr. Ching suggests that there could be many cultural sites associated with Kaniakapūpū in the *mauka* forest that have not yet been documented.

Kaniakapūpū also served as a place of regal learning in Hawai‘i during the hot summers for all the young noble children who ever sat on the throne. Kamehameha III developed the Royal School for children of *ali‘i* to prepare for their future leadership roles, especially Kamehameha IV.

Later, in 1885, David Kalākaua ordered the construction of a waterline in upper Nu‘uanu Valley to power a water turbine for Hawaiian Electric. A segment of this culvert, which most likely replaced an *‘auwai*, ran through Kaniakapūpū, and remnants remain today (Figure 41).

Figure 28. *‘Auwai* (1) near Kaniakapūpū (CSH November 7, 2010)

Figure 29. Kaniakapūpū (CSH November 7, 2010)

Figure 30. Pavement in front of Kaniakapūpū (CSH November 7, 2010)

Figure 31. Stone walls along the perimeter of Kaniakapūpū (CSH November 7, 2010)

Figure 32. Cooking house of Kaniakapūpū (CSH November 7, 2010)

Figure 33. Bridge (1) *mauka* of Kaniakapūpū leading to taro patches (CSH November 7, 2010)

Figure 34. Bridge (2) *mauka* of Kaniakapūpū (CSH November 7, 2010)

Figure 35. *‘Auwai* (2) near Kaniakapūpū (CSH November 7, 2010)

Figure 36. Stone with marks indicative of adze sharpening (CSH November 7, 2010)

Figure 37. Site of possible *heiau* or platform for *lua* fighting (CSH November 7, 2010)

Figure 38. A representative post holes along the perimeter of the *heiau*/platform (CSH November 7, 2010)

Figure 39. Trail leading to Kaniakapūpū (CSH November 7, 2010)

Figure 40. Bottle dating to 1820–1870 previously discovered *mauka* of Kaniakapūpū in dense foliage (CSH November 7, 2010)

Figure 41. Remnants of 1885 waterline running through the site of Kaniakapūpū (CSH November 7, 2010)

5.3 Baron Ching, Lynette Cruz, Spencer Leinweber, Ulla Hassager

CSH accompanied four members of ‘Ahahui Malama o Kaniakapūpū—Baron Ching, Lynette Cruz, Spencer Leinweber, and Ulla Hassager—on a site visit to the Nu‘uanu Reservoir No. 4 (Figure 42) and the forested region *makai* of the Project area and *mauka* of Kaniakapūpū on January 9, 2011. In order to locate known and suspected sites that may be connected culturally to Kaniakapūpū as habitation sites or remnants of medicinal gardens, Mr. Ching led the other members and CSH to the forested area just *makai* of the spillway on the eastern edge of the Project area, entered a dense grove of bamboo farther *makai* near the intersection of the Pali Highway and the Nu‘uanu Pali Road, and traversed through the dense bamboo forest from Kaniakapūpū *mauka* toward the reservoir (Figure 43).

A long-term goal of ‘Ahahui Malama o Kaniakapūpū is to restore Kaniakapūpū, but they face a problem of access since currently only a small trail connects the site to the Nu‘uanu Pali Drive. One solution is to use an old water pipe access road that once traversed the now densely forested region *mauka* of Kaniakapūpū toward the spillway on the eastern edge of the reservoir. Based on previously gathered coordinates, Mr. Ching located the beginning of this road, a relatively flat section of land flanked by Lulumahu Stream and a high bank. Ms. Cruz immediately identified this location as a potential habitation site due to several *ti* (Polynesian introduced plants) enclosing a space that contained a concentration of *pōhaku* (Figure 44). According to Mr. Ching, ‘Ahahui Malama o Kaniakapūpū takes the position that any rocks on the landscape in upper Nu‘uanu Valley were placed there by people, and according to Ms. Cruz, *ti* plants, which are used for a variety of cultural purposes, do not spread beyond their initial cultivation. Thus, the combined presence of rock clusters and *ti* are highly suggestive of former sites of habitation. Mr. Ching continued to walk along this overgrown former access road until the vegetation became too thick, at which point Ms. Cruz located more *ti* leaves. In close proximity to the spillway overflow, the group discovered a place with a concentration of *pōhaku* (Figure 45), ti, *laua‘e* (a fragrant fern), and *‘ie‘ie* (an endemic woody, branching climber) (Figure 46), also indicative of former habitation. According to Ms. Hassager and Mr. Ching, the aerial roots of *‘ie‘ie* were woven to form a *kā‘ai* (a sennit casket) for the *iwi* of *ali‘i*. Although *‘ie‘ie* are no longer used for such practices, Ms. Cruz collected a broken section for her personal use. Ms. Leinweber notes that she has never before come across such a large concentration of *‘ie‘ie*, nor of such large size.

Mr. Ching led CSH to a dry-stacked wall approximately three feet high in a dense grove of bamboo *makai* of the reservoir near the Nu‘uanu Pali Drive (Figure 47). A large stone at a break in the wall may have been a shrine (Figure 48), according to Mr. Ching. He explains that the wall reaches five feet tall in some places and extends *mauka* toward the hunter check-in station near the intersection of the Nu‘uanu Pali Drive and the Pali Highway and *makai* toward the trailhead that leads to Kaniakapūpū, a distance of approximately 1000 feet. He contends that the wall was most likely used as a territorial border. He also notes that stone enclosures and terraces abut the wall at certain locations. Mr. Ching pointed to several large *pōhaku* through the dense foliage, which were most likely placed there by people. Based on previous excursions into this forested region, he contends that the area is filled with similar cultural artifacts and sites.

Mr. Ching also led CSH on a route familiar to him through the dense bamboo forest *mauka* of Kaniakapūpū in the general direction of the reservoir. Along the way, he pointed to *‘ie‘ie*, several

shallow ditches that could be former *‘auwai*, including one with a potential overflow channel that would flow toward Nu‘uanu Stream, and a rock structure located along Nu‘uanu Stream with a possible retaining wall near another section of a potential former *‘auwai*.

Overall, the group contends that the landscape in upper Nu‘uanu Valley contains numerous cultural features and sites. They are not surprised that a brief exploratory excursion revealed four potential habitation sites or remnants of former medicinal gardens. After all, as Mr. Ching notes, the area was formerly designated as Crown Lands, which obviated the need to conduct a survey.

According to R.M. Towill Corporation, the proposed Project involves substantially draining the reservoir levels, which would result in approximately three acres of exposed sediment. Complimenting the vision of ‘Ahahui Malama o Kaniakapūpū to restore Kaniakapūpū and the surrounding area to former conditions of extensive irrigated taro cultivation, Mr. Ching recommends that the sediment, which contains natural nutrients for fertilizer, should be left in place and utilized as the base for *lo‘i kalo*.

To improve access to Kaniakapūpū in order to restore the structures and re-cultivate the land, Mr. Ching requests that the Honolulu Board of Water Supply grant ‘Ahahui Malama o Kaniakapūpū access to the gate and reservoir access road, and to grant permission to use the old water pipe access road that leads toward Kaniakapūpū from the spillway.

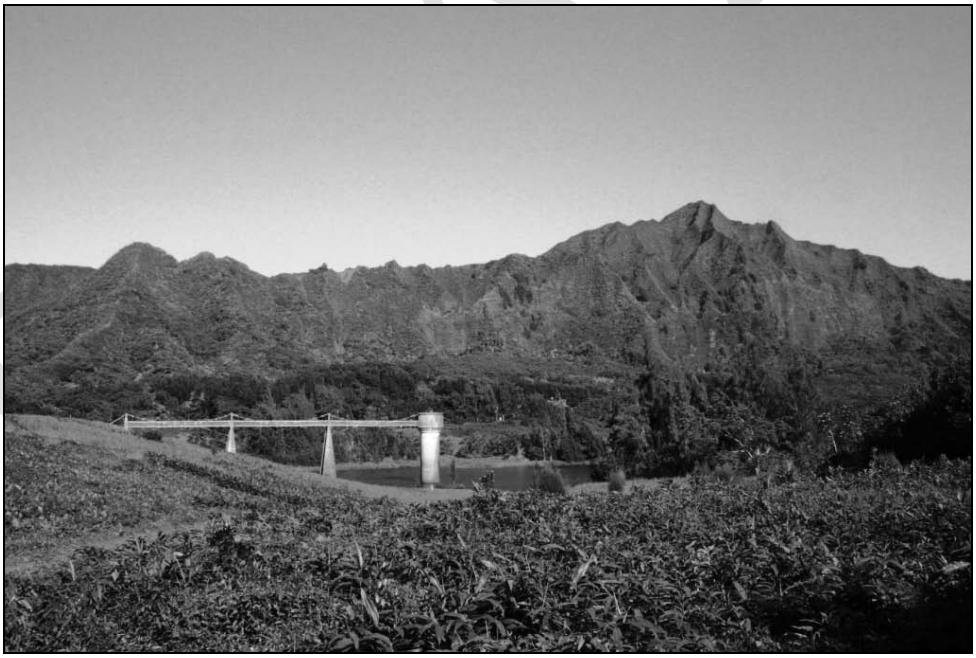

Figure 42. Nu‘uanu Reservoir No. 4, with spillway in the foreground (CSH January 9, 2011)

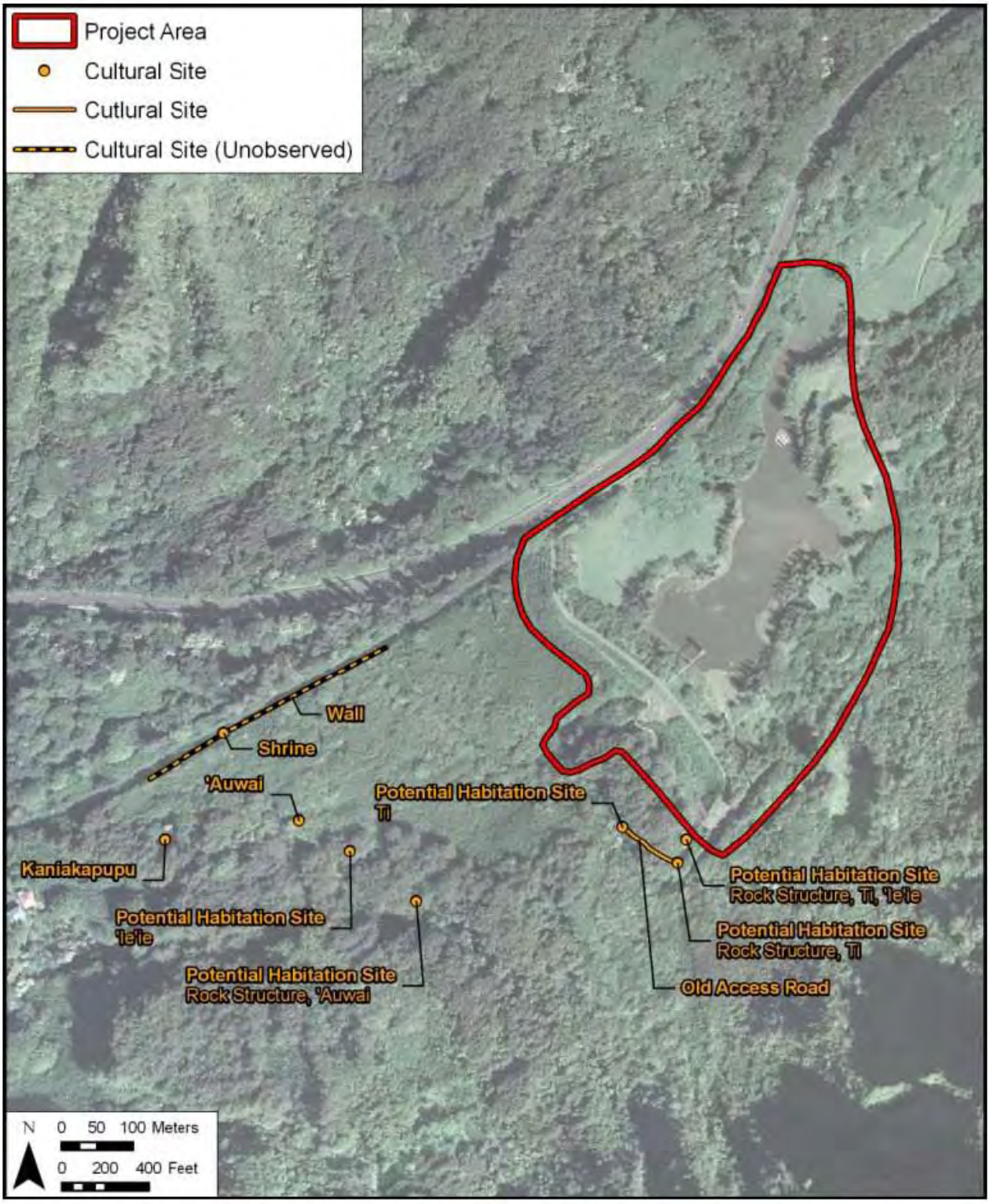

Figure 43. Cultural sites identified by Baron Ching, Lynette Cruz, Spencer Leinweber, and Ulla Hassager (base map, orthoimagery of 1998 USGS)

Figure 44. One of several *ti* plants enclosing a concentration of rocks (CSH January 9, 2011), which suggests former habitation to members of ‘Ahahui Malama o Kaniakapūpū

Figure 45. A concentration of stones (CSH January 9, 2010), which, together with *‘ie‘ie* (see Figure 46), suggest former habitation to members of ‘Ahahui Malama o Kaniakapūpū

Figure 46. One of several *‘ie‘ie* (CSH January 9, 2011), which, together with stones (see Figure 45) suggests former habitation to members of ‘Ahahui Malama o Kaniakapūpū

Figure 47. Dry-stacked stone wall in grove of bamboo, indicated by Mr. Ching (CSH January 9, 2011)

Figure 48. Possible shrine (large upright stone) at break in wall, indicated by Mr. Ching (CSH January 9, 2011)

5.4 Laurel “Seeti” Douglas

CSH interviewed Laurel “Seeti” Douglass on December 1, 2010 at her home on Maui. Mrs. Douglass, now 70 years old, was born on November 13, 1940 to Barbara Montague Gard and Wade Edmund Sheehan. Much of her childhood was spent in upper Nu‘uanu Valley in the *‘ili* of Luakaha at her grandmother’s house *makai* of Kaniakapūpū and the Nu‘uanu Reservoir No. 4. Mrs. Douglass has also conducted extensive archival research on Nu‘uanu Valley that makes her an interested researcher on the region.

Mrs. Douglass traces her lineage back four generations to missionaries in the early 1800s, starting with the departure of the vessel *Mary Frazier* from Boston in 1836. Onboard was missionary Amos Starr Cooke and his wife, Juliette Montague, who arrived in Hawai‘i on April 9, 1837, and, at the request of Kamehameha III, started the Chief’s Children’s School in 1839 to prepare the young nobility for leading their nation. The school was initially located at a site now covered by the capitol building, but the training also took place at Kaniakapūpū. Based on her readings of the journals of the regal children, Mrs. Douglass stresses that “beatings took place there where now laws of the land are being made.” She describes the plight of Moses Kekuaiwa (1829–1848), who died suddenly during the measles epidemic of 1848. Amos Cooke wrote in a letter that his sudden death served as a warning, which, in conjunction with numerous accidental falls and broken limbs of the other children, leads Mrs. Douglass to infer that severe corporal punishment took place at the royal school, which, according to international law, is a form of genocide.

Amos Cooke and his wife Juliette had a daughter in 1843, also named Juliette Montague Cooke. In 1865, she married Joseph Ballard Atherton, who arrived from Boston in 1859 aboard the vessel *Cyrene* and found work with the Cookes' and boarded in their home. Interestingly, Joseph B. Atherton and his wife's younger brother, Charles Montague Cooke (1849–1909), were central figures in the 1893 illegal overthrow of the Hawaiian Kingdom. About the same time, in 1890, Mrs. Douglass's grandmother, Juliette Montague Atherton, was born. She married Jack Guard and had a daughter in 1917, Barbara Montague Guard. She, in turn, married Wade Edmund Sheehan (born 1914) in 1939 and had six children, including Laurel Ann Sheehan (Mrs. Douglass), who was born in 1940 at Kapi‘olani Maternity Hospital.

As a young child, Mrs. Douglass lived on Kahala Avenue but moved with her sister, mother, grandmother, and great-grandmother to Palo Alto, California, during World War II. After the war, her family returned to Hawai‘i and settled in Kāne‘ohe. In 1950, her grandmother built a house in upper Nu‘uanu Valley, adjacent to the *makai* boundary of the Midkiff property (which is just *makai* of Kaniakapūpū). Her childhood memories center on this Luakaha property, especially playing games with her siblings and many cousins in the gulch of Nu‘uanu Stream. She shares moving images of her mother as a child and other missionary children playing games in the 1920s on the current Midkiff property, and of her and her siblings playing in the shallow water of Nu‘uanu Stream. They also played in the upstream waterfall, Luakaha Falls, which falls 80 feet.

Mrs. Douglass remembers that several stone terraces lined the properties adjacent to her grandmother's house. She also remembers cobbled stone trails that ran through the region. After graduating from high school at Punahou, one of her friends, Nolan George, brought several football players to her grandmother's house, and as the group hiked up the side of the Luakaha waterfall, Mrs. Douglass saw, for the first time, the ruins of Kaniakapūpū.

Mrs. Douglass' long-standing quest to understand the history of Nu‘uanu Valley has led her to gather knowledge of the Nu‘uanu Reservoir No. 4. She notes that a freshwater spring was once located in the area now covered by the water of the reservoir (Figure 49). She also describes a garden at Kaniakapūpū, maintained by a chief named Boki (also governor of O‘ahu during the time of Kamehameha II), that once contained numerous medicinal plants, and that travelers had to provide a tithe for safe passage from these gardens at Kaniakapūpū to the *mauka* spring. Mrs. Douglass recounts that Val Ching, an expert of Nu‘uanu Valley, previously mentioned to her that the spores of these former medicinal plants most likely have survived and could be collected to restore the garden.

Figure 49. Spring at the Nu‘uanu Reservoir No. 4 a low reservoir levels; undated photograph supplied by Laurel Douglass

5.5 Mel Kalahiki

CSH interviewed Mel Kalahiki on November 16, 2010 at his home in Kāne‘ohe, and previously conducted interviews in 2008 and 2009. Mr. Kalahiki, now 85 years old, was born on June 25, 1925 to Kamaka Kalahiki of Kahalu‘u and Elisabeth Akau of Kohala. He worked within the Council of Hawaiian Organizations to establish legislation that formed OHA. Mr. Kalahiki also formed ‘Ahahui Mālama o Kaniakapūpū to help preserve the summer home of Kamehameha III.

Tracing his lineage to Kamehameha, Mr. Kalahiki carries a deep responsibility to “carry on Kamehameha’s wishes,” including the preservation and perpetuation of Kamehameha’s knowledge and accomplishments. In 1995, Mr. Kalahiki conceptualized and organized a bicentennial commemoration of the 1795 battle of Nu‘uanu. The Council of Chiefs of Pu‘ukoholā Heiau led about 1000 people on the general path of the battle, starting at Kapi‘olani Park and Waikīkī Beach to symbolically commemorate the arrival of the canoes, and then up Nu‘uanu Valley to reach the precipice of the Nu‘uanu Pali.

As a child in the early 1930s, Mr. Kalahiki spent several years at Kawaihae living with his grandfather, William Paul Mahi-nauli Akau, at the foot of Pu‘ukohalā Heiau (which Kamehameha built between 1790–1791) on the Big Island, so his memories and ties to the *heiau* are very strong. He understood then the legacy of Kamehameha—when he saw Pu‘ukohalā Heiau, he “saw things through the eyes of Kamehameha,” as the structure of the *heiau* had become “the essence of Hawaiian wisdom.”

Mr. Kalahiki became interested in several cultural sites in the valley of Nu‘uanu, including two *heiau* and a large *pōhaku* alongside the western cliffs of the valley that resemble a *mo‘o*.

Clarence Ching first talked with Mr. Kalahiki about Kaniakapūpū in the late 1990s. His first visit to Kaniakapūpū revealed that the site required immediate attention to stabilize the main structure. The head of the DNLR then granted stewardship of Kaniakapūpū to Mr. Kalahiki.

Mr. Kalahiki shares his observations and *mo‘olelo* of two *pōhaku* in and near the site of Kaniakapūpū. Inside the property, water flows down a particular stone that is located in a grove of bamboo. Mr. Kalahiki placed a compass on this stone, but the compass needle circled without resting at a particular direction. Mr. Kalahiki also heard about a stone on the trail leading toward Kaniakapūpū that radiated light. Mr. Kalahiki suggested that such radiance was part of the creation of the island.

Mr. Kalahiki also shared *mo‘olelo* concerning the history of the area. The site of Kaniakapūpū once contained medicinal gardens. High priests associated with these gardens of Kaniakapūpū collected a tithe from travelers to gain protected passage through the area. More recently, Kamehameha’s army rested at a waterfall near Kaniakapūpū during their ascent to their final battle at the Nu‘uanu Pali. Meanwhile, the O‘ahu forces fled toward a side valley *mauka* of Kaniakapūpū and the Nu‘uanu Reservoir No. 4, but their intended escape route ended abruptly at a waterfall. Kamehameha’s forces killed them, and they were buried at the waterfall.

Mr. Kalahiki’s vision for Kaniakapūpū is to stabilize the site, clear the vegetation, document any features and artifacts outside the current boundary, and develop a cultural preservation and education center, including the cultivation of medicinal plants for *lā‘au lapa‘au* (traditional plant medicine). Mr. Kalahiki is aware that fishermen catch catfish at the Nu‘uanu Reservoir No. 4, and does not have any concerns or recommendations for the proposed Project.

Section 6 Cultural Landscape

Discussions of specific aspects of traditional Hawaiian culture as they may relate to the Project area are presented below. This section integrates information from Sections 3–5 in order to examine cultural resources and practices identified within or in proximity to the Project area in the broader context of the encompassing Nu‘uanu landscape.

6.1 Settlement and Habitation

Substantial populations and permanent settlements were likely located close to the mouth of Nu‘uanu Stream at the coastal Kou village, as coastal residents constructed fishponds in Honolulu Bay and developed wetland agriculture, while more modest permanent habitation may have been located downstream of the Project area (Dixon et al. 1994:7).

6.2 Cultivation and Gathering

Archaeological surveys, historic observations, *mo‘olelo*, and *‘ōlelo no‘eau* indicate that Nu‘uanu Valley was an important region for cultivation, especially taro, as well as bananas, *‘awa*, *wauke*, sugarcane, and *olonā*. The site of Kaniakapūpū, located about half a mile makai of the Project area, contains remnant and still flowing *‘auwai*, as identified by Mr. Ching. However, a previous archaeological assessment immediately *makai* of Kaniakapūpū indicated that irrigated, pondfield cultivation of taro with *‘auwai* did not extend as far *mauka* as the Project area; terraces in the region would have likely been used for dryland taro or sweet potato cultivation (Dixen et al. 1994:12).

According to Mrs. Douglass and Mr. Kalahiki, the forested region in the vicinity of the Nu‘uanu Reservoir No. 4 may have contained a medicinal garden maintained by *kāhuna* of Kaniakapūpū. Mrs. Douglass also describes how travelers had to provide a tithe for safe passage from these medicinal gardens of Kaniakapūpū to spring at the reservoir.

6.3 Freshwater Resources

Nu‘uanu Valley is watered by several main and tributary streams, as well as freshwater springs. *Mauka* of the Project area, two waterfalls, Waipuilani and Waipuhia, feed the upper tributaries of Nu‘uanu Stream, which flows into the Nu‘uanu Reservoir No. 4, and then, after flowing through a pipe in the dam, joins Lulumahu Stream to flow past Kaniakapūpū and other cultural sites toward Honolulu. As indicated by Mr. Ching, water from this stream system once flowed through *‘auwai* to irrigate taro in the densely forested region *makai* of the Project area.

The original construction plans for the Nuuanu Reservoir No. 4 indicate that a spring called Keiliohia was located in the Project area, but was covered with the filling of the water for the reservoir (1907, supplied by R.M. Towill Corporation). Mrs. Douglass also notes that a freshwater spring was once located in the area now covered by the water of the reservoir and may still flow at low reservoir levels. The reservoir was originally built for hydropower, flood control, and domestic water, but it has also been used for seasonal recreational fishing since 1969

for channel catfish (Hawai‘i DLNR 2010b), and also supports freshwater clams, tilapia, and cichlids (Hollier 2007; Kawanami 2010).

6.4 Storied Landscape

Previously documented *mo‘olelo* and those shared by community participants Mr. Kalahiki and Mr. Ching indicate that Nu‘uanu Valley is a place with deep ancestral and historical significance. Nu‘uanu Valley was a place of godly residence and travel, the location of the birth of the first human and the construction of the first *heiau* (Thrum 1906:44), the main passage between the *moku* of Kona and Ko‘olaupoko (‘Ī‘ī 1959:92), and the site of several historic battles (e.g., Fornander 1996; Kamakau 1992:111, 138, 172–173; Thrum 1998:102)

The closest documented site near the Project area, Kaniakapūpū, transcends several time periods and may extend geographically *mauka* toward the Nu‘uanu Reservoir No. 4. In ancient times, the forested *‘ili* of Luakaha in the upper valley of Nu‘uanu had been set aside as a relaxation spot for the high *ali‘i* and royalty (C.H. Cooke 1938, cited in Sterling and Summers 1978:307). In the Battle of Nu‘uanu in 1795, this is one of the places that Kamehameha I rested before he began the final push to victory at the Nu‘uanu Pali (Pacific Worlds 2003a). Then, Kamehameha III built Kaniakapūpū into his summer retreat, at which he commemorated the fourth anniversary of Lā Ho‘iho‘i Ea (Hawaiian Annual 1930:102–105, cited in Sterling and Summers 1978:308) and began to train his and other noble children for their future leadership roles (Pacific Worlds 2003a).

Most of the *‘ili* of Luakaha became Crown Lands during the Māhele, which precluded the need for surveys, but community participants describe and identify numerous archaeological and cultural sites in the forested region *makai* of the Nu‘uanu Reservoir No. 4 that may be connected culturally to Kaniakapūpū (see Figure 43). Mr. Ching, Ms. Cruz, Ms. Leinweber, and Ms. Hassager identify concentrations of *pōhaku*, *laua‘e*, ti, and *‘ie‘ie* near the reservoir’s spillway that indicate possible former habitation sites. In the dense bamboo forest farther *makai* of the reservoir, Mr. Ching identifies *‘ie‘ie*, a network of *‘auwai*, and a rock structure indicative of former habitation. Mr. Ching also identifies a three-to five-foot high dry-stacked stone wall that extends from an area near the western portion of the reservoir’s access road approximately 1000 feet to the trailhead leading toward Kaniakapūpū, noting a possible shrine at the wall and describing terraces and enclosures that abut the wall. Mr. Ching also identifies several large *pōhaku* in the dense forest that are indicative of former human activity, and based on previous excursions, he suggests that the entire region contains similar cultural features. University of Hawai‘i archaeology professor Dr. Jim Bayman is aware of other cultural features *mauka* of the main site of Kaniakapūpū, including a carriage road, a guard station, and a wall. Cultural sites may also continue farther *makai* of Kaniakapūpū. Mrs. Douglass remembers that a series of five stone terraces lined the properties adjacent to her grandmother’s house (the second residence *makai* of Kaniakapūpū) and that cobbled stone trails traversed the region.

6.5 Burials

McAllister (193:86) mentions that there are many caves on both sides of Nu‘uanu Valley, but there is no documented evidence from archaeological surveys, historical records or oral traditions of *ilina*, burial caves or *iwi kūpuna* within the Project area.

Section 7 Summary and Recommendations

CSH undertook this CIA at the request of R.M. Towill, Corporation. The cultural survey broadly included the entire *ahupua‘a* of Nu‘uanu, and more specifically the approximately ten acres of public land of the Nu‘uanu Reservoir No. 4, TMK: [1] 2-2-054:001. The Project involves the repair of the Nu‘uanu Reservoir No. 4.

7.1 Results of Background Research

Background research on the Project area and surrounding area of Nu‘uanu Ahupua‘a indicates (presented in approximate chronological order):

1. Coastal settlers in the traditional village of Kou (Honolulu) likely constructed fishponds in Honolulu Bay and developed wetland agriculture close to the mouth of Nu‘uanu Stream (Dixon et al. 1994:7). Irrigated, pondfield cultivation of taro with stone-lined *‘auwai* (ditches) extended *mauka* (inland) to the lower valley of Nu‘uanu (Handy 1940:78–79; Handy and Handy 1972:475; Leidemann 1989, 1991; Yent and Ota 1980), while terraces in the vicinity of the Project area in the upper valley would have likely been used for dryland taro or sweet potato cultivation (Dixen et al. 1994:12).
2. Nu‘uanu Ahupua‘a contains numerous *wahi pana* (storied places) and associated *mo‘olelo* (stories, oral traditions) that place the specific Project area within a broad cultural context. Two waterfalls, Waipuilani and Waipuhia, feed the upper tributaries of Nu‘uanu Stream that flow into the Nu‘uanu Reservoir No. 4. The original construction plans (1907) for the reservoir indicate that a spring called Keiliohia was located in the Project area, but was covered with the filling of the water for the reservoir (plans supplied by R.M. Towill Corporation).
3. The *Project area is located in the cool, forested ‘ili (land division smaller than an ahupua‘*a) of Luakaha (Lyons 1874), which means “a place for relaxation” and neatly captures how Hawaiians during various time periods have similarly used the land for rest and respite. In ancient times, Luakaha ‘Ili had been set aside as a relaxation spot for the high *ali‘i* (chiefs) and royalty (C.H. Cooke 1938, cited in Sterling and Summers 1978:307). According to Charles Kenn, a *heiau* (sacred place of worship, temple) called Kaniakapūpū *makai* (seaward) of the Project area was a place where people came for comfort and medical attention, with guards stationed at a sacred *hau* (hibiscus) grove *mauka* of the Project area (Pacific Worlds 2003a). In one version of the Battle of Nu‘uanu in 1795, Kamehameha I rested at Kaniakapūpū while his men made the final assault on the remaining O‘ahu forces, 300 of which made a final stand in Luakaha ‘Ili in an attempt to allow the others to escape down the *pali* (cliffs) or over the mountains (Pacific Worlds 2003a). Then, Kamehameha III built Kaniakapūpū into his summer palace, one of several places of refuge from the politics taking place in Honolulu, as well as from the heat of the plain of Honolulu. Kaniakapūpū was the scene of a historic feast on July 31, 1847, in which 10,000 people celebrated the fourth anniversary of Lā Ho‘iho‘i Ea (Restoration Day) (Hawaiian Annual 1930:102–105, cited in Sterling and Summers 1978:308). The following year the Chief’s Children School held a picnic at

Kaniakapūpū (Helen Judd manuscript, cited in Anderson and Williams 1993), but afterwards the site fell into disuse (Pacific Worlds 2003a).

4. A trail once wound up Nu‘uanu Valley toward the Nu‘uanu Pali and then traversed the sheer rock cliffs to reach windward O‘ahu (‘Ī‘ī 1959:92). Parts of this steep path later became incorporated into the stone-paved horse trail in 1845, the newly constructed Pali Road in 1897, and recent improvements starting in 1952 that led to the existing Pali Highway that runs next to the Project area (Devaney et al. 1982).
5. The middle nineteenth century marked the introduction of private and public land ownership laws to Hawaiian society during the Māhele (division of Hawaiian lands). Most of the *‘ili* of Luakaha became Crown Lands, including the royal residence of Kaniakapūpū *makai* of the Project area. No Land Commision Awards were awarded in the current Project area (Waihona ‘Aina 2000).
6. There has been very limited development in the *‘ili* of Luakaha in the upper valley of Nu‘uanu during the twentieth century. The four reservoirs in Nu‘uanu Valley were constructed from 1890 to 1910 for hydropower, flood control, and domestic water (Hawai‘i DLNR 2010b). The Nu‘uanu Reservoir No. 4 was constructed between 1905 and 1910, and after modifications in 1934, it has since been used as a flood control structure by regulating the flow of Nu‘uanu Stream (Durkee 2008:2; Townscape, Inc. and Dashiell 2003:18). The reservoir has also been used for seasonal recreational fishing since 1969 for introduced channel catfish (Hawai‘i DLNR 2010b), and also supports freshwater clams, tilapia, and cichlids (Hollier 2007; Kawanami 2010).
7. A previously recorded oral history indicates that children in the early twentieth century swam in streams and went *ti*-leaf sliding in the lower valley *makai* of the Project area (Pacific Worlds 2003d).

7.2 Results of Community Consultation

CSH attempted to contact 28 community members and government agency and community organization representatives. Of the 16 people that responded, seven *kūpuna* (elders) and/or *kama‘āina* (Native-born) participated in formal interviews for more in-depth contributions to the CIA. This community consultation indicates:

1. *Mo‘olelo* (oral traditions) demonstrate that Nu‘uanu Valley is a place with deep ancestral and historical significance. From his reading of documented sources, Mr. Ching relates that Nu‘uanu Valley was a place of godly residence and travel, the location of the birth of the first human and the construction of the first *heiau*, the main passage between the *moku* (district) of Kona and Ko‘olaupoko, and the site of several historic battles.

2. The site of Kaniakapūpū spans several time periods. Mr. Ching and Mr. Kalahiki share *mo‘olelo* of a *heiau* dedicated to Lono (the god of agriculture) and medicinal gardens maintained by *kahūna* (priests), and Mr. Ching identifies rock-lined *‘auwai* that once channeled water to *lo‘i kalo* (irrigated taro fields). Mr. Kalahiki narrates how Kamehameha I’s army rested at a waterfall near Kaniakapūpū during their ascent to their final battle at the Nu‘uanu Pali while the O‘ahu forces fatalistically fled toward a side

valley *mauka* of Kaniakapūpū and the Nu‘uanu Reservoir No. 4 (likely Lulumahu Valley). Mr. Ching describes the construction of Kamehameha III’s summer palace at Kaniakapūpū, the elaborate commemoration of the fourth anniversary of Lā Ho‘iho‘i Ea, and the training of noble children for their future leadership roles. Now, the vision of ‘Ahahui Malama o Kaniakapūpū is to restore the site, document any features and artifacts outside the currently known boundary, and develop a cultural preservation and education center, including the cultivation of medicinal plants for *lā‘au lapa‘au* (traditional plant medicine). Mrs. Douglass recounts that Val Ching, another expert of Nu‘uanu Valley, previously mentioned to her that medicinal gardens were once maintained in the region, and that the spores of these plants most likely have survived and could be collected to restore the gardens.

3. Numerous archaeological and cultural sites are located in the forested region *makai* of the Nu‘uanu Reservoir No. 4 that may be connected culturally to Kaniakapūpū (see Figure 43). Mr. Ching, Ms. Cruz, Ms. Leinweber, and Ms. Hassager identify concentrations of *pōhaku* (stones), *laua‘e* (fragrant ferns), *ti*, and *‘ie‘ie* (endemic woody, branching climbers) near the reservoir’s spillway that indicate possible former habitation sites. In the dense bamboo forest farther *makai*, Mr. Ching identifies *‘ie‘ie*, a network of *‘auwai*, and a rock structure indicative of former habitation. Mr. Ching also identifies a three-to-five-foot high dry-stacked stone wall that extends from an area near the western portion of the reservoir’s access road approximately 1,000 feet to the trailhead leading toward Kaniakapūpū, noting a possible shrine at the wall and describing terraces and enclosures that abut the wall. Mr. Ching also identifies several large *pōhaku* in the dense forest that are indicative of former human activity, and based on previous excursions, he suggests that the entire region contains similar cultural features. Mr. Bayman is aware of other cultural features *mauka* of the main site of Kaniakapūpū, including a carriage road, a guard station, and a wall. Cultural sites may also continue farther *makai* of Kaniakapūpū. Mrs. Douglass remembers that a series of five stone terraces lined the properties adjacent to her grandmother’s house (the second residence *makai* of Kaniakapūpū) and that cobbled stone trails traversed the region.
4. A cultural resource may still be located underneath the Nu‘uanu Reservoir No. 4. Mrs. Douglass notes that a freshwater spring was once located in the area now covered by the water of the reservoir. She describes how travelers had to provide a tithe for safe passage from the medicinal gardens of Kaniakapūpū to this *mauka* spring.
5. Childhood memories of Nu‘uanu Valley shared by Mrs. Douglass include playing with other missionary children in the gulch and shallow waters of Nu‘uanu Stream as well as climbing Luakaha Falls, and discovering the ruins of Kaniakapūpū. Ms. Falemei laments how development has impacted the landscape of Nu‘uanu since her childhood, especially the once freely flowing *wailele* (waterfalls), ever-present mist, and lush vegetation.
6. According to R.M. Towill Corporation, the proposed Project involves substantially draining the reservoir levels, which would result in approximately three acres of exposed sediment. Complimenting the vision of ‘Ahahui Malama o Kaniakapūpū to restore Kaniakapūpū and the surrounding area to former conditions of extensive irrigated taro

cultivation, Mr. Ching recommends that the fertile sediment should be left in place and utilized as the base for *lo‘i kalo*.

7. Mr. Kāne is concerned that the Project may restrict the already diminished flow of Nu‘uanu Stream, while Ms. Leinweber is concerned that any overflow will directly impact the site of Kaniakapūpū.
8. To improve access to Kaniakapūpū in order to restore the structures and re-cultivate the land, Mr. Ching requests that the Honolulu Board of Water Supply grant ‘Ahahui Malama o Kaniakapūpū access to the gate and reservoir access road, and to grant permission to use the old water pipe access road that leads toward Kaniakapūpū from the spillway.

7.3 Impacts and Recommendation

Based on the information gathered for the cultural and historic background and community consultation detailed in this CIA report, CSH foresees potential impacts of the proposed Project on Native Hawaiian or other ethnic groups’ cultural practices customarily and traditionally exercised for subsistence, cultural or religious purposes, and on c ultural, historic, and natural resources, and makes the following recommendations:

1. Land- and water-disturbing activities may uncover cultural resources. The original construction plans for the reservoir indicate that a spring called Keiliohia was located in the Project area but was covered with the filling of the water for reservoir. An undated photograph indicates that an unidentified spring (possibly Keiliohia) inside the reservoir still flows at low water levels (see Figure 49). Keiliohia Spring may have been associated with agricultural and cultural practices; community participant Mrs. Douglass describes a trail that connected the medicinal gardens of Kaniakapūpū to this spring. Should historic, cultural or burial sites or artifacts be identified during ground disturbance, the construction contractor should immediately cease all work and the appropriate agencies notified pursuant to applicable law.
2. The Project may impact sites of cultural, historical, archaeological, and botanical interest. Kaniakapūpū is located about half a mile south of the Project area. Community participants Ms. Leinweber and Mr. Kāne are concerned that an increase or decrease in the flow of the Nu‘uanu Stream may adversely impact Kaniakapūpū. In addition, an exploratory excursion with members of ‘Ahahui Malama o Kaniakapūpū into the forested region immediately *makai* of the reservoir’s spillway uncovered four potential habitation sites based on a combination of rock concentrations and nearby endemic plants used for cultural practices (ti, *‘ie‘ie*, *laua‘e*), and Mr. Ching described a stone wall near the western portion of the dam (see Figure 43). It is thus likely that other cultural sites are located *makai* of the dam in the dense bamboo forest, possibly within the extreme southern portion of the Project area, that could be connected culturally to Kaniakapūpū. If construction work extends into the forested region *makai* of the dam, a monitor should be present with particular botanical expertise in identifying vegetation indicative of former habitation. If such potential habitation sites are discovered, the construction contractor should implement best management practices to avoid impacting these cultural sites.

3. R.M. Towill Corporation should brief and consult with ‘Ahahui Malama o Kaniakapūpū, as well as other community members and organizations, as the Project design progresses. This on-going consultation should keep the community informed of any changes that could result in unanticipated adverse cultural impacts, and it could provide insights into alternative uses of the potential exposed sediment, particularly Mr. Ching’s recommendation to convert the area to *lo‘i kalo*.

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Appendix A Glossary

To highlight the various and complex meanings of Hawaiian words, the complete translations from Pukui and Elbert (1986) are used unless otherwise noted. In some cases, alternate translations may resonate stronger with Hawaiians today; these are placed prior to the Pukui and Elbert (1986) translations and marked with "(common)."

Diacritical markings used in the Hawaiian words are the *ʻokina* and the *kahakō*. The *ʻokina*, or glottal stop, is only found between two vowels or at the beginning of a word that starts with a vowel. A break in speech is created between the sounds of the two vowels. The pronunciation of the *ʻokina* is similar to saying "oh-oh." The *ʻokina* is written as a backwards apostrophe. The *kahakō* is only found above a vowel. It stresses or elongates a vowel sound from one beat to two beats. The *kahakō* is written as a line above a vowel.

Hawaiian Word	English Translation
ahupuaʻa	Land division usually extending from the uplands to the sea, so called because the boundary was marked by a heap (*ahu*) of stones surmounted by an image of a pig (*puaʻa*), or because a pig or other tribute was laid on the altar as tax to the chief.
aliʻi	Chief, chiefess, officer, ruler, monarch, peer, headman, noble, aristocrat, king, queen, commander.
ʻaumakua	Family of personal gods, deified ancestors who might assume the shape of sharks, owls, hawks (etc…). A symbiotic relationship existed; mortals did not harm or eat *ʻaumakua*, and *ʻaumakua* warned and reprimanded mortals in dreams, visions, and calls.
ʻauwai	Ditch, canal.
ʻawa	Kava.
hau	Hibiscus.
heiau	Pre-Christian place of worship, shrine; some *heiau* were elaborately constructed stone platforms, others simple earth terraces. Many are preserved today.
ʻieʻie	endemic woody, branching climber
ʻili	Land section, next in importance to an ahupuaʻa and usually a subdivision of an *ahupuaʻa*.

Hawaiian Word	English Translation
ilina	Grave, tomb, sepulcher, cemetery, mausoleum, plot in a cemetery.
iwi kūpuna	Ancestral bone remains (common).
kama‘āina	Native-born, one born in a place, host; native plant; acquainted, familiar, Lit., land child.
kuleana	Native Hawaiian land rights (common). Right, privilege, concern, responsibility, title, business, property, estate, portion, jurisdiction, authority, liability, interest, claim, ownership, tenure, affair, province.
kupuna	Elders (common). Grandparent, ancestor, relative or close friend of the grandparent's generation, grandaunt, granduncle. *Kūpuna*—plural of *kupuna*.
Lā Ho‘iho‘i Ea	Restoraton Day
laua‘e	a fragrant fern
lo‘i	Irrigated terrace, especially for taro, but also for rice; paddy.
loko i‘a	Fishpond (common).
lua	A type of dangerous hand-to-hand fighting in which the fighters broke bones, dislocated bones at the joints, and inflicted severe pain by pressing on nerve centers.
makai	Seaward.
mauka	Inland.
moku	District, island, islet, section.
mō‘ī	King, sovereign, monarch, majesty, ruler, queen.
mo‘olelo	Story, tale, myth, history, tradition, literature, legend, journal, log, yarn, fable, essay, chronicle, record, article; minutes, as of a meeting. (From *mo‘o ‘ōlelo*, succession of talk; all stories were oral, not written).
nuku	Mountain pass.

Hawaiian Word	English Translation
‘ōlelo no‘eau	Proverb, wise saying, traditional saying.
oli	Chant that was not danced to, especially with prolonged phrases chanted in one breath, often with a trill at the end of each phrase; to chant thus.
olonā	A native shrub.
pali	Cliff, precipice, steep hill or slope.
poi	*Poi*, the Hawaiian staff of life, made from cooked taro corms, or rarely breadfruit, pounded and thinned with water.
wahi pana	Storied place (common). Legendary place.
wailele	Waterfall.
wauke	Paper mulberry.

Appendix B Common and Scientific Names for Plants and Animals Mentioned by Community Participants

Common Names		Possible Scientific Names		Source
Hawaiian	**Other**	**Genus**	**Species**	
‘ie‘ie	(endemic woody, branching climber)	*Freycinetia*	*arborea*	Wagner et al. 1999
kī	*ti*	*Cordyline*	*fruticosa*	Wagner et al. 1999
laua‘e	(a fragrant fern)	*Phymatosorus*	*grossus*	Imada et al. 2005
pili	(a grass)	*Heteropogon*	*contortus*	Wagner et al. 1999

Appendix C Authorization and Release Form

Cultural Surveys Hawai'i, Inc.
Archaeological and Cultural Impact Studies
Hallett H. Hammatt, Ph.D., President

P.O. Box 1114 Kailua, Hawai'i 96734 Ph: (808) 262-9972 Fax: (808) 262-4950

Job code: NUUANU 7 jgenz@culturalsurveys.com www.culturalsurveys.com

AUTHORIZATION AND RELEASE FORM

Cultural Surveys Hawai'i appreciates the generosity of the *kūpuna* and *kama'āina* who are sharing their knowledge of cultural and historic properties, and experiences of past and present cultural practices for the Cultural Impact Assessment for the *ahupua'a* of Nu'uanu.

We understand our responsibility in respecting the wishes and concerns of the interviewees participating in our study. Here are the procedures we promise to follow:

1. You will have the opportunity to review the written transcript of our interview with you. At that time you may make any additions, deletions or corrections you wish.
2. You will be given a copy of the interview notes for your records.
3. You will be given a copy of this release form for your records.

For your protection, we need your written confirmation that:

1. You consent to the use of the complete transcript and/or interview quotes for reports on cultural sites and practices, historic documentation, and/or academic purposes.
2. You agree that the interview shall be made available to the public.

I, _____, agree to the procedures outlined above and, by my
(Please print your name here)
signature, give my consent and release for this interview to be used as specified.

_____
(Signature)

_____
(Date)

Appendix D Expanded Mo‘olelo

***Mo‘olelo* of Kahaukomo (Kamakau 1992:111)**

Na-maka was one of the noted men of Ka-lani-‘opu‘u’s time [ca. 1770]. He was a man skilled in politics, oratory, genealogies, spear-throwing (*lono ma ka ihe*), the conformation of the earth’s surfaces (*kulikuhi pu‘u one*), bone-breaking (*lua*), cliff-leaping (*lele pali*), and the interpretation of omens (*kilo*), all accomplishments which he had learned on Kauai. Then he set out to find a *haku* (lord) to whom he might impart all his learning, and Ka-lani-‘opu‘u was the *haku* whom he selected. Arrived at Oahu he heard that Pakua-nui was skilled in debate and in bone-breaking. This Pakua-nui was the father of Ka-‘ele-o-waipi‘o, a man of learning of Kamehameha’s day who lived at Kailua and composed the dirges of Jesus. Na-maka met Pakua-nui at Kahaukomo in Nu‘uanu, and after they had matched their skills, Pakua-nui realized the skill of the tentacle-breaking son of Kilohana and the *koai‘e* wood-breaking son of Kailila‘au. The shafts of wit flew, brilliant as the rainbow arching over the *hau* trees of Kahaukomo that lends its color to the *‘ulalena* rain blown by the *kiowao* breeze against the *pali*, bending the *kawelu* grasses of Lanihuli; swift as the gusts that lift the leaves of the tangled *lehua* of Malailua. There was no limit to his knowledge. He slipped out of the grasp of Pakua-nui like an eel or wormed his way through his fingers like a slim *‘opule* fish; a hard question he dodged like a blow aimed at the nose. Unable to defeat Na-maka at Kahaukomo Pakua-nui crowded Na-maka a little toward the edge of the path and with a shove of his foot sent him over the cliff. Those who saw this say that Na-maka flew like a hawk poised on the wind as he sailed above Lanihuli and whirled about like a kite as the wind turned, and as it struck the *pali* he descended upon it and lit on the top of a *kukui* tree directly below Kawaikilo.

Appendix E Community Consultation Letter

Cultural Surveys Hawai‘i, Inc.
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October 20, 2010

Aloha e Kāua,

At the request of R.M. Towill Corp., Cultural Surveys Hawai‘i (CSH) is conducting a Cultural Impact Assessment (CIA) for the Nu‘uanu Reservoir No.4 Project, Nu‘uanu Ahupua‘a, Honolulu District, O‘ahu Island (TMK: [1] 2-2-054:001). The Honolulu Board of Water Supply (BWS) is undertaking repair work on the Nu‘uanu #4 Reservoir. The ten-acre reservoir is located in Nu‘uanu Valley adjacent to the Pali Highway, State Route 61, approximately four miles northeast of downtown Honolulu.

The Nu‘uanu No.4 Reservoir Dam consists of a 65-foot high earthen embankment dam with a 1,750-foot crest length and partial rip-rap on the upstream face. Appurtenances to the dam include an intake tower, outlet access tunnel, spillway, tower footbridge, access road, and monitoring wells. The reservoir has a normal pool storage capacity of 120 acre-feet with a surface area of 10 acres. Discharges from the dam flow into Nu‘uanu Stream and through the city of Honolulu before entering the Pacific Ocean at Honolulu Harbor.

The primary function of the existing Nu‘uanu No.4 Reservoir Dam is to provide flood control from the 1.4 square mile watershed on the heavily vegetated leeward slopes of the Ko‘olau Mountains for Nu‘uanu Valley and part of downtown Honolulu that lies within the Nu‘uanu Stream corridor. The reservoir is also used for recreation and as a fresh water fish refuge by the Department of Land and Natural Resources (DLNR), Division of Aquatic Resources (DAR).

The purpose of the planned repair work is to meet dam safety requirements listed in the State of Hawai‘i-Department of Land and Natural Resources Dam Safety Program inspection report (dated January 13, 2010) and the Gannett Fleming Phase 1 Investigation Report (August 2008) on the Nu‘uanu Reservoir No.4. Planned repair work includes the following:

1. Removal and disposal of accumulated sediments at the base of the existing reservoir intake tower structure and repair and rehabilitation of the existing lower level sluice gate and operational controls.
2. Repair of 3 existing debris cages (trash racks) and lower level sluice gate on the intake tower.
3. Construction of measuring weirs at 3 existing seepage points on the downstream slope and outlet structure.
4. Dredging of outlet receiving area and installation of extension of outlet pipe.
5. Removal of the temporary access road located on the downstream face of the dam embankment and restoration of the embankment slope.
6. Repair and repaving of the existing reservoir access road on the top of the dam.
7. Inspection of the downstream slope and repair of the upstream slope rip-rap deficiencies and depressions.
8. Inspection and cleaning of the existing outlet tunnel structure.
9. Recalibrate/repaint water level markings on the existing intake tower.
10. Creation of subdivision map for Nuuanu No.4 reservoir.

The purpose of this CIA is to evaluate potential impacts to cultural practices and resources as a result of the proposed development in Nu‘uanu Ahupua‘a. We are seeking your *kōkua* and guidance regarding the following aspects of our study:

- **General history and present and past land use of the Project area.**
- **Knowledge of cultural sites which may be impacted by future development of the Project area - for example, historic sites, archaeological sites, and burials.**
- **Knowledge of traditional gathering practices in the Project area both past and ongoing.**
- **Cultural associations of the Project area, such as *mo‘olelo* and traditional uses.**
- **Referrals of *kūpuna* and *kama‘āina* who might be willing to share their cultural knowledge of the Project area and the surrounding *ahupua‘a* lands.**
- **Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the Project area.**

I invite you to contact me, Joe Genz, at 262-9972 or send me an email at jgenz@culturalsurveys.com if you have any information you would like to share.

Mahalo nui,

Joe Genz

Appendix D

Biological and Water Quality Survey

AECOS No. 1248

Biological surveys at Nu‘uanu Reservoir No. 4, O‘ahu, Hawai‘i

Prepared by:

AECOS, Inc.
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December 9, 2011

Biological surveys at Nu‘uanu Reservoir No. 4, O‘ahu, Hawai‘i

December 9, 2011 | ***Draft*** | *AECOS* No. 1248

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Introduction

In October 2010, *AECOS*, Inc. biologists conducted aquatic resource, water quality, botanical, and terrestrial/avifaunal surveys at Nu‘uanu Reservoir No. 4 located 4 mi (6.4 km) northeast of downtown Honolulu, on the island of O‘ahu (Fig 1). The City and County of Honolulu, Board of Water Supply is planning miscellaneous repairs to the existing embankment dam and removal of accumulated sediments within the reservoir. *AECOS*, Inc. was contracted by R.M. Towill, Corporation[1] to investigate biological resources present within the proposed project work area. This report details findings of those surveys.

Project Description

The purpose of the planned work is to meet dam safety requirements as listed in the State of Hawai‘i, Department of Land and Natural Resources (DLNR), Dam Safety Program Inspection Report, dated January 12, 2010 and the Gannet Fleming Phase 1 Investigation Report from August 2008. Planned work includes:

1. Removal and disposal of accumulated sediments at the base of the existing reservoir intake tower structure and repair and rehabilitation of the existing lower sluice gate and operational controls.

[1] This document prepared for R.M. Towill, Corp. will be incorporated into the Environmental Assessment (EA) for the Nu‘uanu No. 4 Reservoir Repair Project and will become part of the public record.

2. Repair of three existing debris cages and lower level sluice gate on the intake tower.
3. Construction of measuring weirs at three existing seepage points on the downstream slope and outlet structure.
4. Dredging of outlet receiving area and installation of an extension to the existing outlet pipe.
5. Removal of the temporary access road located on the downstream face of the dam embankment and restoration of the embankment slope.
6. Repair and repaving of the existing reservoir access road on the top of the dam.
7. Inspections of the downstream slope and repair of rip rap deficiencies and depressions on the upstream slope.
8. Inspection and cleaning of the existing outlet tunnel structure.
9. Recalibrate and repaint water level marking on the existing intake tower.
10. Creation of subdivision map for Nu'uanu Reservoir No. 4.

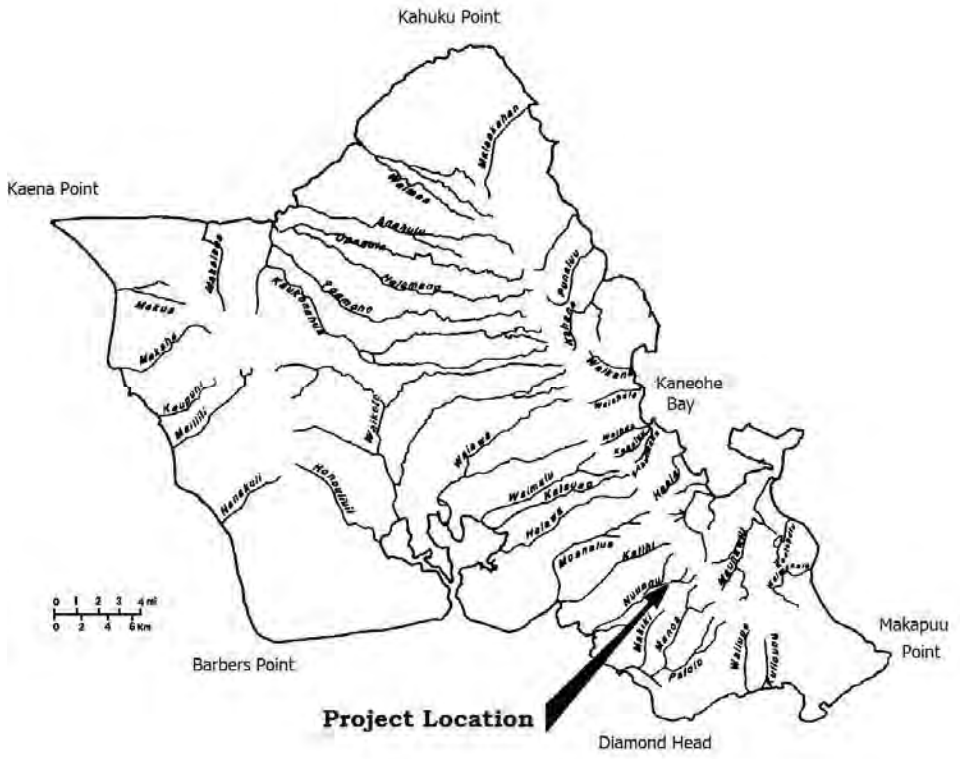

Figure 1. The general location of the project on the island of O'ahu.

Nu'uanu Stream and Reservoir

The waters of Nu'uanu reservoir originate as bifurcated streamlets and cascades fed by rainfall and cloud drip along the upper ridges of Nu'uanu and Mo'ole Valleys on the leeward slopes of the Ko'olau Mountains. Nu'uanu Stream, a perennial stream (HDAR, 2010), begins about a half mile upslope from Reservoir No. 4 and flows southwest for six miles through Nu'uanu Valley and downtown Honolulu, before reaching its coastal estuary south of Beretania Park, between Piers 15 and 16 in Honolulu Harbor. Tributaries contributing input to Reservoir No. 4 include Waipuhia—also known as Upside Down Falls (Pukui et al, 1974)—and an unnamed stream. Both originate as cascades above the 1400-ft (425-m) elevation. Water from Mo'ole Stream is also diverted to the reservoir via a tunnel and ditch that enters from the west, just downslope from Makuku Ridge.

Located near the upper end of Nu'uanu Valley, the reservoir is in a moderately wet area.

Methods

Botanical Resources

The botanical survey entailed walking the perimeter of the reservoir, the embankment dam, seepage repair work areas, and the anticipated location of a sediment stockpile identifying all species of ferns and flowering plants encountered. Plants were identified in the field, or collected for later identification in the laboratory. In some cases, photographs were taken in lieu of collected material. Fern names follow Palmer (2003). Flowering native and naturalized plant nomenclature follows *Manual of the Flowering Plants of Hawai'i* (Wagner et al., and Wagner and Herbst, 1990, 1999) updated by more recent published literature; names of ornamentals comer from *A Tropical Garden Flora* (Staples and Herbst, 2005).

Avian and Terrestrial Fauna

A running tally of avian and terrestrial species observed in the vicinity of the reservoir was kept during the aquatic resource, water quality, and botanical surveys as well as during transit between surveys areas and when entering and exiting the property.

Additionally, six avian count stations located near project work areas were surveyed for twenty minutes each to identify species present in or transiting

through the survey area (Fig. 2). Auditory patterns or calls were not counted as individuals. Rather, identification and avian species counts were based on visual observations of physical features and flight patterns. Avian phylogenetic order and nomenclature follows *The American Ornithologists' Union Check-list of North American Birds.*

Water Quality

Field measurements for temperature, dissolved oxygen (DO), and pH were conducted and water samples for analyses of conductivity, total suspended solids, turbidity, ammonia nitrogen, nitrate-nitrite nitrogen, total nitrogen, and total phosphorus were collected from three stations in Nu'uanu Reservoir No. 4. All water samples were collected in screw cap-polypropylene bottles on October 5, 2010 and delivered to *AECOS*, Inc. in Kane'ohe, O'ahu for laboratory analyses (*AECOS* Log No 26689). Table 1 lists analytical methods and instrumentation used in the analyses.

Table 1. Analytical methods and instruments used for water quality analyses of Nu'uanu Reservoir waters sampled on October 5, 2010.

Analysis	Method	Reference	Instrument
Ammonia	EPA 350.1 M	USEPA (1993)	Technicon AutoAnalyzer II
Conductivity	SM 2510-B	Standard Methods, 20th Edition (1998)	Hydach pH/conductivity meter
Dissolved Oxygen	SM 4500-O G	Standard Methods 20th Edition (1998)	YSI Model 550A Dissolved Oxygen Meter
Nitrate + Nitrite	EPA 353.2 Rev 2.0	USEPA (1993)	Technicon AutoAnalyzer II
pH	SM 4500 H+	Standard Methods 20th Edition (1998)	Hannah pocket pH meter
Temperature	thermister calibrated to NBS. Cert. thermometer SM 2550 B	Standard Methods 20th Edition (1998)	YSI Model 550A Dissolved Oxygen Meter
Total Nitrogen	persulfate digestion/EPA 353.2	Grasshoff et al (1986)/ USEPA (1993)	Technicon AutoAnalyzer II
Total Phosphorus	EPA 365.1 Rev 2.0	USEPA (1993)	Technicon AutoAnalyzer II
Total Suspended Solids	Method 2540 D	Standard Methods 20th Edition (1998)	Mettler H31 balance
Turbidity	EPA 180.1 Rev 2.0	EPA (1993)	Hach 2100N Turbidimeter

Station "North End" was collected from the north end of the reservoir, approximately 1000 ft (305 m) from the embankment dam in 4.5 ft (1.5 m) of water. Station "Mid Reservoir" was near the center of the reservoir, approximately 500 ft (152 m) from the embankment dam. Station "Tower" was collected from the north side of the intake tower located along the embankment dam. Water quality stations are depicted alongside avian count stations in Figure 2.

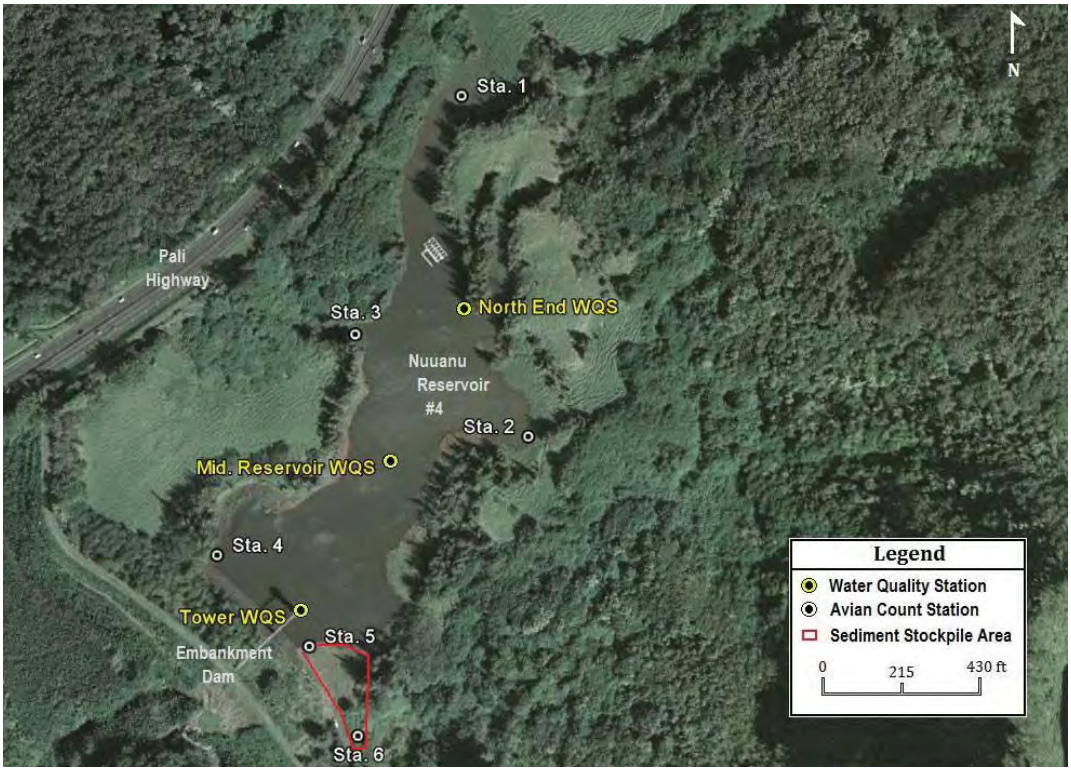

Figure 2. The locations of water quality stations and avian count stations for the Nu'uanu Reservoir No. 4 project.

Aquatic Resources

Aquatic resources in the reservoir were identified by surveying surface waters of the reservoir by kayak and walking or wading around the perimeter of the reservoir. Poor underwater visibility precluded surveying the reservoir with mask and snorkel and limited visibility from the kayak to shallow waters near the shore. Dip netting from kayak and from shore was conducted to confirm

identifications of aquatic species observed in the reservoir. The entire perimeter of the reservoir was surveyed via kayak on Oct. 5 and Oct. 20, 2010. Additionally, the southwest, south, and east shorelines were surveyed from shore on both survey dates.

Survey Results

Botanical Survey

Flora - A list of all ferns, conifers, and flowering plants encountered during the survey is presented in Table 2. Total species recorded was 103. Eight of the species (7.7%) are native plants (7 indigenous, 1 endemic); all of the remaining species are plants introduced to the Hawaiian Islands after 1778 that have become naturalized (i.e., grow in the wild). The native species are mostly common plants in the landscape of low to moderate elevations in the Islands.

Figure 3. Nu'uanu Reservoir No. 4 as seen from the eastern end of the dam.

Vegetation – The vegetation around the immediate vicinity of the dam is partly ruderal weeds (plants that favor disturbed areas) and partly plant species invading from the surrounding lands, as this area is frequently disturbed by mowing or other activities related to maintenance. Around much of the reservoir, the ground is a patchwork of small forest copses and open grassy areas (Figs. 2 and 3, above).

Forest copses are typically dominated by ironwood trees (*Casauarina equisetifolia*), although *hau* (*Hibiscus tiliaceus*), Java plum (*Syzigium cuminii*), Padang cassia (*Cinnamomum burmanni*), gunpowder tree (*Trema orientalis*), fiddlewood (*Citharexyllum caudatum*), eucalyptus (*Eucalyptus* spp.), native koa (*Acacia koa*), common guava (*Psidium guajava*), and paperbark (*Melaleuca quinquenervia*) are mixed in. In some areas, a closed canopy forest is more extensive, particularly on the upper west side of the reservoir. This forest is dominated by *hau*. Further from the reservoir monotypic bamboo forests cover large swaths of ground.

While the reservoir is mostly an open body of water, some flooded areas are covered by either *hau* or California grass (*Urochloa mutica*). The latter grass also occurs in large patches away from the water. Drawdowns of the reservoir create areas of bare, red soil, but these are usually colonized rapidly by herbaceous plants, mostly sedges and grasses close to the water line.

Table 2. Checklist of plants surrounding Nu'uanu Reservoir No. 4.

Family Species	Common name	ABUNDANCE STATUS	
PTERIDOPHYTES - FERNS & FERN ALLIES			
BLECHNACEAE			
Blechnum appendiculatum Willd.	blechnum fern	Nat	U
LINDSAEACEAE			
Sphenomeris chinensis (L.) Maxon	*pala'ā*	**Ind**	R
NEPHROLEDIACEAE			
Nephrolepis multiflora(Roxb.) F.M. Jarrett ex C.V. Morton	sword fern	Nat	C
POLYPODIACEAE			
Phymatosorus grossus (Langsd. & Fisch.) Brownlie	*laua'e* ; *maile*-scented fern	Nat	C
PTERIDACEAE			
Pityrogramma austroamericana Domin	golden fern	Nat	R

Table 2 (continued).

Family Species	Common name	ABUNDANCE STATUS	
THELYPTERIDACEAE			
Christella dentata (Forssk.) Brownsey & Jermy	wood fern	Nat	
Christella parasitica (L.) H. Lév.	wood fern	Nat	U
Cyclosorus interruptus (Wild.) H. Ito	*neke*	**Ind**	R
FLOWERING PLANTS – DICOTYLEDONS			
APIACEAE			
Centella asiatica (L.) Urb.	Asiatic pennywort	Nat	O
Ciclospermum leptophyllum (Pers.) Sprague	fir-lvd. celery	Nat	R
ARALIACEAE			
Schefflera actinophylla (Endl.) Harms	octopus tree	Nat	U
ASTERACEAE			
Ageratum conyzoides L.	maile honohono	Nat	C3
Bidens alba (L.) DC	beggartick	Nat	R
Bidens pilosa L.	Spanish needle	Nat	O
Conyza *canadensis* (L.) Cronq.	horseweed	Nat	O
Conyza bonariensis (L.) Cronq.	hairy horseweed	Nat	O
Crassocephalum crepidioides (Benth) S. Moore	---	Nat	O3
Eclipta prostrata (L.) L	false daisy	Nat	U
Emilia fosbergii Nicolson	Flora's paintbrush	Nat	O
Erechtites valerianifolia (Wolf) DC.	fireweed	Nat	U2
Erigeron bellioides DC	fleabane	Nat	U
Erigeron karvinskianus DC	daisy fleabane	Nat	R
Gnaphalium sp.	cudweed	Nat	O
Pluchea carolinensis (Jacq.) G. Don	sourbush	Nat	U
Sonchus oleraceus L.	*pualele*	Nat	R
Spagneticola trilobata (L.) Pruski	wedelia	Nat	C
Synedrella nodiflora (L.) Gaertn.	nodeweed	Nat	C
Youngia japonica (L.) DC	Oriental hawksbeard	Nat	U
BEGONACEAE			
Begonia hirtella Link	---	Nat	U
BIGNONIACEAE			
Spathodea campanulata P. Beauv.	African tulip tree	Nat	R
BORAGINACEAE			
Heliotropium procumbens Mill.	---	Nat	O
BUDDLEIACEAE			
Buddleia asiatica Lour.	dog tail	Nat	R
CARYOPHYLLACEAE			
Drymaria cordata var. *pacifica* M. Mizush.	---	Nat	R
Indet.	---	Nat	R

Table 2 (continued).

Family Species	Common name	ABUNDANCE STATUS	
CASUARINACEAE			
Casuarina equisetifolia L.	common ironwood	Nat	A
CECROPIACEAE			
Cecropia obtusifolia Bertol.	trumpet tree	Nat	R
CONVOLVULACEAE			
Ipomoea indica (Burm.) Merr.	*koali 'awa*	**Ind**	R
EUPHORBIACEAE			
Euphorbia albomarginata Torr. & A. Gray	rattlesnake weed	Nat	U
Euphorbia hypericifolia L.	graceful spurge	Nat	R
Phyllanthus debilis Klein ex Willd.	niruri	Nat	U
FABACEAE			
Acacia confusa Merr.	Formosan koa	Nat	O
Acacia koa A. Gray	koa	**End**	U2
Chamaecrista nictitans (L.) Moench	partridge pea	Nat	U
Desmodium incanum DC	Spanish clover	Nat	O
Leucaena leucocephala (Lam.) deWit	koa haole	Nat	C
Mimosa pudica var. *unijuga* (Duchass. & Walp.) Griseb.	sensitive plant	Nat	C3
LAURACEAE			
Cinnamomum burmanni (Nees) Blume	Padang cassia	Nat	U1
LYTHRACEAE			
Cuphea carthagenensis (Jacq.) J.F. Macbr.	Columbian waxweed	Nat	R
MALVACEAE			
Hibiscus tiliaceus L.	*hau*	**Ind**	AA
MELASTOMATACEAE			
Clidemia hirta (L.) D. Don	Koster's curse	Nat	U
Arthrtostemma ciliatum Pav. ex D. Don	---	Nat	U
MYRSINACEAE			
Ardisia elliptica Thunb.	shoebutton ardisia	Nat	U
MYRTACEAE			
Eucalyptus crebra F. Mueller	nrw-lvd ironbark	Nat	R
Melaleuca quinquenervia (Cav.) S.T. Blake	paperbark	Nat	U
Psidium guajava L.	common guava	Nat	U2
ONAGRACEAE			
Ludwigia octovalvis (Jacq.) Raven	primrose willow	Nat	U
OXALIDACEAE			
Oxalis corniculata L.	yellow wood sorrel	**Ind**	R
PLANTAGINACEAE			
Plantago major L.	common plantain	Nat	O
PRIMULACEAE			
Anagallis arvensis L.	scarlet pimpernel	Nat	R
ROSACEAE			
Rubus rosifolius Sm.	thimbleberry	Nat	R

Table 2 (continued).

Family Species	Common name	ABUNDANCE STATUS	
RUBIACEAE			
Paederia scandens L.	maile pilau	Nat	C
Spemacoce assurgens Ruiz & Pav.	buttonweed	Nat	U
unid.	indet. Rubiaceae	---	R
SOLANACEAE			
Solanum americanum Mill.	*pōpolo*	**Ind**	R
ULMACEAE			
Trema orientalis (L.) Blume	gunpowder tree	Nat	U
URTICACEAE			
Pilea microphylla (L.) Liebm.	artillery plant	Nat	O
VERBENACEAE			
Citharexylum caudatum L.	fiddlewood	Nat	A
Clerodendron philippinum Schauer	*pīkake* honohono	Nat	R
Stachytarpheta urticifolia (Salisb.) Sims	vervain	Nat	O
Verbena litoralis Kunth	*ōwī*	Nat	
FLOWERING PLANTS – MONOCOTYLEDONS			
COMMELINACEAE			
Commelina diffusa N.L. Burm.	day flower	Nat	C3
CYPERACEAE			
Cyperus involucratus Rottb.	umbrella sedge	Nat	R
Cyperus halpan L.	---	Nat	R2
Cyperus polystachyos Rottb.	---	**Ind**	C3
Fimbristylis aestivalis (Retz.) Vahl	summer fimbry	Nat	R
Kyllinga brevifolia Rottb.	*kili'o'opu*	Nat	U
Kyllinga nemoralis (J.R. Forster & G. Forster) Dandy ex Hutchinson & Dalziel	*kili'o'opu*	Nat	R
ORCHIDACEAE			
Arundina graminifolia (D. Don) Hochr.	bamboo orchid	Nat	U
Epidendrum x *obrienianum* Rolfe	scarlet butterfly orchid	Nat	R
Spathoglottis plicata Blume	Philippine ground orchid	Nat	R
POACEAE (GRAMINEAE)			
Axonopus compressus (Swartz) P. Beauv.	brd-lvd carpetgrass	Nat	U
Axonopus fissifolius (Raddi) Kuhlm.	nrw-lvd carpetgrass	Nat	U
Coix lachryma-jobi L.	Job's tears	Nat	O
Chrysopogon aciculatus (Retz) Trin.	*mānienie 'ula*	Nat	U
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat	C
Dichanthium cf. aristatum (Poir.) Hubb.	?Wilder grass	Nat	C
Digitaria ciliaris (Retz.) Koeler	Henry's crabgrass	Nat	U
Digitaria sp.	indet. crabgrass	Nat	R
Echinochloa colona (L.) Link	jungle-rice	Nat	U
Echinochloa crus-galli (L.) P. Beauv.	barnyard grass	Nat	O3
Eleusine indica (L.) Gaertn.	wiregrass	Nat	C

Table 2 (continued).

Family Species	Common name	ABUNDANCE STATUS	
POACEAE (cont.)			
Leptochloa uninervia (J. Presl.) Hitchc. & Chase	sprangletop	Nat	U
Oplismenus hirtellus (L.) P. Beauv.	basket grass	Nat	R
Paspalum conjugatum Bergius	Hilo grass	Nat	A
Paspalum dilatatum Poir.	Dallis grass	Nat	U
Paspalum urvillei Steud.	Vasey grass	Nat	O
Phyllostachys nigra henionis (Mitford) Rendle	Henon black bamboo	Nat	A
Sacciolepis indica (L.) Chase	Glenwood grass	Nat	C
Setaria gracilis Kunth	yellow foxtail	Nat	U
Setaria palmifolia (J. König) Stapf	palmgrass	Nat	U
Sporobolus africanus (Poir.) Robyns & Tournay	smutgrass	Nat	U
Urochloa mutica (Forssk.) Nguyen	California grass	Nat	AA
ZINGIBERACEAE			
Hedychium flavescens Carey ex Roscoe	yellow ginger	Nat	C

Legend to Table 2:

Status = distributional status

End = endemic; native to Hawaii and found naturally nowhere else.

Ind = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.

Nat = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.

Pol = Polynesian introduction before 1778.

Abundance = occurrence ratings for plants in survey area.

R – Rare - only one, two, or three plants seen.

U - Uncommon - several to a dozen plants observed.

O - Occasional - found regularly around the site.

C - Common - considered an important part of the vegetation and observed numerous times.

A - Abundant - found in large numbers; may be locally dominant.

AA - Abundant - abundant and dominant in some areas surveyed, defining vegetation in those areas.

Avian Survey

A total of 67 individual birds, of 12 different species representing eight families, were recorded in the project area during the avian surveys. Very few birds were observed during surveys at the six avian count stations, as most individuals were observed during the perimeter surveys of the reservoir or

Table 3. List of birds and their abundances encountered in the survey area.

PHYLUM, CLASS, ORDER, FAMILY *Genus species*	Common name	Status	Abundance Dam	 Res.	 Sto.
AVES, ANSERIFORMES					
ANATIDAE					
Anas sp. Linnaeus	unid. duck	--	--	1	--
AVES, CICONIIFORMES					
ARDEIDAE					
Nycticorax nycticorax Linnaeus	Black-crowned Night Heron; *'auku'u*	**Ind**.	--	11	--
CHARADRIIDAE					
Pluvialis fulva J. F. Gmelin	Pacific Golden Plover; *kolea*	**Ind**.	7	11	2
AVES, COLOMBIFORMES					
COLUMBIDAE					
Geopelia striata Linnaeus	Zebra Dove	Nat.	--	2	--
Streptopelia chinensis Scopoli	Spotted Dove	Nat.	--	1	--
AVES, PASSERIFORMES					
ESTRILDIDAE					
Estrilda astrild Linnaeus	Common Waxbill	Nat.	8	--	--
Lonchura atricapilla Vieillot	Chestnut Munia	Nat.	--	16	--
Padda oryzivora Linnaeus	Java Sparrow	Nat.	--	2	--
FRINGILLIDAE					
Carpodacus mexicanus Muller	House Finch	Nat.	--	1	--
PYCNONOTIDAE					
Pycnonotus cafer Linnaeus	Red-vented Bulbul	Nat.	--	3	--
ZOSTEROPIDAE					
Zosterops japonicus Temminck & Schlegel	Japanese White-eye	Nat.	--	1	--

Table 3 Legend:

Status
- **End**. – Native and unique to the Hawaiian Islands;
- **Ind**. - indigenous; native to Hawai'i, but not unique to the Hawaiian Islands;
- Nat. - naturalized; exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.

Locations:
- Dam – specimen observed along slope or top of embankment dam
- Res. – specimen observed above or within a 40 ft perimeter surrounding the reservoir.
- Sto. – specimen observed within the anticipated location of sediment stockpile.

during transit between count stations. Table 3 list all avian species observed and number of individuals encountered in three of the proposed work areas within the project site: embankment dam, reservoir, and sediment stockpile. No birds were observed at the seepage work areas or the outlet receiving area in Nu'uanu Stream.

10 of the 12 species recorded are considered to be introduced or naturalized to the Hawaiian Islands. Two species sighted consistently and comprising nearly half of the birds encountered during the survey—the Pacific Golden Plover (*Pluvialis fulva*) and *'auku'u* or Black-crowned Night Heron (*Nycticorax nycticorax*)—are indigenous to the main Hawaiian Islands.

Water Quality

Results from *in situ* measurements and analyses of water samples collected from three stations located in the reservoir are provided in Table 4. Generally, the water quality in the reservoir is typical for impounded waters in Hawaiian watersheds. Sluggish water movement created by the impoundment allows sediments and biotic waste to accumulate in the water body. Particulates in the water column, as measured by TSS and turbidity, were high, reflecting the brown water observed during the surveys. Temperature and pH readings varied little from station to station; concentrations of dissolved oxygen (DO), total nitrogen, and total phosphorus were also similar at all three stations. Only ammonia varied substantially between locations, presumably reflecting local conditions of water exchange or perhaps breakdown of accumulated organic matter on the bottom.

Aquatic Biota

The aquatic biota in Nu'uanu Reservoir No. 4 comprises mostly naturalized, non-native species (Table 5). The only native species encountered during the survey was the globe skimmer dragonfly (*Pantala flavescens*), which is circumglobal in distribution throughout both tropical and temperate climate regions (Clausnitzer and Suhling, 2008).

Tilapia and poeciliids are the predominant fishes in the reservoir surface waters. Two tilapia species, the black-chinned tilapia (*Sarotherodon melanotheron*) and the Mozambique tilapia (*Oreochromis mossambicus*) appear to be common, though correct field identification of these fishes to species level is difficult due to hybridization. Mollies (*Poecilia* sp.) are common, while other Poeciliids, like swordtails (*Xiphophorus helleri*), mosquitofish (*Gambusia affinis*), and guppies (*Poecilia reticulata*) are encountered less regularly. Channel catfish

Table 4. Water quality results for samples collected on October 5, 2010 from three station in Nu'uanu Reservoir No. 4.

Station	Time	Temp. (°C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% sat.)	pH --	Conductivity (µmhos/cm)
North End	1031	23.3	6.31	74	7.05	94
Mid. Reservoir	1046	23.2	6.38	75	7.07	195
Tower	1059	23.3	6.49	76	7.25	93

	TSS (mg/l)	Turbidity (ntu)	Ammonia (µg N/l)	Nitrate+ Nitrite (µg N/l)	Total N (µg N/l)	Total P (µg P/l)
North End	7.0	6.48	94	<9	497	23
Mid. Reservoir	10	8.56	<3	<9	512	27
Tower	9.0	7.53	40	<9	504	27

(*Ictalurus punctatus*) are occasionally seen, usually resting on *hau* (*Hibiscus tiliaceus*) branches or swimming slowly along the shore. Red-rimmed melania snails (*Melanoides tuberculatus*) are uncommon, generally only observed where basaltic bedrock or boulders occur as substratum in the reservoir. The Asiatic flume clam (*Corbicula fluminea*) is found in the reservoir and broken shells of this species are ubiquitous in shallow waters.

Assessment

Botanical Resources

The primary function of the reservoir and surrounding vegetation is to promote infiltration of rainwater to recharge the groundwater in the Honolulu aquifer.

Table 5. List of aquatic species and their relative abundances in Nu'uanu Reservoir No. 4 and spillway into Nu'uanu Stream.

PHYLUM, CLASS, ORDER, FAMILY *Genus species*	Common name	Abundance	Status	Location Code
	INVERTEBRATES			
MOLLUSCA,GASTROPODA				
NEOTAENIOGLOSSA				
THIARIDAE				
Melanoides tuberculatus Muller	red rimmed melania	U	Nat.	1,2
MOLLUSCA,BIVALVIA				
VENEROIDA				
CORBICULIDAE				
Corbicula fluminea O. F. Müller	Asiatic flume clam	O	Nat.	1,2
ARTHROPODA,INSECTA				
ODONATA, ANISOPTERA				
COENAGRIONIDAE				
Ischnura ramburi Selys	Rambur's forktail	R	Nat.	1
LIBELLULIDAE				
Crocothemis servilla Drury	scarlet skimmer	R	Nat.	1
Pantala flavescens Fabricius	globe skimmer	R	**Ind.**	1
ARTHROPODA,				
MALACOSTRACA,				
DECOPODA				
CAMBARIDAE				
Procambarus clarkii Girard	American crayfish	R	Nat.	2
	FISHES			
CHORDATA,				
ACTINOPTERYGII				
ICTALURIDAE				
Ictalurus punctatus Rafinesque	channel catfish	O	Nat.	1
CICHLIDAE				
Archocentrus nigrofasciatus Günther	convict cichlid	O	Nat.	1,2
Oreochromis mossambicus Peters	Mozambique tilapia	C	Nat.	1,2
Sarotheron melanotheron Rüppell	blackchin tilapia	C	Nat.	1,2
unid.	hybrid tilapia	O	Nat.	1

Table 5 (continued).

PHYLUM, CLASS, ORDER, FAMILY *Genus species*	Common name	Abundance	Status	Location Code
POECILIIDAE				
Gambusia affinis Baird and Girard	mosquitofish	O	Nat.	1,2
Poecilia reticulata Peters	guppy	O	Nat.	1,2
Poecilia sp. Bloch and Schneider	unid. mollies	C	Nat.	1
Xiphophorus hellerii Heckel	orange/green swordtail	O	Nat.	1,2

Legend for Table 5:

Abundance categories:
- R – Rare – only one or two individuals observed.
- U – Uncommon – several to a dozen individuals observed.
- O – Occasional – seen irregularly in small numbers
- C – Common -observed everywhere, although generally not in large numbers.
- A – Abundant – observed in large numbers and widely distributed.

Status categories:
- **End** – Endemic – species found only in Hawaii.
- **Ind.** – Indigenous – species found in Hawaii and elsewhere.
- Nat. – Naturalized – species were introduced to Hawaii intentionally, or accidentally.

Location codes:
- 1 –observed in Nu'uanu Reservoir No. 4).
- 2 – observed in spillway into Nu'uanu stream downslope from embankment dam.

Both the reservoir and the surrounding vegetation also function in reducing particulate loading in Nu'uanu Stream. As to the nature of the vegetation, this would likely be all forest in this location were it not for the reservoir and selected clearings made as part of reservoir maintenance. However, the flora is one very much dominated by non-native species. Other than a few *koa* trees towards the middle and upper end of the reservoir, no particular plants are deserving of preservation.

Aquatic Resources

Aquatic biota observed during the October 2010 surveys consisted almost entirely of naturalized species. The Nu'uanu watershed is reported (Parham et al., 2008) to host some native fish and invertebrate species including *'o'opu nākea* (*Awaous guamensis*), *'o'opu nōpili* (*Sicyopterus stimpsoni*i), *'o'opu alamo'o* (*Lentipes concolor*) and *'opae kala'ole* (*Atyoida bisulcata*). Although these populations are reported from the estuarine, lower, and middle reaches of the

stream, these species are also found in the upper reaches of O'ahu streams at similar elevations to Reservoir No. 4. However, species accounts of fishes and invertebrates in reservoirs of the Hawaiian Islands suggest that the environment favors non-native species (see Parham et al, 2008; AECOS, 2008; HDAR, 2011). Competition and predation may prevent significant populations of native species inhabiting a reservoir.

The Oceanic Hawaiian damselfly (*Megalagrion oceanicum*) is reported to historically inhabit the Nu'uanu watershed (Parham et al, 2008; Polhemus 2007) However, recent (1991-2003) O'ahu surveys indicate that populations are limited to eight stream catchments from Kahalu'u Stream in the southeast to Kahamainui Stream in the northwest of the windward side of the Ko'olau Ridge (Polhemus, 2007). No Oceanic Hawaiian Damselflies were observed during the October 2010 surveys and none is anticipated to utilize resources in the reservoir or project work area since preferred habitat for the species is stream riffles, rapids and waterfall faces, habitats which do not exist within the project area.

Avian Resources

Ten of the twelve avian species detected during the course of this survey are considered to be alien to the Hawaiian Islands. The two native species observed—Pacific Golden Plover or *kolea* and Black-crowned Night Heron or *'auku'u*—are a winter migrant and a waterbird, respectively, with stable, widespread Hawaiian populations (Mitchell et al, 2005). Neither species is listed by the Endangered Species Act or its amendments (USFWS, 2009).

Four species encountered at the project site: Pacific Golden Plover, Duck, Zebra Dove, and Spotted Dove are protected by the Migratory Bird Treaty Act (MBTA) of 1918. Protection via the MBTA is administered by the U.S. Fish and Wildlife Service and implemented through the protection or regulation of taking of a listed species including nests, eggs, and feathers. The proposed project at Nu'uanu Reservior is not anticipated to have any adverse impacts on the population or habitat of any species of bird.

Mammalian Resources

Tracks of feral pigs (*Sus scrofa*) were identified along the western shore of the reservoir. It is likely that one or more of the four established alien rodents known from the Island of O'ahu (Tomich, 1986): roof rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans*), and European house mice (*Mus domesticus*), use resources within the general project area, on

at least a seasonal basis. Likewise, the Indian mongoose, also known as the small Asian mongoose (*Herpestes javanicus*), may be found in the project area. All of these mammalian species are pest species naturalized to the Hawaiian Island without value from a resource conservation perspective.

The only mammalian species of concern that could be expected to utilize resources at the proposed gulch crossings is the Hawaiian hoary bat (*Lasiurus cinereus semotus*). The species, known locally as *ōpe'ape'a*, is listed as endangered and protected by the Endangered Species Act of 1972. Hawaiian hoary bats occur in a wide variety of habitats and have been documented to roost in a variety of trees (Mitchell et al., 2005). Federal regulators (like USFWS) may choose to recommend BMPs to prevent impacts to bat populations. Such BMPs, if requested, usually prevent removal or trimming of trees over 4.5 m (15 ft) during bat birthing and rearing season (June 1 to September 15). If the project schedule requires vegetation clearing to take place during this period a bat survey of the project footprint by a "knowledgeable biologist" may be required prior to commencement of project work. However, such surveys do not reveal the presence of bat pups in specific trees and therefore at risk during the pupping season.

Critical Habitat

There are no federally designated Critical Habitats for any plant or animal species currently protected under the Endangered Species Act of 1973, as amended within the project area (USFWS, 2002). The O'ahu 'Elepaio (*Chasiempis sandwichensis ibidis*) does have designated critical habitat in the Ko'olau nearby. However, the area is over 330 ft (100m) from the south east end of the reservoir access road. Anticipated project work will not impinge on this critical habitat or adversely impact on the species.

Conclusions

None of the botanical, avian, or aquatic species observed during the survey is listed as threatened or endangered by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973, as amended, or by the State of Hawaii under its endangered species program (DLNR 1998; USFWS, 2009). Furthermore, the proposed action will not result in modification of any federally designated Critical Habitat, as there is none present on or adjacent to the subject property. A Best Management Practices (BMP) plan should be designed and implemented to minimize environmental impacts to Nu'uanu Stream waters downslope from the project area.

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Appendix E

Hazardous Materials Survey

HAZARDOUS MATERIALS SURVEY REPORT

NUUANU RESERVOIR #4 AND ASSOCIATED INFRASTRUCTURE

Upper Nuuanu Valley, Oahu

January 2011

PREPARED BY:

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Hazardous Materials Survey Report

Nuuanu Reservoir #4 and Associated Infrastructure

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SECTION 1: INTRODUCTION

This report presents the results of a complete Hazardous Materials Survey (HMS) covering infrastructure associated with Nuuanu Reservoir #4 in Upper Nuuanu Valley on the Island of Oahu in Hawaii. This survey has been completed by Owen Environmental Inc. for R. M. Towill Corporation (RMTC) in support of the Nuuanu Reservoir #4 Repairs project.

The Nuuanu Reservoir #4 dam was originally constructed between 1905 and 1910, and later renovated in the 1930s. The dam and reservoir sit on property owned by the State of Hawaii and managed by the State Department of Land and Natural Resources (DLNR). The dam and reservoir are owned and operated by the Honolulu Board of Water Supply (BWS). An aerial view of the dam and reservoir property is included as **Figure 1** (**Appendix A**). Recent evaluations of the dam and reservoir have concluded that the dam is in need of maintenance and repairs. RMTC is currently designing a project to complete the repairs and renovations necessary to maintain the integrity of the dam. This survey was completed in support of that project.

1.1 Objectives

This survey was conducted to identify the presence of any potentially hazardous building materials that may be encountered during renovations and repairs that are planned for Nuuanu Reservoir #4 under the Nuuanu Reservoir #4 Repair project. Potentially hazardous building materials include materials in areas that will be disturbed during the project and which may present hazards to construction workers performing the work, to the general public, or to the environment. This report details the methods used during this evaluation of potentially hazardous materials and presents the results of all surveys and inspections performed.

If found to be present in areas where they would be disturbed during renovation and repair activities, certain materials may require removal, treatment, or special handling and disposal procedures to comply with State and Federal regulations, as well as landfill disposal requirements. Any special requirements may be determined at a later time based on the results of this report.

1.2 Scope of Work

This HMS covers all exposed building materials within the Nuuanu Reservoir #4 dam and the associated infrastructure. Structures evaluated during this survey include the dam itself, the intake tower and the suspended bridge used to access the tower, the sand filter pit area above the dam spillway, and the outfall at the foot of the dam. Monitoring wells installed within the dam were specifically excluded from the scope of work.

The types of potentially hazardous materials that were surveyed during this investigation include: asbestos-containing building materials, lead-based paint, PCB-containing electrical equipment, mercury-containing light fixtures, radioactive smoke detectors,

storage tanks for fuel or other types or petroleum, and other lead-containing materials. Soil contamination was not evaluated beyond a superficial visual inspection for obvious signs of spills, stains, or stressed vegetation. Sediments that have accumulated within the reservoir were not evaluated as part of this investigation.

This HMS consisted of the following steps:

- A review of historical information related to construction and operation of the Nuuanu Reservoir #4 dam;
- Interviews with persons familiar with the facilities at the dam and reservoir;
- Visual inspection of all accessible areas and materials associated with the dam;
- Sampling and laboratory analysis of any materials suspected of potentially containing asbestos;
- Sampling and laboratory analysis of paint from any painted surfaces that may be disturbed.

Methodologies used during these inspections are documented in **Section 2.0**. All results are documented in **Section 3.0**.

SECTION 2: METHODS

The methods used during this investigation were selected to meet the stated objectives of this survey for the presence of hazardous materials, and to ensure that the planned renovation activities may be completed in safely and efficiently. All physical inspections were performed on December 21, 2010 by Benjamin Owen of Owen Environmental, Inc., under supervision from David Gerow of Kauai Environmental, Inc. Mr. Owen is a State-certified asbestos inspector (State Certification # HIASB-0904) and a Registered Environmental Assessor. Mr. Gerow is a Certified Industrial Hygienist (CIH) and a Certified Safety Professional (CSP).

This section outlines the methods used to collect background information and perform inspections for asbestos, lead-based paint, and other hazardous materials. Methods used to collect background information are described in **Section 2.1**. Visual inspection methods are described in **Section 2.2**. Asbestos inspection methods, lead paint inspection methods, and methods for inspections for other hazardous materials are described in **Sections 2.3, 2.4** and **2.5**, respectively.

2.1 Review of Background Information

Prior to conducting physical inspections at the reservoir facility, Owen Environmental reviewed all relevant historical documentation provided by RMTC. Documents reviewed as part of this process included the following:

- Survey maps of the Nuuanu Reservoir #4 dam and surrounding reservoir and watershed areas;
- Historical aerial photographs of the dam, reservoir and watershed areas provided by RMTC's Photogrammetry Department;
- Phase 1 Investigation Report, Nuuanu Dam #4 (*Gannet Fleming, 2008*); and
- A History of Nuuanu Reservoir #4 Dam (*BWS, 1988*)

The survey maps and aerial photographs of the Nuuanu Reservoir #4 and dam areas reviewed for this report were useful in confirming the locations of the various components of the infrastructure associated with the dam, while the Phase 1 Investigation Report and other documentation provided insight into the methods and materials used in the initial construction of, and subsequent modifications to, the dam and reservoir structures.

Interviews were also conducted with BWS personnel familiar with the history and operation of the Nuuanu Reservoir #4 dam and reservoir. Mr. Darryl Wong, a hydrologist/geologist who has worked or BWS for 15 years, was interviewed regarding his knowledge of the facilities, equipment, and other materials stored and/or used at the facility. Several maintenance workers encountered at the site during the physical inspection of the property were also interviewed regarding their knowledge of operations at the site.

2.2 Visual Inspection

All accessible areas of the Nuuanu Reservoir #4 dam and the infrastructure associated with the dam were subject to a thorough visual inspection. This inspection was performed to meet the following objectives:

- To locate all infrastructure identified in the various surveys, maps, and historic documentation reviewed prior to the visual inspection of the property;
- To identify any suspect materials (i.e., materials suspected of potentially containing asbestos);
- To identify all painted surfaces that might be disturbed during repair activities, and which could potentially be coated with lead-based paint;
- To screen the facility for any other building materials or equipment that might contain hazardous materials, such as PCB-containing transformers or lighting ballasts, mercury-containing light bulbs, or smoke detectors that might contain radioactive isotopes;
- To survey the area for any other indication of potential contamination including trash or debris, stained soils, or stressed vegetation that might indicate illegal dumping activities, petroleum contamination, or the release of other unknown chemicals at the site.

Photographs taken at the time of the inspection are included in **Appendix B**. Results from this visual inspection are described in **Sections 3.1, 3.2** and **3.3**.

2.3 Asbestos Inspection Methods

The asbestos inspection documented in this report was performed in accordance with regulations and guidance documents published by the US Environmental Protection Agency (EPA) and the Hawaii State Department of Health. All samples were collected and handled by Benjamin Owen (HI State Certification # HIASB-0904). In the performance of this inspection, all buildings and areas were first thoroughly inspected to identify the types of materials that had been used in their construction. Suspect building materials, or materials that are identified as potentially containing asbestos based on the presence of fibrous constituents, were inventoried. Materials such as wood, foam, metal, rubber and plastic were assumed to be free of asbestos based on EPA guidelines. Suspect materials that appeared to be the same from one room to another based on their appearance or time of installation were considered to be part of the same homogeneous material.

Once the location, type, and total area of each suspect material had been documented, samples were collected from each suspect material in accordance with EPA and State regulations, which specify minimum sampling requirements based on the type and amount of the specific materials in question. If any one sample from a given suspect material is positive, then the entire homogeneous material is considered positive for asbestos.

For each sample collected, a small quantity of the material in question was collected and placed in a small plastic bag. Sample bags were immediately labeled with a unique sample identification code, and submitted along with chain-of-custody documentation to a analytical laboratory certified for analysis of bulk asbestos content.

All samples collected during this inspection were submitted to Environmental Hazard Services (EHS) laboratory in Richmond, VA. EHS is accredited by the EPA and Hawaii State Department of Health to perform laboratory analysis of building materials for bulk asbestos content. All samples were analyzed using EPA Method 600/R-93/116, the method required for identification and quantification of bulk asbestos content in building material samples. This method uses a Polarized Light Microscope (PLM) and standard mineralogical techniques to positively identify the presence of asbestos and to determine the concentration of asbestos fibers within the sample on a percentage basis. Materials that are thus determined to contain greater than 1% asbestos are classified as asbestos containing building materials (ACBM). Results from the analysis of all asbestos samples collected during this inspection are presented in **Section 3.1**.

This inspection was a partial building inspection, conducted for the purpose of demolition and/or renovation. As such, only certain areas were inspected for the presence of ACBM. Areas inspected included all readily accessible areas where renovation activities are anticipated. Roofing materials were not inspected, and inaccessible areas such as the lower portion of the outlet works tower and the interior of the out flow portal at the foot of the dam were not inspected.

2.4 Lead Paint Inspection Methods

The inspection for the presence of lead-based paint documented in this report was performed in accordance with regulations and guidance documents published by the EPA and US Department of Housing and Urban Development. All samples were collected and handled by Benjamin Owen of Owen Environmental. In the performance of this inspection, all buildings and areas were thoroughly inspected to identify all painted surfaces that might be disturbed during planned renovation activities, and which could potentially be coated with lead-based paint. Representative samples of the paint from these painted surfaces were then collected for laboratory analysis of lead content. Paint samples were collected to include all layers of paint from the surface layers down to the unpainted substrate, so that all layers of paint are represented in the sample.

For each sample collected, a small quantity of paint was collected and placed in a small plastic bag. Paint samples were collected to include all layers paint down to the bare substrate. Sample bags were immediately labeled with a unique sample identification code, and submitted with chain-of-custody documentation to a certified analytical laboratory for analysis of lead content.

All samples collected during this inspection were submitted to Environmental Hazard Services (EHS) laboratory in Richmond, VA. EHS is fully qualified and accredited to perform the analysis of paint chip samples for bulk lead content. Lead paint samples were

analyzed using EPA Method SW846 7420. This method involves acid digestion of the sample, followed by analysis of the extract using atomic absorption (AA) spectroscopy. Results from the analysis of all lead paint samples collected during this inspection are presented in **Section 3.2**.

2.5 Survey Methods for Other Hazardous Materials

Other hazardous materials evaluated during Owen Environmental's inspection of the Nuuanu Reservoir #4 dam included: PCB-containing electrical equipment, mercury-containing light fixtures, radioactive smoke detectors, storage tanks for fuel or other types or petroleum, and other lead-containing materials. Assessment for the potential presence of these hazards was evaluated based on review of historical documentation, interviews with persons familiar with the history and operation of the facility, and visual inspection of the facility and surrounding area. Results from this assessment are documented in **Section 3.3**.

SECTION 3: RESULTS

This section presents results of inspections for asbestos containing building materials, lead-based paint, and other hazardous materials. Asbestos inspection results are described in **Section 3.1**. Lead paint inspection results are described in **Section 3.2**. Results for inspections for other hazardous materials are described in **Section 3.3**.

3.1 Asbestos Inspection Results

Visual inspections for the presence of suspect materials were performed at the outlet works tower, sand filter pit area, and the outfall below the dam. No suspect materials were identified at the sand filter pit or outfall areas. Within the outlet works tower control room, only minimal building materials were identified including concrete and metal. However, due to the advanced age and generally good condition of the solid concrete substrate, samples were collected from the concrete itself to evaluate the material for the presence of asbestos fibers. In some cases prior to the 1960s, asbestos was used as a fill material to lighten concrete structures and make them more durable. In this case, the concrete substrate of the tower itself was the only suspect material identified.

A total of three samples were collected from the surface of the concrete walls inside the outlet works tower control room. Laboratory analysis of these samples demonstrated that the concrete substrate does not contain asbestos fibers. A complete copy of the laboratory report documenting results from the analysis of these samples for bulk asbestos content as well as chain of custody documentation is included in **Appendix C**.

3.2 Lead Paint Inspection Results

Representative paint samples were collected from two painted surfaces during this inspection: the painted surface of the manual control valves within the outlet works tower control room, and the painted surface of the hand rails on the suspended bridge that provides access to the intake tower. No other painted surfaces were identified in areas that may be affected by the planned repair project.

A total of four paint chip samples were collected, with two samples representing each of the two painted surfaces indicated above. Results from the analysis of these samples is presented below in **Table 1**. Sample locations are identified in **Figures 2** and **3 (Appendix A)**. A complete copy of the laboratory report documenting results from the analysis of these paint samples for total lead content as well as chain of custody documentation is included in **Appendix C**.

The US Department of Housing and Urban Development defines lead-based paint as a paint coating with a total lead content of greater than 0.5% lead by weight. The results reported here indicate that the silver pant on the manual control valves inside the intake tower control room and on the hand rails of the bridge leading to the tower contain lead at concentrations ranging from 3.2% to 5.5% lead by weight.

Table 1: Results of Lead-based Paint Analysis

Sample No.	Location of Painted Surface	Paint Color	Paint Condition	Lead Concentration (% by weight)
NR-PBP-01	Interior: surface of manual control valves	silver	poor	3.2%
NR-PBP-02	Interior: surface of manual control valves	silver	poor	1.0%
NR-PBP-03	Exterior: surface of bridge handrails	silver	good	0.28%
NR-PBP-04	Exterior: surface of bridge handrails	silver	good	5.5%

3.3 Results for Other Hazardous Materials

This section describes results of research, interviews and inspections for the presence of other hazardous materials including PCB-containing electrical equipment, mercury-containing light fixtures, radioactive smoke detectors, storage tanks for fuel or other types or petroleum, and other lead-containing materials.

PCB and Mercury-containing Electrical Equipment and Light Fixtures

No lighting or electrical systems were indicated in any of the historical documentation reviewed for this survey, nor were any identified during interviews or physical inspection of the facilities associated with the Nuuanu Reservoir #4 dam and reservoir.

Radioactive Smoke Detectors

No smoke detectors of any kind were indicated in any of the historical documentation reviewed for this survey, nor were any identified during interviews or physical inspection of the facilities associated with the Nuuanu Reservoir #4 dam and reservoir.

Storage Tanks for Petroleum Products

No storage tanks of any kind associated with the Nuuanu Reservoir #4 dam were indicated in any of the historical documentation reviewed for this survey, and no indication of the current or historical presence of any storage tanks at the site was identified during interviews or physical inspection of the facilities associated with the Nuuanu Reservoir #4 dam and reservoir.

Other Lead-containing Materials

No lead-containing materials were indicated in any of the historical documentation reviewed for this survey, and no lead-containing materials were identified during interviews or physical inspection of the facilities associated with the Nuuanu Reservoir #4 dam and reservoir.

Trash and Other Debris

No significant amount of trash or debris was observed during inspection of the dam and reservoir facilities, and no other sign of potential contamination was observed during visual inspection of the area. Although much of the area was inaccessible to close inspection due to thick vegetation, water in the reservoir, steep mountain slopes and generally wet conditions, the areas including and immediately surrounding all of the infrastructure associated with the dam was observed to be well maintained, clean, and in extremely good condition. There was no indication of any unanticipated hazardous materials that could potentially impact the planned repair and renovation of the facilities associated with the Nuuanu Reservoir #4 dam and reservoir.

SECTION 4: CONCLUSIONS

This report presents the results of a complete Hazardous Materials Survey covering the Nuuanu Reservoir #4 dam, as well as all infrastructure and appurtenances associated with the dam. The purpose of this survey was to identify the presence of any potentially hazardous materials that might be encountered during repairs and maintenance of the dam that are anticipated as part of the Nuuanu Reservoir #4 Repair project.

This survey covered all exposed building materials within the Nuuanu Reservoir #4 dam and the associated infrastructure, including: the dam itself, the intake tower and the suspended bridge used to access the tower, the sand filter pit area above the dam spillway, and the outfall at the foot of the dam. Monitoring wells installed within the dam were specifically excluded from the scope of work. The types of materials that were surveyed during this investigation included: asbestos-containing building materials, lead-based paint, PCB-containing electrical equipment, mercury-containing light fixtures, radioactive smoke detectors, storage tanks for fuel or other types or petroleum, and other lead-containing materials. Soil contamination was not evaluated beyond a superficial visual inspection for obvious signs of spills, stains, or stressed vegetation. Sediments that have accumulated within the reservoir were not evaluated as part of this investigation.

Specific results from this hazardous materials survey may be summarized as follows:

- No asbestos containing materials were identified.
- No PCB-containing electrical equipment was identified.
- No mercury-containing light fixtures were identified.
- No radioactive smoke detectors were identified.
- No storage tanks intended or used for the storage of fuel or any other type or petroleum products were identified.
- No lead-containing materials were identified.
- Lead-based paint was identified on painted surfaces within the intake tower control room and on the suspended bridge leading to the tower.

Laboratory analysis of lead paint samples collected from the painted surfaces of the manual control valves within the intake tower control room and the hand rails along the suspended bridge leading to the intake tower indicates that the paint on these structures contains lead at concentrations ranging from 3.2% to 5.5% lead by weight.

The US Department of Housing and Urban Development defines lead-based paint as a paint coating with a total lead content of greater than 0.5% lead by weight. The results reported here indicate that the silver pant on the manual control valves inside the intake tower control room and on the hand rails of the bridge leading to the intake tower contain lead at concentrations ranging from 3.2% to 5.5% lead by weight. These results should be provided to all contractors working in and around the intake control tower, even if their scope of work does not include disturbing these painted surfaces.

SECTION 5: REFERENCES

Gannet Flemming; *Phase 1 Investigation Report, Nuuanu Dam No. 4, Honolulu, Oahu, Hawaii. National Inventory of Dams No. HI00001* (August 2008).

Lao, Chester; *A History of Nuuanu Reservoir No. 4 Dam.* Board of Water Supply Conference on Dam Safety, Ala Moana Hotel (November 17-18, 1988

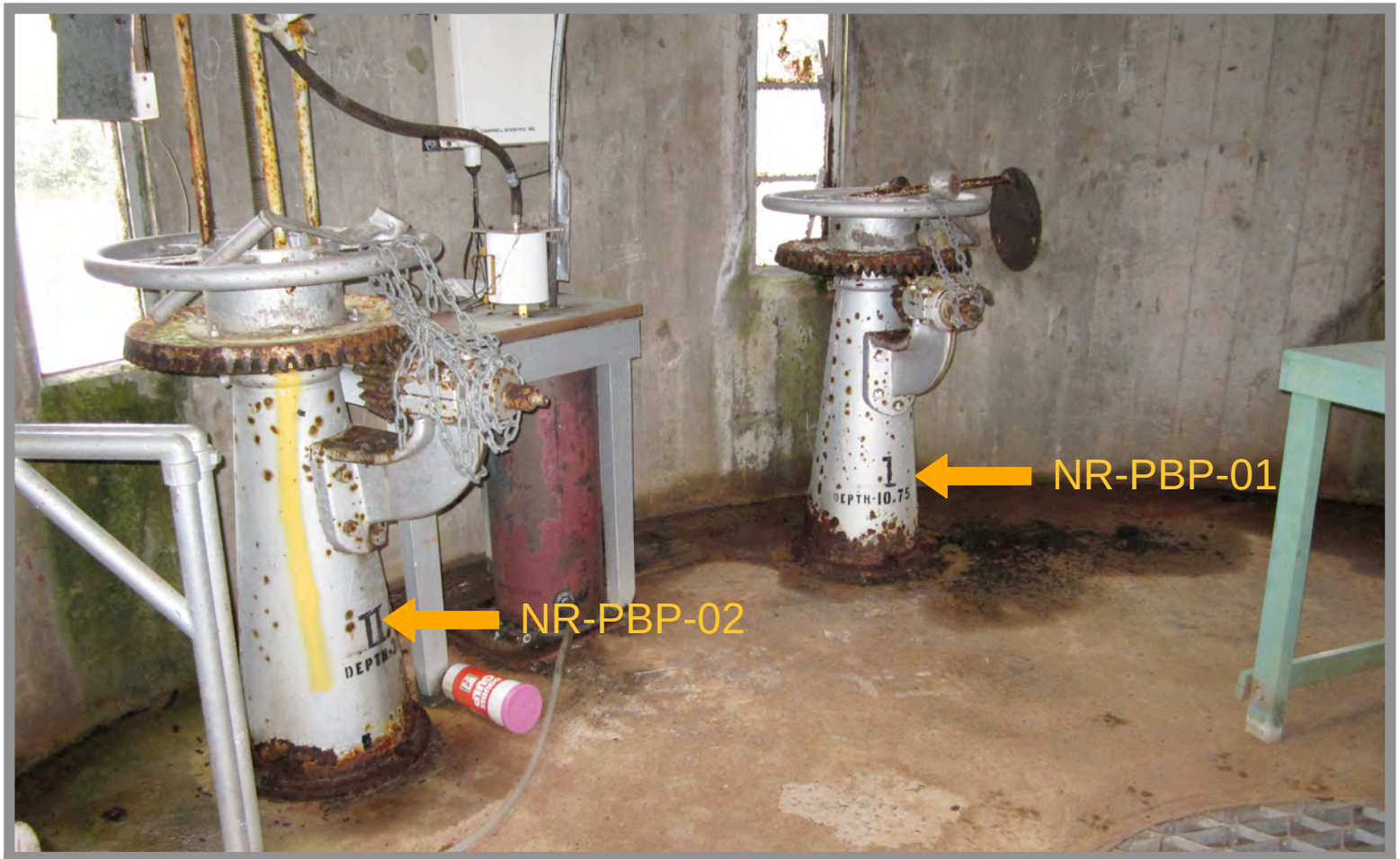
APPENDIX A:

FIGURES

Owen Environmental Inc.
Hazardous Materials Survey
Nuuanu Reservoir #4
January 2011

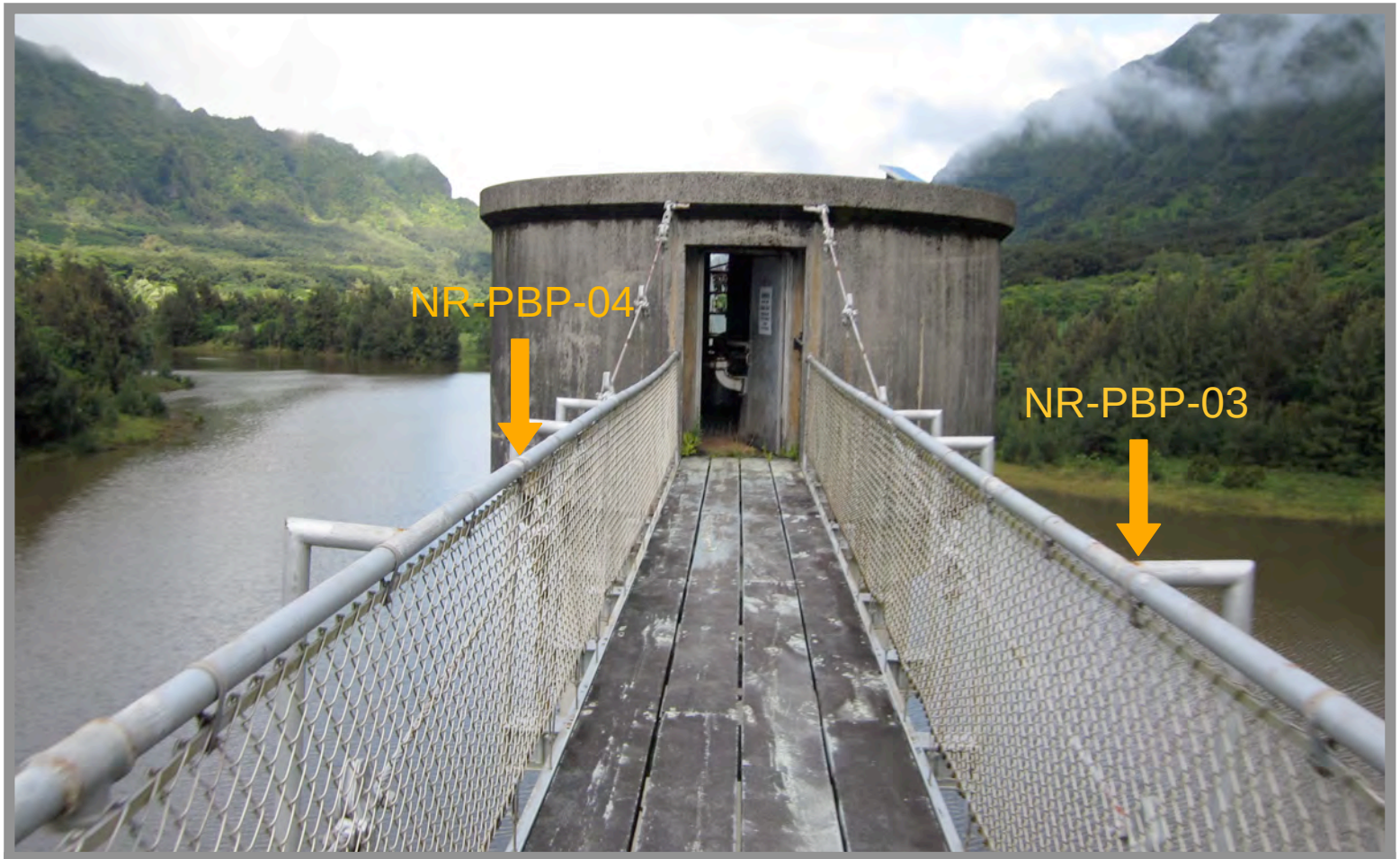
Figure 1: Aerial View of Nuuanu Reservoir #4 and Associated Infrastructure

Source: Google Earth



Owen Environmental Inc.
Hazardous Materials Survey
Nuuanu Reservoir #4
January 2011

Figure 2: Lead Paint Sample Locations Interior Painted Surfaces



Owen Environmental Inc.
Hazardous Materials Survey
Nuuanu Reservoir #4
January 2011

Figure 3: Lead Paint Sample Locations Exterior Painted Surfaces

APPENDIX B:

PHOTOGRAPHS

Photo 1: Intake tower at Nuuanu Reservoir #4.

Photo 2: Suspended bridge leading to intake tower at Nuuanu Reservoir #4.

Photo 3: Side view of suspended bridge and intake tower.

Photo 4: View of dam from intake tower at Nuuanu Reservoir #4. Two monitoring wells on dam are visible.

Photo 5: Inlet control valves inside control room of intake tower at Nuuanu Reservoir #4.

Photo 6: Outlet control valve.

Photo 7: Painted surfaces on valves is rusting and in poor condition.

Photo 8: Access to sluice gates below control room is via confined space entry.

Photo 9: Outflow from steel pipe below at Nuuanu Reservoir #4.

Photo 10: Steel outlet pipe emerges from Nuuanu Reservoir #4 dam.

Photo 11: Sand filters are located within secure enclosure.

Photo 12: Close up of historic sand filter pits.

APPENDIX C:

LABORATORY RESULTS

Environmental Hazards Services, L.L.C.
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Asbestos Bulk Analysis Report

Report Number: 10-12-03247

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Received Date: 12/27/2010
Analyzed Date: 12/30/2010
Reported Date: 12/30/2010

Project/Test Address: Nuvanu Reservoir HMS

Client Number:
200621

Fax Number:

Laboratory Results

Lab Sample Number	Client Sample Number	Layer Type	Lab Gross Description	Asbestos	Other Materials
10-12-03247-001	NR-ASB-01		Gray Cementitious	NAD	100% Non-Fibrous
10-12-03247-002	NR-ASB-02		Gray Cementitious	NAD	100% Non-Fibrous
10-12-03247-003	NR-ASB-03		Gray Cementitious	NAD	100% Non-Fibrous

Environmental Hazards Services, L.L.C

Client Number: 200621 Report Number: 10-12-03247

Project/Test Address: Nuvanu Reservoir HMS

Lab Sample Number	Client Sample Number	Layer Type	Lab Gross Description	Asbestos	Other Materials

QC Sample: 41-M1-1999-1

QC Blank: SRM 1866 Fiberglass

Reporting Limit: 1% Asbestos

Method: EPA Method 600/R-93/116

Analyst: Timothy Harris

Reviewed By Authorized Signatory: Tasha Eaddy

Tasha Eaddy

The condition of the samples analyzed was acceptable upon receipt per laboratory protocol unless otherwise noted on this report. Results represent the analysis of samples submitted by the client. Sample location, description, area, volume, etc., was provided by the client. This report cannot be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government. This report shall not be reproduced except in full, without the written consent of the Environmental Hazards Service, L.L.C. California Certification #2319 NY ELAP #11714. All information concerning sampling location, date, and time can be found on Chain-of-Custody. Environmental Hazards Services, L.L.C. does not perform any sample collection.

Environmental Hazards Services, L.L.C. recommends reanalysis by point count (for more accurate quantification) or Transmission Electron Microscopy (TEM), (for enhanced detection capabilities) for materials regulated by EPA NESHAP (National Emission Standards for Hazardous Air Pollutants) and found to contain less than ten percent (<10%) asbestos by polarized light microscopy (PLM). Both services are available for an additional fee.

* All California samples analyzed by Polarized Light Microscopy, EPA Method 600/M4-82-020, Dec. 1982.

LEGEND: NAD = no asbestos detected

ENVIRONMENTAL HAZARDS SERVICES, L.L.C.

7469 Whitepine Road Richmond, Virginia 23237 Phone (804) 275-4788 Fax (804) 275-4907

3PLM

CHAIN OF CUSTODY FORM

Company Name: Owen Environmental Inc. **Date:** 12/22/2010

Address: PO Box 457 **Contact Name:** Ben Owen

City, State, Zip: Kalaheo HI 96741 **Sampler Name:** Ben Owen

EHS Client Account #: _____ **Project #:** Nuuanu Reservoir HMS

Phone #: 808 482 0724 **Fax #:** _____

P.O. #: _____ email results to: ben.owen@owen808.com

10-12-03247

Due Date: 12/30/2010 (Thursday) Elnv

T

Sample Number	Sample Date & Time	Asbestos: Bulk ID by PLM	Asbestos: (PCM) Fiber Count	Asbestos: PLM Point Count	Asbestos: PLM Gravimetric	Asbestos: TEM AHERA (Air)	Asbestos: TEM Chatfield (Bulk)	Lead: Air	Lead: Paint (%)	Lead: Paint (PPM)	Lead: Paint (mg/cm²)	Lead: Soil	Lead: Wipe * (See Note)	Lead: TCLP (Pb)	Lead: Waste Water	Other Metals (Specify metals below): TCLP RCRA 8	Other Metals: Welding Fume	Other Metals: Toxic Metal Profile	Indoor Air Quality: Biocassette	Indoor Air Quality: Slide	Indoor Air Quality: Surface Swab	Indoor Air Quality: Surface Tape	Indoor Air Quality: Bulk	Particul: Air / Wip / Scrap
NR-PBP-01	12/21/10									X														
NR-PBP-02	12/21/10									X														
NR-PBP-03	12/21/10									X														
NR-PBP-04	12/21/10									X														
NR-ASB-01	12/21/10	X																						
NR-ASB-02	12/21/10	X																						
NR-ASB-03	12/21/10	X																						

* Do wipe samples submitted meet ASTM E1792 requirements? Yes ☐ No ☐

Released by: Ben Owen	Signature:	Date/Time: 12/22/10 11:00 am
Received by:	Signature:	Date/Time: 12/28/10
Released by:	Signature:	Date/Time:
Received by:	Signature:	Date/Time:

Environmental Hazards Services, L.L.C.
7469 Whitepine Rd
Richmond, VA 23237
Telephone: 800.347.4010

Lead Paint Chip Analysis Report

Report Number: 10-12-03245

Client: Owen Environmental Inc.
P.O. Box 457
Kalaheo, HI 96741

Received Date: 12/27/2010
Analyzed Date: 12/29/2010
Reported Date: 12/30/2010

Project/Test Address: Nuuanu Reservoir HMS
Collection Date: 12/21/2010

Client Number: 200621

Fax Number:

Laboratory Results

Lab Sample Number	Client Sample Number	Collection Location	Pb (ug/g) ppm	% Pb by Wt.	Narrative ID
10-12-03245-001	NR-PBP-01		32000	3.2	
10-12-03245-002	NR-PBP-02		10000	1.0	
10-12-03245-003	NR-PBP-03		2800	0.28	
10-12-03245-004	NR-PBP-04		55000	5.5	

Environmental Hazards Services, L.L.C

Client Number: 200621 Report Number: 10-12-03245

Project/Test Address: Nuuanu Reservoir HMS

Lab Sample Number	Client Sample Number	Collection Location	Pb (ug/g) ppm	% Pb by Wt.	Narrative ID

Method: EPA SW846 7420

Reviewed By Authorized Signatory:

DeeDee Bray

The HUD lead guidelines for lead paint chips are 0.50% by Weight, 5000 ppm, or 1.0 mg/cm². The Reporting Limit (RL) is 10.0 ug Total Pb. Paint chip area and results are calculated based on area measurements determined by the client. All internal quality control requirements associated with this batch were met, unless otherwise noted.

The condition of the samples analyzed was acceptable upon receipt per laboratory protocol unless otherwise noted on this report. Results represent the analysis of samples submitted by the client. Sample location, description, area, etc., was provided by the client. Results reported above in mg/cm3 are calculated based on area supplied by client. This report shall not be reproduced except in full, without the written consent of the Environmental Hazards Service, L.L.C. California Certification #2319 NY ELAP #11714.

LEGEND	Pb= lead	ug = microgram	ppm = parts per million
	ug/g = micrograms per gram	Wt. = weight	

4 Pb Paints

ENVIRONMENTAL HAZARDS SERVICES, L.L.C.

7469 Whitepine Road Richmond, Virginia 23237 Phone (804) 275-4788 Fax (804) 275-4907

CHAIN OF CUSTODY FORM

Company Name: Owen Environmental Inc. **Date:** 12/22/2010

Address: PO Box 457 **Contact Name:** Ben Owen

City, State, Zip: Kalaheo HI 96741 **Sampler Name:** Ben Owen

EHS Client Account #: _____ **Project #:** Nuuanu Reservoir #15

Phone #: 808 482 0724 **Fax #:** _____

P.O. #: _____ email results to: ben.owen@owen808.com

Sample Number	Sample Date & Time	Asbestos: Bulk ID by PLM	Asbestos: (PCM) Fiber Count	Asbestos: PLM Point Count	Asbestos: PLM Gravimetric	Asbestos: TEM AHERA (Air)	Asbestos: TEM Chatfield (Bulk)	Lead: Air	Lead: Paint (%)	Lead: Paint (PPM)	Lead: Paint (mg/cm²)	Lead: Soil	Lead: Wipe * (See Note)	Lead: TCLP (Pb)	Lead: Waste Water	Other Metals (Specify metals below): TCLP RCRA 8	Other Metals: Welding Fume	Other Metals: Toxic Metal Profile	Indoor Air Quality: Biocassette	Indoor Air Quality: Slide	Indoor Air Quality: Surface Swab	Indoor Air Quality: Surface Tape	Indoor Air Quality: Bulk
NR-PBP-01	12/21/10									X													
NR-PBP-02	12/21/10									X													
NR-PBP-03	12/21/10									X													
NR-PBP-04	12/21/10									X													
NR-ASB-01	12/21/10	X																					
NR-ASB-02	12/21/10	X																					
NR-ASB-03	12/21/10	X																					

10-12-03245

Due Date:
12/30/2010
(Thursday)
Elnv

RS

* Do wipe samples submitted meet ASTM E1792 requirements? Yes ☐ No ☐

Released by: Ben Owen	Signature: Ben Owen	Date/Time: 12/22/10 11:00 am
Received by: Tdhlgman	Signature:	Date/Time: 12/28/10
Released by:	Signature:	Date/Time:
Received by:	Signature:	Date/Time:

Appendix F

Phase 1 Environmental Site Assessment

PHASE 1 ENVIRONMENTAL SITE ASSESSMENT REPORT

NUUANU RESERVOIR #4 AND SURROUNDING WATERSHED AREA
TMK PARCELS (1) 2-2-054:001 and (1) 1-9-007:001

Upper Nuuanu Valley, Oahu

January 2011

PREPARED BY:

Owen Environmental, Inc.
P. O. Box 457
Kalaheo, HI 96741

PREPARED FOR:

R. M. TOWILL CORPORATION
2024 North King Street, suite 200
Honolulu, HI 96819

Phase 1 Environmental Site Assessment Report

Nuuanu Reservoir #4 and Surrounding Watershed Area
TMK Parcels (1) 2-2-054:001 and (1) 1-9-007:001

Upper Nuuanu Valley, Oahu

January 2011

PREPARED BY:

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Phase 1 Environmental Site Assessment Report

Nuuanu Reservoir #4 and Surrounding Watershed Area

EXECUTIVE SUMMARY

This report documents the results of a Phase 1 Environmental Site Assessment (ESA) performed for an area of land covering approximately 1,000 acres in the upper Nuuanu Valley on the Island of Oahu. This assessment, conducted by Benjamin Owen of Owen Environmental Inc. on behalf of R. M. Towill Corporation, was performed in accordance with the 2000 ASTM E 1527-00 Standard. The subject property consists of portions of two adjacent parcels identified by the TMK numbers (1) 2-2-054:001 and (1) 1-9-007:001. This property includes the Nuuanu Reservoir #4 and the surrounding watershed area, as well the dam below the reservoir and all associated appurtenances and other infrastructure. The property is owned by the State of Hawaii and managed by the Department of Land and Natural Resources (DLNR), while the dam and reservoir are owned and operated by the Honolulu Board of Water Supply (BWS).

The Phase 1 ESA process is a structured methodology for researching the history and use of a given property and the surrounding properties for the purpose of identifying any environmental liabilities that may be associated with the subject property. The process includes: an extensive review of database information maintained by State and Federal environmental regulatory agencies; a review of historical land use information; interviews with current and former owners, tenants, and other persons familiar with the history and use of the subject property; a site reconnaissance to evaluate the current use and condition of the property; and a summary report documenting all aspects of the process. Each of these components has been completed as defined and required by the 2005 ASTM E 1527-00 Standard.

This investigation was performed as a preliminary assessment to evaluate the potential for contamination of sediments within Nuuanu Reservoir #4 due to historical uses of the land within the reservoir and the surrounding watershed area. The Phase 1 ESA process was adapted for this purpose, with additional emphasis placed on review of historical use information and physical inspection of the subject property, and reduced emphasis on interviews with current and former owners and occupants of the property.

An extensive review of State and Federal environmental regulatory databases intended to identify properties (including the subject property and surrounding properties) with various reported environmental conditions was performed. No recognized environmental conditions were identified during this review. The subject property was not listed on any of the State or Federal databases reviewed, and no listings for adjacent or nearby properties were identified within a search radius that was expanded to account for the large size of the subject property.

A review of historical land use records including aerial photographs and historical topographic maps of the area indicated the following: historical topographic maps and aerial photographs covering the subject property and dating back to 1949 indicate limited

access to the area and virtually no development other than the existing roadways and reservoir system. No other historical activities or land use patterns were identified within or close to the watershed area.

Inspection of State Department of Health records indicated that the State has no records of any reportable spill events or other environmental issues associated with the reservoir or the surrounding watershed area.

Visual inspection of the subject property indicated that the property was free of any obvious sign of use or development other than the reservoir, the dam, and the Pali Highway. No evidence of any use or storage of hazardous materials was observed, and no indication and current or historical recognized environmental condition associated with the dam, the reservoir, or the surrounding watershed area was identified.

Review of additional historical documentation provided by R. M. Towill Corporation indicated that the dam was originally constructed in the early 1900's for use as a municipal water supply facility, but that since 1919 the reservoir has been primarily used for purposes of flood control. The surrounding watershed area, however, has been managed as a municipal watershed forest reserve and is zoned for conservation use.

Interviews with persons familiar with the history of the subject property indicated that the area surrounding the reservoir is both undeveloped and relatively inaccessible. None of the persons interviewed for this report had any knowledge of any potentially significant environmental condition or historical activity that could have impacted the sediment within the reservoir. The only known current of historical development within the area is the reservoir and dam, as well as the Old Pali Road and Pali Highway roadways. Other known uses of the land in the area include recreational hunting and fishing. There was also a quarry in the area where materials for construction of the dam originated. It is also possible that limited taro farming and cattle grazing may have occurred historically within the watershed area. None of these activities would be expected to impact the sediment within the reservoir.

In summary, this Phase 1 Environmental Site Assessment has not identified any current or historical recognized environmental conditions associated with the subject property. No environmental conditions or historical uses of the property with the potential to impact the sediment within the Nuuanu Reservoir #4 have been identified. Although limited characterization of the material will be required per State Department of Health guidelines prior to disposal or reuse of the sediment if it is taken off site, this investigation has not identified any reason to anticipate that the material is likely to be contaminated due to current or historical land use activities within the watershed area.

SECTION 1: INTRODUCTION

This report presents the results of a modified Phase 1 Environmental Site Assessment (ESA) performed by Owen Environmental Inc. (OWEN) on behalf of the R. M. Towill Corporation. The property evaluated during this modified Phase 1 ESA includes Oahu's Nuuanu Reservoir #4 and the surrounding watershed area in the upper Nuuanu Valley. The property evaluated is part of the Honolulu Watershed Forest Reserve, and includes portions of the parcels identified by the following TMK parcel numbers: (1) 2-2-054:001 and (1) 1-9-007:001. The location of the subject property and the boundaries of these parcels are shown in **Figures 1-3** (**Appendix A**).

The subject property consists of portions two adjacent parcels identified by the TMK parcel numbers (1) 2-2-054:001 and (1) 1-9-007:001. Together, these parcels encompass a total of approximately 1,977 acres of land. This area, which falls within the Honolulu Watershed Forest Reserve, is heavily forested and zoned for conservation use. This investigation is limited to the Nuuanu Reservoir #4 (identified in **Figure 3** as "Reservoir #4") and approximately 1,000 acres of watershed lands which drain into this reservoir.

As shown in **Figure 3**, parcel 2-2-054:001 includes both the Nuuanu Reservoir #4 and a portion of the Pali Highway. To the south and east, the parcel extends to the steep Pali or mountain ridge that surrounds the watershed. As shown in **Figure 2**, parcel 1-9-007:001 includes the watershed area across the highway from the reservoir, extending to the Pali ridge above the reservoir to the north and west. Most of the land area within these parcels beyond the highway corridor and the reservoir is undeveloped, and relatively inaccessible.

This Phase 1 ESA was performed in accordance with the procedures established in the American Society for Testing and Materials (ASTM) 2000 Standard: E 1527-00, "Standard Practice for Environmental Site Assessments: Phase 1 Environmental Site Assessment Process." The practice was modified to emphasize research of historical use over a large, relatively inaccessible and undeveloped area. Additional emphasis was allocated toward review of historical use information and physical inspection of the subject property, with reduced emphasis on interviews with current and former owners and occupants of the property.

1.1 Purpose

This modified Phase 1 ESA was performed on behalf of the Board of Water Supply as a preliminary investigation to evaluate of the potential for contamination in sediments to be dredged from the Nuuanu Reservoir as part of the Nuuanu Reservoir #4 Repair Project. While this project is still in the planning stages, it is anticipated that sediments will be removed from an area of up to three acres to a depth of 15 feet, producing a total volume of approximately 72,600 cubic yards of dredged material. State Department of Health regulations require that this material be characterized prior to being taken off site for reuse or disposal. However, testing the sediment in advance of the dredging would be prohibitively expensive. Therefore, this preliminary investigation was performed as a

means of evaluating the potential for inputs of contamination from current and/or historical sources within the surrounding watershed area, which may have impacted the sediment that has collected within the reservoir. Recommendations for sampling and analysis of dredged materials have also been included with this report.

1.2 Scope of Work

This investigation was performed using procedures established in the American Society for Testing and Materials (ASTM) 2000 Standard: E 1527-00, "Standard Practice for Environmental Site Assessments: Phase 1 Environmental Site Assessment Process."

The 2000 ASTM Standard (ASTM E 1527-00) defines the Phase 1 ESA process as consisting of four components: review of environmental and historical records from various sources; site reconnaissance; interviews; and report. These four components are to be used in concert, with each component providing information that may be used to inform the other components.

In the process of conducting this assessment, OWEN performed the following tasks:

- Reviewed available environmental records for the subject property and surrounding properties, including State and Federal records and database information, to determine whether any adverse environmental conditions with the potential to impact the use or value of the subject property have been reported at the property or on nearby properties;
- Reviewed available sources of historical information including historical topographic maps and other historic documentation to assess patterns of historical land use in the vicinity of the subject property;
- Conducted a thorough site reconnaissance to assess current uses and conditions at the subject property and adjacent properties;
- Conducted interviews with persons familiar with the history and use of the property and other properties in the area;
- Prepared this Phase 1 Environmental Site Assessment Report to document the process and findings of this assessment.

This Phase 1 ESA was limited to Nuuanu Reservoir #4, the infrastructure associated with the reservoir, and those portions of the subject properties (parcels 2-2-054:001 and 1-9-007:001) which drain into the Nuuanu Reservoir #4. This area covers approximately 1,000 acres of land at the northeast end of the Nuuanu Valley.

1.3 Limitations and Exceptions

OWEN has completed this Phase 1 ESA for portions of the properties identified by TMK parcel numbers 2-2-054:001 and 1-9-007:001, as delineated in **Figures 1-3** (the "Subject Property"). The findings and conclusions in this Phase 1 ESA are professional opinions based solely upon visual observations, research and interviews conducted by OWEN, OWEN's interpretation of the available environmental records and historical

information, information provided by the client, and OWEN's interpretation of other documents reviewed during this Phase 1 ESA process. Requests for information resources are made by OWEN to collect relevant data on current and past practices at the Subject Property. OWEN may not receive all information requested or be able to verify or confirm received information during the Phase 1 ESA process. Therefore, OWEN shall not be held responsible for errors, omissions, or misrepresentations resulting from missing documentation or from inaccurate information provided by such sources.

Limitations encountered during physical inspections of the subject property included: many areas within the subject property were largely inaccessible due to dense vegetation, steep mountain ridges and canyons, and a general lack of roads, paths and trails onto, into, and throughout the property. As a result, direct physical inspection of the subject property beyond the existing roadways and reservoir area was largely infeasible.

OWEN's services are performed with the usual thoroughness and competence of the consulting profession, in accordance with the standard for professional services at the time those services are rendered. No warranty or representation, either expressed or implied, is included or intended in its proposals, contracts, or reports.

Opinions and recommendations presented herein apply to site conditions existing at the time of our investigation and those reasonably foreseeable; they cannot necessarily apply to site changes of which OWEN is not aware and has not had the opportunity to evaluate.

SECTION 2: SITE DESCRIPTION

This section summarizes information related to the description, location, and current and historical uses of the subject property. The information presented here has been gleaned from all aspects of this Phase 1 ESA process, including review of historical and environmental records, interviews and site reconnaissance.

2.1 Location and Legal Description of Subject Property

The subject property consists of approximately 1,000 acres within the Honolulu Watershed Forest Reserve in central Oahu, including the Nuuanu Reservoir #4 and the associated watershed area. This area comprises approximately half of the total land area within the two adjacent parcels identified by the TMK parcel numbers (1) 2-2-054:001 and (1) 1-9-007:001, which are shown in **Figures 2 and 3**, respectively. The area that drains into the Nuuanu Reservoir #4 includes approximately half of the area within these two parcels. The approximate center of the subject property is located at 21^{o} 21' 33.5" North latitude and 157^{o} 48' 4.0" West longitude.

While the reservoir and watershed are located on land owned by the State of Hawaii, the reservoir infrastructure including the dam and all associated appurtenances is owned and operated by the Honolulu Board of Water Supply (BWS).

2.2 Site and Vicinity Characteristics

This section describes physical and geologic characteristics of the subject property and the surrounding area.

2.2.1 Geology and Soils

The subject property is located within a bowl on the southwest slope of the Koolau Mountains, a large volcanic mountain ridge that spans the eastern portion of the island of Oahu. The elevation of the subject property is ranges from approximately 965 feet above mean sea level (msl) at the foot of the dam to approximately 3,150 feet above msl along the ridge of the Koolau Pali. The geology of the area has been formed by gradual erosion of the volcanic soil and rock. The property slopes steeply at the edges, gradually flattening through the valley.

The U.S. Soil Conservation Service Soil Survey of the Island of Oahu classifies soils at the subject property as Lolekaa series soils (ML-K). The Lolekaa series soils consist of deep and moderately deep well-drained silty clay loams with moderately coarse texture.

2.2.2 Surface Water Resources

The subject property falls within the boundaries of the Honolulu Watershed Forest Reserve, which surrounds the Nuuanu Reservoir system. These four reservoirs were originally constructed to provide drinking water and as a source of hydroelectric power

for the residents of Honolulu, and are currently used for flood control purposes. Reservoir #4 is also managed by the State DLNR for recreational use as a stocked fishing preserve. Due to the high elevation and steep Pali ridges that surround the Nuuanu Valley, the area is subject to frequent precipitation and receives in excess of 100 inches of rain per year. Intermittent streams flow off the Pali at various locations, occasionally forming waterfalls along the Pali. Streams from the northeast portion of the Nuuanu Valley feed into the Nuuanu Reservoir #4, which is used as a water storage area. The Nuuanu Stream flows out of the reservoir, toward other reservoirs further down slope.

2.2.3 Site Flood Boundaries

According to the Flood Insurance Rate Map (FIRM) panel #15003C, the subject property is outside the 500-year flood zone.

2.3 Use of Subject Property

This section summarizes information related to current and historical land use at the subject property. Current land uses are described in Section 2.3.1; historical uses are described in Section 2.3.2.

2.3.1 Current Use of Subject Property

The subject property includes the Nuuanu Reservoir #4, the associated infrastructure including the dam, and the surrounding watershed area. This area is in use as a municipal watershed and water storage facility. Although the reservoir has not been used as a source of drinking water since 1919, the land surrounding the reservoir is maintained as a forest watershed reserve and is zoned for conservation use.

Running through the middle of the subject property and adjacent to the reservoir is the Pali Highway, a major roadway connecting Honolulu to Kailua and Kaneohe. According to Darryl Wong of BWS, runoff from the highway is channeled into storm drains so runoff from the Pali Highway does not flow into the reservoir.

The Nuuanu Reservoir #4 Dam consists of an earthen embankment that is 65 feet high and 1,750 feet long at its crest. An access road along the top of the dam leads from the Pali Highway to the spillway on the far side of the dam. The elevation at the downstream toe of the dam is 965 feet above msl. Elevation at the top of the dam is 1,038 above msl.

2.3.2 Historical Use of Subject Property

The upper Nuuanu Valley was historically used as a source of drinking water dating back to at least the 1800's, and has been exploited and developed as a municipal watershed serving Honolulu since early in the 20th century. The dam associated with the Nuuanu Reservoir #4 was originally constructed between 1905 and 1910, and later improved in the 1930's. Materials used in the construction of the dam were taken from a quarry at the site. Though originally constructed as a drinking water supply facility, the discovery of

artesian wells at lower elevation made this use of the reservoir unnecessary. Nevertheless, the dam was useful for flood control purposes as well as for hydroelectric power generation. The dam and reservoir have been in use since 1910, and the surrounding watershed area has remained largely undeveloped.

2.4 Use of Adjacent Properties

This section documents information regarding current and historical use of adjacent properties. Current land uses are described in Section 2.4.1; historical uses are described in Section 2.4.2.

2.4.1 Current Use of Adjacent Properties

The subject property, which consists of the northeast portion of the Honolulu Watershed Forest Reserve area within the Nuuanu Valley, is surrounded by high, steep Pali ridges on three sides (to the north, south and west). Forest and watershed reserves continue beyond these ridges in most areas, including the Waimanalo Forest Reserve to the east and the Kaneohe Forest Reserve to the north (see EDR Historical Topographic Map Report, **Appendix E**.). With the exception of the Pali Highway descending toward Kailua, the steeps slopes of the Pali are undeveloped. To the east and southeast, the subject properties are bordered by additional forested watershed reserve areas, which remain protected and undeveloped. The surface waters from watershed lands below the subject property but within TMK parcels 2-2-054:001 and 1-9-007:001 feed into additional reservoirs down slope from Nuuanu Reservoir #4, including Nuuanu Reservoir #3 and Nuuanu Reservoir #2.

2.4.2 Historical Use of Adjacent Properties

The subject property is surrounded on all sides by other conservation lands, including the Waimanalo Forest Reserve to the east and the Kaneohe Forest Reserve to the north, as well as additional Honolulu Watershed Forest Reserve lands to the south and west. Many of these areas are steep, rugged, and extremely difficult to access. No evidence of any other historical use of these areas has been identified.

SECTION 3: REVIEW OF ENVIRONMENTAL AND HISTORICAL RECORDS

In order to identify the presence of any current or historical recognized environmental conditions at the subject property or on adjacent or nearby properties, a database search was performed to review environmental records maintained for this purpose by State and Federal regulatory agencies. This section lists the major environmental databases that were searched, and describes the results of each search. Additional database search information is included in **Appendix C**.

3.1 Standard Environmental Record Sources

The 2000 ASTM Standard (ASTM E 1527-00) defines a list of Federal and State regulatory databases as "Standard Environmental Record Sources" to be searched for relevant information as part of the Phase 1 ESA process. These databases record reported environmental incidents, conditions, and permitted or regulated operations that have the potential to impact the use or value of a listed property and/or other nearby properties.

A summary of standard environmental database records was provided by Environmental Data Resources, Inc. on December 17, 2010 (*EDR, 2010a*). This report includes the most recent versions available at that time for all required database records, as described below, as well as other State and Federal databases. The major Federal environmental databases reviewed for this report are detailed in **Section 3.1.1**, while major State environmental databases are detailed in **Section 3.1.2.** Tribal databases were also reported in EDR's summary, however these results are not summarized here since, at this time, there are no tribal lands in the State of Hawaii. A copy of EDR's Radius Map Report with complete results for all databases searched is included here as **Appendix C**.

3.1.1 Federal Database Search Results

The 2000 ASTM Standard (ASTM E 1527-0) defines a list of "standard" federal environmental databases to be searched, and also specifies a minimum search distance for each database. The ASTM Standard also mandates that each database record used must have been updated by the source within 90 days of the search. These standard databases are listed below in **Table 1**, along with search distances, dates of most recent updates, and number of hits, or number of listed sites identified from each database within the area searched. Descriptions of each "standard" federal database and detailed search results for each database are provided below.

Due to the large size of the subject property, all database search distances were extended one half mile beyond the minimum search distances (as recommended by the ASTM Standard) from the center of the search area, which was located at the center of the reservoir watershed. The resulting search area includes the entire reservoir watershed and

meets or exceeds the minimum search distances for all databases as recommended in the ASTM standard.

In addition to the database search results summarized here, EDR's Radius Map report includes results for a number of additional federal databases. The subject property was not listed in any of these databases, and no properties in the vicinity of the subject property were identified in any of these additional databases. Complete database search results are included in **Appendix C**.

Table 1: Search Results for Standard Federal Environmental Databases

Database	Sites Included	Data Updated	Search Distance	Hits
NPL	National Priorities List (Superfund) Sites	10/13/10	1.5 miles	0
	Proposed NPL Sites	10/13/10	1.5 miles	0
	Sites with NPL Liens	11/22/10	0.5 miles	0
DELISTED NPL	De-listed NPL Sites	10/13/10	1.5 miles	0
CERCLIS	CERCLIS Sites	10/01/10	1.0 miles	0
CERLIS NFRAP	CERCLIS – No Further Remedial Action Planned	12/06/10	1.0 miles	0
CORRACTS	RCRA Corrective Action Sites	11/22/10	1.5 miles	0
RCRIS TSD	RCRA Transport, Storage and Disposal Facilities	10/07/10	1.0 miles	0
RCRIS Generators	RCRA Large Quantity Generators	10/07/10	0.75 miles	0
	RCRA Small Quantity Generators	10/07/10	0.75 miles	0
	Conditionally Exempt Small Quantity Generators	12/10/10	0.75 miles	0
US ENG CONTROLS	Sites with Engineering Controls in place	12/10/10	1.0 miles	0
US INST CONTROLS	Sites with Institutional Controls in place	12/10/10	1.0 miles	0
ERNS	Emergency Response Notification System Sites	10/06/10	0.5 miles	0

NPL = National Priority List
CERCLIS = Comprehensive Environmental Response, Compensation and Liability Information System
CORRACTS = Corrective Action Report
RCRA = Resource Conservation and Recovery Act
TSD = Transport, Storage and Disposal

USEPA National Priorities List (NPL)

The National Priorities List, compiled by the USEPA, lists all Superfund or CERCLA Hazardous Waste Sites. The identification of the hazardous waste sites presenting the greatest risk to human health and the environment is mandated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) passed in 1980. This list is prioritized according to the severity of the risk to public health and the environment. Proposed NPL Sites that have been proposed through the issuance of a proposed rule in the Federal Register are also included, as are sites against which Superfund Liens have been filed. **No NPL sites, proposed NPL sites, or NPL lien sites were identified within the designated search area.**

USEPA National Priorities List Deletions (DELISTED NPL)
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CRF 300.425.(e) sites may be deleted from the NPL when no further response is appropriate. **No De-listed NPL sites were identified within the designated search area.**

USEPA CERCLIS List (CERCLIS)
The CERCLIS List, or Comprehensive Environmental Response, Compensation, and Liability Information System database, contains data on potentially hazardous waste sites that have been reported to the EPA by states, municipalities, private companies, and individuals. These sites are under consideration for possible clean up activities or inclusion onto the NPL. **No CERCLIS sites were identified within the designated search area.**

USEPA CERCLIS List-No Further Remedial Action Planned (CERC-NFRAP)
The CERC-NFRAP List contains sites that have been removed from the CERCLIS list and archived. Archived status indicates that, to the best of the EPA's knowledge, assessment at a site has been completed and the EPA has determined that no further steps will be taken to list the site on the NPL at this time. This decision does not mean that there is no hazard or contamination associated with a given site, rather, it means that based on available information, the site has not been judged to be a potential NPL site. **No CERC-NFRAP sites were identified within the designated search area.**

USEPA RCRA CORRACTS List (CORRACTS)
The RCRA CORRACTS or Corrective Action Report database lists those facilities that generate, treat, store, or dispose of hazardous wastes and have undergone remediation activity. These sites have experienced spills or releases of hazardous chemicals prompting the need for clean up action. The extent and type of contamination is listed in this report as well as the status of the corrective actions. **No hazardous waste facilities that have undergone corrective action were identified within the designated search area**.

USEPA RCRA TSD Facilities List (RCRIS)
The EPA maintains this list of Treatment, Storage, and Disposal (TSD) Facilities that either handle or dispose of hazardous waste as defined by the hazardous waste regulations published by the EPA according to the Resource Conservation and Recovery Act (RCRA). This information is contained in the Resource Conservation and Recovery Information System (RCRIS). **No TSD facilities were identified within the designated search area.**

USEPA RCRA Generators List (RCRIS)
The EPA tracks all facilities that generate hazardous wastes in excess of threshold quantities set in the RCRA regulations. RCRA large quantity generators (LQG) produce

more than 1000 kilograms of hazardous waste per month, while small quantity generators (SQG) produce greater than 100 kg per month but less than 1000 kg per month, and conditionally exempt small quantity generators (CESQG) produce less than 100 kg per month. This information is also contained in the Resource Conservation and Recovery Information System (RCRIS). **No RCRA hazardous waste generators were identified within the designated search area.**

USEPA Engineering Controls Sites List (US ENG CONTROLS)
The EPA maintains this list of sites with engineering controls. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to prevent regulated or hazardous substances from entering environmental media or effecting human health. **No sites with engineering controls were identified within the designated search area.**

USEPA Institutional Controls Sites List (US INST CONTROL)
The EPA maintains this list of sites with institutional controls. Institutional controls include long-term administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions and post-remediation care requirements intended to prevent exposure to contaminants at the site. Deed restrictions are generally required as part of institutional controls. **No sites with institutional controls were identified within the designated search area.**

USEPA ERNS List (ERNS)
The Emergency Release Notification System list, compiled by the US EPA, lists the locations and other data on reported releases of petroleum products and hazardous materials. By law, all releases in excess of specific threshold quantities must be reported. All reported releases are included in this list. **No entries on the ERNS database were identified within the designated search area.**

3.1.2 State Database Search Results

The 2000 ASTM Standard (ASTM E 1527-00) defines a list of "standard" state environmental databases to be searched, and also specifies a minimum search distance for each database. The ASTM Standard also mandates that each database record used must have been updated by the source within 90 days of the search. These standard databases are listed below in **Table 2**, along with search distances, dates of most recent updates, and number of hits, or number of listed sites identified from each database within the area searched. Descriptions of each "standard" state database and detailed search results for each database are provided below. Complete database search results are included in **Appendix C**.

Due to the large size of the subject property, all database search distances were extended one half mile beyond the minimum search distances (as recommended by the ASTM

Standard) from the center of the search area, which was located at the center of the reservoir watershed. The resulting search area includes the entire reservoir watershed and meets or exceeds the minimum search distances for all databases as recommended in the ASTM standard.

Table 2: Search Results for Standard State Environmental Databases

Database	Sites Included	Data Updated	Search Distance	Hits
SHWS	State-recognized Hazardous Waste Sites	12/06/10	1.5 miles	0
SWF/LF	Solid Waste Facilities and Landfill Sites	10/05/10	1.0 miles	0
LUST	Leaking Underground Storage Tank (LUST) Sites	12/06/10	1.0 miles	0
UST	Underground Storage Tank (UST) Sites	12/06/10	0.75 miles	0
VCP	Voluntary Response Program (VCP) Sites	12/06/10	1.0 miles	0
BROWNSFIELDS	State Brownsfields Sites	12/06/10	1.0 miles	0
ENG CONTROLS	State list of sites with Engineering Controls in place	12/06/10	1.0 miles	0
INST CONTROLS	State list of VCP and Brownsfields Sites with Institutional Controls	12/06/10	1.0 miles	0
SPILLS	HEER Release Notifications	12/06/10	0.5	0
DRYCLEANERS	Permitted Dry Cleaning Facilities	10/12/10	0.75 miles	0

HEER = Hazard Evaluation and Emergency Response

State of Hawaii Hazardous Waste Sites (SHWS)

This state database includes all facilities, sites, or areas in which the Office of Hazard Evaluation and Emergency Response has an interest, has investigated, or may investigate under Hawaii Revised Statutes. **No state-recognized hazardous waste sites were identified within the designated search area.**

State of Hawaii Landfill Sites (SWF/LF)

The state list of Solid Waste Facilities and Landfill sites contains an inventory of all solid waste disposal facilities and landfills in the State of Hawaii. These facilities may be active or inactive or open dumps that failed to meet RCRA criteria for proper solid waste landfills. **No state recognized landfills or disposal sites were identified within the designated search area.**

State of Hawaii UST List (UST)

This list of registered underground storage tanks is administered by the State of Hawaii Underground Storage Tank (UST) division. All tanks that are registered as required by the federal RCRA regulations are contained on this list. The database also includes the number and types of tanks registered, the regulatory status of each tank, and whether the tanks have been closed and/or removed according to state law. **No registered underground storage tank sites were identified within the designated search area.**

State of Hawaii Leaking UST List (LUST)
The state Department of Health UST Division records the location and regulatory status of all UST sites where leaking underground storage tanks have been identified. **No leaking underground storage tank sites were identified within the designated search area**.

State of Hawaii Hazard Evaluation and Emergency Response Spills List (SPILLS)
The Department of Health HEER office maintains a record of all spills and releases of chemicals and petroleum products above the regulatory threshold quantity that have been reported to the HEER office since 1988. These records are used to track all incidents to ensure that they are properly cleaned up. **No records of any spills that have been reported to the HEER office were identified within the designated search area**. A small amount of motor oil was reported to have leaked onto the Pali Highway and potentially into the Nuuanu Reservoir following a car accident, as described below in **Section 3.3.1**. This incident was not included on the SPILLS database as the amount spilled was only 0.5 gallons, far less than the minimum reportable quantity of 25 gallons.

State of Hawaii Engineering Controls Sites List (ENG CONTROLS)
The Department of Health maintains this list of sites with engineering controls in place. **No sites with engineering controls were identified within the designated search area**.

State of Hawaii Institutional Controls Sites List (INST CONTROLS)
The Department of Health maintains this list of Voluntary Response Program and Brownsfields sites with institutional controls in place. **No sites with institutional controls were identified within the designated search area**.

State of Hawaii Voluntary Response Program Sites List (VCP)
The Department of Health maintains this list of Voluntary Response Program sites, which are sites where voluntary clean-up projects are underway or have been completed by current or former owners. **No Voluntary Response Program sites were identified within the designated search area.**

State of Hawaii Drycleaners Sites List (DRYCLEANERS)
The Department of Health maintains this list of permitted dry cleaning facilities in the state, as these facilities are common sources of groundwater contamination. This search is not required by the ASTM standard but is included due to the prevalence of contamination associated with dry cleaning facilities. **No dry cleaners were identified within the designated search area.**

State of Hawaii Brownsfields Sites List (BROWNSFIELDS)
The Department of Health maintains this list of Brownsfields sites in the State of Hawaii. **No Brownsfields sites were identified within the designated search area.**

3.2 Standard Historical Record Sources

The historical record sources listed in this section are listed in the 2000 ASTM Standard (ASTM E 1527-00) as "standard" sources of historical information for review during the Phase 1 ESA process. In some cases, records from all listed sources may not be available for certain properties.

3.2.1 Aerial Photographs

Historical aerial photographs covering the subject property and the surrounding area were requested from the Photogrammetry Department at R. M. Towill Corporation in Honolulu, HI. Aerial photographs covering this area were available from the years 1949, 1952, 1969-1970, and 1973-1974. These photographs were examined for evidence of historic land use patterns. This section describes the apparent uses of the subject property and the adjacent areas noted in each photograph or set of photographs.

1949 Photos: In these black and white aerial photographs taken from an altitude of 6,000 feet, the upper Nuuanu Valley is visible as a largely undeveloped area framed within the sharp ridges of the Koolau Mountains. The Pali Highway is visible as what appears to be two single lane roads with a wide divider. The Nuuanu Reservoir #4 is clearly visible, as is the dam and the associated infrastructure, including the unpaved access road from the highway and the outlet works tower. The water level in the reservoir at the time of the photo was very low, with the base of the dam exposed all the way to the bottom of the outlet works tower. As a result, much of the area along the sides of the reservoir that are now covered with water and sediment are exposed. Within this area, a network of unpaved roads or paths is evident along the side of the reservoir opposite the highway. These paths appear to continue well above the upper end of the reservoir. Other than these paths, the reservoir and dam, and the Pali Highway, no development or infrastructure is evident within the watershed area.

1952 Photos: In these black and white aerial photographs taken from an altitude of 10,000 feet, the Nuuanu Reservoir #4 and dam are again visible but the water level in the reservoir is much higher than in the photos from 1949. Many of the unpaved roads or paths along the side of the reservoir opposite the highway are therefore covered, and none are visible in these photos. The path of the Pali Highway above the reservoir and dam toward the lookout at the top of the Pali Highway is not clear; there appear to be multiple routes. This may be due to the path of a stream leading down to the reservoir, but the resolution of the photograph is not clear enough to be sure.

1969 and 1970 Photos: In these black and white aerial photographs taken from an altitude of 8,500 feet, the dam and reservoir are clearly visible and appear essentially unchanged from the earlier photographs dating back to 1949. Other than the Pali

Highway and lookout, there is no visual evidence of development or land use within the reservoir watershed area.

1973 and 1974 Photos: In these black and white aerial photographs taken from an altitude of up to 7,500 feet, the dam and reservoir are clearly visible and remain essentially unchanged from the earlier photographs dating back to 1949. Again, other than the Pali Highway and lookout, there is no visual evidence of development or land use within the reservoir watershed area.

3.2.2 Sanborn Fire Insurance Maps

The Sanborn Library includes a large collection of historical fire insurance maps dating back to as early as the late 1800's in some areas. These maps show all insurable structures in a given area at a specific point in time, and are thus useful indicators of historical land use and changes in land use over time.

A Certified Sanborn Map Report covering the area of the Nuuanu Reservoir #4 and the associated dam was provided by Environmental Data Resources, Inc. on December 17, 2010 (*EDR, 2010b*). This report includes copies of all historical Sanborn maps available for the area. According to this report, the property is unmapped, indicating that no Sanborn fire insurance maps covering the subject property are available in the Sanborn collection.

3.2.3 Historical Topographic Maps

The United States Geological Survey (USGS) creates topographic maps covering all US states and territories. These maps, which are updated periodically, also show roads and buildings. Historical topographic maps can thus be used to evaluate changes in land use patterns over time.

A Historical Topographic Map Report covering the entire watershed of the Nuuanu Reservoir #4 was provided by Environmental Data Resources, Inc. on December 20, 2010 (*EDR, 2010c*). This report includes copies of all historical USGS topographic maps available for the area, which falls within the Honolulu Quadrangle.

Historical topographic maps covering the subject property and the surrounding area were available from the years 1953, 1959, 1969, 1983 and 1998. These maps, from the USGS's Honolulu Quadrangle, were examined for evidence of historic land use patterns. The following discussion describes the apparent uses of the subject property and the adjacent areas noted in each of the maps provided by EDR. A copy of EDR's Historical Topographic Map Report is included here as **Appendix E**.

1953 Quad Topo Map: In this historical topographic map from 1953, the Nuuanu Reservoir #4 is visible between ridges of the Koolau Mountains as the only reservoir in the area, and is labeled "Reservoir." The spillway and outlet works tower are also visible, along with the roadway along the top of the dam. Several streams area also visible draining into the reservoir from both sides of the valley, including streams leading from Waipukia Falls to the north and Lulumahu Falls to the south. The Pali Highway has not yet been constructed; Nuuanu Pali Road is visible as the route of access to the other side of the Pali. There is a well located near the upper end of the reservoir. Other than the well, the reservoir and the Nuuanu Pali Road, there is no indication of any development or route of access to the watershed area.

1959 Quad Topo Map: In this historical topographic map from 1959, the Pali Highway has been constructed and is visible as a four-lane road adjacent to the reservoir. The Pali lookout and associated access roads have also been constructed. The well above the reservoir is now labeled "water tunnel," indicating that there may not have been a well at this location. The reservoir and associated infrastructure appear unchanged. There are no other signs of use, development, or access to the remainder of the watershed area.

1969 Quad Topo Map: In this historical topographic map from 1969, the subject property and the surrounding areas appear unchanged from the 1959 topographic map.

1983 Quad Topo Map: In this historical topographic map from 1983, the subject property and the surrounding areas appear unchanged from the 1959 topographic map.

1998 Quad Topo Map: In this historical topographic map from 1998, the subject property and the surrounding areas appear unchanged from the 1959 topographic map.

3.3 Additional Sources of Environmental Records and Information

The record sources listed in this section were reviewed in addition to those listed in the 2000 ASTM Standard (ASTM E 1527-00) as "standard" sources of environmental information for review during the Phase 1 ESA process.

3.3.1 Hawaii State Department of Health Records

Written requests to review all files related to the Nuuanu Reservoir and the surrounding watershed area were submitted to the Solid and Hazardous Waste Branch (SHWB) and the Hazard Evaluation and Emergency Response (HEER) office of the State Department of Health. The SHWB responded that they had no records related to this area. The HEER office provided copies of records related to an incident in May 2001 when half a gallon of motor oil may have spilled into the reservoir area following a car accident at the intersection of the Pali Highway and Nuuanu Pali Drive. No environmental impact from this minor spill incident was anticipated.

3.4 Additional Sources of Historical Use Information

The historical record sources listed in this section were reviewed in addition to those listed in the 2000 ASTM Standard (ASTM E 1527-00) as "standard" sources of historical information for review during the Phase 1 ESA process.

3.4.1 Phase 1 Investigation Report, Nuuanu Dam #4, August 2008

This report, completed by Gannet Fleming of Phoenix, AZ as part of a national Inventory of Dams (#HI00001), documented a visual inspection and review of information associated with the dam at the Nuuanu Reservoir #4. According to this report, the dam was originally constructed between 1905 and 1910 for use as a municipal water source. The infrastructure was later expanded and improved in 1933 and 1934 to address seepage of water that was occurring. According to this report, the dam was originally constructed as a water supply source for the City of Honolulu, but that later became unnecessary when reliable and clean sources or artesian water were discovered closer to town. Although the use of the dam as part of the municipal water supply was not necessary after 1919, the dam and the other reservoirs in the Nuuanu Valley have remained in use as a source of hydroelectric power as well as for municipal flood control purposes. The report characterizes the dam as in "POOR" condition and in need of numerous upgrades as well as general maintenance.

3.4.2 A History of Nuuanu Reservoir #4 Dam

This report, prepared for a Conference on Dam Safety that was held at the Ala Moana Hotel in November 1988, describes the history of the reservoir, dam and watershed in great detail. Much of the historical information contained in this report was reiterated in the Phase 1 Investigation Report described above in **Section 3.4.1**. According to this report, the watershed area draining into the reservoir is approximately 930 acres. The report further states that this area receives in excess of 100 inches of rain per year, and may receive in excess of 10 inched per day during major storm events.

According to this document, the dam was originally constructed as a gravity earth fill embankment dam. The basic structure consists of an internal concrete and timber "diaphragm" that forms an internal wall between the upstream and downstream embankments. The upstream embankment is constructed of hydraulic fill using native soil materials sluiced into place and compacted by water forces. The downstream embankment is constructed of hand-places rock quarried from the adjacent mountain, and covered with rolled earth fill. Native soils and materials from the area were used in these operations.

SECTION 4: SITE RECONNAISSANCE

A visual inspection of the subject property was performed by Benjamin Owen of Owen Environmental, Inc. on December 12, 2010. Mr. Owen is a qualified Environmental Professional under the terms set forth in 40 CFR 312 and ASTM E 1527-05. A resume documenting Mr. Owen's qualifications is included in **Appendix F**. Photographs taken at the time of these inspections are included in **Appendix B**.

4.1 Methodology and Limiting Conditions

Due to the large size and lack of access to the subject property and the lack of historical development at the site, the majority of the property was inaccessible for a thorough visual inspection. The area around the dam and outlet works, including all accessible areas at the base of the reservoir was physically inspected on foot. The water and sediment within the reservoir basin made that area inaccessible, and dense foliage in other areas was also a limiting condition.

4.2 Observations

The 2005 ASTM Standard for the Phase 1 Environmental Site Assessment process (ASTM E1527-05) requires that observations of certain specific features and conditions be made during the site inspection, and that these observations be documented in the Phase 1 ESA report. Although not required in the 2000 ASTM Standard, they have been included in this report and are documented in **Table 3**. This table also identifies the section(s) of this report where any items noted in the table are described in greater detail.

All accessible areas were within the property were accessed and inspected by Mr. Owen during the site inspection. No indication of any current or historical environmental condition associated with the dam, the reservoir, or the surrounding watershed area was observed at any time during this inspection.

Mr. Owen was escorted onto the property by Darryl Wong, a representative and employee of the Honolulu Board of Water Supply. Though not included in this report, a Hazardous Materials Survey including asbestos and lead-based paint inspections of the infrastructure associated with the dam and outlet works tower was also completed during the same visit. Results from the Hazardous Materials Survey were documented and produced as a separate report.

Nuuanu Reservoir #4 is accessible via a gated access road leading off from a driveway on the Windward-bound lanes of the Pali Highway, approximately one half mile north of the intersection of the Pali Highway with Nuuanu Pali Drive (also known as Old Pali Road). This partially paved access road runs along the crest of the reservoir dam, ending at the spillway on the southern end of the structure. At the midpoint of the dam is a suspended bridge leading to the outlet works tower within the reservoir. The dam itself is approximately 1,750 feet in length. Opposite the reservoir, the upper edge of the down slope side of the dam is lined with tree stumps, where a row Norfolk pine trees once

stood. According to Mr. Wong, these trees were removed along with other maintenance improvements that were made following the recommendations from the Phase 1 Investigation Report produced by Gannet Fleming in 2008 (see **Section 3.4.1**). A series of monitoring wells line both sides of the dam; these were installed in the 1980 to monitor water levels within the dam structure.

Table 3: Observations During Inspection of Subject Property

Item	Observed	Not Observed	N/A	Section of Report
Interior and Exterior Observations				
Hazardous substances		X		
Petroleum products		X		
Storage tanks		X		
Odors		X		
Pools of liquid		X		
Drums		X		
Unidentified substance containers		X		
Electrical or hydraulic equipment		X		
Interior Observations				
Heating/cooling systems		X		
Fuel source		X		
Stains		X		
Corrosion		X		
Drains		X		
Sumps		X		
Exterior Observations				
Pits	X			Section 4.2
Ponds	X			Section 4.2
Lagoons		X		
Stained soil or pavement		X		
Stressed vegetation		X		
Solid waste		X		
Waste water		X		
Wells	X			Section 4.2
Septic systems		X		
Fill materials	X			Section 3.4.2

N/A = Not Applicable

The interior of the control room at the top of the outlet works tower was accessible via a long suspended footbridge. The inside of the control room was Spartan, with minimal equipment. The room was dominated by several large manual valve controls which operate the inlet and outlet gates below. A grated access panel in the floor of the control room is accessible only under confined space entry conditions. There is also a small amount of modern equipment associated with a remote rain gauge operated by BWS on the roof of the tower. There were no chemicals or other potentially hazardous materials stored or in use within the tower.

Opposite the outlet works tower at the center of the dam, a footpath leads down to the outfall at the foot of the dam. Water flows from a large diameter steel pipe, which leads out of a cement culvert. There were no indications of any use or storage of chemicals or other materials in this area.

At the far end of the dam is a concrete-lined spillway that is approximately 200 feet long and 50 feet wide. The partially paved access road ends at this point. A concrete stairway and footpath leads up the slope opposite the dam to a fenced area containing two identical pits. The pits are rectangular in shape and lined with concrete. According to Mr. Wong, these pits were the original sand filtration system used to filter water from the reservoir for potable use prior to 1919. The pits and the area around the pits are well maintained by BWS personnel.

Several muddy footpaths led away from the sand pit area, however these paths were not accessible for inspection due to extremely wet conditions at the time. According to Mr. Wong, the paths are hunters' trails that lead off into the mountains toward an historic quarry that had been used as a source of materials for the original construction of the dam in the early 1900's. Mr. Wong indicated that the paths were treacherous and not well maintained, and that he had not been able to make it to the quarry in drier conditions despite making several attempts.

The mouth of the spillway on the reservoir side is a gently slope leading down to the reservoir. According to Mr. Wong, this area is "packed" when catfish season opens and permits are issued for recreational fishing. Mr. Wong further indicated that an unpaved road of sorts leads out along the edge of the reservoir, but this access route was submerged due to high water levels in the reservoir at the time of our inspection. However, numerous large catfish were visible near the surface of the water.

Other than immediate access to the dam and the associated infrastructure at the base of the subject property, access to the subject property was extremely limited. Access routes from the dam area were not accessible do to high water levels in the reservoir and wet, muddy conditions on hunters' access trails that are not well maintained. At higher elevation, the only other access to the property was via the cutoff roads leading to and from the Pali lookout. These roadways were inspected for any sign or alternative access routes into or onto the subject property, but no other routes of access were evident. According to Mr. Wong, the only access to the watershed area is from the dam.

SECTION 5: INTERVIEWS

This section documents interviews with persons having knowledge of the history and use of the subject property. The following individuals were interviewed for this report:

Darryl Wong, Honolulu Board of Water Supply
Darryl Wong was interviewed during the site inspection performed by Mr. Owen, and again later by telephone. Mr. Wong has been employed as a hydrologist/geologist with the BWS for approximately 15 years. He has worked in and around the Nuuanu Reservoir #4 during that time, and is familiar with the watershed area and the history of the reservoir. Mr. Wong was not aware of any other historical use of the property, and was not aware of any current or historical conditions at the reservoir or within the watershed area that might have impacted the sediment within the reservoir.

Joe Genz, Cultural Surveys Hawaii
Joe Genz, who is working on a Cultural Impact Assessment for the Nuuanu Reservoir #4 project, was interviewed regarding any information he had uncovered relating to historic land use within the reservoir watershed area. Mr. Genz indicated that most of the significant cultural information he had reviewed was related to areas downstream from the reservoir, and that he had not been able to find much information related to the mauka or upper watershed area. He did indicate that several terraces possibly related to taro farming may have been located near one of the waterfalls high up in the valley, and that some of the area may have been used for cattle grazing.

Jody Kaulukukui, The Nature Conservancy Hawaii
The Nature Conservancy is actively involved in preservation of conservation lands throughout Hawaii. Ms. Kaulukukui was interviewed via email regarding any information that The Nature Conservancy might have related to the subject property, which is within the Honolulu Watershed Forest Reserve. She responded that TNC does not have information about this specific area, other than that the area may have been grazed at one time.

State Dept. of Health, Hazard Evaluation and Emergency Response (HEER) Office
A written request to review all HEER office files related to the Nuuanu Reservoir and surrounding watershed area was submitted to the DOH HEER office. A representative of the office responded, indicating that the HEER office had only one record of any incident in that area: a minor incident involving one half gallon of motor oil spilling from a vehicle after a traffic accident. The records related to this incident are reviewed in **Section 3.3.1**.

State Dept. of Health, Solid and Hazardous Waste Branch (SHWB)
A written request to review all SHWB office files related to the Nuuanu Reservoir and surrounding watershed area was submitted to the DOH SHWB office. A representative of the office responded, indicating that the SHWB office has no records related to any incident within that area.

SECTION 6: CONCLUSIONS

A modified Phase 1 ESA was performed for an area covering approximately 1,000 acres of land in the upper Nuuanu Valley on Oahu. This property, including Nuuanu Reservoir #4, the associated dam and infrastructure, and the entire watershed area associated with the reservoir, includes portions of two adjacent parcels. These parcels are identified by the TMK numbers (1) 2-2-054:001 and (1) 1-9-007:001. This assessment was conducted by Owen Environmental Inc. on behalf of R. M. Towill Corporation, and was performed in accordance with the 2000 ASTM E 1527-00 Standard. The purpose of this investigation was to identify any current or historical land use activities or recognized environmental conditions that could have potentially impacted the sediments that have accumulated within the reservoir, prior to the anticipated dredging and removal of these materials.

An extensive review of State and Federal environmental regulatory databases intended to identify properties (including the subject property and surrounding properties) with various reported environmental conditions was performed. No recognized environmental conditions were identified during this review. The subject property was not listed on any of the State or Federal databases reviewed, and no listings for adjacent or nearby properties were identified within a search radius that was expanded to account for the large size of the subject property.

A review of historical land use records including aerial photographs and historical topographic maps of the area indicated the following: historical topographic maps and aerial photographs covering the subject property and dating back to 1949 indicate limited access to the area and virtually no development other than the existing roadways and reservoir system. No other historical activities or land use patterns were identified within or close to the watershed area.

Inspection of State Department of Health records indicated that the State has no records of any reportable spill events or other environmental issues associated with the reservoir or the surrounding watershed area.

Visual inspection of the subject property indicated that the property was free of any obvious sign of use or development other than the reservoir, the dam, and the Pali Highway. No evidence of any use or storage of hazardous materials was observed, and no indication and current or historical recognized environmental condition associated with the dam, the reservoir, or the surrounding watershed area was identified.

Review of additional historical documentation provided by R. M. Towill Corporation indicated that the dam was originally constructed in the early 1900's for use as a municipal water supply, but that since 1919 the reservoir has been primarily used for purposes of flood control. The surrounding watershed area, however, has been managed as a municipal watershed forest reserve and is zoned for conservation use.

Interviews with persons familiar with the history of the subject property indicated that the area surrounding the reservoir is both undeveloped and relatively inaccessible. None of the persons interviewed for this report had any knowledge of any potentially significant environmental condition or historical activity that could have impacted the sediment within the reservoir. The only known current of historical development within the area is the reservoir and dam, as well as the Old Pali Road and Pali Highway roadways. Other known uses of the land in the area include recreational hunting and fishing. There was also a quarry in the area where materials for construction of the dam originated. It is also possible that limited taro farming and cattle grazing may have occurred historically within the watershed area. None of these activities would be expected to impact the sediment within the reservoir.

In summary, this Phase 1 Environmental Site Assessment has not identified any current or historical recognized environmental conditions associated with the subject property. No environmental conditions with the potential to impact the sediment within the Nuuanu Reservoir #4 have been identified. Although limited characterization of the material will be required per State Department of Health guidelines prior to disposal or reuse of the sediment if it is taken off site, this investigation has not identified any reason to anticipate that the material is likely to be contaminated due to current or historical land use activities within the watershed area.

SECTION 7: RECOMMENDATIONS

This Phase 1 Environmental Site Assessment has not identified any current or historical activities within the watershed area of Nuuanu Reservoir #4 that are likely to have contributed to contamination of sediments that have accumulated within the reservoir basin. Based on these results, it is unlikely that the material will require any special handling or disposal procedures. Nevertheless, State Department of Health guidelines require characterization of the material prior to reuse or disposal if the material is moved off site.

The following recommendations for characterization and disposal of sediments to be dredged from Nuuanu Reservoir #4 are based on discussions with Roger Brewer of the State DOH HEER office.

If, as anticipated, the material does not exceed DOH Environmental Action Levels (EALs) for residential areas, disposal options for the dredged material would include re-use as fill material, disposal as cover material at one of the landfills in the Kapolei area (Waimanalo Gulch or PVT Land Co.), or amendment and distribution for reuse as topsoil at the Kapa'a Quarry transfer station in Kaliua.

The following recommendations are based on a sampling approach that was recently approved by the DOH HEER office for another dredging project where clean sediment was removed, characterized, and recycled for re-use as topsoil. It should be noted that if the material exceeds DOH EALs for residential areas, additional characterization may be required to satisfy landfill disposal requirements.

- Multi-incremental sampling techniques used to collect a minimum of 15 samples (i.e., one sample from each "decision unit" of ~5,000 CY of material). Several additional samples would also be necessary for initial characterization of smaller decision units, and for quality control. A total of approximately 20 to 24 samples would be required.

- All samples to be analyzed for 8 RCRA metals and organochlorine pesticides. Limited number of samples to be analyzed for PCBs.

- DOH can provide written approval for this approach provided that a written Sampling and Analysis Plan (SAP) is submitted to the HEER in advance.

Based on these characterization requirements and the findings from this Phase 1 ESA, it is recommended that arrangements be made to amend and re-use the material as topsoil, possibly through the Kapa'a Quarry transfer station, and/or dispose of the material at one of the Oahu landfills if it does not meet criteria for residential re-use. A SAP with contingencies for both of these options should be prepared in advance and submitted to the DOH office for their written approval. This course of action will allow the project to move forward with minimal delay no matter what the results are when the sediment is characterized.

SECTION 8: SIGNATURE

This Phase 1 Environmental Site Assessment for Nuuanu Reservoir #4 and the associated watershed area, including portions of two adjacent parcels on the Island of Oahu identified by TMK numbers (1) 2-2-054:001 and (1) 1-9-007:001, was performed by Benjamin Owen of Owen Environmental Inc. Mr. Owen is a qualified "Environmental Professional" under the terms set forth in the "All Appropriate Inquiries" rule (40 CFR 312) and the ASTM Standard Practice for Phase 1 Environmental Site Assessment Process (ASTM E 1527-05). A resume documenting Mr. Owen's qualifications is included in **Appendix F**. Mr. Owen performed all aspects of the Phase 1 ESA process personally. His signature below is a declaration that the following statements are true, as required by ASTM E 1527-05 and 40 CFR 312:

"I declare that, to the best of my knowledge and belief, I meet the definition of 'Environmental Professional' as defined in 312.0 of 40 CFR 312."

"I have the specific qualifications based on education, training and experience to assess a property of the nature, history, and setting of the subject property. I have developed and performed the 'all appropriate inquiries' in conformance with the standards and practices set forth in 40 CFR 312."

Benjamin Owen
President, Owen Environmental Inc.

January 25, 2011
Date

SECTION 9: REFERENCES

American Society for Testing and Materials (ASTM); *"Standard Practice for Environmental Site Assessments: Phase 1 Environmental Site Assessment Process,"* ASTM 2000 Standard: E 1527-00.

Environmental Data Resources, Inc. (EDR); *Certified Sanborn Map Report, Nuuanu Watershed, Upper Nuuanu Valley, Honolulu HI* (December 17, 2010).

EDR; *EDR Historical Topographic Map Report, Nuuanu Watershed, Upper Nuuanu Valley, Honolulu HI* (December 20, 2010).

EDR; *EDR Radius Map Report, Nuuanu Watershed, Upper Nuuanu Valley, Honolulu HI* (December 17, 2010).

Gannet Flemming; *Phase 1 Investigation Report, Nuuanu Dam No. 4, Honolulu, Oahu, Hawaii. National Inventory of Dams No. HI00001* (August 2008).

Lao, Chester; *A History of Nuuanu Reservoir No. 4 Dam*. Board of Water Supply Conference on Dam Safety, Ala Moana Hotel (November 17-18, 1988).

APPENDIX A:

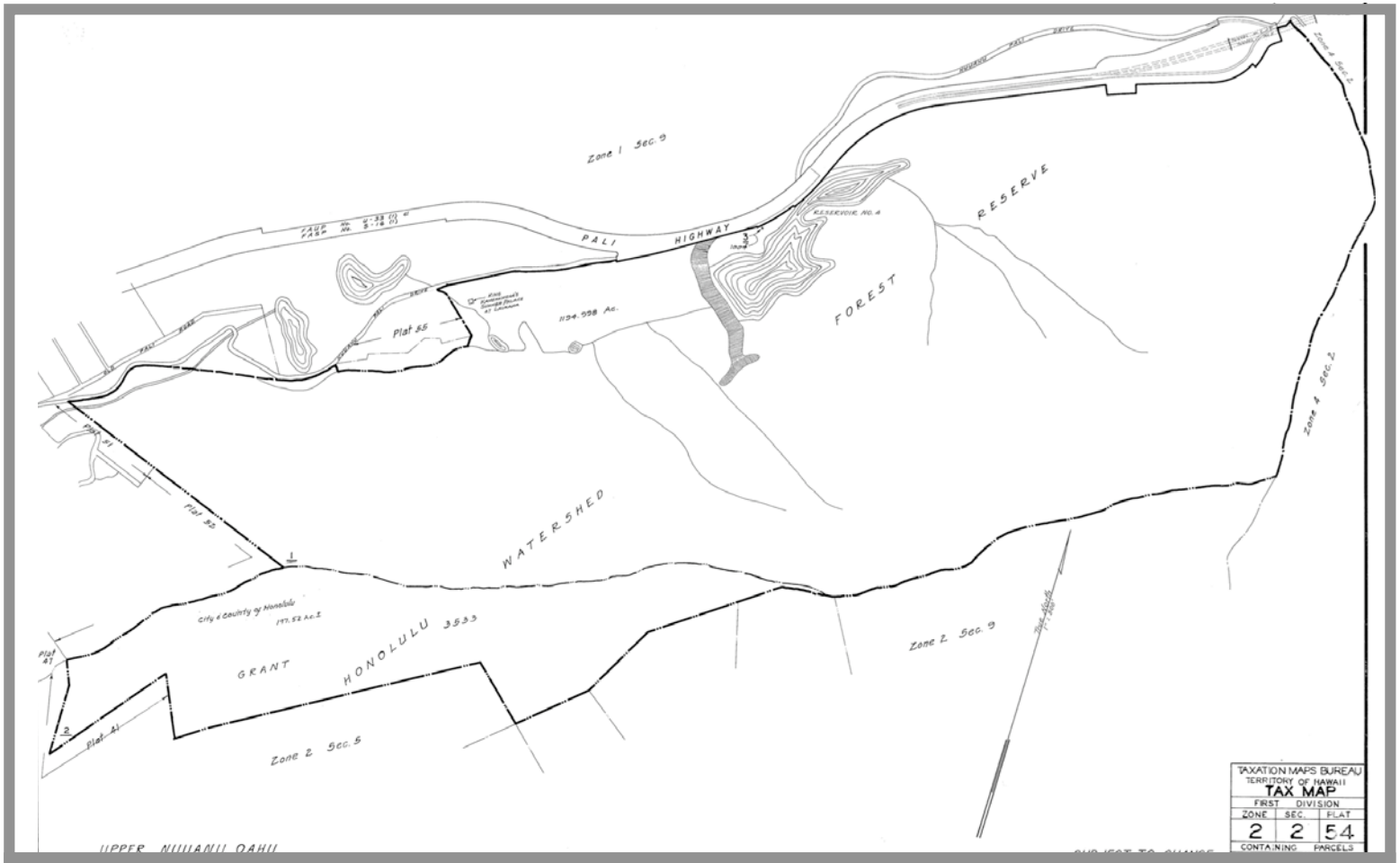
FIGURES

Owen Environmental Inc.
Phase 1 Environmental Site Assessment
Nuuanu Reservoir #4
January 2011

N

Figure 1: Aerial Photo of Nuuanu Reservoir and Surrounding Watershed Area

Source: Google Earth



Owen Environmental Inc.
Phase 1 Environmental Site Assessment
Nuuanu Reservoir #4
January 2011

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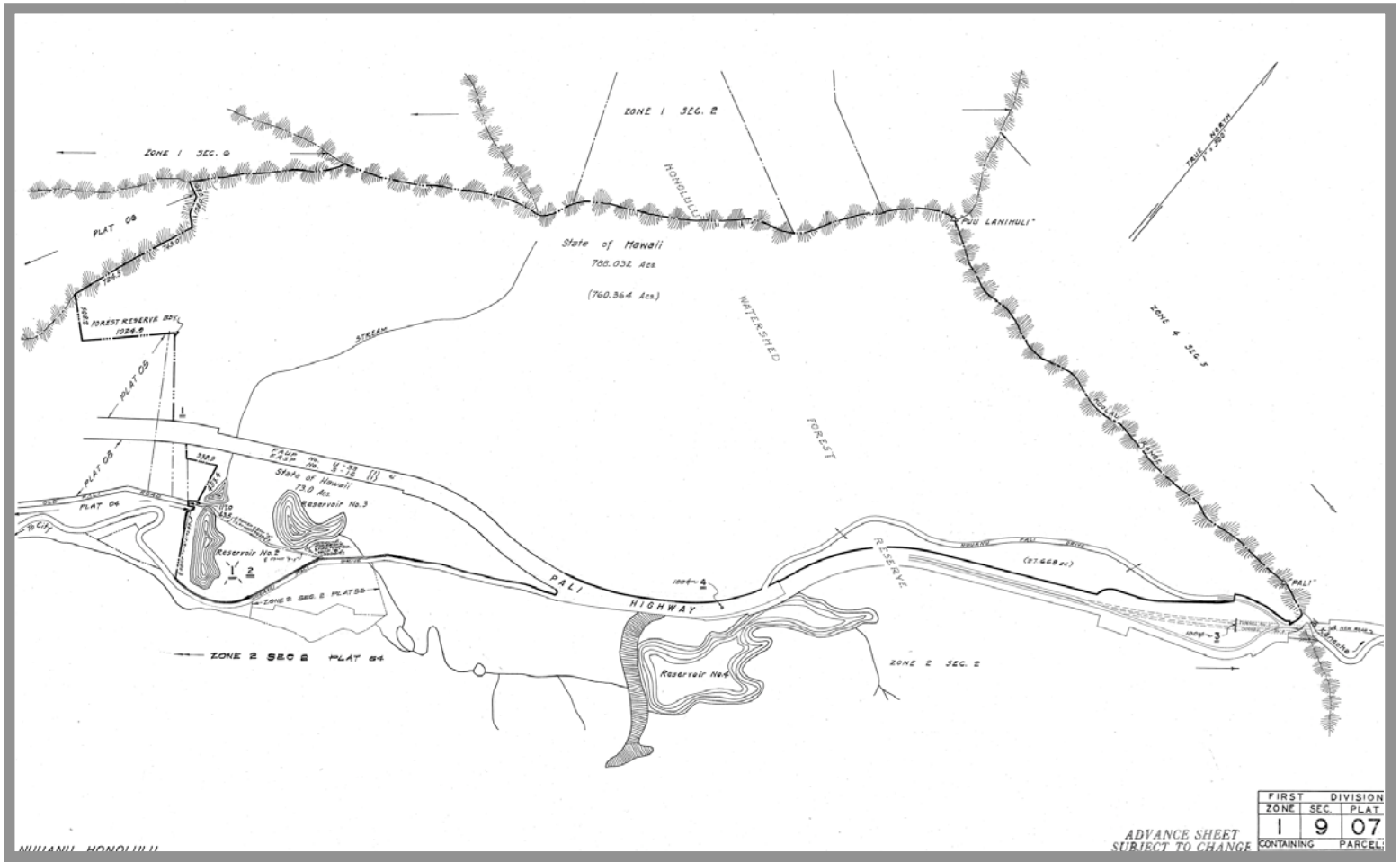
Figure 2: TMK Map of Parcel Containing Nuuanu Reservoir #4

Source: Hawaii State Tax Maps



Owen Environmental Inc.
Phase 1 Environmental Site Assessment
Nuuanu Reservoir #4
January 2011

Figure 3: TMK Map of Parcel Across Pali Highway from Nuuanu Reservoir #4

Source: Hawaii State Tax Maps

APPENDIX B:

PHOTOGRAPHS

Photo 1: Access road from Pali Highway leading to Nuuanu Reservoir #4.

Photo 2: Suspended bridge leading to outlet works tower at Nuuanu Reservoir #4.

Photo 3: Side view of suspended bridge and outlet works tower.

Photo 4: Equipment inside control room at the top of outlet works tower, Nuuanu Reservoir #4.

Photo 5: Outflow from outlet pipe at toe of Nuuanu Reservoir #4 dam.

Photo 6: Outlet pipe emerging from base of dam at Nuuanu Reservoir #4.

Photo 7: face of dam as seen from bridge to outlet works tower.

Photo 8: View from dam spillway looking toward reservoir at Nuuanu Reservoir #4.

Photo 9: Stairway leading from paved spillway toward sand filter area at Nuuanu Reservoir #4.

Photo 10: Sand filter area at Nuuanu Reservoir #4.

Photo 11: Close-up of sand filter construction.

Photo 12: Float valve for sand filters at Nuuanu Reservoir #4.

APPENDIX C:

EDR RADIUS MAP REPORT

Nuuanu Watershed
Upper Nuuanu Valley
Honolulu, HI 96813

Inquiry Number: 2949052.2s
December 17, 2010

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
Toll Free: 800.352.0050
www.edrnet.com

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Map Findings Summary	4
Map Findings	7
Orphan Summary	8
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GEOCHECK ADDENDUM

Physical Setting Source Addendum	A-1
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Physical Setting SSURGO Soil Map	A-5
Physical Setting Source Map	A-9
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Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-05) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

UPPER NUUANU VALLEY
HONOLULU, HI 96813

COORDINATES

Latitude (North):	21.359300 - 21° 21' 33.5''
Longitude (West):	157.801100 - 157° 48' 4.0''
Universal Tranverse Mercator:	Zone 4
UTM X (Meters):	624308.3
UTM Y (Meters):	2362247.8
Elevation:	1058 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	21157-C7 HONOLULU, HI
Most Recent Revision:	Not reported

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL ---------- National Priority List
Proposed NPL ---------- Proposed National Priority List Sites
NPL LIENS ---------- Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ---------- National Priority List Deletions

EXECUTIVE SUMMARY

Federal CERCLIS list

CERCLIS ..... Comprehensive Environmental Response, Compensation, and Liability Information System
FEDERAL FACILITY ..... Federal Facility Site Information listing

Federal CERCLIS NFRAP site List

CERC-NFRAP ..... CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS ..... Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF ..... RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG ..... RCRA - Large Quantity Generators
RCRA-SQG ..... RCRA - Small Quantity Generators
RCRA-CESQG ..... RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS ..... Engineering Controls Sites List
US INST CONTROL ..... Sites with Institutional Controls

Federal ERNS list

ERNS ..... Emergency Response Notification System

State- and tribal - equivalent CERCLIS

SHWS ..... Sites List

State and tribal landfill and/or solid waste disposal site lists

SWF/LF ..... Permitted Landfills in the State of Hawaii

State and tribal leaking storage tank lists

LUST ..... Leaking Underground Storage Tank Database
INDIAN LUST ..... Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

UST ..... Underground Storage Tank Database
INDIAN UST ..... Underground Storage Tanks on Indian Land
FEMA UST ..... Underground Storage Tank Listing

State and tribal institutional control / engineering control registries

ENG CONTROLS ..... Engineering Control Sites

INST CONTROL ---------- Sites with Institutional Controls

State and tribal voluntary cleanup sites

INDIAN VCP ---------- Voluntary Cleanup Priority Listing
VCP ---------- Voluntary Response Program Sites

State and tribal Brownfields sites

BROWNFIELDS ---------- Brownfields Sites

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS ---------- A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9 ---------- Torres Martinez Reservation Illegal Dump Site Locations
ODI ---------- Open Dump Inventory
INDIAN ODI ---------- Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL ---------- Clandestine Drug Labs
CDL ---------- Clandestine Drug Lab Listing
US HIST CDL ---------- National Clandestine Laboratory Register

Local Land Records

LIENS 2 ---------- CERCLA Lien Information
LUCIS ---------- Land Use Control Information System

Records of Emergency Release Reports

HMIRS ---------- Hazardous Materials Information Reporting System
SPILLS ---------- Release Notifications

Other Ascertainable Records

RCRA-NonGen ---------- RCRA - Non Generators
DOT OPS ---------- Incident and Accident Data
DOD ---------- Department of Defense Sites
FUDS ---------- Formerly Used Defense Sites
CONSENT ---------- Superfund (CERCLA) Consent Decrees
ROD ---------- Records Of Decision
UMTRA ---------- Uranium Mill Tailings Sites
MINES ---------- Mines Master Index File
TRIS ---------- Toxic Chemical Release Inventory System
TSCA ---------- Toxic Substances Control Act
FTTS ---------- FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS ---------- FIFRA/TSCA Tracking System Administrative Case Listing

SSTS Section 7 Tracking Systems
ICIS Integrated Compliance Information System
PADS PCB Activity Database System
MLTS Material Licensing Tracking System
RADINFO Radiation Information Database
FINDS Facility Index System/Facility Registry System
RAATS RCRA Administrative Action Tracking System
UIC Underground Injection Wells Listing
DRYCLEANERS Permitted Drycleaner Facility Listing
AIRS List of Permitted Facilities
INDIAN RESERV Indian Reservations
SCRD DRYCLEANERS State Coalition for Remediation of Drycleaners Listing
COAL ASH EPA Coal Combustion Residues Surface Impoundments List
COAL ASH DOE Sleam-Electric Plan Operation Data
PCB TRANSFORMER PCB Transformer Registration Database

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants EDR Proprietary Manufactured Gas Plants

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were not identified.

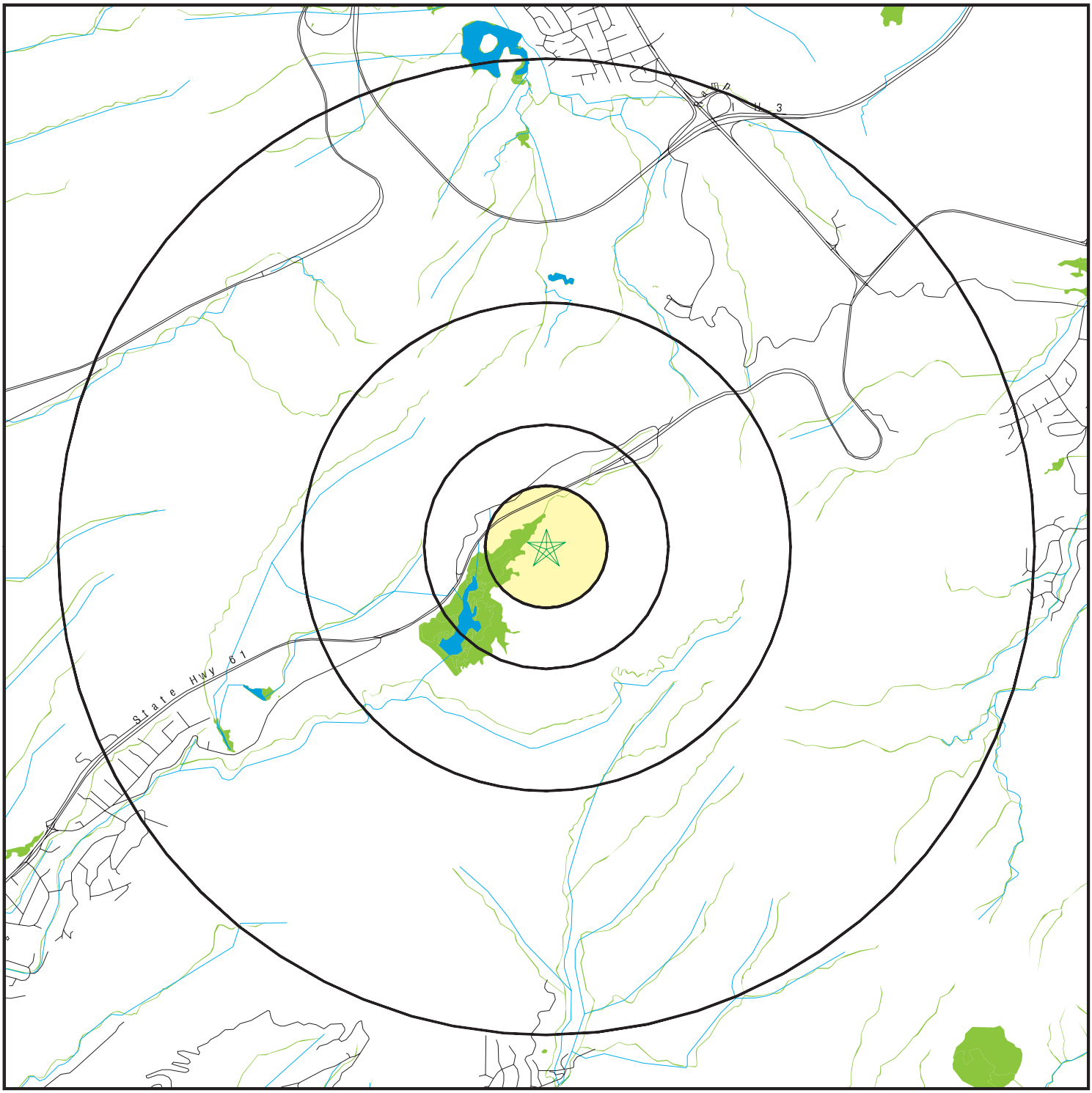
Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
CITIZENS ENERGY SERVICES PIER 38	HWS,SPILLS,ENG CONTROLS
HPU, HAWAII LOA CAMPUS UNUSED DISP	UIC
ACADEMIC CENTER BUILDING, HPU-HAWA	UIC
PROFESSIONAL LEAD TRAINING	FTTS
WINDWARD DISTRICT OFFICE	FTTS,FINDS
ABC DISPOSAL COMPANY	FINDS,HWS
NIMITZ HIGHWAY WATER IMPROVEMENT P	HWS
KAILUA CORPORATION YARD	FINDS,SPILLS,HWS
ABC DSPL	CERCLIS-NFRAP
OAHU TIRE SERVICE & CO.	FINDS,LUST
MIDDLE STREET INTERMODAL CENTER	LUST,UST
KAILUA CORPORATION YARD	LUST
HAWAII STEVEDORES - MAINTENANCE YA	UST
420 N. NIMITS HWY DEMOLOTION PROJE	UST
HAWAII YOUTH CORRECTIONAL FACILITY	RCRA-SQG,FINDS
NUUANU CONGREGATIONAL CHURCH	RCRA-NLR
J & M AUTOMOTIVE	FINDS,RCRA-NLR
AMERICAN MARINE CORP	PADS,RCRA-CESQG
WINDWARD TOYOTA SERVICE	RCRA-CESQG
MANHOLE #19 AT FORT STEET MALL & N	FINDS
NUUANU RESERVOIR	FINDS
HAWAII WHOLESALE FUMIGATORS	ICIS

OVERVIEW MAP - 2949052.2s



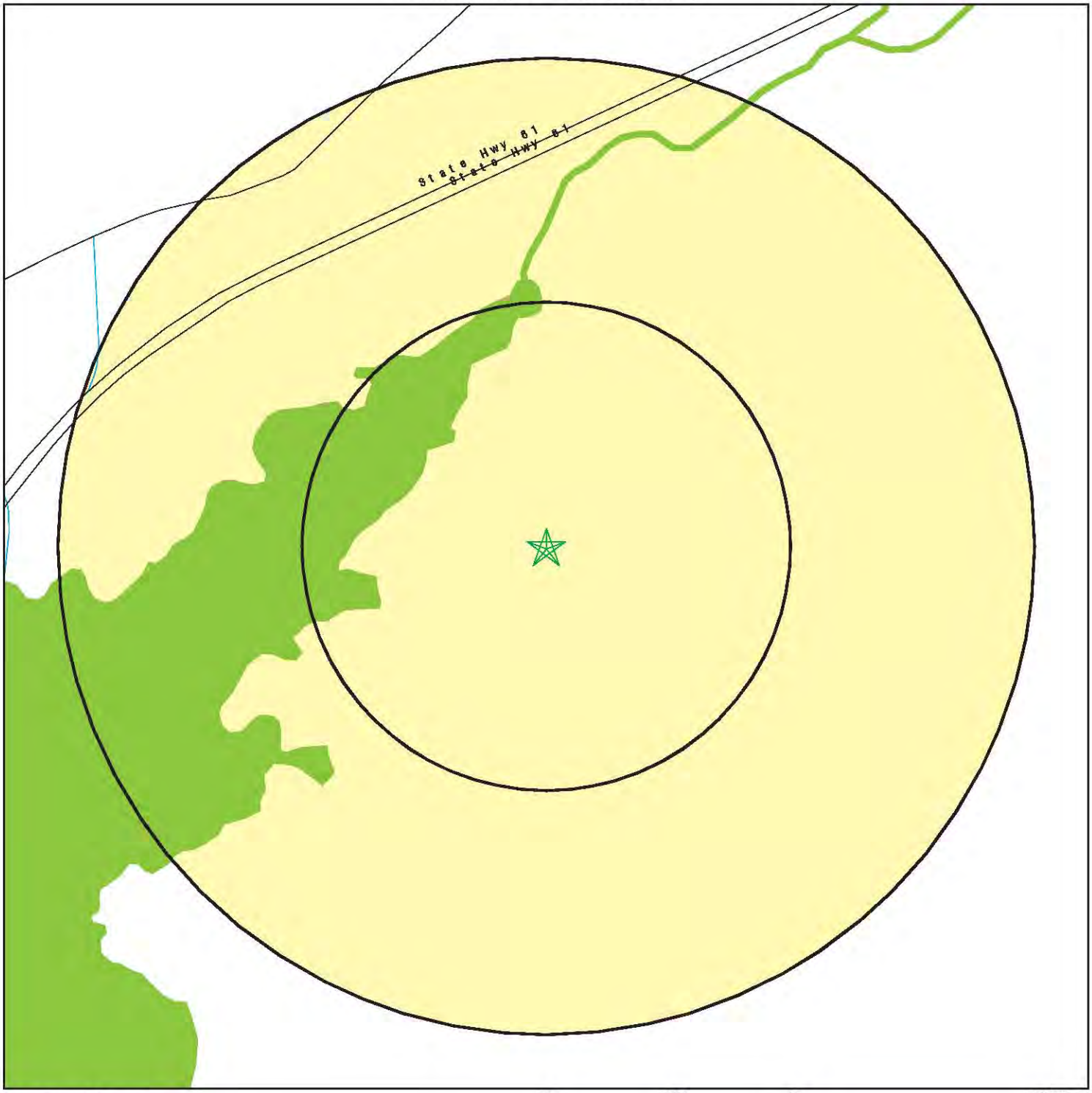
0 1/2 1 2 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Nuuanu Watershed	CLIENT:	Owen Environmental
ADDRESS:	Upper Nuuanu Valley Honolulu HI 96813	CONTACT:	Ben Owen
LAT/LONG:	21.3593 / 157.8011	INQUIRY #:	2949052.2s
		DATE:	December 17, 2010 7:24 pm

DETAIL MAP - 2949052.2s



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory

0 1/16 1/8 1/4 Miles

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Nuuanu Watershed	CLIENT:	Owen Environmental
ADDRESS:	Upper Nuuanu Valley Honolulu HI 96813	CONTACT:	Ben Owen
LAT/LONG:	21.3593 / 157.8011	INQUIRY #:	2949052.2s
		DATE:	December 17, 2010 7:24 pm

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL		1.500	0	0	0	0	0	0
Proposed NPL		1.500	0	0	0	0	0	0
NPL LIENS		0.500	0	0	0	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL		1.500	0	0	0	0	0	0
Federal CERCLIS list								
CERCLIS		1.000	0	0	0	0	NR	0
FEDERAL FACILITY		1.500	0	0	0	0	0	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP		1.000	0	0	0	0	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS		1.500	0	0	0	0	0	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF		1.000	0	0	0	0	NR	0
Federal RCRA generators list								
RCRA-LQG		0.750	0	0	0	0	NR	0
RCRA-SQG		0.750	0	0	0	0	NR	0
RCRA-CESQG		0.750	0	0	0	0	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS		1.000	0	0	0	0	NR	0
US INST CONTROL		1.000	0	0	0	0	NR	0
Federal ERNS list								
ERNS		0.500	0	0	0	NR	NR	0
State- and tribal - equivalent CERCLIS								
SHWS		1.500	0	0	0	0	0	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF		1.000	0	0	0	0	NR	0
State and tribal leaking storage tank lists								
LUST		1.000	0	0	0	0	NR	0
INDIAN LUST		1.000	0	0	0	0	NR	0
State and tribal registered storage tank lists								
UST		0.750	0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
INDIAN UST		0.750	0	0	0	0	NR	0
FEMA UST		0.750	0	0	0	0	NR	0
State and tribal institutional control / engineering control registries								
ENG CONTROLS		1.000	0	0	0	0	NR	0
INST CONTROL		1.000	0	0	0	0	NR	0
State and tribal voluntary cleanup sites								
INDIAN VCP		1.000	0	0	0	0	NR	0
VCP		1.000	0	0	0	0	NR	0
State and tribal Brownfields sites								
BROWNFIELDS		1.000	0	0	0	0	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS		1.000	0	0	0	0	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
DEBRIS REGION 9		1.000	0	0	0	0	NR	0
ODI		1.000	0	0	0	0	NR	0
INDIAN ODI		1.000	0	0	0	0	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL		0.500	0	0	0	NR	NR	0
CDL		0.500	0	0	0	NR	NR	0
US HIST CDL		0.500	0	0	0	NR	NR	0
Local Land Records								
LIENS 2		0.500	0	0	0	NR	NR	0
LUCIS		1.000	0	0	0	0	NR	0
Records of Emergency Release Reports								
HMIRS		0.500	0	0	0	NR	NR	0
SPILLS		0.500	0	0	0	NR	NR	0
Other Ascertainable Records								
RCRA-NonGen		0.750	0	0	0	0	NR	0
DOT OPS		0.500	0	0	0	NR	NR	0
DOD		1.500	0	0	0	0	0	0
FUDS		1.500	0	0	0	0	0	0
CONSENT		1.500	0	0	0	0	0	0
ROD		1.500	0	0	0	0	0	0
UMTRA		1.000	0	0	0	0	NR	0
MINES		0.750	0	0	0	0	NR	0
TRIS		0.500	0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
TSCA		0.500	0	0	0	NR	NR	0
FTTS		0.500	0	0	0	NR	NR	0
HIST FTTS		0.500	0	0	0	NR	NR	0
SSTS		0.500	0	0	0	NR	NR	0
ICIS		0.500	0	0	0	NR	NR	0
PADS		0.500	0	0	0	NR	NR	0
MLTS		0.500	0	0	0	NR	NR	0
RADINFO		0.500	0	0	0	NR	NR	0
FINDS		0.500	0	0	0	NR	NR	0
RAATS		0.500	0	0	0	NR	NR	0
UIC		0.500	0	0	0	NR	NR	0
DRYCLEANERS		0.750	0	0	0	0	NR	0
AIRS		0.500	0	0	0	NR	NR	0
INDIAN RESERV		1.500	0	0	0	0	0	0
SCRD DRYCLEANERS		1.000	0	0	0	0	NR	0
COAL ASH EPA		1.000	0	0	0	0	NR	0
COAL ASH DOE		0.500	0	0	0	NR	NR	0
PCB TRANSFORMER		0.500	0	0	0	NR	NR	0
EDR PROPRIETARY RECORDS								
EDR Proprietary Records								
Manufactured Gas Plants		1.500	0	0	0	0	0	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

NO SITES FOUND

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
KANEOHE	1000122673	J & M AUTOMOTIVE	45 620 C KAM HWY	96744	FINDS,RCRA-NLR
HONOLULU	1001967856	AMERICAN MARINE CORP	65 N NIMITZ HWY PIER 14	96817	PADS,RCRA-CESQG
HONOLULU	1003879112	ABC DSPL	2760 KAMEHAMEHA HWY	96819	CERCLIS-NFRAP
KANEOHE	1004688794	WINDWARD TOYOTA SERVICE	45-655 KAM HWY	96744	RCRA-CESQG
KAILUA	1004689024	HAWAII YOUTH CORRECTIONAL FACILITY	42 KALANIANAOLE HWY	96734	RCRA-SQG,FINDS
HONOLULU	1006820337	ABC DISPOSAL COMPANY	2760 KAMEHAMEHA HWY	96819	FINDS,HWS
KAILUA	1006820819	KAILUA CORPORATION YARD	42-377 KALANIANAOLE HWY	96734	FINDS,SPILLS,HWS
HONOLULU	1006842904	OAHU TIRE SERVICE & CO.	2808 KAMEHAMEHA HWY	96819	FINDS,LUST
HONOLULU	1009791374	MANHOLE #19 AT FORT STEET MALL & N	FORT ST & NIMITZ HWY	96813	FINDS
HONOLULU	1009796105	NUUANU RESERVOIR	NUUANU PALI DR & PALI HWY	96817	FINDS
HONOLULU	1010008738	PROFESSIONAL LEAD TRAINING	113O NORTH NIMITZ HWY., B220	86817	FTTS
KANEOHE	1010345518	WINDWARD DISTRICT OFFICE	46-169 JAM HIGHWAY	96744	FTTS,FINDS
KANEOHE	1011621977	HAWAII WHOLESALE FUMIGATORS	45-1048 KAMEHAMEHA HWY RM 203	96744	ICIS
HONOLULU	1012178118	NUUANU CONGREGATIONAL CHURCH	2651 PALI HWY	96817	RCRA-NLR
HONOLULU	S106819311	NIMITZ HIGHWAY WATER IMPROVEMENT P	N NIMITZ HWY	96817	HWS
HONOLULU	S108008765	CITIZENS ENERGY SERVICES PIER 38	NIMITZ HWY		HWS,SPILLS,ENG CONTROLS
KANEOHE	S109953138	HPU, HAWAII LOA CAMPUS UNUSED DISP	45-045 KAMEHAMEHA HWY	96744	UIC
KANEOHE	S109953482	ACADEMIC CENTER BUILDING, HPU-HAWA	45-045 KAMEHAMEHA HWY	96744	UIC
KAILUA	U003541813	KAILUA CORPORATION YARD	42-377 KALANIANAOLE HWY	96734	LUST
HONOLULU	U004022801	MIDDLE STREET INTERMODAL CENTER	MIDDLE STREET AND KAMEHAMEHA H	96817	LUST,UST
HONOLULU	U004155569	HAWAII STEVEDORES - MAINTENANCE YA	765 N. NIMITZ HWY	96819	UST
HONOLULU	U004155570	420 N. NIMITS HWY DEMOLOTION PROJE	420 N. NIMITZ HWY	96819	UST

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 07/02/2010
Date Data Arrived at EDR: 07/14/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 82

Source: EPA
Telephone: N/A
Last EDR Contact: 10/13/2010
Next Scheduled EDR Contact: 01/24/2011
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 07/02/2010
Date Data Arrived at EDR: 07/14/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 82

Source: EPA
Telephone: N/A
Last EDR Contact: 10/13/2010
Next Scheduled EDR Contact: 01/24/2011
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 11/22/2010
Next Scheduled EDR Contact: 02/28/2011
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 07/02/2010
Date Data Arrived at EDR: 07/14/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 82

Source: EPA
Telephone: N/A
Last EDR Contact: 10/13/2010
Next Scheduled EDR Contact: 01/24/2011
Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 01/29/2010
Date Data Arrived at EDR: 02/09/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 62

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 10/01/2010
Next Scheduled EDR Contact: 01/10/2011
Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPAa??s Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 06/23/2009
Date Data Arrived at EDR: 01/15/2010
Date Made Active in Reports: 02/10/2010
Number of Days to Update: 26

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 10/13/2010
Next Scheduled EDR Contact: 01/24/2011
Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 06/23/2009
Date Data Arrived at EDR: 09/02/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 19

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 12/01/2010
Next Scheduled EDR Contact: 03/14/2011
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 05/25/2010
Date Data Arrived at EDR: 06/02/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 124

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 11/22/2010
Next Scheduled EDR Contact: 02/28/2011
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 10/07/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 10/07/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 10/07/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 10/07/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Varies

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 12/20/2009
Date Data Arrived at EDR: 01/20/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 82

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/10/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 12/20/2009
Date Data Arrived at EDR: 01/20/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 82

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/10/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 07/09/2010
Date Data Arrived at EDR: 07/09/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 39

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 10/06/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Annually

State- and tribal - equivalent CERCLIS

SHWS: Sites List

Facilities, sites or areas in which the Office of Hazard Evaluation and Emergency Response has an interest, has investigated or may investigate under HRS 128D (includes CERCLIS sites).

Date of Government Version: 12/01/2009
Date Data Arrived at EDR: 12/07/2009
Date Made Active in Reports: 01/08/2010
Number of Days to Update: 32

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 12/06/2010
Next Scheduled EDR Contact: 03/14/2011
Data Release Frequency: Semi-Annually

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Permitted Landfills in the State of Hawaii

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 04/01/2010
Date Data Arrived at EDR: 04/08/2010
Date Made Active in Reports: 05/19/2010
Number of Days to Update: 41

Source: Department of Health
Telephone: 808-586-4245
Last EDR Contact: 10/05/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Varies

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tank Database
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 09/20/2010
Date Data Arrived at EDR: 09/20/2010
Date Made Active in Reports: 10/22/2010
Number of Days to Update: 32
Source: Department of Health
Telephone: 808-586-4228
Last EDR Contact: 12/06/2010
Next Scheduled EDR Contact: 03/21/2011
Data Release Frequency: Semi-Annually

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 08/05/2010
Date Data Arrived at EDR: 08/06/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 59
Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 08/30/2010
Date Data Arrived at EDR: 08/30/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 35
Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Quarterly

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 05/24/2010
Date Data Arrived at EDR: 05/27/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 74
Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 11/04/2009
Date Data Arrived at EDR: 05/04/2010
Date Made Active in Reports: 07/07/2010
Number of Days to Update: 64
Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 12/03/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 08/27/2010
Date Data Arrived at EDR: 08/30/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 35
Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Semi-Annually

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/19/2009
Date Data Arrived at EDR: 02/19/2009
Date Made Active in Reports: 03/16/2009
Number of Days to Update: 25

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 11/02/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 08/05/2010
Date Data Arrived at EDR: 08/06/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 59

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Quarterly

State and tribal registered storage tank lists

UST: Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 09/20/2010
Date Data Arrived at EDR: 09/20/2010
Date Made Active in Reports: 10/07/2010
Number of Days to Update: 17

Source: Department of Health
Telephone: 808-586-4228
Last EDR Contact: 12/06/2010
Next Scheduled EDR Contact: 03/21/2011
Data Release Frequency: Semi-Annually

INDIAN UST R9: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 08/30/2010
Date Data Arrived at EDR: 08/30/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 35

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Quarterly

INDIAN UST R8: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 05/24/2010
Date Data Arrived at EDR: 05/27/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 74

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Quarterly

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 02/19/2009
Date Data Arrived at EDR: 02/19/2009
Date Made Active in Reports: 03/16/2009
Number of Days to Update: 25

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 11/02/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 04/01/2008
Date Data Arrived at EDR: 12/30/2008
Date Made Active in Reports: 03/16/2009
Number of Days to Update: 76

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 11/09/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 08/03/2010
Date Data Arrived at EDR: 08/04/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 61

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 02/11/2010
Date Data Arrived at EDR: 02/11/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 60

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 08/05/2010
Date Data Arrived at EDR: 08/06/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 59

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Quarterly

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 08/27/2010
Date Data Arrived at EDR: 08/30/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 35

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Semi-Annually

FEMA UST: Underground Storage Tank Listing

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 10/29/2010
Next Scheduled EDR Contact: 01/31/2011
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

ENG CONTROLS: Engineering Control Sites
A listing of sites with engineering controls in place.

Date of Government Version: 12/01/2009
Date Data Arrived at EDR: 12/07/2009
Date Made Active in Reports: 01/08/2010
Number of Days to Update: 32
Source: Department of Health
Telephone: 404-586-4249
Last EDR Contact: 12/06/2010
Next Scheduled EDR Contact: 03/14/2011
Data Release Frequency: Varies

INST CONTROL: Sites with Institutional Controls
Voluntary Remediation Program and Brownfields sites with institutional controls in place.

Date of Government Version: 12/01/2009
Date Data Arrived at EDR: 12/07/2009
Date Made Active in Reports: 01/08/2010
Number of Days to Update: 32
Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 12/06/2010
Next Scheduled EDR Contact: 03/14/2011
Data Release Frequency: Varies

State and tribal voluntary cleanup sites

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 04/02/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27
Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 10/04/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Varies

VCP: Voluntary Response Program Sites
Sites participating in the Voluntary Response Program. The purpose of the VRP is to streamline the cleanup process in a way that will encourage prospective developers, lenders, and purchasers to voluntarily cleanup properties.

Date of Government Version: 12/01/2009
Date Data Arrived at EDR: 12/07/2009
Date Made Active in Reports: 01/08/2010
Number of Days to Update: 32
Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 12/06/2010
Next Scheduled EDR Contact: 03/14/2011
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27
Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Sites
With certain legal exclusions and additions, the term ‘brownfield site’ means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

Date of Government Version: 12/01/2009
Date Data Arrived at EDR: 12/07/2009
Date Made Active in Reports: 01/08/2010
Number of Days to Update: 32
Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 12/06/2010
Next Scheduled EDR Contact: 03/14/2011
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA's Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA's Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become Brownfields Cleanup Revolving Loan Fund (BCRLF) cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities.

Date of Government Version: 06/24/2010
Date Data Arrived at EDR: 06/25/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 53

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 09/29/2010
Next Scheduled EDR Contact: 01/10/2011
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 11/09/2010
Next Scheduled EDR Contact: 01/10/2011
Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 11/09/2010
Next Scheduled EDR Contact: 02/21/2011
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 05/07/2010
Date Data Arrived at EDR: 06/18/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 60

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 12/08/2010
Next Scheduled EDR Contact: 03/21/2011
Data Release Frequency: Quarterly

CDL: Clandestine Drug Lab Listing
A listing of clandestine drug lab site locations.

Date of Government Version: 08/04/2010
Date Data Arrived at EDR: 09/10/2010
Date Made Active in Reports: 10/22/2010
Number of Days to Update: 42

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 12/17/2010
Next Scheduled EDR Contact: 03/21/2011
Data Release Frequency: Varies

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 09/01/2007
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 03/30/2009
Number of Days to Update: 131

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

Local Land Records

LIENS 2: CERCLA Lien Information
A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 05/06/2010
Date Data Arrived at EDR: 05/11/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 90

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

LUCIS: Land Use Control Information System
LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 12/09/2005
Date Data Arrived at EDR: 12/11/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 31

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 11/22/2010
Next Scheduled EDR Contact: 03/07/2011
Data Release Frequency: Varies

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 04/06/2010
Date Data Arrived at EDR: 04/07/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 50

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 10/07/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Annually

SPILLS: Release Notifications

Releases of hazardous substances to the environment reported to the Office of Hazard Evaluation and Emergency Response since 1988.

Date of Government Version: 03/10/2010
Date Data Arrived at EDR: 03/16/2010
Date Made Active in Reports: 04/13/2010
Number of Days to Update: 28

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 12/06/2010
Next Scheduled EDR Contact: 03/14/2011
Data Release Frequency: Varies

Other Ascertainable Records

RCRA-NonGen: RCRA - Non Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 02/17/2010
Date Data Arrived at EDR: 02/19/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 10/07/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 01/12/2010
Date Data Arrived at EDR: 02/09/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 62

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 11/09/2010
Next Scheduled EDR Contact: 02/21/2011
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 703-692-8801
Last EDR Contact: 10/28/2010
Next Scheduled EDR Contact: 01/31/2011
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 08/12/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 112

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 12/13/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 07/01/2010
Date Data Arrived at EDR: 08/11/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 113

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 10/04/2010
Next Scheduled EDR Contact: 01/17/2011
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 06/01/2010
Date Data Arrived at EDR: 06/16/2010
Date Made Active in Reports: 08/17/2010
Number of Days to Update: 62

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 12/10/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 12/14/2009
Date Data Arrived at EDR: 09/29/2010
Date Made Active in Reports: 10/04/2010
Number of Days to Update: 5

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 11/29/2010
Next Scheduled EDR Contact: 03/14/2011
Data Release Frequency: Varies

MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/04/2010
Date Data Arrived at EDR: 09/09/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 84

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 09/09/2010
Next Scheduled EDR Contact: 03/21/2011
Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2008
Date Data Arrived at EDR: 01/13/2010
Date Made Active in Reports: 02/18/2010
Number of Days to Update: 36

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 12/17/2010
Next Scheduled EDR Contact: 03/14/2011
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 09/29/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 64

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 10/01/2010
Next Scheduled EDR Contact: 01/10/2011
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 11/29/2010
Next Scheduled EDR Contact: 03/14/2011
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25
Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 11/29/2010
Next Scheduled EDR Contact: 03/14/2011
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing
A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40
Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing
A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40
Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems
Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2008
Date Data Arrived at EDR: 01/06/2010
Date Made Active in Reports: 02/10/2010
Number of Days to Update: 35
Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 11/01/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System
The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 04/24/2010
Date Data Arrived at EDR: 04/29/2010
Date Made Active in Reports: 05/17/2010
Number of Days to Update: 18
Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 09/27/2010
Next Scheduled EDR Contact: 01/10/2011
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 02/01/2010
Date Data Arrived at EDR: 04/22/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 109

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 11/10/2010
Next Scheduled EDR Contact: 01/31/2011
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 03/18/2010
Date Data Arrived at EDR: 04/06/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 51

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 12/13/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 07/13/2010
Date Data Arrived at EDR: 07/14/2010
Date Made Active in Reports: 08/09/2010
Number of Days to Update: 26

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 10/14/2010
Next Scheduled EDR Contact: 01/24/2011
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 04/14/2010
Date Data Arrived at EDR: 04/16/2010
Date Made Active in Reports: 05/27/2010
Number of Days to Update: 41

Source: EPA
Telephone: (415) 947-8000
Last EDR Contact: 12/10/2010
Next Scheduled EDR Contact: 03/28/2011
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 02/25/2010
Date Made Active in Reports: 05/12/2010
Number of Days to Update: 76

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 11/30/2010
Next Scheduled EDR Contact: 03/07/2011
Data Release Frequency: Biennially

UIC: Underground Injection Wells Listing
A listing of underground injection well locations.

Date of Government Version: 09/21/2010
Date Data Arrived at EDR: 10/01/2010
Date Made Active in Reports: 10/22/2010
Number of Days to Update: 21

Source: Department of Health
Telephone: 808-586-4258
Last EDR Contact: 12/06/2010
Next Scheduled EDR Contact: 03/21/2011
Data Release Frequency: Varies

DRYCLEANERS: Permitted Drycleaner Facility Listing
A listing of permitted drycleaner facilities in the state.

Date of Government Version: 06/30/2010
Date Data Arrived at EDR: 07/13/2010
Date Made Active in Reports: 08/04/2010
Number of Days to Update: 22

Source: Department of Health
Telephone: 808-586-4200
Last EDR Contact: 10/12/2010
Next Scheduled EDR Contact: 01/24/2011
Data Release Frequency: Varies

AIRS: List of Permitted Facilities
A listing of permitted facilities in the state.

Date of Government Version: 09/30/2010
Date Data Arrived at EDR: 10/20/2010
Date Made Active in Reports: 10/25/2010
Number of Days to Update: 5

Source: Department of Health
Telephone: 808-586-4200
Last EDR Contact: 10/12/2010
Next Scheduled EDR Contact: 01/24/2011
Data Release Frequency: Varies

INDIAN RESERV: Indian Reservations
This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 10/28/2010
Next Scheduled EDR Contact: 01/31/2011
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing
The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 08/31/2010
Date Data Arrived at EDR: 09/01/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 92

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 12/13/2010
Next Scheduled EDR Contact: 02/07/2011
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 01/01/2008
Date Data Arrived at EDR: 02/18/2009
Date Made Active in Reports: 05/29/2009
Number of Days to Update: 100

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 11/10/2010
Next Scheduled EDR Contact: 02/14/2011
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76
Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 10/28/2010
Next Scheduled EDR Contact: 01/31/2011
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List
A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 11/09/2009
Date Data Arrived at EDR: 12/18/2009
Date Made Active in Reports: 02/10/2010
Number of Days to Update: 54
Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 09/15/2010
Next Scheduled EDR Contact: 12/27/2010
Data Release Frequency: Varies

FEDLAND: Federal and Indian Lands
Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339
Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 10/28/2010
Next Scheduled EDR Contact: 01/31/2011
Data Release Frequency: N/A

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants: EDR Proprietary Manufactured Gas Plants
The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A
Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: Rextag Strategies Corp.
Telephone: (281) 769-2247
U.S. Electric Transmission and Power Plants Systems Digital GIS Data

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2009 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

NUUANU WATERSHED
UPPER NUUANU VALLEY
HONOLULU, HI 96813

TARGET PROPERTY COORDINATES

Latitude (North):	21.35930 - 21° 21' 33.5''
Longitude (West):	157.8011 - 157° 48' 4.0''
Universal Tranverse Mercator:	Zone 4
UTM X (Meters):	624308.3
UTM Y (Meters):	2362247.8
Elevation:	1058 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	21157-C7 HONOLULU, HI
Most Recent Revision:	Not reported

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

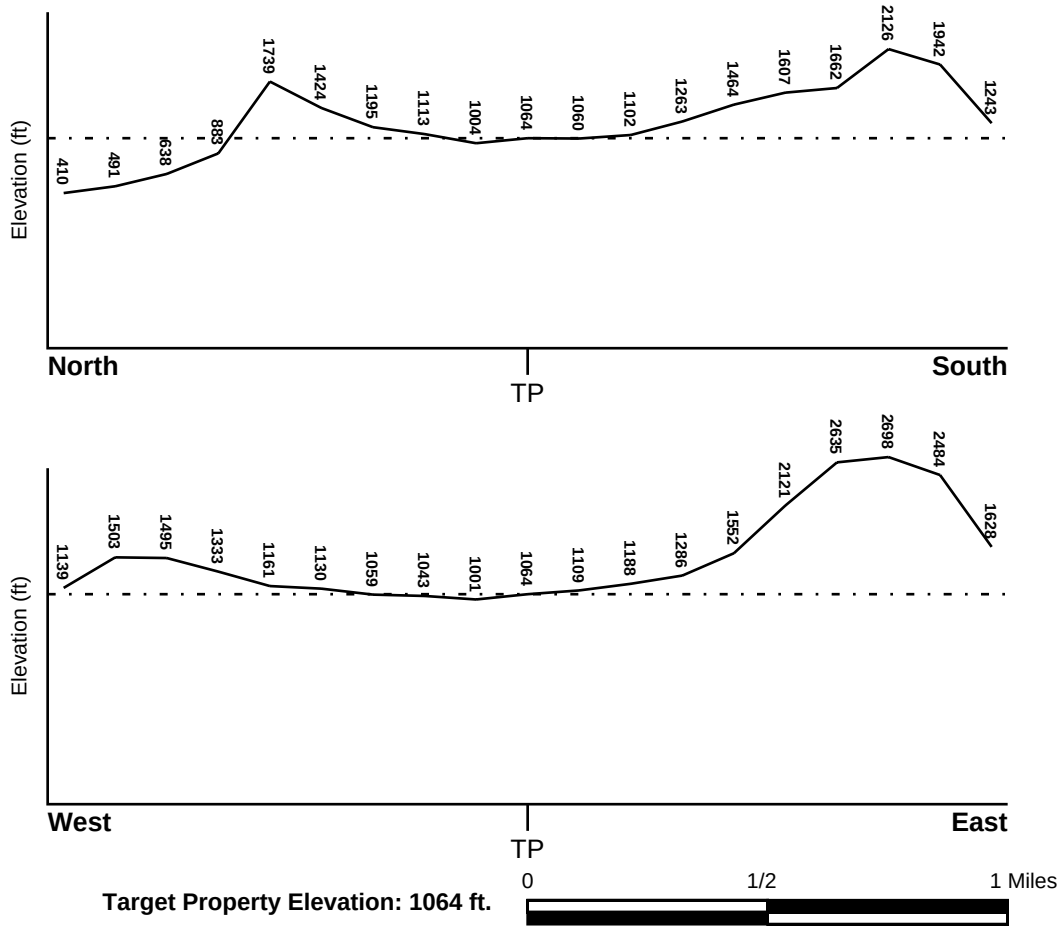
TOPOGRAPHIC INFORMATION

Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General West

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
HONOLULU, HI	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: 15003C - FEMA DFIRM Flood data

Additional Panels in search area: Not Reported

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
HONOLULU	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

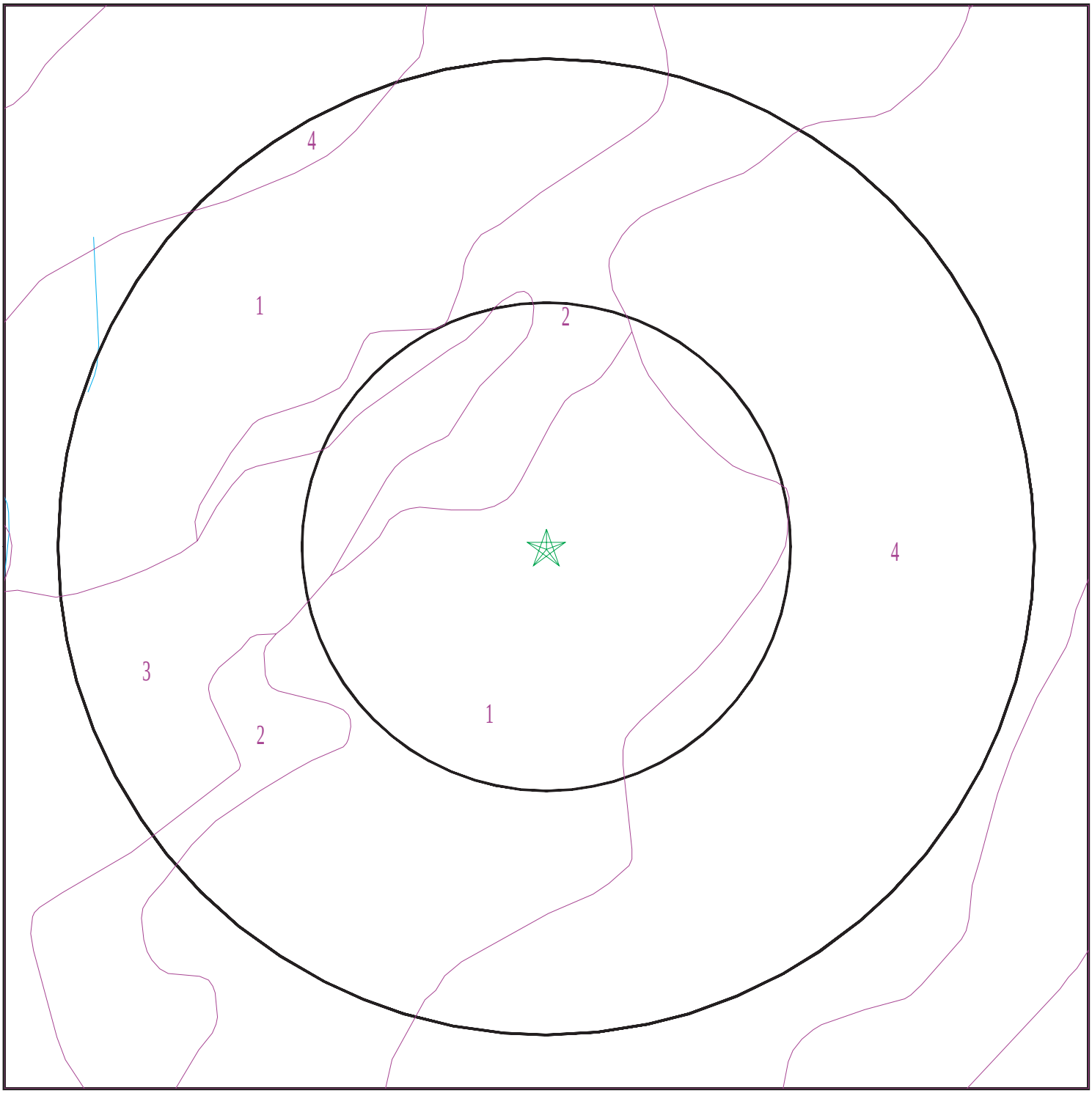
Era: -
System: -
Series: -
Code: N/A *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: -

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 2949052.2s



Target Property
SSURGO Soil
Water

0 1/16 1/8 1/4 Miles

N

SITE NAME:	Nuuanu Watershed	CLIENT:	Owen Environmental
ADDRESS:	Upper Nuuanu Valley Honolulu HI 96813	CONTACT:	Ben Owen
LAT/LONG:	21.3593 / 157.8011	INQUIRY #:	2949052.2s
		DATE:	December 17, 2010 7:24 pm

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Lolekaa

Soil Surface Texture: silty clay

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	9 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	ML-K (proposed)	Max: 4.23 Min: 1.41	Max: 5 Min: 3.5
2	9 inches	42 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	ML-K (proposed)	Max: 4.23 Min: 1.41	Max: 5 Min: 3.5
3	42 inches	64 inches	paragravelly loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	ML-K (proposed)	Max: 4.23 Min: 1.41	Max: 5 Min: 3.5

Soil Map ID: 2

Soil Component Name: Lolekaa

Soil Surface Texture: silty clay

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	9 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	ML-K (proposed)	Max: 4.23 Min: 1.41	Max: 5 Min: 3.5
2	9 inches	42 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	ML-K (proposed)	Max: 4.23 Min: 1.41	Max: 5 Min: 3.5
3	42 inches	64 inches	paragravelly loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	ML-K (proposed)	Max: 4.23 Min: 1.41	Max: 5 Min: 3.5

Soil Map ID: 3

Soil Component Name: Water > 40 acres

Soil Surface Texture: silty clay

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class:

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Not Reported

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

No Layer Information available.

Soil Map ID: 4

Soil Component Name: Lolekaa

Soil Surface Texture: silty clay

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	9 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	ML-K (proposed)	Max: 4.23 Min: 1.41	Max: 5 Min: 3.5
2	9 inches	42 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	ML-K (proposed)	Max: 4.23 Min: 1.41	Max: 5 Min: 3.5
3	42 inches	64 inches	paragravelly loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	ML-K (proposed)	Max: 4.23 Min: 1.41	Max: 5 Min: 3.5

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.500
Federal FRDS PWS	Nearest PWS within 0.500 miles
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

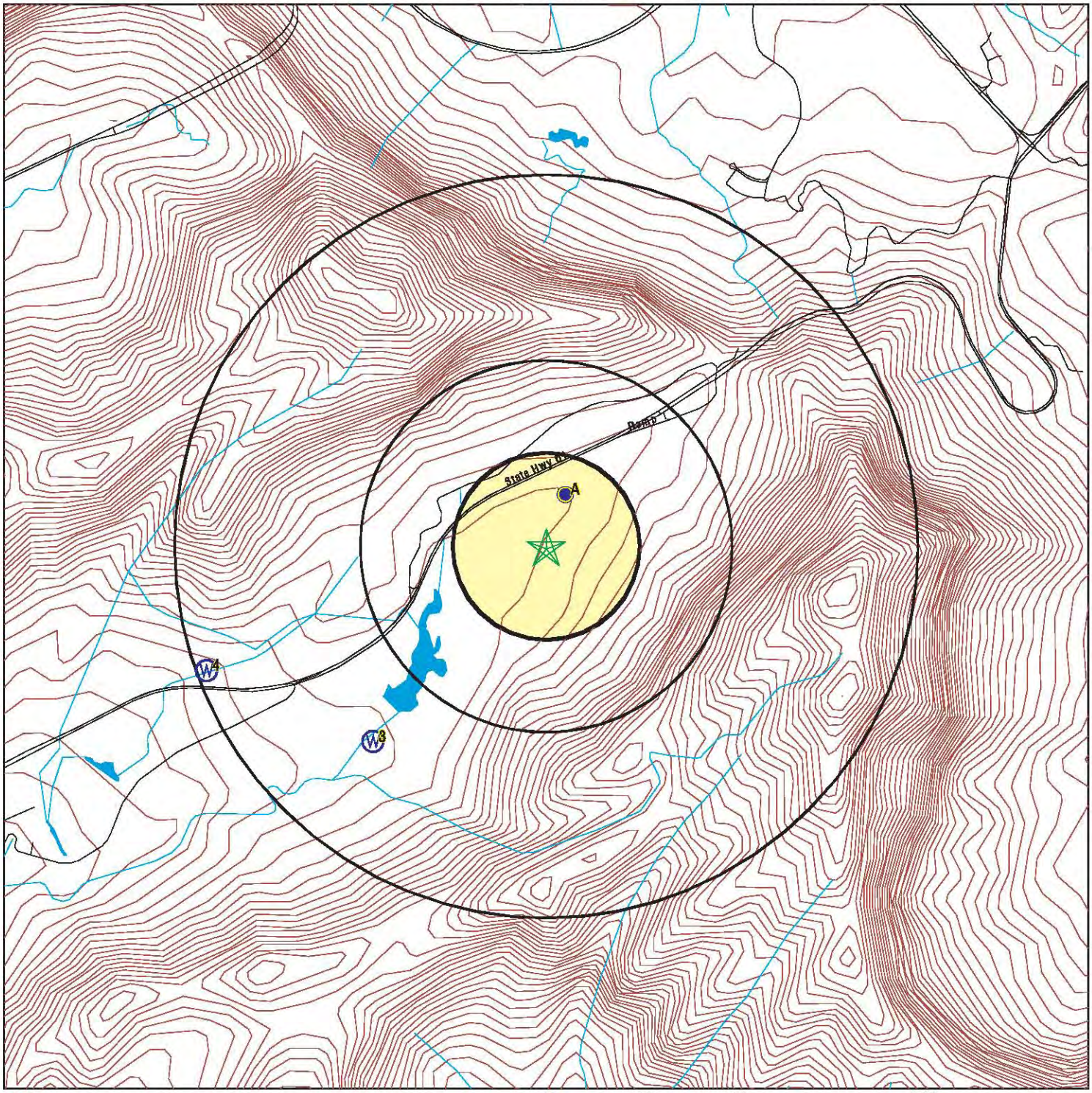
MAP ID	WELL ID	LOCATION FROM TP
A1	HI0000331	1/8 - 1/4 Mile NNE

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A2	HI5000000002557	1/8 - 1/4 Mile NNE
3	HI5000000002492	1/2 - 1 Mile SW
4	HI5000000002505	1/2 - 1 Mile WSW

PHYSICAL SETTING SOURCE MAP - 2949052.2s



County Boundary
Major Roads
Contour Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

0 1/4 1/2 1 Miles

Groundwater Flow Direction
GI Indeterminate Groundwater Flow at Location
GV Groundwater Flow Varies at Location

N

SITE NAME:	Nuuanu Watershed	CLIENT:	Owen Environmental
ADDRESS:	Upper Nuuanu Valley Honolulu HI 96813	CONTACT:	Ben Owen
LAT/LONG:	21.3593 / 157.8011	INQUIRY #:	2949052.2s
		DATE:	December 17, 2010 7:24 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation | Database | EDR ID Number

A1
NNE
1/8 - 1/4 Mile
Lower

FRDS PWS **HI0000331**

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	701		
Facility name:	PUNALUU II PUMP 2		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	702		
Facility name:	PUNALUU II PUMP 3		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	703		
Facility name:	PUNALUU II PUMP 4		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	704		
Facility name:	PUNALUU II PUMP 5		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	705		
Facility name:	PUNALUU II PUMP 6		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	706		
Facility name:	PUNALUU III PUMP 1		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	707		
Facility name:	PUNALUU III PUMP 2		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	708		
Facility name:	PUNANANI WELL PUMP 2		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	709		
Facility name:	PUNANANI WELL PUMP 3		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	710		
Facility name:	PUNANANI WELL PUMP 4		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	711		
Facility name:	PUNANANI WELL PUMP 5		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	712		
Facility name:	PUNANANI WELL PUMP 6		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	713		
Facility name:	WAIAU WELL PUMP 2		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	714		
Facility name:	WAIAU WELL PUMP 3		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	715		
Facility name:	WILDER WELL 2		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	716		
Facility name:	WILDER WELL 3		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	717		
Facility name:	WILDER WELL 4		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	865		
Facility name:	HONOLULU WINDWARD PEARL DIST		
Facility type:	Distribution_system_zone	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	894		
Facility name:	MANOA II		
Facility type:	Treatment_plant	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1002		
Facility name:	BERETANIA STAT 1		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1003		
Facility name:	HALAWA WELL 1		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1004		
Facility name:	HALAWA WELL 2		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1006		
Facility name:	HALAWA WELL 3		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1007		
Facility name:	KAHALUU TUNNEL		
Facility type:	Infiltration_gallery	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1008		
Facility name:	KAHANA WELL 2		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1009		
Facility name:	KALIHI AERATOR WELL		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1010		
Facility name:	LULUKU WELL		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1011		
Facility name:	LULUKU TUNNEL		
Facility type:	Infiltration_gallery	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1012		
Facility name:	MAKIKI SPRING A		
Facility type:	Spring	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1013		
Facility name:	MAKIKI SPRING B		
Facility type:	Spring	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1014		
Facility name:	MANANA WELL		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1015		
Facility name:	MOANALUA WELL 1		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1018		
Facility name:	WAIHEE TUNNEL		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1185		
Facility name:	PUNALUU II P4		
Facility type:	Treatment_plant	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1186		
Facility name:	BERETANIA STAT 4		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1187		
Facility name:	BERETANIA STAT 6		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1188		
Facility name:	BERETANIA STAT 5		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1189		
Facility name:	BERETANIA STAT 9		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1190		
Facility name:	BERETANIA STAT 8		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1191		
Facility name:	BERETANIA STAT 7		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1192		
Facility name:	BERETANIA STAT 2		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1193		
Facility name:	BERETANIA STAT 3		
Facility type:	Well	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1194		
Facility name:	BERETANIA TP 1		
Facility type:	Treatment_plant	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1195		
Facility name:	BERETANIA TP 4		
Facility type:	Treatment_plant	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1196		
Facility name:	BERETANIA TP 5		
Facility type:	Treatment_plant	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1197		
Facility name:	BERETANIA TP 6		
Facility type:	Treatment_plant	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1198		
Facility name:	BERETANIA TP 7		
Facility type:	Treatment_plant	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1199		
Facility name:	BERETANIA TP 8		
Facility type:	Treatment_plant	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		

Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1200		
Facility name:	BERETANIA TP 9		
Facility type:	Treatment_plant	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

Pwsid:	HI0000331	Epa region:	09
State:	HI	County:	Not Reported
Pws name:	HONOLULU-WINDWARD-PEARL H		
Population Served:	606905	Pwssvcconn:	104864
PWS Source:	Groundwater_under_infl_of_surface_water		
Pws type:	CWS		
Status:	Active	Owner type:	Local_Govt
Facility id:	1201		
Facility name:	BERETANIA TP 2		
Facility type:	Treatment_plant	Treatment process:	gaseous chlorination, post
Treatment objective:	disinfection		
Contact name:	BWS HONOLULU		
Original name:	BWS HONOLULU		
Contact phone:	808-748-5080	Contact address1:	BOARD OF WATER SUPPLY
Contact address2:	630 SOUTH BERETANIA STREET, RM 308		
Contact city:	HONOLULU		
Contact zip:	96843		

PWS ID:	HI0000331
Date Initiated:	Not Reported Date Deactivated: Not Reported
PWS Name:	HONOLULU-WINDWARD-PEARL HARBOR 630 S BERETANIA STREET 630 SOUTH BERETANIA HONOLULU, OANU, HI 96843
Addressee / Facility:	System Owner/Responsible Party MR. KAZU HAYASHIDA BOARD OF WATER SUPPLY 630 SOUTH BERETANIA STREET HONOLULU, HI 96843

Facility Latitude:	21 12 17.0000	Facility Longitude:	157 48 58.0000
Facility Latitude:	21 17 7.0000	Facility Longitude:	157 46 17.0000
Facility Latitude:	21 17 13.0000	Facility Longitude:	157 46 53.0000
Facility Latitude:	21 17 27.0000	Facility Longitude:	157 48 58.0000
Facility Latitude:	21 17 53.0000	Facility Longitude:	157 45 19.0000
Facility Latitude:	21 18 13.0000	Facility Longitude:	157 49 47.0000
Facility Latitude:	21 18 31.0000	Facility Longitude:	157 51 43.0000
Facility Latitude:	21 19 36.0000	Facility Longitude:	157 46 27.0000
Facility Latitude:	21 20 2.0000	Facility Longitude:	157 52 8.0000
Facility Latitude:	21 21 17.0000	Facility Longitude:	157 48 40.0000
Facility Latitude:	21 22 35.0000	Facility Longitude:	157 49 55.0000
Facility Latitude:	21 22 57.0000	Facility Longitude:	157 55 14.0000
Facility Latitude:	21 23 38.0000	Facility Longitude:	157 56 49.0000
Facility Latitude:	21 24 7.0000	Facility Longitude:	157 58 25.0000
Facility Latitude:	21 24 10.0000	Facility Longitude:	157 56 45.0000
Facility Latitude:	21 24 12.0000	Facility Longitude:	157 56 47.0000
Facility Latitude:	21 26 16.0000	Facility Longitude:	157 51 23.0000
Facility Latitude:	21 34 50.0000	Facility Longitude:	157 53 12.0000
Facility Latitude:	21 35 17.0000	Facility Longitude:	157 53 49.0000
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Facility Latitude:	21 18 37.0000	Facility Longitude:	157 47 29.0000
Facility Latitude:	21 20 14.0000	Facility Longitude:	157 45 1.0000
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Facility Latitude:	21 23 13.0000	Facility Longitude:	127 55 35.0000
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Facility Latitude:	21 23 37.0000	Facility Longitude:	157 57 27.0000
Facility Latitude:	21 24 14.0000	Facility Longitude:	158 57 25.0000
Facility Latitude:	21 34 41.0000	Facility Longitude:	157 49 17.0000
Facility Latitude:	21 35 17.0000	Facility Longitude:	157 53 46.0000
Facility Latitude:	21 18 33.0000	Facility Longitude:	157 51 23.0000
Facility Latitude:	21 19 59.0000	Facility Longitude:	157 47 33.0000
Facility Latitude:	21 19 59.0000	Facility Longitude:	157 48 18.0000
Facility Latitude:	21 20 12.0000	Facility Longitude:	157 44 55.0000
Facility Latitude:	21 24 13.0000	Facility Longitude:	157 58 12.0000
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Facility Latitude:	21 33 14.0000	Facility Longitude:	157 53 8.0000
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Facility Latitude:	21 20 52.0000	Facility Longitude:	157 52 36.0000
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Facility Latitude:	21 23 38.0000	Facility Longitude:	157 55 54.0000
Facility Latitude:	21 23 38.0000	Facility Longitude:	157 55 55.0000
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Facility Latitude:	21 25 53.0000	Facility Longitude:	157 57 31.0000
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Facility Latitude:	21 19 58.0000	Facility Longitude:	157 43 58.0000
Facility Latitude:	21 21 20.0000	Facility Longitude:	157 53 55.0000
Facility Latitude:	21 22 14.0000	Facility Longitude:	157 50 11.0000
Facility Latitude:	21 22 58.0000	Facility Longitude:	157 49 35.0000
Facility Latitude:	21 23 39.0000	Facility Longitude:	157 55 55.0000
Facility Latitude:	21 23 42.0000	Facility Longitude:	157 56 47.0000
Facility Latitude:	21 24 11.0000	Facility Longitude:	157 56 46.0000
Facility Latitude:	21 24 14.0000	Facility Longitude:	157 57 6.0000
Facility Latitude:	21 23 20.0000	Facility Longitude:	157 56 3.0000
Facility Latitude:	21 23 22.0000	Facility Longitude:	157 55 3.0000
Facility Latitude:	21 23 27.0000	Facility Longitude:	157 56 43.0000
Facility Latitude:	21 23 39.0000	Facility Longitude:	157 55 54.0000
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Facility Latitude:	21 23 49.0000	Facility Longitude:	157 56 22.0000
Facility Latitude:	21 24 13.0000	Facility Longitude:	158 57 24.0000
Facility Latitude:	21 24 39.0000	Facility Longitude:	157 57 59.0000
Facility Latitude:	21 26 16.0000	Facility Longitude:	157 51 32.0000
Facility Latitude:	21 33 15.0000	Facility Longitude:	157 53 11.0000
Facility Latitude:	21 34 39.0000	Facility Longitude:	157 53 47.0000
City Served:	PEARL CITY		
City Served:	KANEOHE		
City Served:	AIEA		
City Served:	KAILUA		
City Served:	HONO-WINDW-PEAR		
City Served:	HONOLULU		
Treatment Class:	Mixed (treated and untreated)	Population:	645741

Violations information not reported.

A2
NNE
1/8 - 1/4 Mile
Lower

HI WELLS **HI5000000002557**

Wid:	3-2148-001	Island:	3
Well no:	2148-01	Well name:	Nuuanu C&C Tun 4
Old name:	Not Reported	Yr drilled:	Not Reported
Driller:	W A WALL	Quad map:	13
Longitude2:	1574811	Latitude27:	212152
Longitude8:	1574801	Latitude83:	212141
Lat83d:	21	Lat83m:	21
Lat83s:	41	Lon83d:	157
Lon83m:	48	Lon83s:	01
Lat83dd:	21.36139		

Lon83dd:	-157.80028		
Long83dd:	-157.80028		
Lat83dd 1:	21.36139		
Gps:	0	Utm:	1
Owner user:	Honolulu BWS	Old number:	Not Reported
Well type:	Tunnelled	Casing dia:	Not Reported
Ground el:	1027	Well depth:	Not Reported
Solid case:	Not Reported	Perf case:	Not Reported
Use:	MUN - County		
Use year:	77		
Init water:	Not Reported		
Init head:	0		
Init chlor:	Not Reported	Init cl:	Not Reported
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Temp unit:	Not Reported
Pump gpm:	Not Reported	Draft mgy:	Not Reported
Head feet:	Not Reported	Max chlor:	Not Reported
Min chlor:	Not Reported	Geology:	PA
Pump yr:	Not Reported	Draft yr:	77
Head yr:	Not Reported	Maxchl:	Not Reported
Maxchl yr:	Not Reported	Minchl:	Not Reported
Minchl yr:	Not Reported	Bot hole:	Not Reported
Bot solid:	Not Reported	Bot perf:	Not Reported
Spec capac:	Not Reported	Pump mgd:	Not Reported
Draft mgd:	Not Reported	Aquifer:	30102
Tmk:	2-2-054:001	Old aqui:	Not Reported
Aqui code:	30102	Latest hd:	Not Reported
Cur head:	Not Reported	Cur cl:	Not Reported
Cur temp:	Not Reported	Wcr:	01/01/1992
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Site id:	HI5000000002557

3
SW
1/2 - 1 Mile
Lower

HI WELLS **HI5000000002492**

Wid:	3-2148-002	Island:	3
Well no:	2148-02	Well name:	Nuuanu C&C Tu 4B
Old name:	Not Reported	Yr drilled:	Not Reported
Driller:	W A WALL	Quad map:	13
Longitude2:	1574840	Latitude27:	212117
Longitude8:	1574830	Latitude83:	212106
Lat83d:	21	Lat83m:	21
Lat83s:	06	Lon83d:	157
Lon83m:	48	Lon83s:	30
Lat83dd:	21.35167		
Lon83dd:	-157.80833		
Long83dd:	-157.80833		
Lat83dd 1:	21.35167		
Gps:	0	Utm:	1
Owner user:	Honolulu BWS	Old number:	Not Reported
Well type:	Tunnelled	Casing dia:	Not Reported
Ground el:	968	Well depth:	Not Reported
Solid case:	Not Reported	Perf case:	Not Reported
Use:	MUN - County		
Use year:	77		
Init water:	Not Reported		

Init head:	0		
Init chlor:	Not Reported	Init cl:	Not Reported
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Temp unit:	Not Reported
Pump gpm:	Not Reported	Draft mgy:	Not Reported
Head feet:	Not Reported	Max chlor:	Not Reported
Min chlor:	Not Reported	Geology:	PA
Pump yr:	Not Reported	Draft yr:	77
Head yr:	Not Reported	Maxchl:	Not Reported
Maxchl yr:	0	Minchl:	Not Reported
Minchl yr:	0	Bot hole:	Not Reported
Bot solid:	Not Reported	Bot perf:	Not Reported
Spec capac:	Not Reported	Pump mgd:	Not Reported
Draft mgd:	Not Reported	Aquifer:	30102
Tmk:	2-2-054:001	Old aqui:	Not Reported
Aqui code:	30102	Latest hd:	Not Reported
Cur head:	Not Reported	Cur cl:	Not Reported
Cur temp:	Not Reported	Wcr:	01/01/1992
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Site id:	HI5000000002492

4
WSW **HI WELLS** **HI5000000002505**
1/2 - 1 Mile
Lower

Wid:	3-2149-002	Island:	3
Well no:	2149-02	Well name:	Nuuanu C&C Tu 3A
Old name:	Not Reported	Yr drilled:	Not Reported
Driller:	W A WALL	Quad map:	13
Longitude2:	1574905	Latitude27:	212127
Longitude8:	1574855	Latitude83:	212116
Lat83d:	21	Lat83m:	21
Lat83s:	16	Lon83d:	157
Lon83m:	48	Lon83s:	55
Lat83dd:	21.35444		
Lon83dd:	-157.81528		
Long83dd:	-157.81528		
Lat83dd 1:	21.35444		
Gps:	0	Utm:	1
Owner user:	Honolulu BWS	Old number:	Not Reported
Well type:	Tunnelled	Casing dia:	Not Reported
Ground el:	900	Well depth:	Not Reported
Solid case:	Not Reported	Perf case:	Not Reported
Use:	MUN - County		
Use year:	77		
Init water:	Not Reported		
Init head:	0		
Init chlor:	Not Reported	Init cl:	Not Reported
Test date:	Not Reported	Test gpm:	Not Reported
Test ddown:	Not Reported	Test chlor:	Not Reported
Test temp:	Not Reported	Temp unit:	Not Reported
Pump gpm:	Not Reported	Draft mgy:	Not Reported
Head feet:	Not Reported	Max chlor:	Not Reported
Min chlor:	Not Reported	Geology:	QHB
Pump yr:	Not Reported	Draft yr:	77
Head yr:	Not Reported	Maxchl:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Maxchl yr:	Not Reported	Minchl:	Not Reported
Minchl yr:	Not Reported	Bot hole:	Not Reported
Bot solid:	Not Reported	Bot perf:	Not Reported
Spec capac:	Not Reported	Pump mgd:	Not Reported
Draft mgd:	Not Reported	Aquifer:	30103
Tmk:	1-9-007:001	Old aqui:	Not Reported
Aqui code:	30103	Latest hd:	Not Reported
Cur head:	Not Reported	Cur cl:	Not Reported
Cur temp:	Not Reported	Wcr:	01/01/1992
Pir:	Not Reported	Surveyor:	Not Reported
T:	Not Reported	Pump elev:	Not Reported
Pump depth:	Not Reported	Site id:	HI5000000002505

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

Federal EPA Radon Zone for HONOLULU County: 3

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 96813

Number of sites tested: 3

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.067 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	0.350 pCi/L	100%	0%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2009 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW^{R} Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Well Index Database
Source: Department of Land and Natural Resources
Telephone: 808-587-0214
CWRM maintains a Well Index Database to track specific information pertaining to the construction and installation of production wells in Hawaii

OTHER STATE DATABASE INFORMATION

RADON

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

APPENDIX D:

EDR CERTIFIED SANBORN MAP REPORT

Nuuanu Watershed
Upper Nuuanu Valley
Honolulu, HI 96813

Inquiry Number: 2949052.3
December 17, 2010

Certified Sanborn® Map Report

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

12/17/10

Site Name:
Nuuanu Watershed
Upper Nuuanu Valley
Honolulu, HI 96813

Client Name:
Owen Environmental
PO Box 457
Kalaheo, HI 96741

EDR Inquiry # 2949052.3

Contact: Ben Owen

EDR® Environmental Data Resources Inc

The complete Sanborn Library collection has been searched by EDR, and fire insurance maps covering the target property location provided by Owen Environmental were identified for the years listed below. The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by Sanborn Library LLC, the copyright holder for the collection.

Certified Sanborn Results:

Site Name: Nuuanu Watershed
Address: Upper Nuuanu Valley
City, State, Zip: Honolulu, HI 96813
Cross Street:
P.O. # NA
Project: NA
Certification # DFD1-43B3-9FFA

Sanborn® Library search results
Certification # DFD1-43B3-9FFA

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

The Sanborn Library includes more than 1.2 million Sanborn fire insurance maps, which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ✓ Library of Congress
- ✓ University Publications of America
- ✓ EDR Private Collection

The Sanborn Library LLC Since 1866™

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Owen Environmental (the client) is permitted to make up to THREE photocopies of this Sanborn Map transmittal and each fire insurance map accompanying this report solely for the limited use of its customer. No one other than the client is authorized to make copies. Upon request made directly to an EDR Account Executive, the client may be permitted to make a limited number of additional photocopies. This permission is conditioned upon compliance by the client, its customer and their agents with EDR's copyright policy; a copy of which is available upon request.

APPENDIX E:

EDR HISTORIC TOPOGRAPHIC MAP REPORT

Nuuanu Watershed
Upper Nuuanu Valley
Honolulu, HI 96813

Inquiry Number: 2949052.4
December 20, 2010

The EDR Historical Topographic Map Report

EDR® Environmental Data Resources Inc

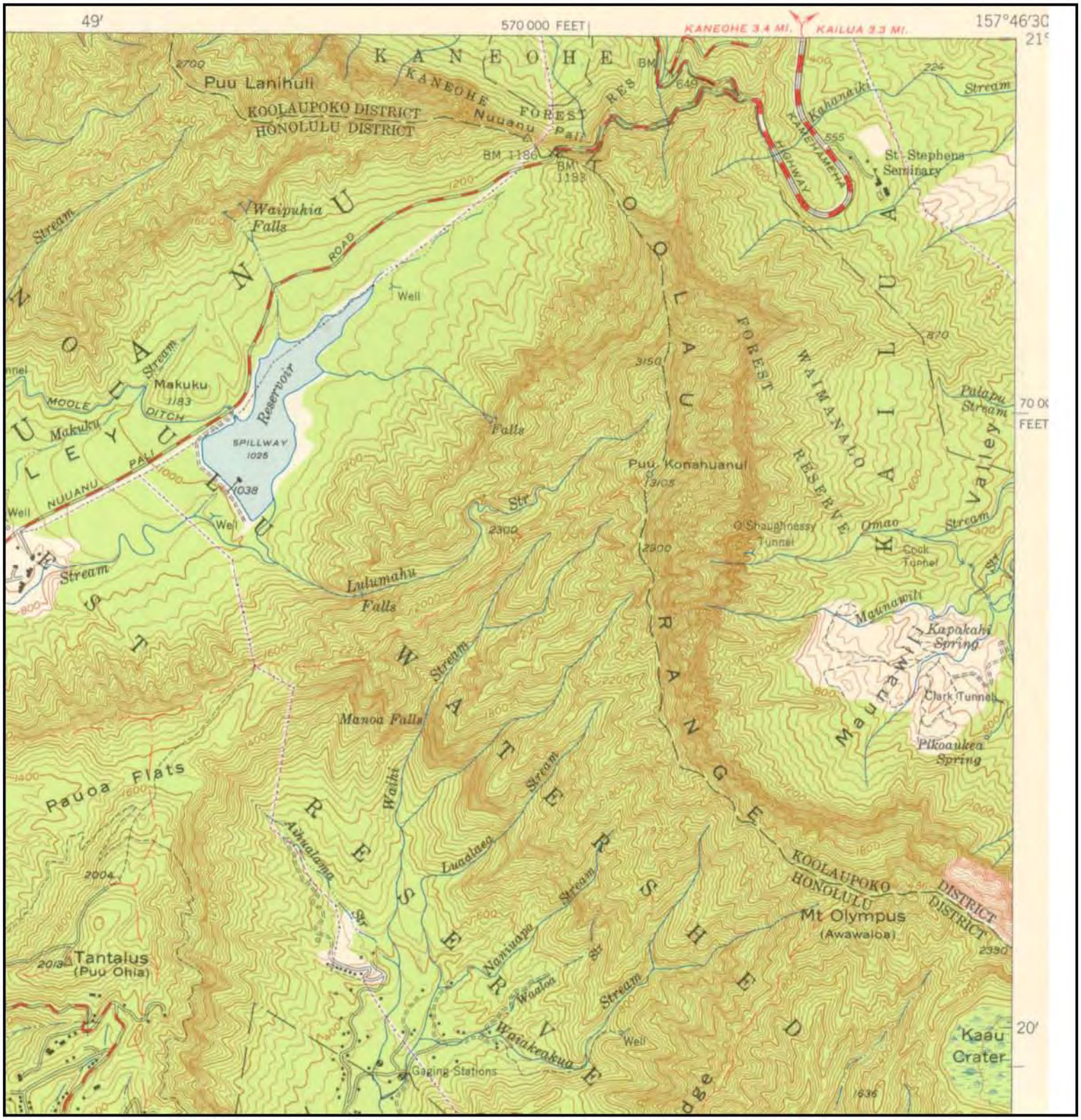
440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

EDR Historical Topographic Map Report

Environmental Data Resources, Inc.s (EDR) Historical Topographic Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topographic Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the early 1900s.

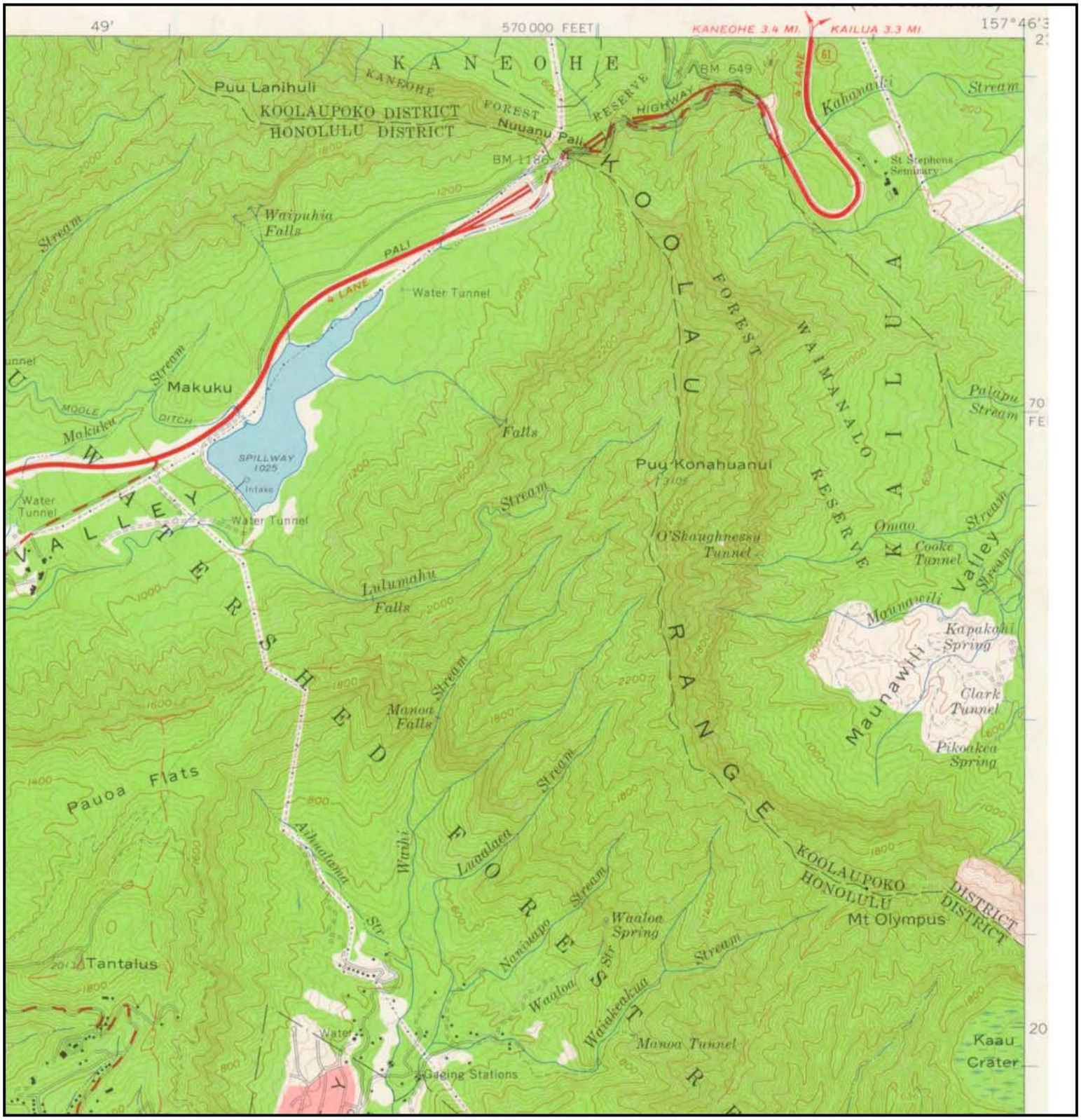
Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Historical Topographic Map



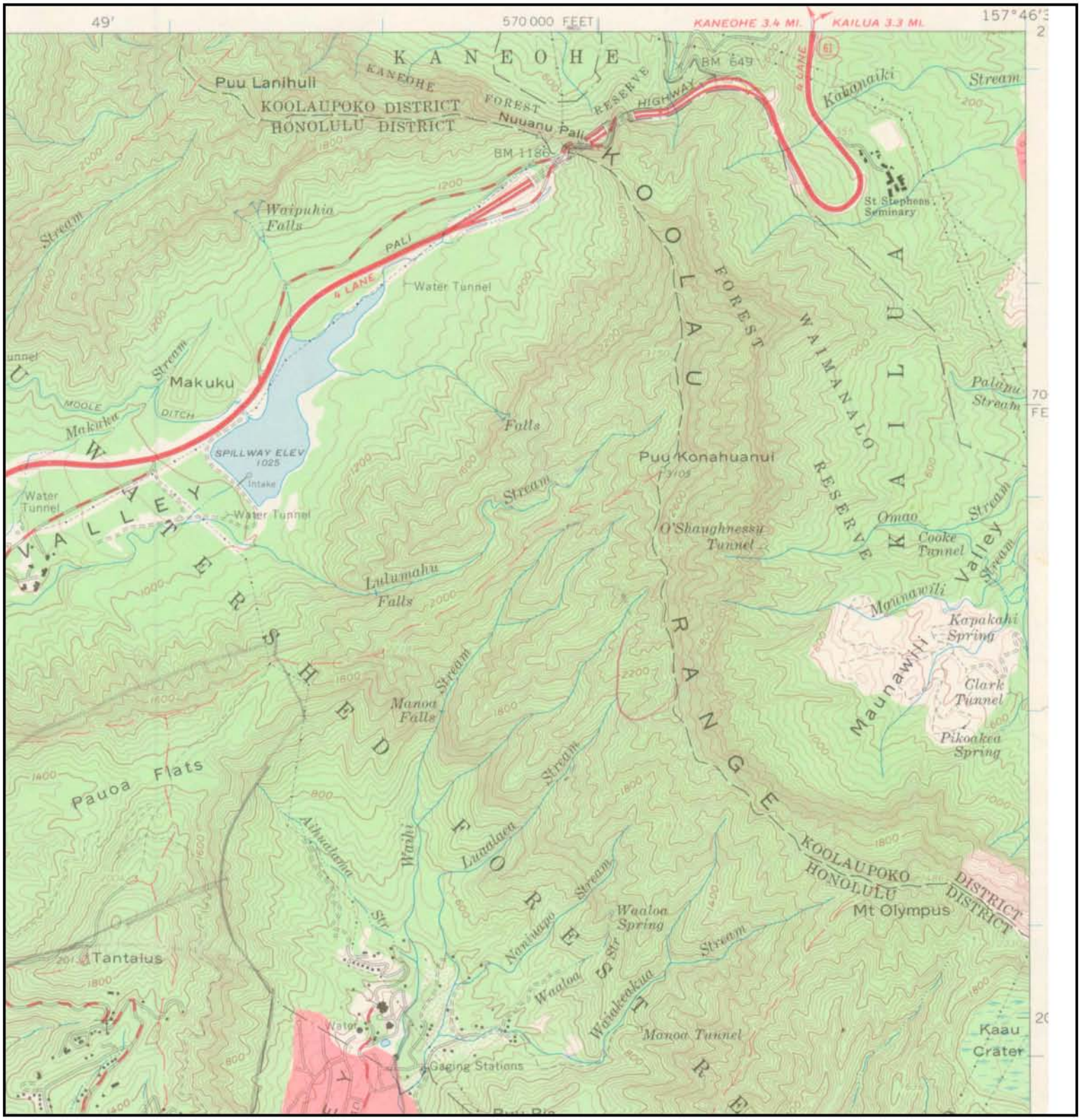
N	TARGET QUAD NAME: HONOLULU, HI MAP YEAR: 1953 SERIES: 7.5 SCALE: 1:24,000	SITE NAME: Nuuanu Watershed ADDRESS: Upper Nuuanu Valley Honolulu, HI 96813 LAT/LONG: 21.3593 / 157.8011	CLIENT: Owen Environmental CONTACT: Ben Owen INQUIRY#: 2949052.4 RESEARCH DATE: 12/20/2010

Historical Topographic Map



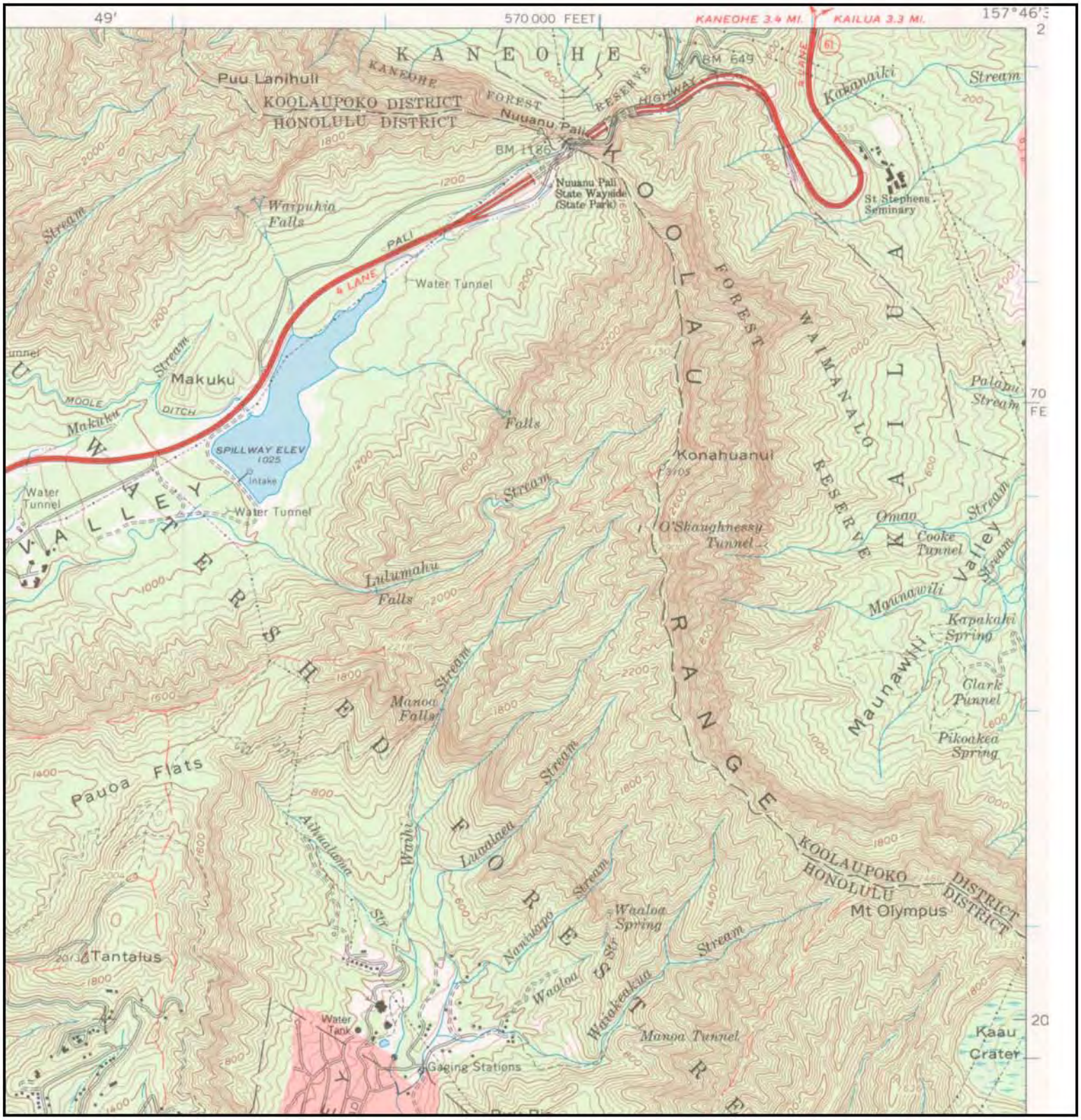
N	TARGET QUAD NAME: HONOLULU, HI MAP YEAR: 1959 SERIES: 7.5 SCALE: 1:24,000	SITE NAME: Nuuanu Watershed ADDRESS: Upper Nuuanu Valley Honolulu, HI 96813 LAT/LONG: 21.3593 / 157.8011	CLIENT: Owen Environmental CONTACT: Ben Owen INQUIRY#: 2949052.4 RESEARCH DATE: 12/20/2010

Historical Topographic Map



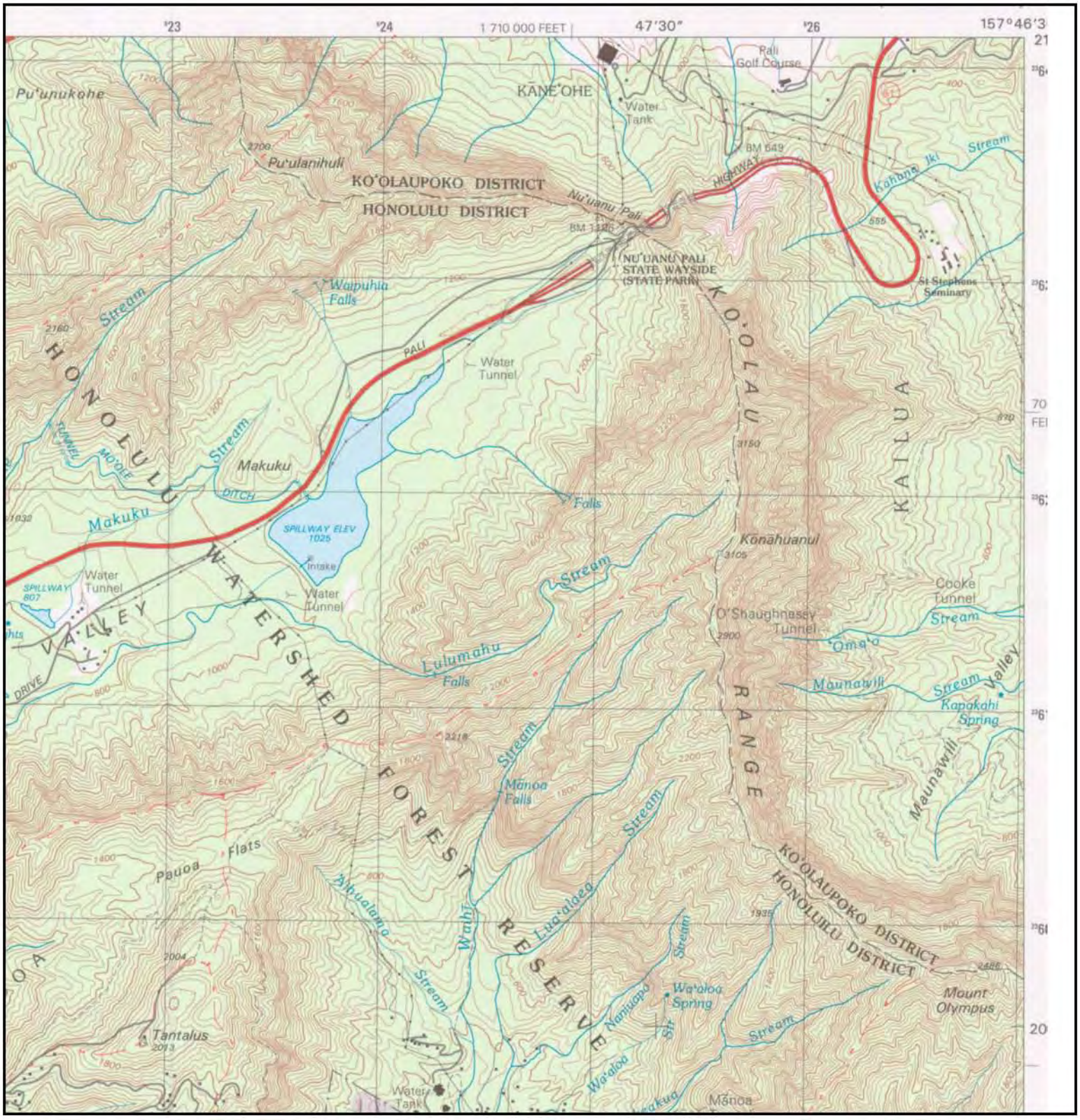
N	TARGET QUAD NAME: HONOLULU, HI MAP YEAR: 1969 SERIES: 7.5 SCALE: 1:24,000	SITE NAME: Nuuanu Watershed ADDRESS: Upper Nuuanu Valley Honolulu, HI 96813 LAT/LONG: 21.3593 / 157.8011	CLIENT: Owen Environmental CONTACT: Ben Owen INQUIRY#: 2949052.4 RESEARCH DATE: 12/20/2010

Historical Topographic Map



N	TARGET QUAD NAME: HONOLULU, HI MAP YEAR: 1983 SERIES: 7.5 SCALE: 1:24,000	SITE NAME: Nuuanu Watershed ADDRESS: Upper Nuuanu Valley Honolulu, HI 96813 LAT/LONG: 21.3593 / 157.8011	CLIENT: Owen Environmental CONTACT: Ben Owen INQUIRY#: 2949052.4 RESEARCH DATE: 12/20/2010

Historical Topographic Map



N	TARGET QUAD NAME: HONOLULU, HI MAP YEAR: 1998 SERIES: 7.5 SCALE: 1:24,000	SITE NAME: Nuuanu Watershed ADDRESS: Upper Nuuanu Valley Honolulu, HI 96813 LAT/LONG: 21.3593 / 157.8011	CLIENT: Owen Environmental CONTACT: Ben Owen INQUIRY#: 2949052.4 RESEARCH DATE: 12/20/2010

APPENDIX F:

QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONAL

BENJAMIN OWEN, MS, REA

President, Owen Environmental Inc.

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EDUCATION

- M.S. Marine Science, UC Santa Cruz, 1996
- B.A. Anthropology, Univ. of Chicago, 1992

ACTIVE REGISTRATIONS

- Registered Environmental Assessor (REA)
- AHERA Asbestos Inspector
- AHERA Asbestos Project Designer

PROFESSIONAL EXPERIENCE

Mr. Owen has over 15 years experience in chemistry, toxicology, environmental science and industrial hygiene. His background includes trace metal and trace organic sampling and analysis, sediment toxicology, project management, hazardous materials assessments, industrial hygiene, occupational health and safety, and biological assessment in marine environments.

As a Project Manager for Kauai Environmental from 2002 through 2009, Mr. Owen performed numerous asbestos and lead paint inspections, hazardous materials surveys, and Phase 1 and Phase 2 Environmental Site Assessments throughout the state. As a Registered Environmental Assessor, Mr. Owen has performed numerous Environmental Site Assessments (ESAs) for commercial, residential, industrial and agricultural properties. As an industrial hygienist, Mr. Owen has designed, managed and monitored asbestos abatement projects and written emergency response, environmental protection, and health and safety plans for various construction, demolition, and remediation projects.

Owen Environmental was formed in January 2010. Mr. Owen continues to work on a variety of environmental projects statewide.

PROJECT EXPERIENCE

Environmental Audit and Compliance Survey, Hilo Medical Center. Mr. Owen performed an EH&S survey of all fuel and/or oil storage facilities at this hospital complex and prepared a Spill Prevention Control and Countermeasure (SPCC) Plan for the facility and a Corrective Action Plan to bring the facility into compliance with various environmental regulations.

Sand Island WWTP Site Investigation, City and County of Honolulu. Mr. Owen coordinated this extensive site investigation to identify subsurface contamination of soils to be disturbed during the Primary Treatment Expansion Project. The project required sampling soils and groundwater at 150 locations with analysis for a wide variety of potential contaminants.

Statewide Airports Asbestos Inventory. As one of the asbestos management consultants for the State DOT Airports Division, Mr. Owen has performed comprehensive asbestos inspections at airport facilities statewide, has designed and managed numerous abatement projects, and maintains a GIS database containing all relevant asbestos data.

Hazardous Materials Survey and Site Characterization, Frear Hall, UH Manoa Mr. Owen performed a survey for hazardous materials, including lead paint, asbestos, PCBs, mercury, etc. prior to the demolition and replacement of the Frear Hall dormitory at UH Manoa.

Hazardous Materials Survey, Pier 1, Port of Honolulu. Mr. Owen performed a survey for hazardous materials including lead paint, asbestos, PCBs, mercury, etc. prior to the demolition and replacement of Pier 1 freight storage facilities. This project also included preparation of drawings and specifications for removal of asbestos materials, and services during construction.

Chlordane Site Characterization, Family Housing Replacement Project, MCBH Kaneohe, Oahu. Mr. Owen helped coordinate and organize this large-scale site characterization requiring soil sampling at over 120 locations.

Hazardous Materials Survey, Guam Naval Hospital, Guam. With Kauai Environmental, Mr. Owen inspected nineteen buildings at this facility to identify all potentially hazardous materials that might create health risks or environmental concerns during proposed demolition and replacement of the facility.

Ewa Mill Environmental Site Remediation, City and County of Honolulu. Mr. Owen supervised remediation field work at this historic sugar mill and mixed use industrial site, including removal and disposal of lead and PCB contaminated soils, air monitoring, subsurface investigations, excavation of buried waste drums, closure and removal of sumps, ASTs and USTs.

Phase 1 and Phase 2 ESAs. As a Registered Environmental Assessor, Mr. Owen has performed more than 50 Phase I ESAs over the past 8 years to identify potential environmental liabilities associated with commercial property, and has performed numerous Phase 2 ESAs to characterize soil and groundwater contamination associated with environmental liabilities identified during the Phase I ESA process.

Appendix G

OCCL Correspondence and
Governor of Hawai‘i’s 7th Supplementary Proclamation

BOARD OF WATER SUPPLY

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

March 5, 2009

BOARD OF WATER SUPPLY
Honolulu, Hawaii

To Legal

____ Please see me
____ For necessary action
____ For reply
____ For your information
____ For your files
____ Please return to our files
____ Sent at your request
____ For your approval and signature

Comments: Jan –
do you need to
review this before
Manager signs

Date 3/4/09 Sig. Nancy

WS-619 (5/97)

Ms. Laura H. Thielen, Chairperson
Board of Land and Natural Resources
Department of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Attention: Mr. Samuel Lemmo, Administrator
Office of Conservation and Coastal Lands

Dear Ms. Thielen:

Subject: Conservation District Use Permit Determination Request for Proposed Maintenance Improvements at Nuuanu Reservoir No. 4 as Specified in the Nuuanu Dam No. 4 Phase 1 Investigation Report (August 2008), Nuuanu, Oahu, Hawaii, TMK: 2–2-54: 001

We request a determination on the need for a Conservation District Use Permit for the planned maintenance improvements at Nuuanu Reservoir No. 4. The Nuuanu Reservoir No. 4 lies within the State, General Conservation district.

The Department of Land and Natural Resources is requiring the Board of Water Supply to conduct the following remedial actions per the attached letters dated November 6, 2008 (Phase 1 Dam Safety Inspection - Final Report) and November 28, 2008 (Visual Dam Safety Inspection). The specific actions are further identified in the enclosed CD (Phase 1 Investigation for Nuuanu Dam No. 4 – August 2008):

1. General maintenance involving clearing and grubbing trees, brush and tall vegetation from the upstream and downstream slopes of the dam, the crest, and the spillway approach and discharge channel.

2. Installation of monitoring weirs at various seepage points.

3. Construction of a maintenance access road to the toe of the dam to improve access for inspection and maintenance of the dam. A map of the proposed access road is provided to facilitate your review and determination.

4. Repair of the outlet tower structure trash racks and sluice gates.

5. The repair of the lowest sluice gate will require dewatering the reservoir, dredging the accumulated silt covering the gate and installing a trash rack. The dredged material will be stockpiled along the reservoir banks. Dewatering effluent will be discharged into the spillway channel where filtration and sedimentation controls will be constructed to minimize sediment transport into Nuuanu Stream. The sluice gate repair will be scheduled in the drier, summer months to expedite the project and to mitigate impacts.

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

Sincerely,

WAYNE M. HASHIRO, P.E.
Manager and Chief Engineer

Attachments

090285

WR
cc: FO
Land

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

2009 MAR 19 A 11:20

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

ref:OCCL:MC

Corr OA-09-172

MAR 17 2009

Wayne M. Hashiro, P.E.
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, HI 96843

Dear Mr. Hashiro,

SUBJECT: MAINTENANCE IMPROVEMENTS
NU`UANU RESERVOIR NO. 4
Nu`uanu, Honolulu, O`ahu
TMK (1) 2-2-54:01

The Department of Land and Natural Resources (DLNR) Office of Conservation and Coastal Lands (OCCL) has reviewed the information you provided regarding the Board of Water Supply's (BWS) proposed maintenance work at the Nu`uanu Reservoir No. 4. The reservoir is in the Resource Subzone of the State Land Use Conservation District.

DLNR's Engineering Division made a number of recommendations for work at the dam. Engineering advocated immediate action due to the concern for public safety.

OCCL agrees that the work is in the furtherance of public health, safety, and welfare, and is consistent with the Governor's7th Supplementary Proclamation, which includes the suppression of Chapter 183C, Hawai`i Revised Statutes. We thus have no objections to those parts of the proposal that were recommended by DLNR's Engineering Division:

- the clearing and grubbing of vegetation from the upstream and downstream slopes of the dam, the crest, and the spillway approach and discharge channel;
- the installation of monitoring weirs at various seepage points;
- the repair of the outlet tower structure trash racks and sluice gates; *and*
- the repair of the lowest sluice gate.

The last item will require dewatering the reservoir, dredging the silt, and installing a trash rack. The dredged material will be stockpiled along the reservoir banks, while the dewatering effluent will be discharged into the spillway channel where filtration and sedimentation controls will be constructed to minimize sediment transport into Nu`uanu Stream.

OCCL recommends that the BWS have a biological survey done first to inspect for endangered, threatened, or other significant species. We also recommend that the BWS have the area surveyed for historical or archaeological resources.

Finally, OCCL requests that Best Management Practices be implemented to control for any erosion caused by the clearing of vegetation.

Please call Michael Cain at 587-0048 should you have any further questions.

Sincerely,

Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

cc: County of HI Planning; DLNR Engineering

OFFICE OF THE GOVERNOR
STATE OF HAWAII

7th SUPPLEMENTARY PROCLAMATION

By the authority vested in me as Governor by the Constitution and laws of the State of Hawaii, in order to provide relief for disaster damages, losses, and suffering, and to protect the health, safety, and welfare of the people, I, LINDA LINGLE, Governor of the State of Hawaii, hereby determine, designate and proclaim as follows:

WHEREAS, it has become necessary to supplement my proclamations of March 2, 2006, March 12, 2006, March 14, 2006, March 18, 2006, March 28, 2006, April 24, 2006, and September 6, 2006 relating to continuous periods of heavy rains and flooding beginning Monday, February 20, 2006 through Sunday, April 9, 2006, which caused localized flooding, saturated ground conditions, and damage to private and public property in the counties of Hawaii, Kauai, Maui, and the City and County of Honolulu; and

WHEREAS, efforts are under way to protect, preserve, repair, restore, and rebuild, with appropriate necessary improvements and mitigation efforts, reservoirs, waters, hillsides, roads, and lands that were seriously damaged as a result of the periods of heavy rains and flooding and saturated ground conditions; and

WHEREAS, I find that certain laws are impeding or are detrimental to the expeditious and efficient efforts to protect, preserve, repair, restore, and rebuild reservoirs, waters, hillsides, roads, and lands that were seriously damaged as a result of the periods of heavy rains and flooding and saturated ground conditions; and

WHEREAS, Hawaii will be entering its annual season of rains which will increase the risk of additional heavy rains and flooding; and

WHEREAS, prompt, expeditious action is necessary to respond to the risk to the public that remains as a result of reservoirs, waters, hillsides, roads, and lands that remain seriously

damaged as a result of the periods of heavy rains and flooding and to alleviate the risk to the public should these repairs be prevented before Hawaii experiences any further periods of heavy rains and flooding; and

WHEREAS, in order to provide additional relief and assistance in the efforts to protect, preserve, repair, restore, and rebuild, with appropriate necessary improvements and mitigation efforts, reservoirs, waters, hillsides, roads, and lands that were seriously damaged as a result of the periods of heavy rains and flooding and saturated ground conditions, it has become necessary to supplement my Proclamations of March 2, 2006, March 12, 2006, March 14, 2006, March 18, 2006, March 28, 2006, April 24, 2006, and September 6, 2006 to authorize and invoke additional measures under the Hawaii Revised Statutes; and

WHEREAS, pursuant to section 128-8(4), Hawaii Revised Statutes, the Governor is authorized to suspend any law which impedes or tends to impede or is detrimental to the expeditious and efficient execution of, or conflicts with, disaster relief or other emergency functions; and

WHEREAS, pursuant to section 128-9(8), Hawaii Revised Statutes, the Governor is further authorized to relieve hardship and inequities or obstructions to the public health, safety, and welfare found by the Governor to exist in the laws by suspending laws in whole or in part, or by alleviating the provisions of laws on such terms and conditions as the Governor may impose.

NOW, THEREFORE, I, LINDA LINGLE, Governor of the State of Hawaii, hereby determine that a major disaster and catastrophe contemplated by sections 128-8(4), 128-9(8), and 128-10(10), Hawaii Revised Statutes exists and I hereby suspend, as allowed by federal law, the following statutes to the extent necessary to protect, preserve, repair, restore, and rebuild, with appropriate necessary improvements and mitigation efforts, reservoirs, waters, hillsides, roads, lands, and other areas and facilities that were seriously damaged as a result of the periods of heavy rains and flooding and saturated ground conditions in the State of Hawaii:

1. Chapter 46, **county organization and administration** to the extent that any county ordinance or regulation impedes or tends to impede or is detrimental to the expeditious and efficient execution of, or is in conflict with, disaster relief or other emergency functions necessary to abate the public nuisance that exists by reason of any reservoirs, waters, hillsides, roads, lands, and other areas and facilities that were severely damaged as a result of the periods of heavy rains and flooding and saturated ground conditions
2. Chapter 6E, **historic preservation** except for those provisions relating to burial sites
3. Chapter 104, **wages and hours of employees on public works**
4. Chapter 171, **public lands, management and disposition of**
5. Chapter 174C, **state water code**
6. Chapter 180, **soil and water conservation districts**
7. Chapter 180C, **soil erosion and sediment control**
8. Chapter 183, **forest reserves, water development, zoning**
9. Chapter 183C, **conservation districts**
10. Chapter 183D, **wildlife**
11. Chapter 184, **state parks and recreation areas**
12. Chapter 195, **natural areas reserves system**
13. Chapter 195D, **conservation of aquatic life, wildlife, and land plants**
14. Chapter 198D, **Hawaii statewide trail and access system**
15. Chapter 205, **land use commission**
16. Chapter 205A, **coastal zone management**
17. Chapter 264, **highways**
18. Chapter 286, **highway safety**
19. Chapter 341, **environmental quality control**
20. Chapter 342B, **air pollution**
21. Chapter 342D, **water pollution**
22. Chapter 342E, **non-point source pollution management and control**
23. Chapter 342F, **noise pollution**
24. Chapter 343, **environmental impact statements**

25. Chapter 343D, **environmental disclosure**

26. Chapter 344, **state environmental policy**

FURTHER, all provisions and requirements of my Proclamations of March 2, 2006, March 12, 2006, March 14, 2006, March 18, 2006, March 28, 2006, April 24, 2006, and September 6, 2006 remain in full force and effect and are made applicable to this Supplementary Proclamation, and all work or other undertaking under this and all prior Proclamations cited above.

Done at the State Capitol, State of Hawaii,
this 15th day of September, 2006.

LINDA LINGLE
Governor of Hawaii

APPROVED:

MARK J. BENNETT
Attorney General
State of Hawaii

Appendix H

Comments Received During the Draft EA
Public Comment Period and Responses

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

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

April 2, 2013

In reply, please refer to:
File:

13-078
Nuuanu Reservoir

Mr. Chester Koga
R.M. Towill Corporation
2024 N. King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Koga:

SUBJECT: Public Review of Draft Environmental Assessment for Proposed Nuuanu Reservoir No. 4 Repair Project, Nuuanu, Honolulu, Oahu, Hawaii

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your letter dated March 25, 2013. Thank you for allowing us to review and comment on the subject document. Your letter was routed to the Safe Drinking Water Branch in the Department of Health. They will provide specific comments to you if necessary. EPO recommends that you review the Standard Comments (www.hawaii.gov/health/epo under the land use tab). You are required to adhere to all Standard Comments specifically applicable to this application.

EPO suggests that you examine the many sources available on strategies to support the sustainable design of communities, including the:
U.S. Environmental Protection Agency's sustainability programs: www.epa.gov/sustainability
U.S. Green Building Council's LEED program: www.new.usgbc.org/leed

The DOH encourages everyone to apply these sustainability strategies and principles early in the planning and review of projects. We also request that for future projects you consider conducting a Health Impact Assessment (HIA). More information is available at www.cdc.gov/healthyplaces/hia.htm. We request you share all of this information with others to increase community awareness on sustainable, innovative, inspirational, and healthy community design.

We request a written response confirming receipt of this letter and any other letters you receive from DOH in regards to this submission. You may mail your response to 919 Ala Moana Blvd., Ste. 312, Honolulu, Hawaii 96814. However, we would prefer an email submission to epo@doh.hawaii.gov. We anticipate that our letter(s) and your response(s) will be included in the final document. If you have any questions, please contact me at (808) 586-4337.

Mahalo,

Laura Leialoha Phillips McIntyre, AICP
Manager, Environmental Planning Office

BOARD OF WATER SUPPLY

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

May 15, 2013

Ms. Laura Leialoha Phillips McIntyre, AICP
Manager, Environmental Planning Office
Department of Health
State of Hawaii
919 Ala Moana Boulevard, Suite 312
Honolulu, Hawai'i 96814

Dear Ms. McIntyre:

Subject: Draft Environmental Assessment (EA) for Proposed Nu'uanu Reservoir No. 4 Repair Project
Nu'uanu, Kona District, Honolulu, O'ahu, Hawai'I

Thank you for your letter dated April 2, 2013 concerning the subject project. We appreciate the time you have taken to review the subject document. We have also received comments from the State Department of Health, Safe Drinking Water Branch, and have responded to them in a separate letter.

The Final EA will take into account, and incorporate as applicable, the information provided under the Department of Health's standard comments, as well as the sustainable design approaches identified by the U.S. Environmental Protection Agency, the Green Building Council's LEED program, and the Center for Disease Control and Prevention's Health Impact Assessment.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

OFFICE OF PLANNING
STATE OF HAWAII

NEIL ABERCROMBIE
GOVERNOR

JESSE K. SOUKI
DIRECTOR
OFFICE OF PLANNING

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: http://hawaii.gov/dbedt/op/

Ref. No. P-13934

April 4, 2013

Mr. Chester Koga
R. M. Towill Corporation
2024 N. King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Koga:

Subject: Draft Environmental Assessment for the Proposed Nuuanu Reservoir No. 4 Repair Project, Nuuanu, Honolulu, Oahu,
Tax Map Key: (1) 2-2-54: 001 (portion)

Thank you for the opportunity to provide comments on the Draft Environmental Assessment (Draft EA) for the proposed Nuuanu Reservoir No. 4 Repair Project.

The Office of Planning has reviewed the subject Draft EA and acknowledges that the document provides a discussion of the Coastal Zone Management (CZM) objectives and policies found in Hawaii Revised Statutes Section 205A-2, addressing the areas of Recreational Resources, Historic Resources, Scenic and Open Spaces, Coastal Ecosystems, Economic Uses, Coastal Hazards, Managing Development, Public Participation, Beach Protection, and Marine Resources. We have no further comments to offer at this time.

If you have any questions regarding this comment letter, please contact Leo Asuncion, CZM Program Manager, at 587-2875.

Sincerely,

Jesse K. Souki
Director

c: Mr. Michael Matsuo, Board of Water Supply

BOARD OF WATER SUPPLY

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

May 15, 2013

Mr. Jesse K. Souki
Director
Office of Planning
State of Hawaii
P.O. Box 2359
Honolulu, Hawai'i 96804

Dear Mr. Souki:

Subject: Draft Environmental Assessment for Proposed
Nu'uanu Reservoir No. 4 Repair Project
Nu'uanu, Kona District, Honolulu, O'ahu, Hawai'i

Thank you for your letter dated April 4, 2013 concerning the subject project. We appreciate the time you have taken to review the subject document and acknowledge that you have no comments to offer.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF STATE PARKS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 8, 2013

Mr. Chester Koga, AICP
Project Coordinator
R.M. Towill Corporation
2024 N. King St., Suite 200
Honolulu, Hawai'i 96819-3494

Public Review of DEA for the Proposed Nu'uanu Reservoir No. 4 Repair Project, Nu'uanu, O'ahu

Dear Mr. Koga:

Thank you for the opportunity to review the subject document.

Nu'uanu Pali State Wayside is located approximately 1.5 miles northeast of the dam. The DEA states that the project is not expected to impact the lookout due to its distance from the project area. Specifically, the work activities within the reservoir and downstream are not expected to be visible from the wayside, thereby having no effect on scenic views from the lookout.

As such, we have no objections to the proposed project. Please do not hesitate to contact Lauren Tanaka should you have questions or need additional information.

Very truly yours,

Daniel S. Quinn
State Parks Administrator

BOARD OF WATER SUPPLY

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

May 15, 2013

Mr. Daniel S. Quinn
State Parks Administrator
Division of State Parks
Department of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawai'i 96809

Dear Mr. Quinn:

Subject: Draft Environmental Assessment for Proposed
Nu'uanu Reservoir No. 4 Repair Project
Nu'uanu, Kona District, Honolulu, O'ahu, Hawai'i

Thank you for providing comments on the subject project. We appreciate the time you have taken to review the subject document and acknowledge that you have no comments of objections to the subject project.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

NEIL ABERCROMBIE
GOVERNOR

Dean H. Seki
Comptroller

Maria E. Zielinski
Deputy Comptroller

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P)1086.3

APR 10 2013

Chester Koga, AICP
Project Coordinator
R.M. Towill Corporation
2024 N. King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Koga:

Subject: Draft Environmental Assessment for
Nuuanu No. 4 Reservoir Repair Project, Oahu
TMK: (1) 2-2-054: 001 (por.)

Thank you for the opportunity to comment on the subject project. The proposed project does not impact any of the Department of Accounting and General Services' projects or existing facilities and we have no comments at this time.

If you have any questions, please contact me at 586-0400 or your staff may call Ms. Gayle Takasaki of the Public Works Division at 586-0584.

Sincerely,

DEAN H. SEKI
Comptroller

BOARD OF WATER SUPPLY

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

May 15, 2013

Mr. Dean H. Seki
Comptroller
Department of Accounting and General Services
State of Hawaii
1151 Punchbowl Street
Honolulu, Hawai'i 96813

Dear Mr. Seki:

Subject: Draft Environmental Assessment for Proposed
Nu'uanu Reservoir No. 4 Repair Project
Nu'uanu, Kona District, Honolulu, O'ahu, Hawai'i

Thank you for your letter dated April 10, 2013 concerning the subject project. We appreciate the time you have taken to review the subject document and acknowledge that you have no comments to offer.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

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

In reply, please refer to:
EMD/CWB

04029PST.13

April 11, 2013

Mr. Michael Matsuo
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Matsuo:

SUBJECT: Comments on the Draft Environmental Assessment for the Nu'uanu Reservoir No. 4 Repair Project Nu'uanu, Honolulu, Island of Oahu, Hawaii

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated March 25, 2013, requesting comments on your project. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://www.hawaii.gov/health/environmental/env-planning/landuse/CWB-standardcomment.pdf.

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. You may be required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. To request NPDES permit coverage, you must submit the CWB Individual NPDES Form through the e-Permitting Portal and the hard copy certification statement

with $1,000 filing fee. Please open the e-Permitting Portal website at: https://eha cloud.doh.hawaii.gov/epermit/View/home.aspx. You will be asked to do a one-time registration to obtain your login and password. After you register, click on the Application Finder tool and locate the "CWB Individual NPDES Form." Follow the instructions to complete and submit this form.

3. If your project involves work in, over, or under waters of the United States, it is highly recommend that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 438-9258) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and Hawaii Administrative Rules (HAR), Chapter 11-54.

4. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

If you have any questions, please visit our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/index.html, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

ALEC WONG, P.E., CHIEF
Clean Water Branch

ST:rh

c: DOH-EPO [via email only]
Mr. Chester Koga, R.M. Towill Corporation

BOARD OF WATER SUPPLY

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

May 29, 2013

Mr. Alec Wong, P.E., Chief
Clean Water Branch
Department of Health
State of Hawai'i
P.O. Box 3378
Honolulu, Hawai'i 96801-3378

Dear Mr. Wong:

Subject: Your Letter Dated April 11, 2013, Regarding the Draft Environmental Assessment for the Proposed Nuuanu Reservoir No. 4 Repair Project, Nuuanu, Honolulu, Island of O'ahu, Hawaii

Thank you for your letter. We appreciate the time you spent reviewing the Draft Environmental Assessment (DEA) and offer the following responses to your comments:

1. The subject project shall take into account and incorporate as applicable the information provided under the Department of Health's standard comments, and comply with the anti-degradation policy (Hawaii Administrative Rules (HAR) Section 11-54-1.1), designated uses (HAR, Section 11-54-6) and water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. A National Pollutant Discharge Elimination System (NPDES) Individual Permit (NOI Form-C) and Site-Specific Construction Best Management Practice (SSCBMP) Plan were submitted on April 11, 2013 to address and mitigate the potential of storm water and wastewater runoff entering State waters. It was determined after the submittal of the DEA that a dewatering permit would not be required. Thus, this permit was removed from Section 5 of the DEA. In addition to the NPDES Individual Permit and SSCBMP Plan, the subject project shall comply with the State's Water Quality Standards as there will be no discharge from the subject project. In the implementation of the practices identified in the permitting process, the aforementioned anti-degradation policy, designated uses, and water quality criteria shall all be met. There will be no discharge from the site, thus the project shall be in compliance with the Clean Water Act Section 404.

3. The U.S. Army Corps of Engineers has been mailed a copy of the DEA as one of the parties to be consulted during the review period. We shall also be applying for a Jurisdictional Determination of Nuuanu Stream with the U.S. Army Corps of Engineers.

4. The subject project shall comply with the State's Water Quality Standards as contained in HAR, Chapter 11-54 so as to not incur any penalties.

Any further comments can be directed to Michael Matsuo at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8480 • Fax: (808) 768-4567
Web site: www.honolulu.gov

KIRK CALDWELL
MAYOR

CHRIS T. TAKASHIGE, P.E., CCM
DIRECTOR

MARK YONAMINE, P.E.
DEPUTY DIRECTOR

April 12, 2013

R.M. Towill Corporation
2024 N. King Street
Honolulu, Hawaii 96819

Attn: Chester Koga

Dear Mr. Koga:

Subject: Draft Environmental Assessment for proposed Nuuanu Reservoir No. 4 Repair Project

The Department of Design and Construction does not have any comments to offer on this draft environmental assessment.

Thank you for the opportunity to review and comment. Should there be any questions, please contact me at 768-8480.

Sincerely,

Chris T. Takashige, P.E., CCM
Director

CTT: cf (507814)

BOARD OF WATER SUPPLY

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

May 15, 2013

TO: CHRIS T. TAKASHIGE, P.E., CCM, DIRECTOR
DEPARTMENT OF DESIGN AND CONSTRUCTION

FROM: ERNEST Y.W. LAU, P.E., MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR PROPOSED NU'UANU RESERVOIR NO. 4 REPAIR PROJECT
NU'UANU, KONA DISTRICT, HONOLULU, O'AHU, HAWAI'I

Thank you for your letter dated April 12, 2013 concerning the subject project. We appreciate the time you have taken to review the subject document and acknowledge that you have no comments to offer.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

HONOLULU FIRE DEPARTMENT

CITY AND COUNTY OF HONOLULU

636 South Street
Honolulu, Hawaii 96813-5007
Phone: 808-723-7139 Fax: 808-723-7111 Internet: www.honolulu.gov/hfd

KIRK CALDWELL
MAYOR

MANUEL P. NEVES
FIRE CHIEF

LIONEL CAMARA JR.
DEPUTY FIRE CHIEF

April 16, 2013

Mr. Chester Koga, AICP
Project Coordinator
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Koga:

Subject: Public Review of Draft Environmental Assessment for Proposed Nuuanu Reservoir No. 4 Repair Project
Nuuanu, Kona District, Honolulu, Oahu, Hawaii

In response to your letter of March 25, 2013, regarding the above-mentioned subject, the Honolulu Fire Department determined that there will be no significant impact to fire department services.

Should you have questions, please contact Battalion Chief Socrates Bratakos of our Fire Prevention Bureau at 723-7151 or sbratakos@honolulu.gov.

Sincerely,

DAVE TAKEHARA
Acting Assistant Chief

DT/SY:bh

BOARD OF WATER SUPPLY

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

May 15, 2013

TO: DAVE TAKEHARA, ACTING ASSISTANT CHIEF
HONOLULU FIRE DEPARTMENT

FROM: ERNEST Y.W. LAU, P.E., MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR PROPOSED NU'UANU RESERVOIR NO. 4 REPAIR PROJECT
NU'UANU, KONA DISTRICT, HONOLULU, O'AHU, HAWAI'I

Thank you for your letter dated April 16, 2013 concerning the subject project. We appreciate the time you have taken to review the subject document and acknowledge that you have no comments to offer.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

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

IN REPLY REFER TO:
STP 8.1178

April 17, 2013

Mr. Chester Koga, AICP
Project Coordinator
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Koga:

Subject: Nuuanu Reservoir No. 4 Repair Project
Draft Environmental Assessment (DEA)
TMK: 2-2-054:001 (por.)

Thank you for requesting the State Department of Transportation's (DOT) review of the subject project. DOT understands the Board of Water Supply (BWS) plans to undertake priority maintenance and repair work to the Nuuanu Reservoir No. 4 Dam to meet safety requirements.

DOT does not anticipate any significant adverse impacts to the State transportation facilities (Pali Highway) at this time. We do ask that the BWS consult with the DOT Highways Division, Oahu District Office, throughout the planning and design phase of the project to identify the appropriate access requirements, permits and approval for construction traffic and reconstruction of the reservoir access road.

DOT appreciates the opportunity to provide comments. If there are any questions, including the need to meet with DOT staff, please contact Mr. Garrett Smith of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

BOARD OF WATER SUPPLY

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

May 15, 2013

Glenn M. Okimoto, Ph.D.
Director of Transportation
Department of Transportation
State of Hawaii
869 Punchbowl Street, Room 509
Honolulu, Hawai'i 96813

Dear Dr. Okimoto:

Subject: Draft Environmental Assessment for Proposed
Nu'uanu Reservoir No. 4 Repair Project
Nu'uanu, Kona District, Honolulu, O'ahu, Hawai'i

Thank you for your letter dated April 17, 2013 concerning the subject project. We appreciate the time you have taken to review the subject document and acknowledge that you do not anticipate any significant impacts to Pali Highway.

The Board of Water Supply and its consultant, R. M. Towill Corporation, will continue to consult with your department's Highways Division, O'ahu District Office, throughout the planning and design phase of the project to identify the appropriate access requirements, permits and approval for construction traffic and reconstruction of the reservoir access road.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8305 • Fax: (808) 768-4730 • Internet: www.honolulu.gov

KIRK CALDWELL
MAYOR

MICHAEL D. FORMBY
DIRECTOR

MARK N. GARRITY, AICP
DEPUTY DIRECTOR

TP3/13-508281R

April 18, 2013

Mr. Chester Koga
Planner
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaii 96819-3494

Dear Mr. Koga:

SUBJECT: Draft Environmental Assessment (DEA) for proposed Nuuanu Reservoir No. 4 Repair Project, Nuuanu, Kona District, Honolulu, Oahu, Hawaii

In response to R. M. Towill Corporation's letter of March 25, 2013, we have no comments to offer at this time.

Thank you for the opportunity to review this matter. Should you have any further questions, please contact Michael Murphy of my staff at 768-8359.

Very truly yours,

MICHAEL D. FORMBY
Director

BOARD OF WATER SUPPLY

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

May 15, 2013

TO: MICHAEL D. FORMBY, DIRECTOR
DEPARTMENT OF TRANSPORTATION SERVICES

FROM: ERNEST Y.W. LAU, P.E., MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR PROPOSED NU'UANU RESERVOIR NO. 4 REPAIR PROJECT
NU'UANU, KONA DISTRICT, HONOLULU, O'AHU, HAWAI'I

Thank you for your letter dated April 18, 2013 concerning the subject project. We appreciate the time you have taken to review the subject document and acknowledge that you have no comments to offer.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
SAFE DRINKING WATER BRANCH
919 ALA MOANA BLVD., ROOM 308
HONOLULU, HI 96814-4920

In reply, please refer to:
File: SDWB
DEANuuanuReservoir1.doc

April 19. 2013

Mr. Chester Koga, AICP
Project Coordinator
R. M. Towill Corporation
2024 N. King Street, Suite 200
Honolulu, HI 96819-3494

Dear Mr. Koga:

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (DEA)
NU'UANU RESERVOIR NO. 4 REPAIR PROJECT
HONOLULU, HAWAII

The Safe Drinking Water Branch (SDWB) acknowledges receipt of the DEA dated March 2013, for the subject project. We do not have comments at this time since the scope of work appears to be limited to improving the safety and capacity of the reservoir and does not appear to involve or impact water to be used for drinking purposes.

However, if the Honolulu Board of Water Supply (HBWS) eventually improves the reservoir to serve as a surface water source for drinking water, the HBWS would need to comply with the terms of HAR Section 11-20-29, "Use of new sources of raw water for public water systems." This section requires that all new public water system sources be approved by the Director of Health prior to its use. Infrastructure requirements for surface water reservoirs for drinking water include incorporating features to protect the reservoir from potentially contaminating activities and to ensure that the facility has adequate security.

If there are any questions, please call Mr. Craig Watanabe of the SDWB Engineering Section at 586-4258.

Sincerely,

JOANNA L. SETO, P.E., CHIEF
Safe Drinking Water Branch

CW:slm

c: EPO Reference No. 13-078 (via email only)

BOARD OF WATER SUPPLY

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

May 15, 2013

Ms. Laura Leialoha Phillips McIntyre, AICP
Manager, Environmental Planning Office
Department of Health
State of Hawaii
919 Ala Moana Boulevard, Suite 312
Honolulu, Hawai'i 96814

Dear Ms. McIntyre:

Subject: Draft Environmental Assessment (EA) for Proposed Nu'uanu Reservoir No. 4 Repair Project
Nu'uanu, Kona District, Honolulu, O'ahu, Hawai'I

Thank you for your letter dated April 2, 2013 concerning the subject project. We appreciate the time you have taken to review the subject document. We have also received comments from the State Department of Health, Safe Drinking Water Branch, and have responded to them in a separate letter.

The Final EA will take into account, and incorporate as applicable, the information provided under the Department of Health's standard comments, as well as the sustainable design approaches identified by the U.S. Environmental Protection Agency, the Green Building Council's LEED program, and the Center for Disease Control and Prevention's Health Impact Assessment.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

Hawaiian Telcom

April 19, 2013

R.M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaii 96819
Attention: Chester Koga

Dear Mr. Koga:

Subject: **Public Review of Draft Environmental Assessment (DEA) for proposed Nuuanu Reservoir No. 4 Repair Project**
Nuuanu, Kona District, Honolulu, Oahu, Hawai'i

Thank you for the opportunity to review and comment on the Public Review of Draft Environmental Assessment (DEA) for proposed Nuuanu Reservoir No. 4 Repair Project.

Hawaiian Telcom does not have any comments to offer at this time.

If you have any questions or require assistance in the future on this project, please call me at 546-7761.

Sincerely,

Les Loo
Network Engineer – OSP Engineering
Network Engineering & Planning

cc: File [Puunui]

BOARD OF WATER SUPPLY

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

May 15, 2013

Mr. Les Loo
Network Engineer – OSP Engineering
Network Engineering & Planning
Hawaiian Telcom
P.O. Box 2200
Honolulu, Hawai'i 96841

Dear Mr. Loo:

Subject: Draft Environmental Assessment for Proposed
Nu'uanu Reservoir No. 4 Repair Project
Nu'uanu, Kona District, Honolulu, O'ahu, Hawai'i

Thank you for your letter dated April 19, 2013 concerning the subject project. We appreciate the time you have taken to review the subject document and acknowledge that you have no comments to offer.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 23, 2013

R. M. Towill Corporation
Attention: Chester Koga
2024 N. King Street, Suite 200
Honolulu, HI 96819-3494

via email: chesterk@rmtowill.com

Dear Mr. Koga,

SUBJECT: Public Review of Draft Environmental Assessment (DEA) for proposed Nu`uanu Reservoir No. 4 Repair Project, Nu`uanu, Kona District, Honolulu, O`ahu, Hawai`i

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comments.

At this time, enclosed are comments from (1) Land Division – Oahu District; (2) Office of Conservation & Coastal Lands; (3) Commission on Water Resource Management; and (4) Engineering Division. No other comments were received as of our suspense date. Should you have any questions, please feel free to call Supervising Land Agent Steve Molmen at 587-0439. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 28, 2013

MEMORANDUM

TO: **DLNR Agencies:**
__ Div. of Aquatic Resources
__ Div. of Boating & Ocean Recreation
X Engineering Division
__ Div. of Forestry & Wildlife
__ Div. of State Parks
X Commission on Water Resource Management
X Office of Conservation & Coastal Lands
X Land Division Oahu District
X Historic Preservation

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Public Review of Draft Environmental Assessment (DEA) for proposed Nu'uanu Reservoir No. 4 Repair Project
LOCATION: Nu'uanu, Kona District, Honolulu, TMK (1) 2-2-54:001 (portion)
APPLICANT: Board of Water Supply of the City and County of Honolulu, by its consultant, R. M. Towill Corporation

Transmitted for your review and comment on the above-referenced document. We would appreciate your comments on this document.

The applicant has provided only a single CD-ROM and one bound copy of the DEA, which is available for checkout at our reception area. However, the document is available for download from the Office of Environmental Quality Control (OEQC) website at the address provided in the attached cover letter.

Please submit any comments by April 22, 2013. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

( ) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed: T. Oke
Print Name: Tiffany Oke
Date: 4/8/13

c: Central Files

AJR

OA-13-133

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

RECEIVED
LAND DIVISION
2013 APR 15 PM 4:13
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RECEIVED
OFFICE OF CONSERVATION
AND COASTAL LANDS
2013 APR -1 A 9:55
DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 28, 2013

MEMORANDUM

TO: **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
X Commission on Water Resource Management
X Office of Conservation & Coastal Lands
X Land Division Oahu District
X Historic Preservation

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Public Review of Draft Environmental Assessment (DEA) for proposed Nu`uanu Reservoir No. 4 Repair Project
LOCATION: Nu`uanu, Kona District, Honolulu, TMK (1) 2-2-54:001 (portion)
APPLICANT: Board of Water Supply of the City and County of Honolulu, by its consultant, R. M. Towill Corporation

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Please submit any comments by April 22, 2013. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

( ) We have no objections.
(X) We have no comments.
( ) Comments are attached.

Signed:
Print Name: ALEX ROY
Date: 4/12/2013

c: Central Files

4/16/13

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

RECEIVED
LAND DIVISION
2013 APR 18 AM 10:48
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

2013 APR -2 PM 3:

March 28, 2013

MEMORANDUM

TO: **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
X Commission on Water Resource Management
X Office of Conservation & Coastal Lands
X Land Division – Oahu District
X Historic Preservation

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Public Review of Draft Environmental Assessment (DEA) for proposed Nu'uanu Reservoir No. 4 Repair Project
LOCATION: Nu'uanu, Kona District, Honolulu, TMK (1) 2-2-54:001 (portion)
APPLICANT: Board of Water Supply of the City and County of Honolulu, by its consultant, R. M. Towill Corporation

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Please submit any comments by April 22, 2013. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

(✓) We have no objections.
( ) We have no comments.
( ) Comments are attached.

Signed: [signature]
Print Name: Dean Uyeno
Date: 4/16/2013

c: Central Files

FILE ID: RFD 3792 3
DOC ID: L0883

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

RECEIVED
LAND DIVISION
2013 APR 23 AM 10: 08

RECEIVED
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII
2013 APR 23 AM 11: 22

March 28, 2013

MEMORANDUM

TO: FO

DLNR Agencies:
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
X Commission on Water Resource Management
X Office of Conservation & Coastal Lands
X Land Division – Oahu District
X Historic Preservation

TO:
FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Public Review of Draft Environmental Assessment (DEA) for proposed Nu`uanu Reservoir No. 4 Repair Project
LOCATION: Nu`uanu, Kona District, Honolulu, TMK (1) 2-2-54:001 (portion)
APPLICANT: Board of Water Supply of the City and County of Honolulu, by its consultant, R. M. Towill Corporation

Transmitted for your review and comment on the above-referenced document. We would appreciate your comments on this document.

The applicant has provided only a single CD-ROM and one bound copy of the DEA, which is available for checkout at our reception area. However, the document is available for download from the Office of Environmental Quality Control (OEQC) website at the address provided in the attached cover letter.

Please submit any comments by April 22, 2013. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(✔) Comments are attached.

Signed:
Print Name: Carty S. Chang, Chief Engineer
Date: 4/22/13

c: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/SteveMolmen
RE: BWSDEANuuanuReservoir
Oahu.923

( ) We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone ___.

( ) Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zone ___.

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

( ) Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

( ) Mr. Mario Siu Li at (808) 768-8098 or Ms. Ardis Shaw-Kim at (808) 748-8296 of the City and County of Honolulu, Department of Planning and Permitting.

( ) Mr. Frank DeMarco at (808) 961-8042 of the County of Hawaii, Department of Public Works.

( ) Mr. Carolyn Cortez at (808) 270-7813 of the County of Maui, Department of Planning.

( ) Ms. Wynne Ushigome at (808) 241-4890 of the County of Kauai, Department of Public Works.

( ) The applicant should include water demands and infrastructure required to meet project needs. Please note that projects within State lands requiring water service from the Honolulu Board of Water Supply system will be required to pay a resource development charge, in addition to Water Facilities Charges for transmission and daily storage.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

(X) Additional Comments: A Dam Safety Construction/Alteration Permit would be required for this work, in accordance with HRS Chapter 179D. The applicant should contact the Engineering Division of DLNR for additional information on the Dam Safety Permit requirements and process.

( ) Other: _____

_____

Should you have any questions, please call Ms. Suzie S. Agraan of the Planning Branch at 587-0258.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: 4/22/13

BOARD OF WATER SUPPLY

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

May 15, 2013

Mr. Russell Y. Tsuji
Land Administrator
Land Division
Department of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawai'i 96809

Dear Mr. Tsuji:

Subject: Draft Environmental Assessment (DEA) for Proposed Nu'uanu Reservoir No. 4 Repair Project
Nu'uanu, Kona District, Honolulu, O'ahu, Hawai'I

Thank you for your letter dated April 23, 2013 concerning the subject project. We appreciate the time you have taken to review the subject document and that you routed the DEA to other divisions within your department.

We acknowledge and confirm that we have received the following from the divisions that were consulted:

- The Land Division – Oahu District and the Office of Conservation and Coastal Lands had no comments to offer;
- The Commission on Water Resource Management had no objections;
- The Engineering Division provided comments noting that a Dam Safety Construction / Alteration Permit would be required in accordance with the Hawaii Revised Statutes, Chapter 179D (we will respond to this in a separate letter to the Engineering Division); and
- The State Historic Preservation District did not provide any comments.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

BOARD OF WATER SUPPLY

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

May 15, 2013

Mr. Carty S. Chang
Chief Engineer
Engineering Division
Department of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawai'i 96809

Dear Mr. Chang:

Subject: Draft Environmental Assessment (EA) for Proposed Nu'uanu Reservoir No. 4 Repair Project
Nu'uanu, Kona District, Honolulu, O'ahu, Hawai'I

Thank you for providing comments on the subject project. We appreciate the time that you have taken to review the Draft EA.

We acknowledge your comment that a Dam Safety Construction/Alteration Permit would be required in accordance with Hawaii Revised Statutes Chapter 179D. The permit was listed in the Draft EA Section 5, Necessary Permits and Approvals, so no change to the EA will be necessary. Further consultation will occur with your division through the permitting process.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

Water Resources Research Center

UNIVERSITY of HAWAI'I® MĀNOA

April 23, 2013
EA: 2013-03-23-09

Mr. Michael Matsuo
City & County of Honolulu
Board of Water Supply
630 South Beretania Street
Honolulu, HI 96843
VIA EMAIL TO: mmatsuo@hbws.org

Mr. Chester Koga
R.M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, HI 96819-3494
VIA EMAIL TO: chesterk@rmtowill.com

Dear Mr. Matsuo and Mr. Koga:

Draft Environmental Assessment
Nuuanu Reservoir No. 4 Repair Project, Honolulu, Oahu

The Honolulu Board of Water Supply (BWS) proposes various repairs to the Nuuanu Reservoir No. 4, including the removal, stockpiling, dewatering, transport, and disposal of an uncertain amount of accumulated sediment of unknown quality. Sediment removal, along with repair of the lower level sluice gate and intake tower operational controls, would provide natural and operational potential for altering the volume and quality of water that is released from the reservoir under existing conditions. This review of the BWS's Draft Environmental Assessment (DEA) for the proposed action is a service activity of the University of Hawaii's Water Resources Research Center (WRRC) to help determine and maintain the optimum quality of the environment. It does not represent the official views of the University of Hawaii. The objectives of our review process are to enhance environmental consciousness, encourage cooperation and coordination, and facilitate public participation.

Housekeeping

It would helpful to (1) format the digital document with bookmarks and internal hyperlinks in order to facilitate reader navigation among the sections and subsections of the DEA, and (2) revise the orientation of pages in the digital document so that each on-screen page presents a normal, readable profile that does not require the reader to rotate the page.

Page 1 of the DEA states that "[t]he primary function of the reservoir is to provide flood control . . . ." This is inconsistent with other parts of the document state which repeatedly state that "the primary function of the reservoir . . . is to promote infiltration of rainwater to recharge the groundwater in the Honolulu aquifer." Given the justification provided for the operating level of the reservoir pool, it seems that flood control is the primary function. However, if the reservoir is a significant source of groundwater charge, then it may be useful to provide estimates

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of the reservoir's recharge contribution, including its potential variation with reservoir sedimentation, water storage, and water pool level.

It is unclear how proposed activity 3 in Increment 2, create a subdivision map, is connected with repairs undertaken to meet safety requirements. What is the purpose of the proposed subdivision map?

References

Within the text, citations to some references are incomplete, and some documents that are mentioned in the text are not included in the references. It would be helpful to provide more complete information about references. For example, several pages include mention of the DLNR Dam Safety Program inspection report, dated January 13, 2010, however it appears that this report is not listed in the references. On pages 7 and 30, "[d]aily inflows . . . are reported by the ACOE," however the reporting document is not specified (although the default assumption would be the 2008 dam break analysis, which is the only ACOE publication listed in the references). Page 25 includes mention of a delineation of state jurisdictional waters as determined by the ACOE. It may be useful to provide a citation to the determination document and to include all or part of it in the DEA as an appendix. Page 39 refers to a 1978 inspection report "submitted by the ACOE," however it appears that this document is not listed in the references.

1.3 BASIS FOR THE ENVIRONMENAL ASSESSMENT

It would be useful to clarify the specific parts of Chapter 343, HRS, Section 5(a)(1) that apply to the proposed action. It appears that the proposed action would use state lands only, not county lands. Would the proposed action use state funds, county funds, or both?

PROJECT SUMMARY, Accepting Agency
1.4 PROPOSING AGENCY AND ACCEPTING AUTHORITY

Statutory and regulatory language governing the environmental review process can be confounding with regard to distinguishing between entities responsible for (1) accepting an EIS; (2) issuing a determination that a proposed action requires or does not require an EIS; and (3) requiring an *applicant* to prepare an environmental assessment for a proposed action (emphasis added). For this particular proposed action, it may be useful to clarify:

(1) whether the final authority to accept a final EIS for the proposed action would rest with the governor, the mayor, or an authorized representative, *see* Haw. Stat. § 343-5(d) If the governor or mayor authorized a representative to accept a final EIS, then it would be useful to provide documentation of that authorization.

(2) why the proposing agency (BWS) is treating the proposed action as an *applicant* action rather than as an *agency* action (emphasis added). It is unclear why DLNR is identified as the "accepting authority" for the proposed action, or is otherwise involved in the processing of another proposing agency's environmental assessment.

2.1.5 RESERVOIR FEATURES

Given that "stream flow in the watershed increases uniformly in response to high-intensity precipitation," it may be useful to present estimates of peak daily inflows under a range of above-average rainfall intensities. Similarly, it may be useful to provide estimates of low-flow inflows. More importantly, what is the daily average, peak, and low-flow released from the reservoir into Nuuanu Stream?

What additional information is available about the depth of accumulated sediments and associated reduction in water storage capacity throughout the reservoir? If an area-capacity curve is available for this reservoir, it may be useful to include it in the DEA.

The concrete spillway structure transitions into an earthen discharge channel on the downstream side of the dam embankment to convey water back to Nuuanu Stream. Under what conditions does water flow over the spillway? The proposed action includes one such scenario that would occur during the construction period. Depending on spillway overflows and the extent and condition of the earthen discharge channel, it may be useful to discuss post-construction management measures that would reduce erosion and sediment transport associated with this source area.

What is the conveyance capacity of the outlet tunnel and the maximum velocity of released flows? Would the proposed action increase this capacity and flow velocity? What management measures would be implemented to minimize the effects of such increases?

2.2.1 SEDIMENT REMOVAL

It would be useful to clarify the total area of proposed excavation and total quantity of material that would be removed the reservoir basin. Page 17 indicates that 12,265 CY of material would be removed from 0.55 acres around the intake tower, whereas page 25 indicates that 72,000 CY of material would be removed from a 3 acre area around the intake tower.

This is particularly important in determining the size and delineation of the stockpile area, the transportation and traffic-related effects of moving the stockpiled material off-site, and the capacity of off-site use and disposal areas to accept the material. Is there adequate demand for fill and topsoil on Oahu? Where does that demand generally occur, and what vehicle types and how many vehicle miles would be necessary to meet this demand?

3.1.3 SOILS AND GEOLOGY

Although the Phase 1 ESA report did not identify any current or historical activities within the watershed area of Nuuanu Reservoir No. 4 that are likely to have contributed to contamination of reservoir sediments, it is unclear whether or not BWS assessed potential contributions from Pali Highway runoff and its MS4 drainage system. If the MS4 discharges to streams that feed Nuuanu Reservoir, then it may be useful to characterize and assess the potential for associated reservoir pollutant loading and sediment contamination. For example, please see the results of the National Water Quality Assessment for Oahu (various publications, *see*

http://hi.water.usgs.gov/studies/nawqa) and Andrews, S. & R.A. Sutherland, 2004, Cu, Pb and Zn contamination in Nuuanu watershed, Oahu, Hawaii, *Science of the Total Environment* 324(1-3):173-82.

2.4 ALTERNATIVES CONSIDERED

Given ongoing challenges facing the security and sustainability of island water, food, and energy supply, it may be useful to consider alternative that remove greater amounts of sediment from the reservoir and provide larger increases in reservoir storage capacity. The DEA notes the historic use of the reservoir to provide hydroelectric power. It may be helpful for the DEA to discuss how the proposed action, and other alternatives, would support and inhibit future efforts to reactivate such use.

3.1.4 WATER RESOURCES

Wetlands

It may be useful to specify and reference the source of the information used to determine the USFWS wetland classifications and delineations presented on pages 32 and 33.

Water Quality Regulatory Setting

In addition to the water quality impairments listed for Nuuanu Stream, it would be useful to indicate the listed impairments for Honolulu Harbor (the marine receiving water for the stream).

What is the basis for assuming that Nuuanu stream impairments are limited to "its lower segments?" The current EPA-approved 303(d) list does not include such a distinction, and the DOH Water Quality Monitoring and Assessment Report indicates that the stream's impaired status applies to its entire freshwater hydrologic network.

It would be useful to (1) clarify the basis for assuming that "[w]ithin the reservoir area [and for approximately one-half mile downstream], Nuuanu Stream is designated as "Class 1" inland water," and (2) explicitly identify the waterbody class of the reservoir itself. Nuuanu Reservoir itself is not a "stream" in the DOH regulatory sense, although it may be considered part of a "stream system." According to the DEA, the reservoir is located in the Resource Subzone of the Conservation District, which does not confer Class 1 status. If there are Class 1 waters upstream and downstream of the reservoir, it would be useful to delineate them on a map and to indicate the basis for such classification.

Water Quality Sampling and Interpretation

What was the sampling depth within the reservoir? What was the reservoir level, inflow and outflow rates, and antecedent rainfall situation at the time of sampling? How might reservoir water quality respond to changes in these variables?

Because the BWS releases reservoir water into lower reaches of Nuuanu Stream, it would have been useful to sample near the intakes/sluice gates for the outlet tunnel, the tunnel release point, and downstream locations in the stream order to provide an additional basis for assessing the relationship between reservoir water quality and downstream receiving water quality. This could help BWS to analyze how it might modify reservoir operations to reduce downstream pollutant loading and aid the scientific management of downstream inland and marine receiving water quality.

What is the basis for concluding that "the water quality in the reservoir is typical for impounded waters in Hawaiian watersheds?" Watersheds and their impounded waters occur statewide in a wide range of settings, and DOH water quality inventories and monitoring and assessment reports contain little if any quantitative information about impoundment water quality. Thus it may be useful for the DEA to indicate sources of data that could be used to support this conclusion.

Similarly, what is the basis for concluding that water quality in Nuuanu Stream in the vicinity of the reservoir is "generally excellent?" As noted above, these waters are listed as impaired by DOH, and their "undeveloped wilderness environment" includes steep slopes, invasive species, feral ungulates, and other disturbances that negatively effect the biological, chemical, and physical integrity of watershed health, as manifested for example by leptospirosis.

It seems possible that clearance of the 40-foot long paved ditch segment at the base of the intake tower may provide a pathway for increased sediment transport out of the reservoir. However, the planned repairs seem to provide BWS with many opportunities to implement structural and operational improvements that would further reduce the sediment load delivered to downstream receiving waters, and it may be useful for the DEA to further summarize such measures (e.g. enhanced screening at the intake sluice gate) in explaining how the proposed action would help to reduce pollutant loads, improve water quality, and repair ecosystem health in downstream receiving waters.

ADDITIONAL COMMENTS

The DEA notes that DLNR has no current plans to restart the fishing program in the reservoir. Under these circumstances, it may be useful for BWS to consider stricter management of invasive species in the reservoir and the implementation of activities that would enhance the restoration of habitat for native stream organisms and the recovery of native species population throughout the Nuuanu stream system. In this regard, Nuuanu has been the subject of several field assessments of habitat quality and biotic integrity that would provide useful baseline information.

Also, it would be useful for BWS to check with the Hawaii National Hydrography Dataset Stewardship (NHD) to assure that the flowpaths and other hydrographic features and hydrologic events associated with the reservoir are properly represented in the NHD.

Thank you for considering this review of the Draft Environmental Assessment for the Nuuanu Reservoir No.4 Repair Project. Please contact me at 956-7361 if you wish to discuss our comments, and send us one printed copy of the Final Environmental Assessment when it is published.

Sincerely,

David Penn

David Penn, Ph.D.
Assistant Specialist, Environmental Assessment & Protection

copy: State of Hawaii Office of Environmental Quality Control (OEQC)
Chittaranjan Ray, Interim Director, Water Resources Research Center

BOARD OF WATER SUPPLY

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

June 3, 2013

David Penn, Ph.D.
Assistant Specialist, Environmental
Assessment & Protection
Water Resources Research Center
University of Hawai'i at Mānoa
2540 Dole Street, Holmes Hall 283
Honolulu, Hawaii 96822

Dear Dr. Penn:

Subject: Your Letter Dated April 23, 2013, Regarding the Draft Environmental Assessment for the Proposed Nuuanu Reservoir No. 4 Repair Project, Honolulu, O'ahu

Thank you for your letter. We appreciate the time you spent reviewing the Draft Environmental Assessment (DEA) and offer the following responses to your comments:

Housekeeping:

1. The DEA will be revised to include bookmarks for easier reader navigation among sections and subsections. In addition, the orientation of the pages in the appendices will be revised to match the format of the main body of the DEA.

2. The primary purpose of the reservoir when it was first constructed was to serve as a drinking water source. Since 1934, the purpose of the reservoir has been for flood control. The DEA will be revised to make the reservoir's purpose consistent throughout. Ground water recharge was neither an initial design element nor the primary purpose of the reservoir. Thus, estimates of the reservoir's recharge contribution, and its potential variation with sedimentation, water storage and water pool levels will not be addressed in the DEA.

3. The basis for subdivision of the reservoir from Tax Map Key (1) 2-2-054:001 is largely due to the size of the parcel and liability. The estimated area of the parcel in question is over 1,100 acres, the disturbed area is 5 acres, and the impoundment area under normal pool conditions is 10 acres. Section 5 (Necessary Permits and Approvals) of the DEA will be revised to include the Subdivision Application to the City Department of Planning and Permitting.

4. The DEA will be revised to make the citations complete and to ensure that all documents mentioned in the text are included in Section 9 (References) of the DEA. Standard practice is to include as appendices to the DEA only those documents, correspondence, studies, reports, etc. that were prepared specifically for, or are directly related to, the DEA. Attaching every referenced document would make the DEA unwieldy.

Section 1.3 Basis for the Environmental Assessment:

1. The use of state lands and use of county funds are the specific criteria under Section 5 (a) (1) of Chapter 343, Hawaii Revised Statutes that apply to the proposed action. The land on which the reservoir is located is owned by the State of Hawaii and the repair work is being funded by the Board of Water Supply, City and County of Honolulu (BWS).

Section 1.4 Proposing Agency and Accepting Authority:

1. Because the repair work is being performed on county-operated infrastructure using county funds through BWS, BWS is both the proposing agency and accepting authority for the Environmental Assessment. The DEA will be revised to provide greater clarity.

Section 2.1.5 Reservoir Features:

1. Estimates of peak daily and low-flow inflows under a range of above-average rainfall intensities, and the daily average, peak and low-flow released from the reservoir into Nuuanu Stream are not available. The U.S. Army Corps of Engineers *Dam Break Analysis for Nu'uanu Reservoir (H1001)*, however, cites data obtained from the U.S. Geologic Survey that inflow measured at its stream gage No. 16232000 averages about 4 to 5 cubic feet per second (CFS) during summer months and 9 to 10 CFS during winter months.

2. Information about the depth of accumulated sediments and the associated reduction in water storage capacity throughout the reservoir is not available.

3. The spillway, which is located at an elevation of 1,024.5 feet above mean sea level would only be utilized in the event of a failure or blockage of all three sluice gates on the reservoir intake tower. Under normal pool conditions, the reservoir holds 120 acre-feet; top of dam capacity estimates are 3,600 acre-feet. The spillway would be used prior to the reservoir reaching its top of dam capacity. The

spillway has been utilized in overflow conditions six (6) times; five (5) occurrences between 1936 and 1938, and on New Year's Day 1988 as indicated in *A History of Nu'uanu Reservoir* by Chester Lao. As no work is proposed for the spillway and earthen discharge channel and they will continue to operate as originally envisioned, we do not feel it is necessary to discuss any post-construction management measures to reduce erosion and sediment transport from these areas in the DEA.

4. The conveyance capacity of the 24-inch drain line in the outlet tunnel is estimated to be approximately 83 CFS. The maximum velocity of released flows is estimated to be 26 feet per second. The above is assuming water enters the drain line at the lowest sluice gate and there are no losses through the drain line. The proposed action is not increasing the conveyance capacity or flow velocity of the 24-inch drain line. Thus, no management measures are being implemented.

Section 2.2.1 Sediment Removal:

1. The DEA will be corrected so that the amount of excavated sediment will be 12,265 cubic yards from 0.60 acres.

2. The excavated material will be placed in a detention basin where it will be allowed to dewater before removal from the site. The dredged material will be disposed of by the project contractor at an approved disposal site. Deciding how to dispose of the excavated material is the responsibility of the contractor. Thus, information on demand for fill and topsoil, vehicle types and number of vehicle miles is not known.

Section 3.1.3 Soils and Geology:

1. During the preparation of the DEA, a Phase I Environmental Site Assessment and water quality and sediment analyses were performed. We acknowledge that runoff from Pali Highway enters the reservoir at its higher reaches. However, while there is a potential for contaminants to enter the reservoir, the testing performed did not detect items that require action.

Section 2.4 Alternatives Considered:

1. The proposed action is for maintenance and repair purposes to ensure that the dam operates as it was designed to and to reduce the risk of flooding from a dam failure. With the lowered normal pool levels, hydroelectric power is not seen as a feasible option.

Section 3.1.4 Water Resources:

1. Since the U.S. Fish and Wildlife Service has the requisite expertise to determine the wetland classifications and delineations, we do not believe it is necessary to specify and reference the basis of these classifications and delineations in the DEA.

2. Listing impairments for Honolulu Harbor is not relevant to the proposed action. Honolulu Harbor is impacted by impairments that are unrelated to the operation of the dam and not under the control of BWS.

3. The basis for assuming that Nuuanu Stream impairments are limited to "its lower segments" is the fact that these segments pass through heavily populated and urbanized areas, where trash, turbidity, nutrients and pesticides from urban uses are most prevalent.

4. Because the State Department of Health has the requisite expertise to classify Nuuanu Stream as Class 1 inland water, we do not believe it is necessary to provide their basis for this classification in the DEA.

5. Explicitly identifying the water body class of the reservoir and delineating Class 1 waters upstream and downstream of the reservoir on a map in the DEA are not relevant to the proposed action. No changes are being made to where water in the reservoir is coming from, nor does BWS have any control over these sources. Also, the character of the reservoir and its operation will not change once the proposed action is completed.

6. Water quality sampling depth in the reservoir, other than at the North End, where the sampling depth was 4.5 feet, is not known. Also, reservoir level, inflow and outflow rates, and antecedent rainfall situation at the time of sampling is not known. Thus, it is not known how reservoir quality would respond to changes in these parameters. But, since the operation of the reservoir is not being significantly modified by the proposed action, we do not feel that such additional information is relevant.

7. While assessing the relationship between reservoir water quality and downstream receiving water quality might be beneficial, it is not relevant to the intent of the proposed action. BWS's intent is to ensure that the dam operates properly, as it was designed to many years ago, not to make any improvements to its operation or reduce downstream impacts.

8. The basis that water quality is "typical for impounded waters" originates from the Biological Survey performed by AECOS, Inc. (see DEA Appendix D, page 13).

9. "Generally excellent" in context is in comparison to the quality of the lower segments of Nuuanu Stream, which are impaired by trash, turbidity, nutrients, and pesticides unrelated to the management and operation of the dam or reservoir.

10. Implementing improvements to further reduce sediment load delivered to downstream receiving waters and explaining how they would help reduce pollutant loading, improve water quality, and repair downstream receiving water ecosystem health are all beyond the scope of the proposed action for the reasons mentioned above.

Additional Comments:

1. BWS understands the value of upper Nuuanu as an important biological resource and is doing its part to protect this resource. But, because the reservoir is open to others, BWS cannot ensure that the area is totally protected from the introduction of invasive species.

2. BWS will be examining the Hawai'i National Hydrography Database Stewardship to update the information available, as necessary. The primary purpose of this project is dam maintenance; to ensure the dam can and will operate as it was designed to and not to make major modifications that are not needed at this time.

Any further comments can be directed to Michael Matsuo at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
2013-TA-0224

APR 2 6 2013

Mr. Chester Koga
R. M. Towill Corporation
2024 N. King Street, Suite 200
Honolulu, Hawaii 96819-3494

Subject: Technical Assistance for the Draft Environmental Assessment for the proposed Nuuanu Reservoir No. 4 Repair Project, Oahu

Dear Mr. Koga:

The U.S. Fish and Wildlife Service (Service) received your letter on March 27, 2013, requesting our comments to the draft Environmental Assessment (DEA) for the proposed repair work to the Nuuanu Reservoir No. 4, located in Nuuanu Valley, Oahu [TMK (1) 2-2-54:001]. The reservoir infrastructure, including the dam and appurtenances, is owned and operated by the Board of Water Supply. The primary function of the reservoir is to provide flood control for Nuuanu Valley and part of downtown Honolulu that lies within the Nuuanu Stream corridor. Discharges from the reservoir flow into Nuuanu Stream and through downtown Honolulu before entering the Pacific Ocean at Honolulu Harbor. We understand the proposed repair work is required to maintain the integrity and operational adequacy of the dam infrastructure for purposes of safety and control. The project will be undertaken in two increments to include:

1. Remove, stockpile, dewater, and dispose of accumulated sediments from the reservoir basin.
2. Repair and rehabilitate the existing reservoir intake tower structure, including repairs to the lower level sluice gate, debris cages (trash racks) over the three sluice gates, exterior ladder structure, and operational controls located within the tower.
3. Replace shattered window panes in the intake tower.
4. Inspect and repair cables supporting the gangway leading to the intake tower and the handrails along the gangway flanks.
5. Recalibrate and repaint water level markings on the existing intake tower.
6. Construct measuring weirs at existing seepage points on the downstream slope and outlet structure of the reservoir dam.
7. Improve the outlet receiving area by replacing the existing outlet pipe, extending the 24-inch drain pipe to a total length of approximately 188 LF, and constructing a hydro-geo stilling basin to the north of the outlet pipe.

8. Inspect and clean the existing outlet tunnel structure.
9. Remove the temporary access road located on the downstream face of the dam embankment and restore the embankment slope to a uniform condition.
10. Repair and repave the existing reservoir access road on the top of the dam.
11. Inspect the downstream dam slope and repair CRM riprap deficiencies and depressions on the upstream face of the reservoir dam.
12. Conduct geotechnical investigative borings.
13. Install new measuring devices, including piezometers, analyze and monitor dam stability as required based on geotechnical investigation.
14. Create a subdivision map for Nuuanu Reservoir No. 4.

We have reviewed the information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program and the Hawaii GAP Program. Our data indicate that the federally endangered Hawaiian stilt (*Himantopus mexicanus knudseni*), endangered Hawaiian moorhen (*Gallinula chloropus sandvicensis*), endangered Hawaiian coot (*Fulica alai*), endangered Hawaiian duck (*Anas wyvilliana*) (collectively referred to as Hawaiian waterbirds), and endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) may be present in the vicinity of the proposed site. We offer the following recommendations to assist you in avoiding and minimizing impacts to listed species.

Hawaiian Waterbirds

Our records indicate there is a high probability that Hawaiian waterbirds may occur in the vicinity of the proposed project. We recommend you incorporate the following measures into your project description to avoid and minimize impacts to listed Hawaiian waterbirds:

- A biological monitor should conduct Hawaiian waterbird and nest surveys at the proposed project site prior to project initiation (please see the Service's recommended Hawaiian Waterbird Survey Protocols, attached).

- Any documented nests or broods within the project vicinity should be reported to the Service within 48 hours.

- A 100-foot buffer should be established and maintained around all active nests and/or broods until the chicks/ducklings have fledged. No potentially disruptive activities or habitat alteration should occur within this buffer.

- The Service should be notified immediately prior to project initiation and provided with the results of pre-construction Hawaiian waterbird surveys.

- A biological monitor(s) should be present on the project site during all construction or earth moving activities to ensure that Hawaiian waterbirds and nests are not adversely impacted.

- If a listed Hawaiian waterbird is observed within the project site, or flies into the site while activities are occurring, the biological monitor should halt all activities within 100

feet of the individual(s). Work should not resume until the Hawaiian waterbird(s) leave the area on their own accord.

- A post-construction report should be submitted to the Service with 30 days of the completion of the project. The report should include the results of Hawaiian waterbird surveys, the location and outcome of documented nests, and any other relevant information.

Because the proposed activities may impact water resources that provide habitat for listed Hawaiian waterbirds, we are attaching the Service's recommended Best Management Practices regarding sedimentation and erosion in aquatic environments. We encourage you to incorporate the relevant practices into your project design.

Hawaiian Hoary Bat

The Hawaiian hoary bat roosts in both exotic and native woody vegetation and young that are not capable of flight may be present in "nursery" trees and shrubs. If trees or shrubs suitable for bat roosting are cleared during the breeding season, there is a risk that young bats could inadvertently be harmed or killed. To minimize impacts to the endangered Hawaiian hoary bat, woody plants greater than 15 feet (4.6 meters) tall should not be disturbed, removed, or trimmed during the bat birthing and pup rearing season (June 1 through September 15). Site clearing should be timed to avoid the pupping period to minimize disturbance to Hawaiian hoary bats in the project area.

If a project is funded, authorized, or permitted by a Federal agency, and it may affect listed species or critical habitat, then the agency is required to consult with the Service pursuant to section 7(a)(2) of the ESA. It is the Federal agency's responsibility to determine if the proposed project "may affect" federally listed species or designated critical habitat. Projects that are determined to have "no effect" on federally listed species and critical habitat do not require consultation with the Service. A "may affect, not likely to adversely affect" determination is appropriate when effects to federally listed species are expected to be discountable (*i.e.*, unlikely to occur), insignificant (minimal in size), or completely beneficial. This conclusion requires written concurrence from the Service. If adverse impacts to listed species cannot be fully avoided, the federal agency should make a "may affect, likely to adversely affect" determination and formally consult with the Service, resulting in a biological opinion. If no Federal agency is involved with the proposed project and the proposed project may result in incidental take of listed species, that applicant should apply for an incidental take permit under section 10(a)(1)(B) of the ESA. A section 10 permit application must include a habitat conservation plan that specifies the impact that will likely result from incidental take; what steps the applicant will take to minimize and mitigate such impacts; and the funding that will be available to implement these steps.

We appreciate your efforts to conserve protected species. If you have questions regarding this letter, please contact Jiny Kim, Fish and Wildlife Biologist (phone: 808-792-9400; email: jiny_kim@fws.gov).

Sincerely,

Loyal Mehrhoff
Field Supervisor

Enclosure

U.S. Fish and Wildlife Service
Recommended Standard Best Management Practices

The U.S. Fish and Wildlife Service recommends that the measures below be incorporated into projects to minimize the degradation of water quality and minimize the impacts to fish and wildlife resources.

1. Turbidity and siltation from project-related work shall be minimized and contained within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions.

2. Dredging/filling in the marine environment shall be scheduled to avoid coral spawning and recruitment periods and sea turtle nesting and hatching periods.

3. Dredging and filling in the marine/aquatic environment shall be designed to avoid or minimize the loss special aquatic site habitat (beaches, coral reefs, wetlands, etc.) and the function of such habitat shall be replaced.

4. All project-related materials and equipment (dredges, barges, backhoes, etc.) to be placed in the water shall be cleaned of pollutants prior to use.

5. No project-related materials (fill, revetment rock, pipe, etc.) should be stockpiled in the water (intertidal zones, reef flats, stream channels, wetlands, etc.) or on beach habitats.

6. All debris removed from the marine/aquatic environment shall be disposed of at an approved upland or ocean dumping site.

7. No contamination (trash or debris disposal, non-native species introductions, attraction of non-native pests, etc.) of adjacent habitats (reef flats, channels, open ocean, stream channels, wetlands, beaches, forests, etc.) shall result from project-related activities. This shall be accomplished by implementing a litter-control plan and developing a Hazard Analysis and Critical Control Point Plan (HACCP – see http://www.haccp-nrm.org/Wizard/default.asp) to prevent attraction and introduction of non-native species.

8. Fueling of project-related vehicles and equipment should take place away from the water and a contingency plan to control petroleum products accidentally spilled during the project shall be developed. Absorbent pads and containment booms shall be stored on-site, if appropriate, to facilitate the clean-up of accidental petroleum releases.

9. Any under-layer fills used in the project shall be protected from erosion with stones (or core-loc units) as soon after placement as practicable.

10. Any soil exposed near water as part of the project shall be protected from erosion (with plastic sheeting, filter fabric etc.) after exposure and stabilized as soon as practicable (with native or non-invasive vegetation matting, hydroseeding, etc.).

BOARD OF WATER SUPPLY

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

May 15, 2013

Mr. Loyal Mehrhoff
Field Supervisor
Pacific Islands Fish and Wildlife Office
Fish and Wildlife Service
U.S. Department of the Interior
300 Ala Moana Boulevard, Room 3-122 Box 50088
Honolulu, Hawai'i 96850

Dear Mr. Mehrhoff:

Subject: Draft Environmental Assessment (EA) for Proposed
Nu'uanu Reservoir No. 4 Repair Project
Nu'uanu, Kona District, Honolulu, O'ahu, Hawai'i
Reference: 2013-TA-0224

Thank you for your letter dated April 26, 2013 concerning the subject project. We appreciate the time you have taken to review the subject document.

In the Biological Survey performed by AECOS, Incorporated, in December 9, 2011, no endangered birds or mammals were observed and no nests or broods were found. The Draft EA already identifies the potential of the endangered Hawaiian hoary bat roosting in the site area and identifies potential impacts and mitigation measures to be taken before, during, and after construction.

The Final EA will be amended to include the four endangered Hawaiian waterbirds in the section on Avifauna. In addition, Impacts and Mitigation Measures for the section on Flora and Fauna have been amended to include your comments below:

- Any documented nests or broods within the project vicinity should be reported to your office within 48 hours.

- A 100-foot buffer should be established and maintained around all active nests and/or broods until the chicks/ducklings have fledged. No potentially disruptive activities or habitat alteration should occur within this buffer.

- Your office would be notified immediately, prior to project initiation, and provided with the results of pre-construction Hawaiian waterbird surveys.

- A post-construction report should be submitted to your office within thirty (30) days of the completion of the project. The report should include the results of Hawaiian waterbird surveys, the location and outcome of documented nests, and any other relevant information.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
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KIRK CALDWELL
MAYOR

GEORGE I. ATTA, FAICP
DIRECTOR DESIGNATE

ARTHUR D. CHALLACOMBE
DEPUTY DIRECTOR

2013/ELOG-637 (ts)

April 30, 2013

Mr. Chester Koga
R. M. Towill Corporation
2024 N. King Street, Suite 200
Honolulu, Hawai'i 96819-3494

Dear Mr. Koga:

SUBJECT: Public Review of Draft Environmental Assessment (DEA)
for Proposed Nu'uanu Reservoir No. 4 Repair Project
Nu'uanu, Tax Map Key: 2-2-54: 1 (portion)

We have received your memorandum dated March 25, 2013 with the request to review and comment on the attached Draft Environmental Assessment (DEA) dated March 2013 for the Nu'uanu Reservoir No. 4 Repair Project. The DEA identifies the affected parcels as Tax Map Key (TMK): 2-2-54: 1 (portion). We offer the following comments:

- Please describe the significance and boundaries of the Kona District in the DEA.

- Please clarify the purpose for creation of a Subdivision Map for Nu'uanu Reservoir No. 4, as listed under Increment 2, Item 3 of the proposed action for repair work. No subdivision action is listed in Section 5, Necessary Permits and Approvals.

- Our records indicate that the parcel identified as TMK: 2-2-54: 1 for permitting purposes will require consultation with the Department of Land and Natural Resources Historic Preservation Division to verify its historic status, as listed on the Historic Site Register.

Should you have any questions, please contact Tim Streitz of my staff at 768-8042 or tstreitz@honolulu.gov.

Very truly yours,

George I. Atta, FAICP, Director
Department of Planning and Permitting

GIA:bkg
1035089

cc: Michael Matsuo, Board of Water Supply

BOARD OF WATER SUPPLY

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

May 15, 2013

TO: GEORGE I. ATTA, FAICP, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

FROM: ERNEST Y.W. LAU, P.E., MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (EA) FOR PROPOSED NU'UANU RESERVOIR NO. 4 REPAIR PROJECT
NU'UANU, KONA DISTRICT, HONOLULU, O'AHU, HAWAI'I

Thank you for your letter dated April 4, 2013 concerning the subject project. We appreciate the time you have taken to review the subject document.

Based on your comments, the Final EA will be revised to include a more detailed description of the project location in Section 2.1.1, the ahupua'a of Honolulu, and the Kona District.

Subdividing the reservoir from Tax Map Key 2-2-054:001, will be done largely due to the size of the parcel and liability. The estimated area of the original parcel is over 1,100 acres, the disturbed area is 5 acres, and the impoundment area under normal pool condition is 10 acres. Section 5, Necessary Permits and Approvals, has been amended to include the Subdivision Application.

The State Department of Land and Natural Resources (DLNR) has been consulted and is the organization that produced the Dam Safety Inspection Report, which prioritized repair work for the reservoir, as required by the Hawai'i Dam Safety Program and Hawaii Revised Statutes Chapter 179D. The DLNR Historic Preservation Division had an opportunity to respond to the Draft EA, but did not provide any comments.

Any further comments can be directed to Michael Matsuo of our Land Division at 748-5951.

NEIL ABERCROMBIE
GOVERNOR

MAJOR GENERAL DARRYLL D. M. WONG
DIRECTOR OF CIVIL DEFENSE

DOUG MAYNE
VICE DIRECTOR OF CIVIL DEFENSE

PHONE (808) 733-4300
FAX (808) 733-4287

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

May 8, 2013

Mr. Michael Matsuo
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Matsuo:

Public Review of Draft Environmental Assessment (DEA),
Proposed Nuuanu Reservoir No. 4 Repair Project

Thank you for the opportunity to participate in this Pre-Assessment Consultation. As per our Pre Consultation letter dated December 2, 2010, we reiterate the need to address potential dam breaches, evacuation and emergency road egress for both flooding and wild land fires. We also recommend monitoring or potential dam cresting.

If you have any questions of concerns, please contact Mr. Ian Duncan, Sate Hazard Mitigation Officer, at 733-4300, extension 555.

Sincerely,

DOUG MAYNE
Vice Director of Civil Defense

Enc.

c: Mr. Chester Koga, AICP, R. M. Towill Corporation

BOARD OF WATER SUPPLY

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

June 3, 2013

Mr. Doug Mayne
Vice Director of Civil Defense
Office of the Director of Civil Defense
Department of Defense
State of Hawaii
3949 Diamond Head Road
Honolulu, Hawaii 96816

Dear Mr. Mayne:

Subject: Your Letter Dated May 8, 2013, Regarding the Draft Environmental Assessment for the Proposed Nuuanu Reservoir No. 4 Repair Project, Nuuanu, Kona District, Honolulu, Oahu, Hawaii

Thank you for your letter. We appreciate the time you spent reviewing the Draft Environmental Assessment (DEA).

When completed, the planned work identified in the DEA will not only ensure that the dam continues to operate in a safe and efficient manner, but also reduce the risk of dam breaches and failures. In particular, removal of sediments blocking the lowest sluice gates will lower the overall water level in the reservoir by approximately 17 feet; from an elevation of 993.5 feet above mean sea level (MSL) at the middle gate to 975.75 feet above MSL at the lowest gate. In addition, regular clearing and grubbing of vegetation will be performed to ensure easier visual dam inspection, provide access to the face of the dam and prevent undermining of the dam structure and spillway. In addition, in compliance with Hawaii Revised Statutes §179D-30, an Emergency Action Plan (EAP) was prepared to address emergency conditions, such as dam breaches, and evacuations of affected communities.

Other than resurfacing the access road to and on top of the dam to aid general access for maintenance activities, no additional access roads are being planned. Providing additional access roads for wild land fires is beyond the scope of this project.

Regarding monitoring of potential dam cresting, we regularly take water level readings from the reservoir and have procedures in the EAP for initiating emergency actions when reservoir water levels are nearing the dam crest.

Any further comments can be directed to Michael Matsuo at 748-5951.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer