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

ROBERT J. KRONING, P.E.
DIRECTOR

MARK YONAMINE, P.E.
DEPUTY DIRECTOR

WW.CSE 17-086

July 12, 2017

Mr. Scott Glenn, Director
Office of Environmental Quality Control (OEQC)
State Department of Health
235 South Beretania Street, Room 702
Honolulu, Hawaii 96813

Dear Mr. Glenn,

SUBJECT: Draft Environmental Assessment
Dowsett Highlands Relief Sewer
Nuuanu, Oahu, Hawaii

The City and County of Honolulu Department of Design and Construction has reviewed the Draft Environmental Assessment for the subject project, and anticipates a Finding of No Significant Impact. Please publish notice in the July 23, 2017, issue of the OEQC *Environmental Notice*.

We have enclosed a completed OEQC Publication Form and two (2) hardcopies of the Draft EA, and a CD containing electronic files of these documents in MS-Word and PDF format, respectively. Please contact our consultant for this project, Lance Fukumoto of Fukunaga & Associates, Inc. at (808) 944-1821, should you have any questions or concerns.

Very truly yours,

for M. Yonamine

Robert J. Kroning, P.E.
Director

Enclosures

18-014.

AGENCY
PUBLICATION FORM

Project Name:	Dowsett Highlands Relief Sewer
Project Short Name:	(please use no more than five succinct words; count not to include document status, e.g., EA)
HRS §343-5 Trigger(s):	Propose the use of state and county lands and the use of county funds
Island(s):	Oahu
Judicial District(s):	Honolulu
TMK(s):	N/A
Permit(s)/Approval(s):	Permit to Perform Work Upon State Highways Use and Occupancy Agreement within the State Right-of-Way Community Noise Variance National Pollution Discharge Elimination System (NPDES) Permit Street Usage Permit Trenching Permit Construction Dewatering Permit
Proposing/Determining Agency:	City and County of Honolulu, Department of Design and Construction
Contact Name, Email, Telephone, Address	Ms. Shelle Silva, P.E. shelle.silva@honolulu.gov (808) 768-8763 Wastewater Division Department of Design and Construction City and County of Honolulu 650 South King Street, 14th Floor Honolulu, HI 96813
Accepting Authority:	(for EIS submittals only)
Contact Name, Email, Telephone, Address	
Consultant:	Fukunaga & Associates, Inc.
Contact Name, Email, Telephone, Address	Mr. Lance Fukumoto, P.E. lfukumoto@fukunagaengineers.com (808) 944-1821 1357 Kapiolani Blvd., Suite 1530 Honolulu, HI 96814

Status (select one)	**Submittal Requirements**
__X__ DEA-AFNSI	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.
____ FEA-FONSI	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.
____ FEA-EISPN	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.
____ Act 172-12 EISPN ("Direct to EIS")	Submit 1) the proposing agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice.
____ DEIS	Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a

	searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.
____ FEIS	Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice.
____ FEIS Acceptance Determination	The accepting authority simultaneously transmits to both the OEQC and the proposing agency a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
FEIS Statutory Acceptance	Timely statutory acceptance of the FEIS under Section 343-5(c), HRS, is not applicable to agency actions.
____ Supplemental EIS 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 or is not required; no EA is required and no comment period ensues upon publication in the Notice.
____ Withdrawal	Identify the specific document(s) to withdraw and explain in the project summary section.
____ Other	Contact the OEQC if your action is not one of the above items.

Project Summary

The proposed project will improve the City and County of Honolulu's sanitary sewer system by addressing hydraulic capacity inadequacy in existing trunk sanitary sewers, while also addressing structural and operation and maintenance issues. These improvements primarily include the construction of new relief sewers within city and state right-of-ways, and also include replacement/relief sewers, and repair and rehabilitation of existing sewers, to address local conditions. The primary project to implement these improvements will be the City and County of Honolulu Department of Design and Construction's Dowsett Highlands Relief Sewer Project, Job Nos. 05-17 and 06-17, which will involve the design and construction of approximately 14,500 linear feet of 8-inch to 24-inch diameter new gravity relief sewers with a main alignment along Nu'uanu Pali Drive, Dowsett Avenue, Pali Highway and Nu'uanu Avenue, ending at School Street. The proposed project will have short-term traffic impacts associated with construction which will be coordinated with city and state agencies and the general public. No long-term impacts are anticipated.

Dowsett Highlands Relief Sewer

DRAFT
ENVIRONMENTAL ASSESSMENT

Prepared for:
City and County of Honolulu
Department of Design and Construction

Prepared by:
Fukunaga & Associates, Inc.
1357 Kapiʻolani Blvd., Suite 1530
Honolulu, Hawaiʻi 96814

July 2017

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LIST OF ABBREVIATIONS

ALISH	Agricultural Lands of Importance to the State of Hawai‘i
AMP	Archaeological Monitoring Plan
APE	Area of Potential Effect
BMP	Best Management Practices
CCH	City and County of Honolulu
CCTV	Closed Circuit Television
CDP	Census Designated Place
CIP	Cast Iron Pipe / Capital Improvement Program
CIPP	Cured-in-Place Pipe
CSM	City and County of Honolulu, Department of Environmental Services, Collection System Maintenance
CWRM	State of Hawai‘i, Department of Land and Natural Resources, Commission on Water Resource Management
CWSRF	Clean Water State Revolving Fund
CZM	Coastal Zone Management
DAR	Design Alternatives Report
DBEDT	State of Hawai‘i, Department of Business, Economic Development, and Tourism
DLNR	State of Hawai‘i, Department of Land and Natural Resources
DOE	State of Hawai‘i, Department of Education
DOH	State of Hawai‘i, Department of Health
DOT	State of Hawai‘i, Department of Transportation
DPP	City & County of Honolulu, Department of Planning and Permitting
DTS	City & County of Honolulu, Department of Transportation Services
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
F	Fahrenheit
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
FWCA	Fish and Wildlife Coordination Act
GCD	Global Consent Decree
HAR	Hawai‘i Administrative Rules

HBWS	Honolulu Board of Water Supply
HECO	Hawaiian Electric Company
HFD	Honolulu Fire Department
HPD	Honolulu Police Department
HDPE	High Density Polyethylene
HRS	Hawai‘i Revised Statutes
I/I	Infiltration and Inflow
IRH	State of Hawai‘i, Department of Health, Indoor and Radiological Health Branch
LED	Light-Emitting Diode
LRFI	Archaeological Literature Review and Field Inspection
LUC	Land Use Commission
LUO	Land Use Ordinance
MG	Million Gallons
MGD	Million Gallons per Day
MPH	Miles Per Hour
MSL	Mean Sea Level
NEPA	National Environmental Policy Act
NHO	Native Hawaiian Organization
NHPA	National Historic Preservation Act
NHS	National Highway System
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
OCCL	State of Hawai‘i, Department of Land and Natural Resources, Office of Conservation and Coastal Lands
O&M	Operations and Maintenance
OTS	O‘ahu Transit Services
OWMP	O‘ahu Water Management Plan
PCE	Tetrachloroethylene
PUC	Primary Urban Center
PUCDP	Primary Urban Center Development Plan
RLS	Selective Reconnaissance Level Survey
PM	Preventative Maintenance
PTMT	Pilot-Tube Microtunneling
ROH	Revised Ordinances of Honolulu
SCAP	Stream Channel Alteration Permit
SDWA	Safe Drinking Water Act

SHPD	State of Hawai‘i, Department of Land and Natural Resources, Historic Preservation District
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SMA	Special Management Area
SRAP	Spill Reduction Action Plan
SRF	State Revolving Fund
SSO	Sanitary Sewer Overflow
TCP	Terra Cotta Pipe
TMP	Transportation Management Plan
TPH	Total Petroleum Hydrocarbons
TMK	Tax Map Key
UHERO	University of Hawai‘i, Economic Research Organization
USACE	United States Army Corps of Engineers
U.S.	United States
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VCP	Vitrified Clay Pipe
WWI/I	Wet Weather Inflow and Infiltration

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EXECUTIVE SUMMARY

Project Name:

Dowsett Highlands Relief Sewer

Including (but not limited to):

Project 1:
Dowsett Highlands Relief Sewer – Nu‘uanu Avenue (School Street to Wyllie Street)
Job No.: 5-17
Nu‘uanu, O‘ahu, Hawai‘i

Project 2:
Dowsett Highlands Relief Sewer – Pali Highway (Wyllie Street to Nu‘uanu Pali Drive)
Job No.: 6-17
Nu‘uanu, O‘ahu, Hawai‘i

Approving Agency:

Department of Design and Construction
City and County of Honolulu
650 South King Street, 11th Floor
Honolulu, Hawai‘i 96813

Proposing Agency:

Department of Design and Construction
City and County of Honolulu
650 South King Street, 11th Floor
Honolulu, Hawai‘i 96813

Consultant:

Fukunaga & Associates, Inc.
1357 Kapi‘olani Boulevard, Suite 1530
Honolulu, O‘ahu, Hawai‘i 96814

Project Summary:

The City and County of Honolulu, Department of Design and Construction (DDC), proposes to implement improvements to its sanitary sewer system in the Dowsett Highlands and upper Liliha areas to address hydraulic capacity inadequacy in existing trunk sanitary sewers, and structural and operation and maintenance issues. These improvements endeavor to alleviate

flow surcharge conditions which could potentially cause sanitary sewer overflows during wet weather events. The primary project to implement these improvements will be the Dowsett Highlands Relief Sewer Project, DDC Job. Nos. 05-17 and 06-17, which will involve the design and construction of approximately 14,500 linear feet of 8-inch to 24-inch diameter new gravity relief sewers with a main alignment along Nu‘uanu Pali Drive, Dowsett Avenue, Pali Highway and Nu‘uanu Avenue, ending at School Street. The Dowsett Highlands Relief Sewer Project will also include branch relief sewers, intercepting flows from existing mains, along Wyllie Street, La‘imi Road, Pelekane Drive, Jack Lane and Ahi Place; and other improvements. These will include localized relief and/or replacement sewers to rectify existing issues not fully addressed by the proposed main relief sewer, such as the Pelekane Drive and La‘imi Road sanitary sewer bridge crossings.

The project area is located entirely within the Urban State Land Use District; and within A-1, A-2, A-3, B-2, P-2, R-5, R-7.5, R-10 City and County of Honolulu Land Use Zoning Designations. The new sewers and other improvements will be located predominantly within state and City and County of Honolulu roadway right-of ways.

The Dowsett Highlands Relief Sewer Project is on the Department of Health, Clean Water Branch priority list of projects eligible for low-interest loan funding through the Clean Water State Revolving Fund program. Per the 2010 Global Consent Decree, construction of this project must be completed by June 30, 2020.

Permits Required:

Permit to Perform Work Upon State Highways
Use and Occupancy Agreement within the State Right-of-Way
Community Noise Variance
National Pollution Discharge Elimination System (NPDES) Permit
Street Usage Permit
Trenching Permit
Construction Dewatering Permit

Determination:

A Finding of No Significant Impact (FONSI) is anticipated for this project.

CHAPTER 1. INTRODUCTION

1.1 Purpose for Environmental Assessment

The City and County of Honolulu (CCH), Department of Design and Construction (DDC) proposes to construct new trunk sanitary sewers and replace and/or repair selected existing sanitary sewers predominantly within state and CCH roadway right-of-ways in the Liliha and Nuʻuanu areas.

Pursuant to Hawaiʻi Revised Statutes, Chapter 343, an environmental review is required because the proposed project involves the following triggers:

- Propose the use of state and county lands and the use of county funds

1.2 Existing Facilities and Operations

The existing sanitary system study area includes the Liliha and Nuʻuanu sanitary sewer subsystems, which are located within approximately 810 acres of developed communities in upper Liliha and Dowsett Highlands, including roadways, connected parcels and the privately owned Oʻahu Country Club. See **Figure 1-1**. Local branch collector sewer mains discharge flows from these areas to two wastewater trunk sewers located within valleys, the Waolani Stream Trunk Sewer and the Nuʻuanu Stream Trunk Sewer. The Waolani Stream Trunk Sewer generally follows alongside Waolani/Niniko Stream with a length of 11,530 feet and ranges in size from 10- inch to 15-inch diameter. The Nuʻuanu Stream Trunk Sewer generally follows alongside Nuʻuanu Stream with a length of 15,220 feet and ranges in size from 8-inch to 21-inch diameter.

Based on GIS data, approximately 80 percent of the sewers within the study area were constructed between the 1940s and the 1960s. Pipe material of the sewers consists of vitrified clay pipe (VCP), terra-cotta pipe (TCP), cast iron pipe (CIP), and high density polyethylene (HDPE) pipe. Approximately 92 percent of the sewers are made of VCP, and the rest is made of TCP and CIP, each approximately 4 percent.

There are no CCH-owned wastewater pump stations within the study area. However, some properties have small privately-owned pumps that discharge wastewater into the collection system. More than a dozen individual properties have flow holding tanks (FHTs) ranging in capacity from 500 gallons to 1,500 gallons which regulate wastewater discharge by storing wastewater during the day and discharging into the collection system during low-flow periods. Other features of the sewer subsystem areas include under-bridge stream crossings, a siphon, and a flow split manhole. Under-bridge stream crossings are located along Kimo Drive, Pelekane Drive, Laʻimi Road, and Wyllie Street, where 6-inch or 8-inch sewer pipes are suspended from the bridge. A two-barrel, 6-inch inverted sewer siphon crossing Nuʻuanu Stream is located at the end of Klebahn Place which discharges into the Nuʻuanu Stream Trunk Sewer. The flow split manhole is located at the intersection of Nuʻuanu-Pali Drive and Kimo Drive which divides wastewater flow collected in

sewers along Old Pali Road and Nu‘uanu-Pali Drive between the Waolani Stream Trunk Sewer and the Nu‘uanu Stream Trunk Sewer.

1.3 Project Need and Objective

The 1999 *“Final Sewer I/I Plan,”* completed by Fukunaga & Associates, Inc., identified sections of the Waolani Stream and Nu‘uanu Stream Trunk Sewers as hydraulically inadequate and recommended relief sewers to address the hydraulic issues. Hydraulically inadequate sewers are those which do not have sufficient carrying capacity for wastewater flows and are at risk of sanitary sewer overflows (SSOs). In 2010, the U.S. District Court of Hawai‘i issued Civil No. 94-00765 DAE-KSC Consent Decree, referred to as the Global Consent Decree (GCD). The GCD required CCH to upgrade and repair its sewer collection system and implement an improved cleaning and maintenance program intended to eliminate SSOs from the CCH sewer system within 10 years. The GCD further specified projects for planning, design and construction, including the relief sewers to address the Waolani Stream and Nu‘uanu Stream Trunk sewer issues. Per compliance with the GCD, CCH re-evaluated these projects in its 2012 *“Sewer Infiltration and Inflow Assessment and Rehabilitation Program Update”* (I/I Update) which recommended additional sections of relief sewers for the Nu‘uanu Stream Trunk Sewer.

In 2016, Fukunaga & Associates, Inc., completed the *“Dowsett Highlands Relief Sewer Design Alternatives Report”* (DAR), which focused on addressing the hydraulically inadequate sections of the Waolani Stream and Nu‘uanu Stream Trunk Sewers as identified in the 2012 I/I Update, but also addressed sewer structural and operation and maintenance (O&M) issues within the Nu‘uanu Valley area. The objective of the DAR was to develop and evaluate alternatives to address the sewer lines with capacity issues based on the recently developed CCH wastewater system hydraulic model; however, the DAR also incorporated sewer improvement recommendations based on evaluation of structural and O&M conditions primarily from existing CCH sewer assessment studies within the Dowsett Highlands area. These three existing studies, conducted by HDR Consultants, are as follows:

1. *Gravity Sewer Assessment Program, Draft Preliminary Sewer Assessment Report (PSAR) for Liliha Area, dated November 2, 2012* – evaluated selected sewer lines with an elevated risk of SSOs within the Liliha area and provided preliminary recommendations per compliance with the GCD. Recommendations for replacement, rehabilitation, point repair or continued maintenance of the sewer segments were developed using the Sewer Data Assessment Algorithm developed by HDR. The assessments were primarily based on CCTV data but also utilized sewer GIS data, Infix flow data, and O&M data.
2. *Gravity Sewer Assessment Program, Draft PSAR for Nu‘uanu Area, dated November 5, 2012* – as above, but for the Nu‘uanu area.
3. *Preliminary Design Alternatives Report for Kalihi/Nu‘uanu Area Sewer Rehabilitation, dated April 9, 2007* – investigated CCH sewer lines covering a wide range within the Metro region from Kalihi to Punchbowl for structural and capacity issues and developed a rehabilitation plan. The scope included analysis of CCTV inspections, evaluation of spill and preventative maintenance data, manhole condition assessment, and hydraulic capacity

assessment using the CCH flow model. Several alternatives were developed and evaluated, and sewer rehabilitation and upgrade recommendations were provided.

The Dowsett Highlands DAR assessed infiltration and inflow (I/I) conditions within the project area based on flow monitoring conducted by CCH as part of the 2012 I/I Update. Flow data from five flow monitors, three located within the Liliha Subsystem and two located with the Nu‘uanu Subsystem, during two separate storm events was provided by CCH. The analysis revealed that the wastewater system responded quite differently to the two storm events; however all five tributary areas between flow monitors seemed to have similar I/I conditions. The DAR also analyzed output data from the CCH wastewater system hydraulic model (InfoWorks software) runs for a 5-year, 24-hour design storm event projected using year 2030 population projections for dry weather flow in order to determine hydraulic capacity inadequacy within the existing sewer system. A pipe segment was considered hydraulically inadequate when the modeled peak design flow exceeded the calculated full flow capacity.

The DAR provided several findings and challenges regarding hydraulic capacity, structural condition and O&M based on analysis of the CCH InfoWorks model run data, the three existing HDR studies, and review of additional O&M information from the CCH wastewater asset management database. The findings and challenges are summarized as follows:

- The Waolani Stream Trunk Sewer was hydraulically inadequate. The pipe segments identified as inadequate coincided with those recommended for hydraulic upgrade in the 1999 Final I/I Plan. Actual spills during high wet weather flows were reported along three sections of this trunk sewer line near Jack Lane, Ahi Place and Wood Street.
- The Nu‘uanu Stream Trunk Sewer was hydraulically inadequate, including additional pipe segments to those identified for hydraulic upgrade in the 1999 Final I/I Plan.
- Due to the hydraulic inadequacy of the Nu‘uanu Stream Trunk Sewer, diverting wastewater flow from the Liliha Subsystem to the Nu‘uanu Subsystem to provide relief to the Waiolani Stream Trunk Sewer was not an option. There were no other CCH sewers capable of intercepting wastewater flow from either trunk sewer system.
- Improvements to the Waolani Stream and Nu‘uanu Stream Trunk Sewers would involve construction along and across Waolani and Niniko Streams and through private properties, which may prove to be difficult. CCH maintenance crews confirmed that routine maintenance to these sewers within easements was difficult because of limited access.
- The Waolani Stream and Nu‘uanu Stream Trunk Sewers may need to remain in service in order to serve the low-lying lots along the streams. If wastewater flow is diverted away from these two trunk lines, grease and settlement of debris may become an issue due to low wastewater flow, in which case CSM would need to adjust its preventative maintenance (PM) schedules and flush these two trunk lines periodically from upstream to remove settled grease and debris. Alternatively, these low-lying lots could be served by a new low-pressure sewer system which would eliminate the need to keep these two trunk sewers in service.
- The primary O&M issue was root intrusion. Records indicated a few sewer pipe segments with multiple trouble calls and spill reports, most of which were in easements located

within private properties. It was recommended that CSM adjust cleaning frequencies based on the field notes, SSOs, and trouble calls. The two-barrel 6-inch inverted siphon crossing Nuʻuanu Stream near the end of Klebahn Place presented a maintenance issue for CSM. The hydraulic operation of the inverted siphon was prone to heavy grease buildup.

- Structural issues included cracks, fractures, broken pipes, failed patch repairs, offset joints, roots intrusions, and sags. Some of the most significant issues were heavy roots intruding through the pipe joints. These were considered structural rather than O&M issues because, in addition to cutting roots, the recommended solution was to rehabilitate the sewer pipe segments with cured-in-place pipe (CIPP). A few sewer pipe segments had structural issues such as missing walls, broken sections, sag, etc. that would require point repair or replacement.
- Sewers within the project area cross narrow streets, private properties, a state highway and streams. Existence of other under- and above-ground utilities further complicates potential sewer renewal work within these two old communities. Trenchless technologies should be considered for installation of new sewers and renewal of existing sewers in order to minimize impacts to these two communities and motorists during construction.

1.4 Project Description

The DAR identified and evaluated several alternatives to address the system hydraulic capacity inadequacy, including shallow and deep relief sewers, off-line and in-line storage, parallel relief or replacement sewers, and basin-wide sewer rehabilitation. See Chapter 4 for detailed descriptions of the alternatives not selected. The DAR recommended the implementation of a single, shallow, new gravity relief trunk sewer line along the Nuʻuanu-Pali corridor intercepting wastewater flows from the existing Waolani and Nuʻuanu Stream Trunk Sewers as the preferred alternative. Preliminary geotechnical investigations revealed that basalt rock was encountered about 30 feet below ground in borings along Pali Highway and 10 feet below ground in a boring along Nuʻuanu Avenue. Shallower installation of new sewers would therefore avoid costly construction in hard rock conditions. The depth of the new sewers would still be sufficient to allow gravity flow diversions of up to 4.33 MGD from the Waolani Stream Trunk Sewer, up to 6.57 MGD from the Nuʻuanu Stream Trunk Sewer, and additional flows diverted to the new relief sewer along Nuʻuanu Avenue for a total of up to 12.1 MGD. This alternative was selected as the basis for the proposed project for its long-term benefits and feasibility, to: 1) increase the system level of service to 5-year; 2) add extra system capacity for potential new connections; 3) allow easy access for operation and maintenance activities; and 4) provide potential for eliminating the two existing trunk sewers along streams in the future.

The main alignment of the new relief trunk sewer line was proposed within state and CCH right-of-ways along Pali Highway, Dowsett Avenue and Nuʻuanu Avenue with connections to new branch sewers intercepting flows from existing mains at several points along the alignment. Other improvements included localized relief and/or replacement sewers or rehabilitation with CIPP to address existing sewers with inadequate hydraulic capacity not fully addressed by the proposed main relief sewer or to address existing sewers with structural issues. The recommended sewer system improvements were comprised of projects mandated by the GCD (labeled as "GCD") and

additional projects not identified in the GCD and therefore not subject to its requirements (labeled as "Non-GCD"). These improvements are illustrated on **Figure 1-2** and summarized as follows:

1. Modify the flow split manhole along Nu‘uanu Pali Drive that divides the tributary wastewater flow between the Nu‘uanu Stream Trunk Sewer and the Waolani Stream Trunk Sewer. Plug the outlet that directs flow toward the Nu‘uanu Stream Trunk Sewer which will redirect all of the tributary flow toward the new relief trunk sewer. (GCD)
2. Construct new relief sewers along Nu‘uanu Pali Drive toward Pali Highway and along Pelekane Drive to Dowsett Avenue to intercept flow from the Waolani Stream Trunk Sewer and the Nu‘uanu Stream Trunk Sewer, respectively. (GCD)
3. Construct a new relief trunk sewer line beginning along Nu‘uanu Pali Drive, following along Pali Highway, Dowsett Avenue, Pali Highway and Nu‘uanu Avenue and discharging into the sewer tunnel along School Street, intercepting flow from several existing manholes along the alignment. (GCD)
4. Construct branch sewers along Wyllie Street and La‘imi Road intercepting flows from existing manholes and discharging into the new relief trunk sewer line. (GCD)
5. Construct a flow diversion from Pū‘iwa Road to Henry Street to provide hydraulic relief to the 8 inch sewer line within the easement along Nu‘uanu Stream parallel to Dow Street. (GCD)
6. Upgrade Pelekane Drive and La‘imi Road bridge crossings. (Non-GCD)
7. Upgrade the Liliha sewer system. (Non-GCD)
8. Construct branch sewers along Jack Lane and Ahi Place intercepting flows from existing manholes and discharging into the new relief trunk sewer line. (Non-GCD)
9. Construct a parallel "Craigside" relief sewer for the Nu‘uanu Stream Trunk Sewer near the end of South Judd Street. (Non-GCD)
10. Replace and rehabilitate individual pipe segments with structural issues. (Non-GCD)

Construction of the new relief sewers is expected to utilize a combination of trenchless technologies and open-trench excavation. Generally, cost considerations favor open-trench excavation for sections of sewer construction at shallow depths and trenchless technologies for deeper sewer construction. Construction along Pali Highway may utilize trenchless technologies wherever possible to minimize disruption; however, the contractor may be given the option to utilize open-trench excavation if it allows for faster construction. Pilot-tube microtunneling (PTMT) is the most likely trenchless methodology to be employed, and utilization of PTMT may be maximized in areas with displaceable soils. PTMT uses a guided boring process to install steel casings by auger through the ground following the direction established by a pilot tube between excavated shafts. The new pipe is then directly jacked behind the steel casings. The advantage of PTMT over open-trench excavation is that the only surface disruption is in the vicinity of the excavated shafts. Further geotechnical studies are underway, which will assess the feasibility of these and other construction methods. Constructability and cost considerations could necessitate adjustment in sewer line depths.

The proposed project potentially includes five stream crossings as shown on **Figure 1-4**. The crossings of Niniko Stream at Nuʻuanu Pali Drive and at Dowsett Avenue will involve the installation of a new sewer pipeline underneath existing box culverts; the crossings of Nuʻuanu Stream at Pelekane Drive and at Laʻimi Road will involve the replacement and upsizing of an existing sewer pipeline hanging from the underside of existing bridges; and the crossing of Nuʻuanu Stream along Nuʻuanu Avenue will involve the installation of a new sewer pipeline beneath the pavement but above an existing arch culvert. All crossings will be under the existing roadway. An existing sewer pipeline crossing of Waolani Stream at Wyllie Street, as shown on **Figure 1-2**, will be rehabilitated with CIPP.

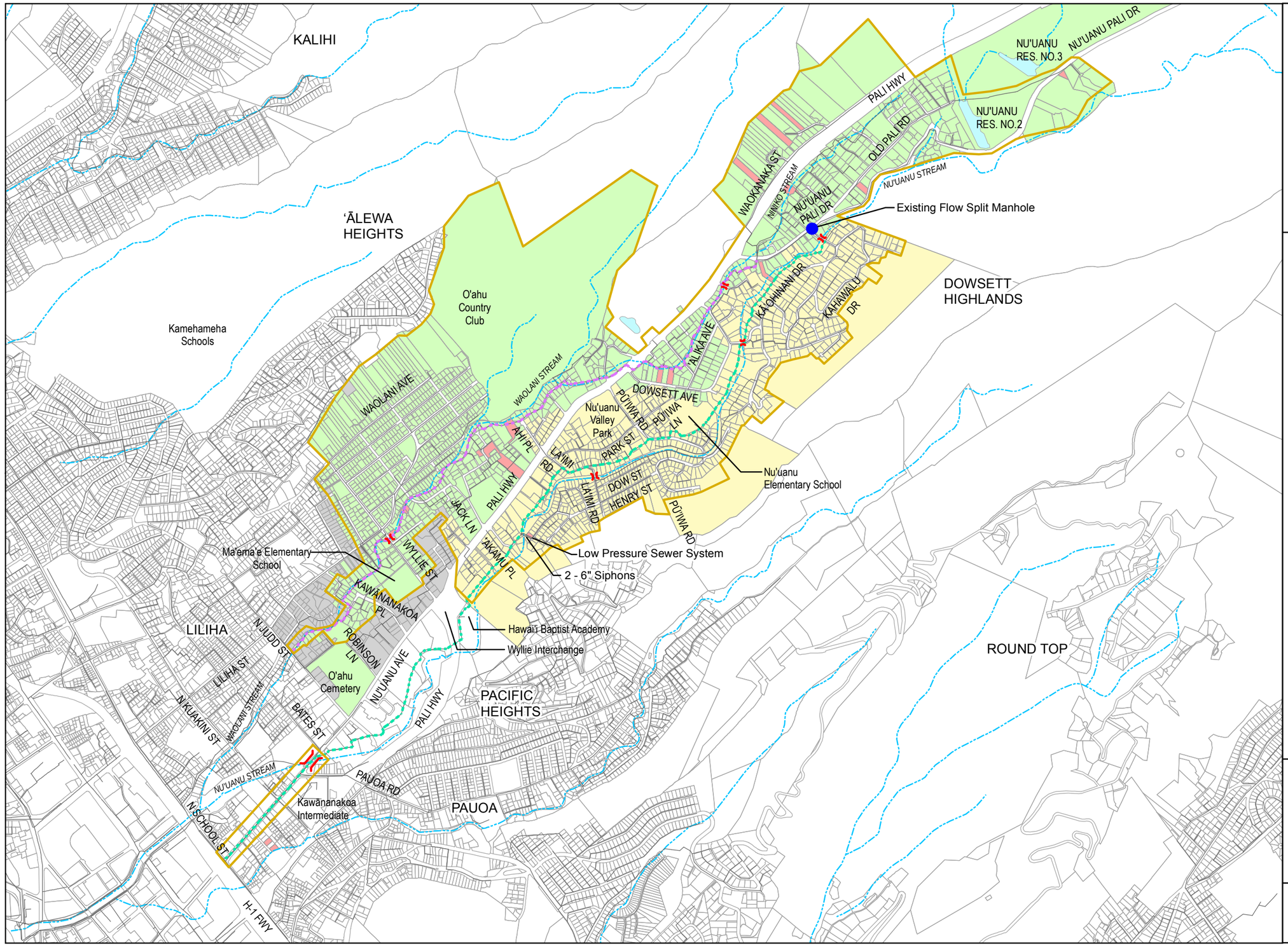
In 2016, the CCH DDC began the design of the Dowsett Highlands Relief Sewer Project, which incorporates most of the sewer system improvements recommended in the DAR, including all of the improvements required by the GCD, except for the flow diversion from Pūʻiwa Road to Henry Street (#5), and also including the non-GCD upgrade of the branch sewers along Jack Lane and Ahi Place (#8). This project involves the design and construction of approximately 14,500 linear feet of 8-inch to 24-inch diameter new gravity sanitary sewers. This Environmental Assessment will cover all of the recommended improvements proposed in the DAR, which will henceforth be referred to as the "project" or "proposed project". The associated area generally includes the roadway right-of-ways and easements in which the proposed sewer improvements, as shown in **Figure 1-2**, will be completed; this will be referred to as the "project area". Because the Dowsett Highlands Relief Sewer Project does not include all of these improvements, it must be differentiated, and will henceforth be abbreviated as "Dowsett project", and the associated area be referred to as the "Dowsett project area". See **Figure 1-3**.

1.5 Construction Schedule and Cost

The Dowsett project is subdivided into two sections for design, bid and construction with the potential for overlap in order to shorten the duration of construction project(s) to meet the GCD deadline of June 30, 2020. Section 1 will include work along Nuʻuanu Avenue and Wyllie Street, and Section 2 will include work along Pali Highway, Dowsett Avenue and Nuʻuanu Pali Drive. CCH estimated the key project milestones and associated dates as follows:

a.	Design Completion	November 2017
b.	Bid Advertisement	December 2017
c.	Bid Open	February 2018
d.	Construction Start	April 2018
e.	Substantial Construction Completion	March 2020
f.	GCD Construction Completion Deadline	June 30, 2020

A cost estimate will be developed for the construction of the Dowsett project.



LEGEND:

- Dowsett Highlands DAR Study Area
- Existing Waolani Stream Trunk Sewer
- Existing Nu'uanu Stream Trunk Sewer
- Stream
- Sewer Main
- Bridge
- Nu'uanu Subsystem
- Liliha Subsystem
- Parcel
- Lot with Flow Holding Tank and Potentially Privately-Owned Pump

Dowsett Highlands Relief Sewer

Draft Environmental Assessment

EXISTING SEWER SYSTEM

Figure 1-1

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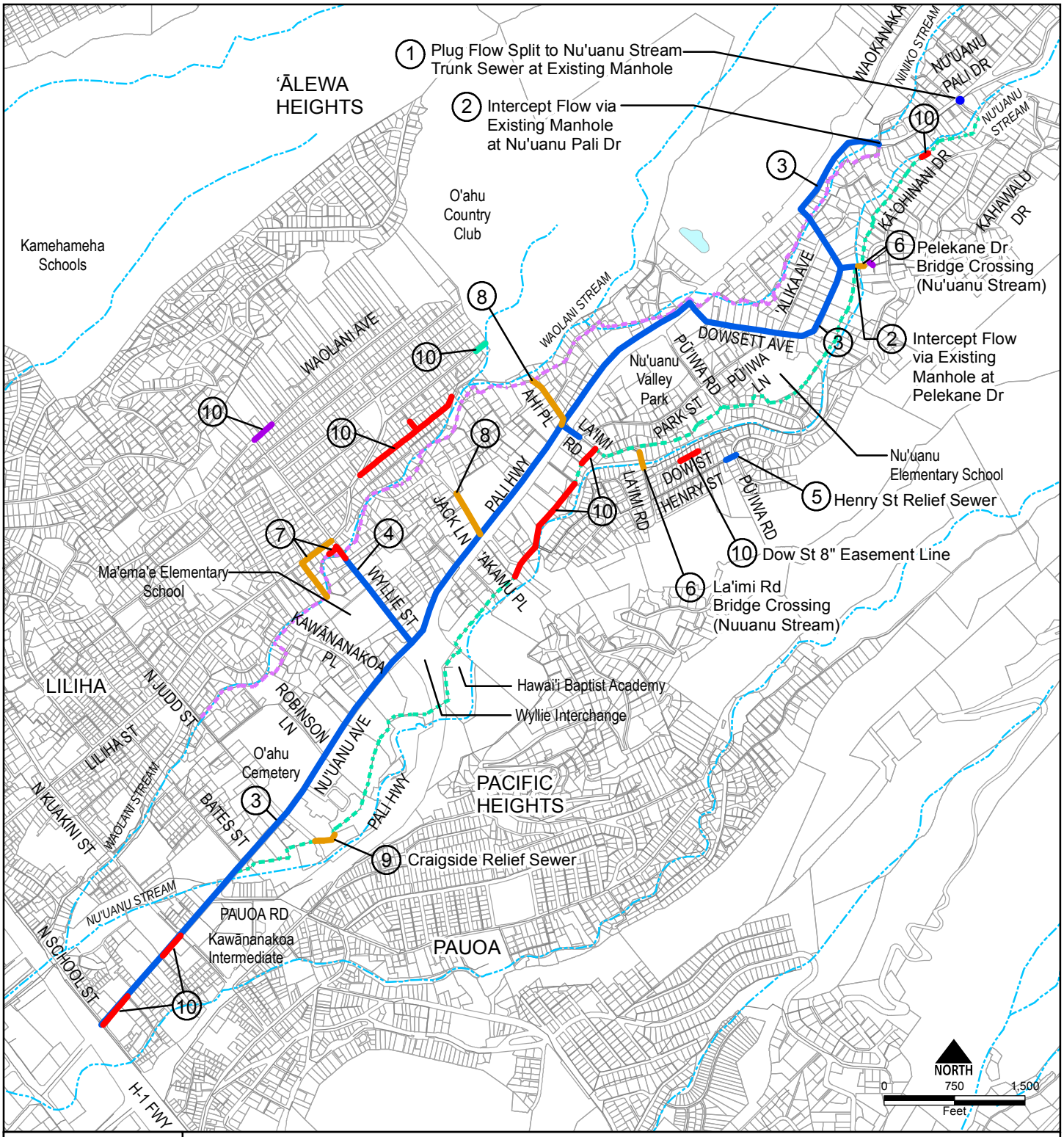

Island of O'ahu

LEGEND:

GCD Recommendations
- New Relief Sewer

Non-GCD Recommendations
- New Relief Sewer
- Replacement Sewer
- Full CIPP
- Point Repair

- Existing Waolani Stream Trunk Sewer
- Existing Nu'uanu Stream Trunk Sewer
- Stream
- Sewer Main
- Water Body
- Parcel

Dowsett Highlands Relief Sewer
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PROPOSED PROJECT RECOMMENDED IMPROVEMENTS

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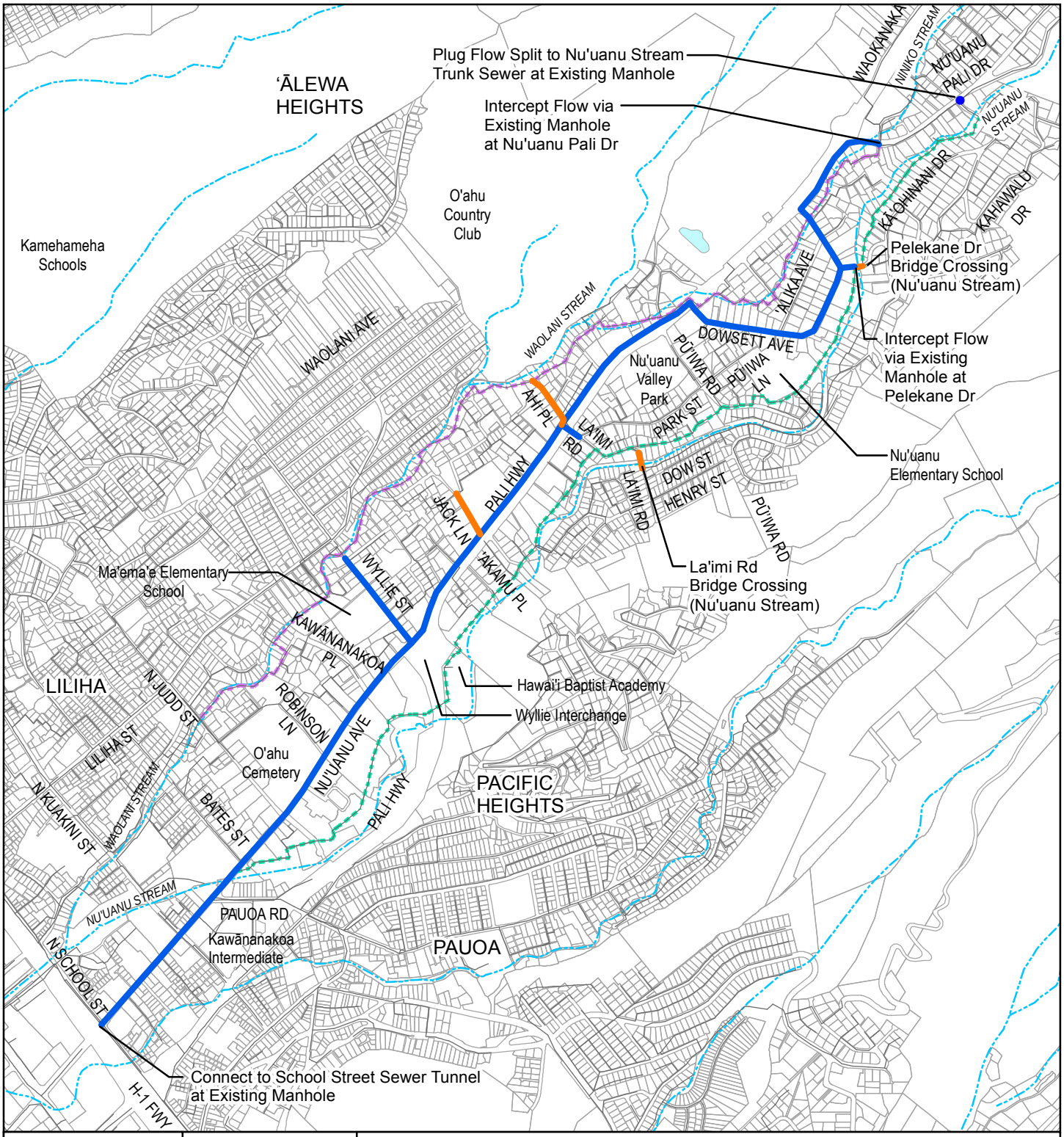
Figure 1-2



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Draft Environmental Assessment

CCH-DDC DOWSETT PROJECT RECOMMENDED IMPROVEMENTS

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Figure 1-3

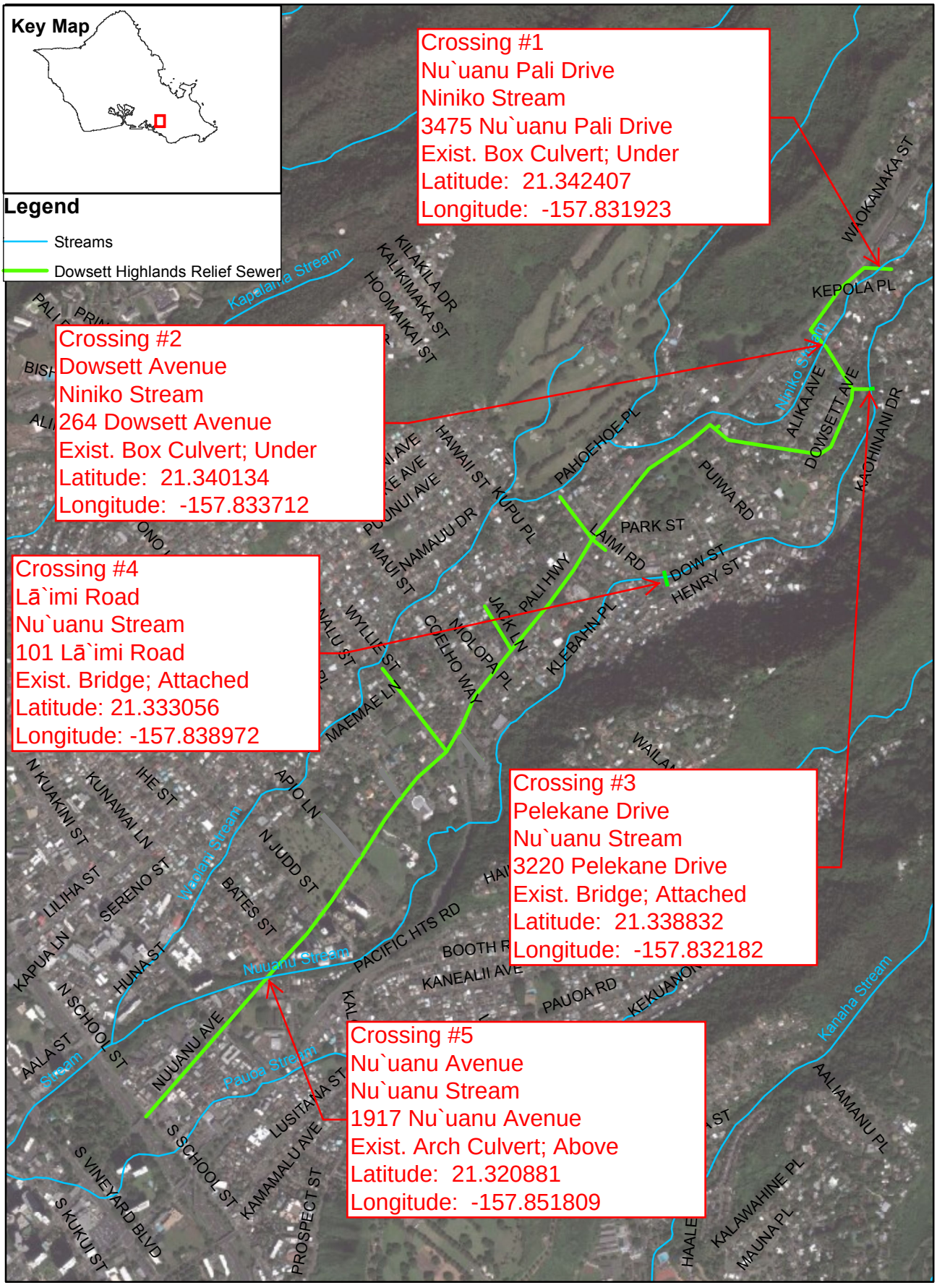

FIGURE 1-4 POTENTIAL STREAM CROSSINGS

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CHAPTER 2. DESCRIPTION OF THE ENVIRONMENT, IMPACTS AND MITIGATIVE MEASURES

2.1 Climate

The island of Oʻahu is characterized by a tropical savanna climate with little seasonal and diurnal variability in temperature. Average monthly temperatures for Honolulu range between 80 and 89 degrees F for the highs and between 66 and 75 degrees F for the lows, with February being the coolest month and August being the warmest. The average annual precipitation varies greatly throughout the project area from north to south, with over 100 inches falling within the Nuʻuanu Pali Drive area, and approximately 35 inches falling within the School Street area, predominantly between the months of October and April. Trade winds flow from east to west and prevail during the greater part of the year.

2.2 Topography

The island of Oʻahu was formed by two different shield volcanoes, the Waiʻanae and the Koʻolau, with the former being the older of the two. Formation of the island began approximately 4 million years ago. Both volcanoes have undergone erosion and coral reef growing stages and have experienced submarine landslides. The shield-building stage of the Koʻolau volcano between 2.5 million and 1.5 million years ago helped form the Nuʻuanu Valley.

The topography throughout the project area increases from south to north with a general slope of about 3.4 percent along Nuʻuanu Avenue and Pali Highway, ranging between 40 feet MSL at School Street to approximately 600 feet MSL in the vicinity of Nuʻuanu Pali Drive and Old Pali Road. The Nuʻuanu Avenue section ranges from 40 feet MSL at School Street to 230 feet MSL at the Wyllie Interchange; the Pali Highway section ranges in elevation from 230 feet MSL at the Wyllie Interchange to 460 feet MSL at Nuʻuanu-Pali Drive, for a total distance of about 2.3 miles. See **Figure 2-1**.

2.3 Soils

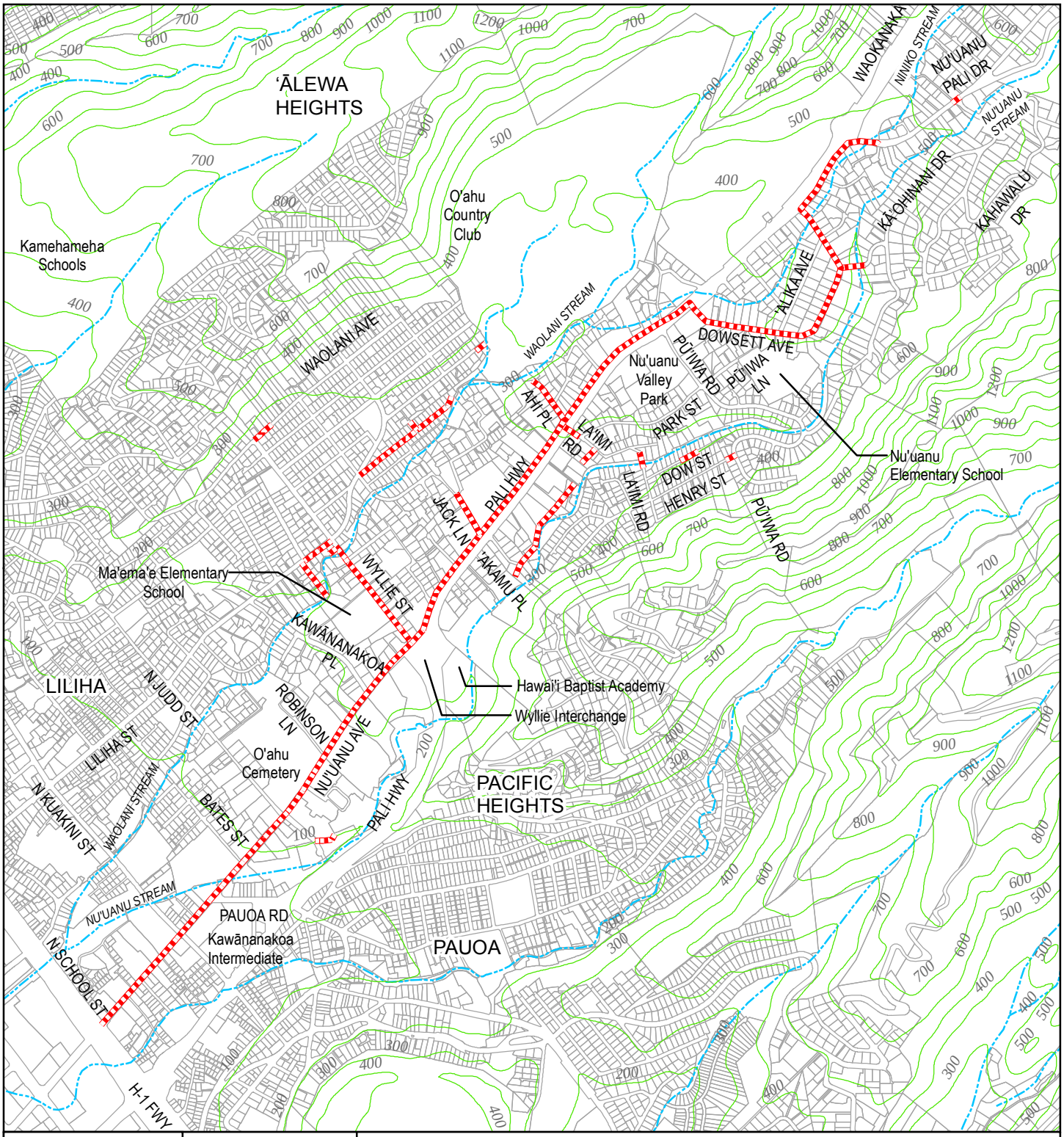
2.3.1 Soil Survey

The USDA, Soil Conservation Service 1972 "Soil Survey" provides detailed information on soil classifications, characteristics and maps showing their locations on the islands. The survey is useful for engineers and builders because the information includes descriptions of soil properties and the relative stability of soils for engineering purposes. According to the survey, the following soil types are found within the project area as described below. **Figure 2-2** shows the locations of these soils.

- ʻEwa stony silty clay, 6-12% slopes (EwC): The ʻEwa series consists of well-drained soils on alluvial fans, developed in alluvium derived from basic indigenous rock. A representative profile includes a dark reddish-brown silty clay loam surface layer 18 inches

thick. Surface stones interfere with the tillage but do not make intertilled crops impracticable. The subsoil is dark reddish-brown and dark red silty clay loam that has subangular blocky structure and is about 42 inches thick. The substratum is coral limestone, sand or gravelly alluvium. Runoff is slow to medium, and the erosion hazard is slight to moderate. This soil is used for pasture.

- Kaʻena clay, 2-6% slopes (KaB): The Kaʻena series consists of very deep, poorly drained soils that are commonly stony. A representative profile includes a dark gray clay, with no stones, about 10 inches thick. The next layer is dark gray and dark grayish-brown clay that has prismatic structure about 36 to over 48 inches thick. The underlying layer is highly weathered gravel. The soil is very sticky, plastic and mottled. Runoff is slow, and erosion hazard is slight. This soil is used for sugarcane, truck crops, pasture and urban development.
- Kaʻena stony clay, 12-20% slopes (KaeD): A representative profile includes a dark gray clay about 10 inches thick. The next layer is dark gray and dark grayish-brown clay that has prismatic structure about 36 to over 48 inches thick. The underlying layer is highly weathered gravel. The soil is very sticky, plastic and mottled. Runoff is medium, and erosion hazard is moderate. This soil is used for sugarcane, pasture and homesites.
- Kawaihāpai stony clay loam, 2-6% (KlaB): The Kawaihāpai series occurs in drainage ways and on alluvial fans on coastal plains. This soil contains enough stones to hinder cultivation. A representative profile includes a dark brown clay loam surface layer about 22 inches thick. The next layer is 32-inch thick dark brown stratified sandy loam. The substratum is stony and gravelly. Runoff is slow, and erosion hazard is slight. This soil is used for sugarcane, truck crops and pasture.
- Lolekaʻa silty clay, 3-8% slopes (LoB): This series consists of well-drained soils terraces and fans on windward Oʻahu. A representative profile consists of a surface layer dark brown silty clay 10 inches thick, subsoil 46 to over 70 inches thick, and strongly weathered gravel substratum. The upper part of the subsoil is dark brown silty clay and the lower part is dark yellowish-brown loam; both parts have subangular blocky structure. Permeability is moderately rapid, runoff is slow, and erosion hazard is slight. The soil is strongly acid to extremely acid. It is used for pasture, homesites, truck crops, bananas and papaya.
- Lolekaʻa silty clay, 8-15% slopes (LoC): Similar to LoB, but runoff is slow to medium and the erosion hazard is slight to moderate.
- Lolekaʻa silty clay, 15-25% slopes (LoD): Similar to LoB, but runoff is medium and erosion hazard is moderate. This soil is found on side slopes of terraces and along drainage ways. It is used for pasture.
- Rock land (rRK): Rock land exists where exposed rock covers 25 to 90 percent of the surface. It consists of rock outcrops, mainly basalt and andesite, and very shallow soils. The terrain is nearly level to very steep and elevations range from nearly sea level to 6,000 feet. Rock land is used for pasture, wildlife habitat and water supply.
- Water (W): Included in the project area is the Nuʻuanu Stream and its tributaries.



Dowsett Highlands Relief Sewer
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ELEVATION MAP

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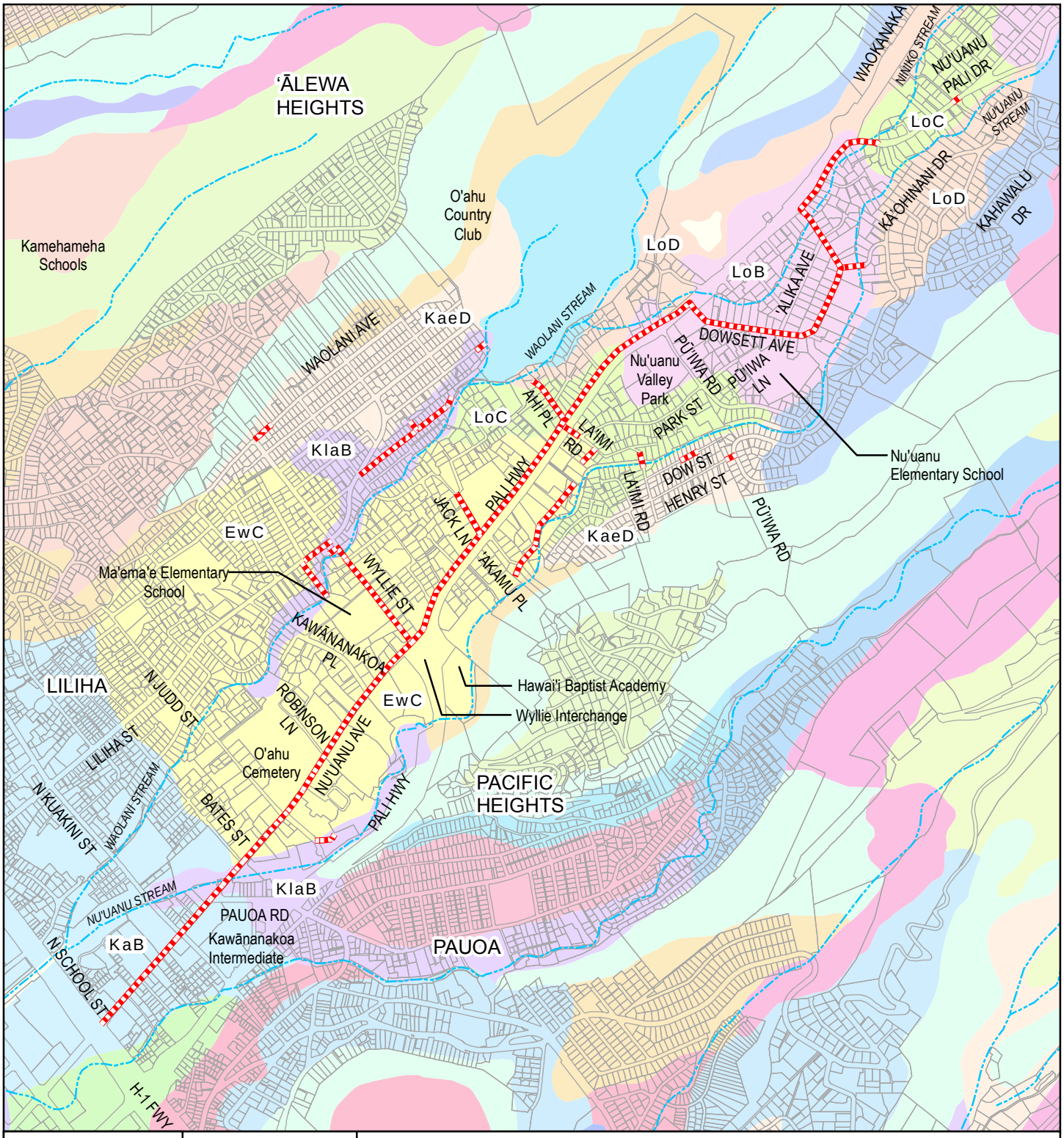
Figure 2-1



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USGS SOIL MAP

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Figure 2-2

2.3.2 Land Study Bureau

The University of Hawai‘i, Land Study Bureau 1972 “Detailed Land Classification – Island of O‘ahu” grouped all non-urban lands into five categories based on their soil properties and capabilities for agricultural productivity measured by their performance for selected crops. The categories were assigned letters “A” through “E” in order of highest to least productive. The project area is entirely within state Urban land and therefore is not associated with a Land Study Bureau category. See **Figure 2-3**.

2.3.3 Agricultural Lands of Importance to the State of Hawai‘i

The Department of Agriculture “Agricultural Lands of Importance to the State of Hawai‘i” (ALISH) provided a classification system for identification of agriculturally important lands to the state, which established three classes of agricultural lands primarily, but not exclusively, on the basis of soil characteristics. The classifications are: Prime Agricultural Land, Unique Agricultural Land and Other Agricultural Land. These classifications provide decision makers understanding of long-term implications of several land use options for production of food, feed, forage, and fiber crops, however, do not designate areas to any specific land use. Lands not considered for classification as ALISH are: 1) Developed urban land over 10 acres; 2) Natural or artificial enclosed bodies of water over 10 acres; 3) Forest reserves; 4) Public use lands, e.g. parks and historic sites; 5) Lands with slopes in excess of 35%; and 6) Military installations, except undeveloped areas over 10 acres. The project area is entirely within lands not considered for classification. See **Figure 2-4**.

2.4 Natural Hazards

As shown on **Figure 2-5**, the Flood Hazard Assessment Report, which is based on the Flood Insurance Rate Map (FIRM) issued by the Federal Emergency Management Agency (FEMA), indicates that nearly the entire project area is located in Zone X. This is an area determined to be outside of the 500 year flood plain and less than 1 foot depth in a 100 year flood event (0.2% annual chance floodplain). A very small section of the project area in the vicinity of Nu‘uanu Stream is located in Zones XS and AE. Zone XS is defined as areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. Zone AE is described as being within the 100-year floodplain (1% chance annual flood) with a determined base flood elevation (BFE), which is the water surface elevation of the 1% annual chance flood. The CCH DPP Honolulu Land Information System (HoLIS) interactive GIS web map indicates a flood elevation at the Nu‘uanu Stream crossing of 75 feet MSL. The significance of the return period for a 100-year flood is that on average a flood of such magnitude occurs once every hundred years, which is greater than the expected service life of the sanitary sewer. Furthermore, the sewer will be installed underground beneath Nu‘uanu Avenue and above the existing arch culvert where the risk of damage from flood is minimal.

According to the City and County of Honolulu, Department of Emergency Management’s Tsunami Evacuation Maps, the entire project area is within the “Safe Zone”. The area is therefore not considered to be vulnerable to tsunamis.

2.5 Hydrology

The Commission on Water Resource Management (CWRM) has established hydrologic units for both groundwater and surface water resources. Groundwater is described in the State Water Code as: "any water found beneath the surface of the earth, whether in perched supply, dike-confined, flowing, or percolating in underground channels or streams, under artesian pressure or not, or otherwise". Surface water is defined as: "both contained surface water—that is, water upon the surface of the earth in bounds created naturally or artificially including, but not limited to, streams, other watercourses, lakes, reservoirs, and coastal waters subject to state jurisdiction—and diffused surface water—that is, water occurring upon the surface of the ground other than in contained water bodies. Water from natural springs is surface water when it exits from the spring onto the earth's surface".

Groundwater hydrologic units have been delineated by Aquifer Sector Areas which are further subdivided into Aquifer System Areas. The project lies within the Honolulu Aquifer Sector Area [301], and is split between the Nu'uanu Aquifer System Area [30102] and the Kalihi Aquifer System Area [30103]. The Sustainable Yield for the two aquifer system areas are 14 MGD and 9 MGD, respectively.

Surface water hydrologic units are divided by watershed units which are comprised of one or more drainage basins. The project is located within the Nu'uanu surface water hydrologic unit [3050]. According to the Hawai'i Stream Assessment, the Nu'uanu Stream system is the only perennial stream within the project area, including tributaries Waolani and Niniko Streams.

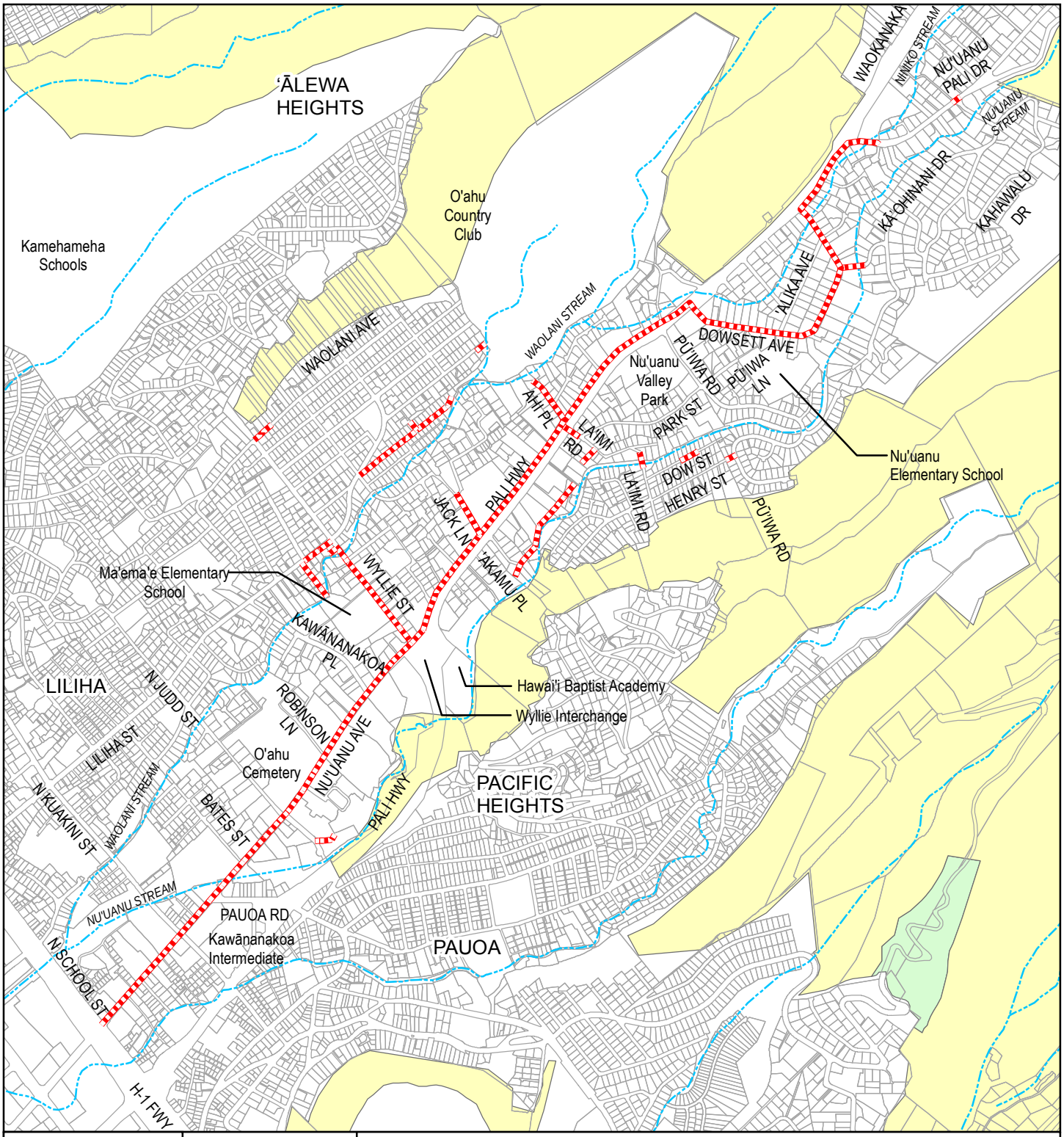
Ground elevations within the project area are sufficiently high above MSL that potential effects of climate change on ground water levels will not have any impact on the proposed project.

2.6 Flora and Fauna

The project area has been substantially altered by urbanization. All of the proposed improvements will be constructed within state and CCH roadway right-of-ways or within easements on improved private properties where impacts on flora and fauna will be minimal. Most of the flora in these areas consist of landscaping and ornamental plants or non-native species.

In a letter dated May 19, 2017, the United States Fish and Wildlife Service (USFWS) indicated that there is no designated critical habitat within the vicinity of the proposed project area, however, offered the following comments:

> ***Hawaiian hoary bat:***
> The endangered Hawaiian hoary bat may be present within the proposed project area. The Hawaiian hoary bat roosts in both exotic and native woody vegetation and will leave young unattended in "nursery" trees and shrubs when they forage. If trees or shrubs suitable for bat roosting are cleared during the pupping 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 tall should not be disturbed, removed, or trimmed during the bat birthing and pup rearing season (June 1 through September 15).



Dowsett Highlands Relief Sewer
Draft Environmental Assessment

LAND STUDY BUREAU MAP

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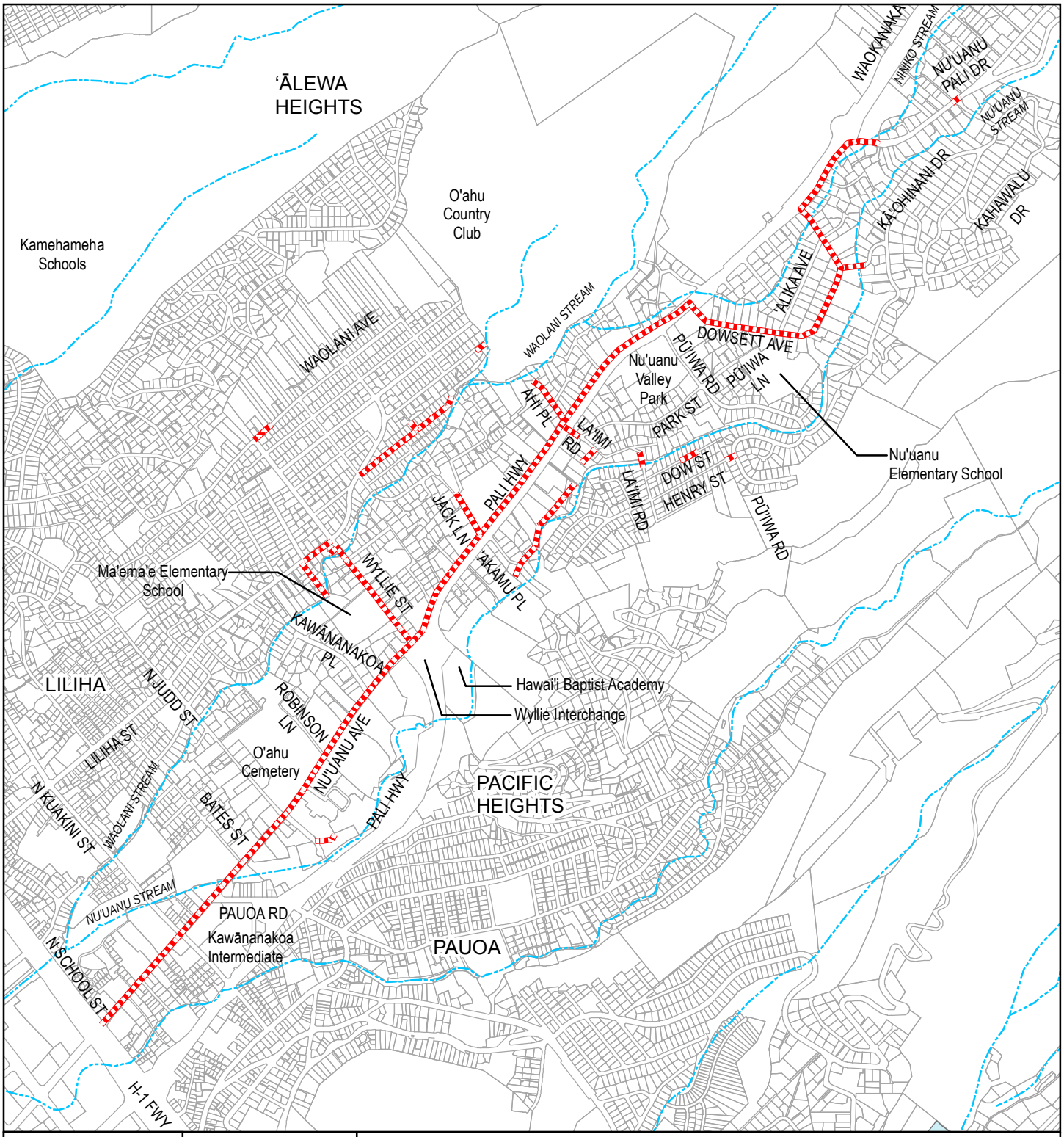
Consulting Engineers

Figure 2-3



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ALISH MAP

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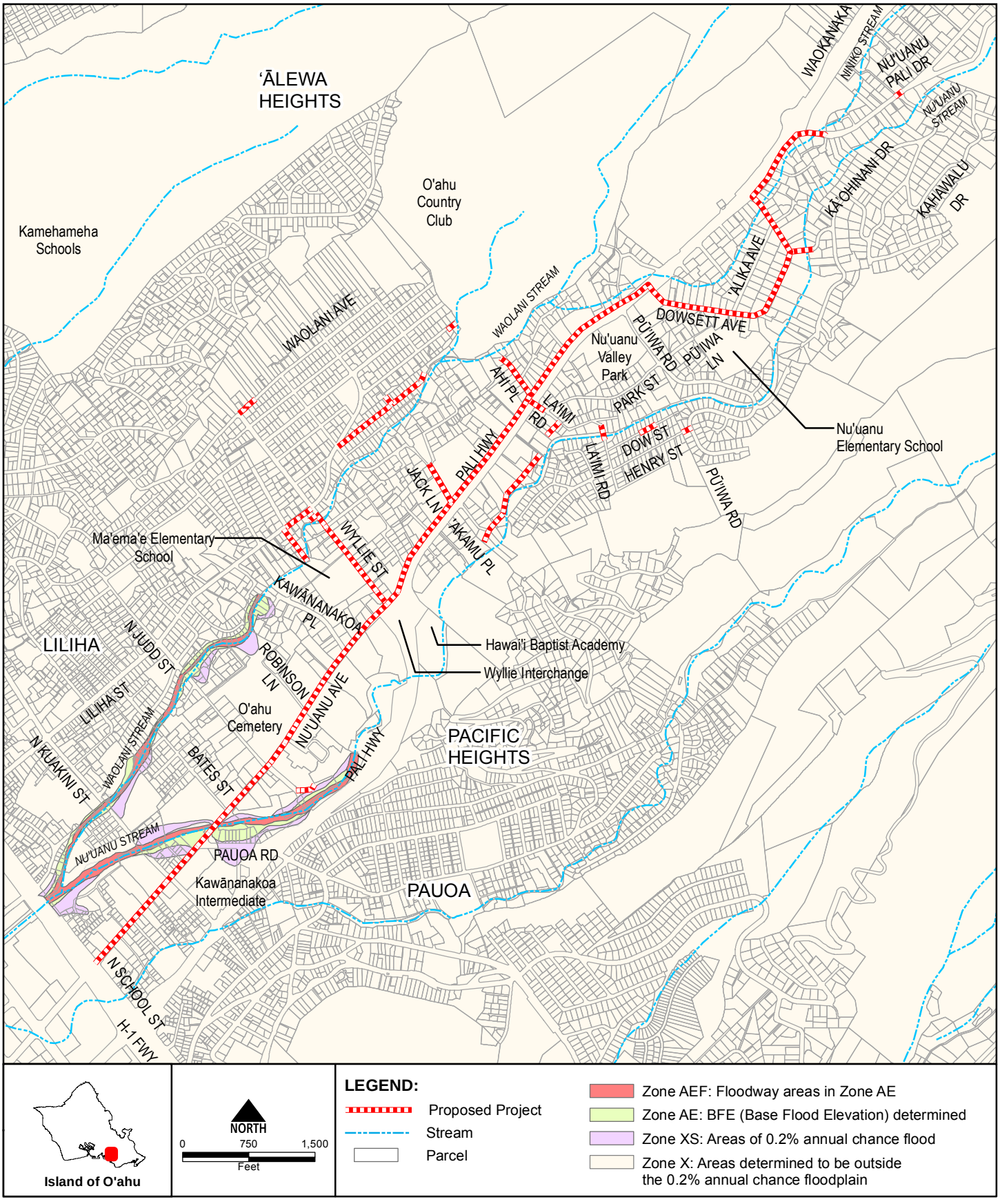
Consulting Engineers

Figure 2-4



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FLOOD HAZARD MAP

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Figure 2-5

Figure 2-6

Dowsett Highlands Relief Sewer
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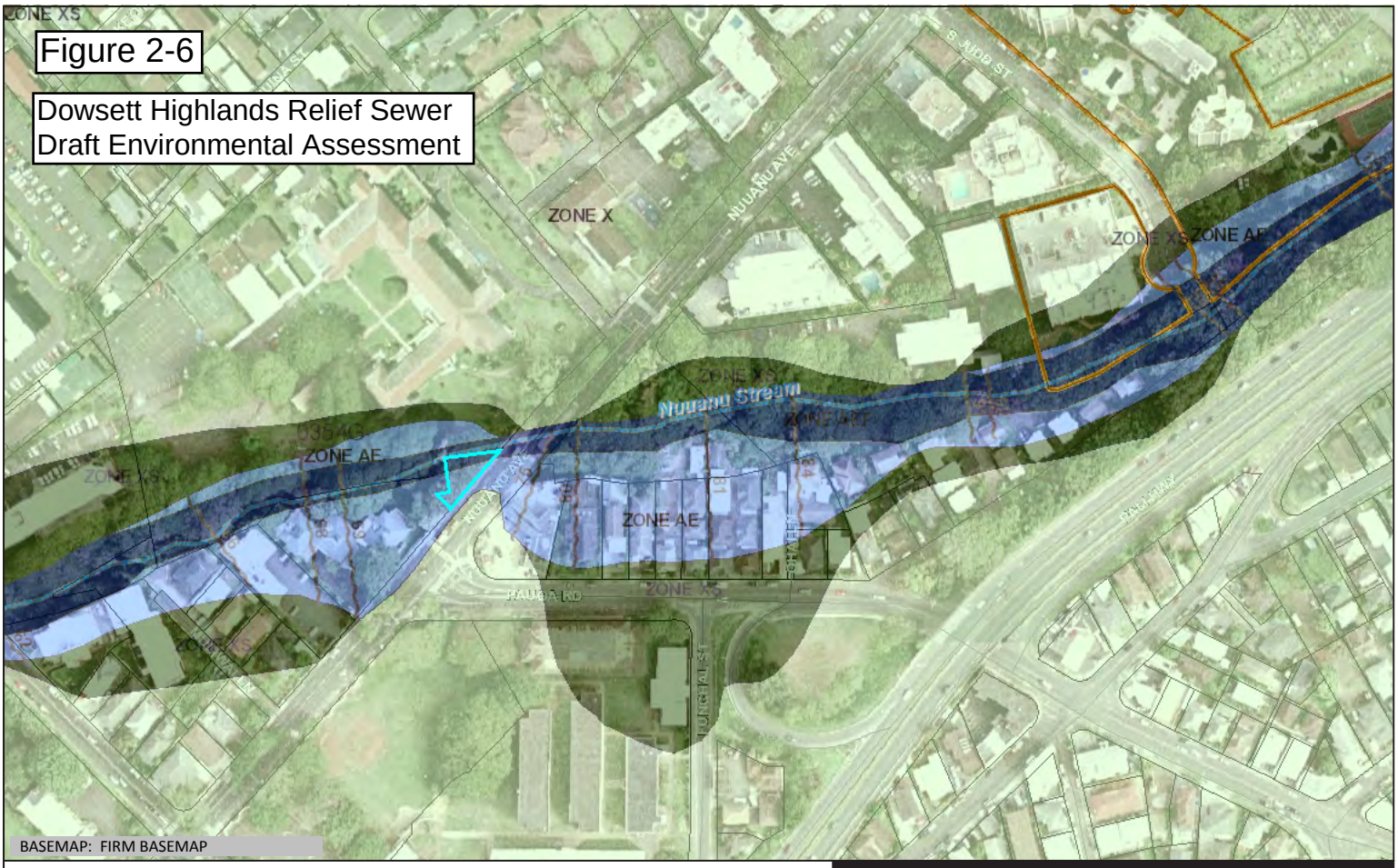

BASEMAP: FIRM BASEMAP

Flood Hazard Assessment Report

www.hawaiinfip.org

Property Information

COUNTY:	HONOLULU
TMK NO:	(1) 1-7-011:002
WATERSHED:	NUUANU
PARCEL ADDRESS:	NUUANU AVE HONOLULU, HI 96817

Notes:

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 05, 2014
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	15003C0354G
PANEL EFFECTIVE DATE:	JANUARY 19, 2011

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: NO
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: YES (OA-0001)
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 200 400 ft

Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(*Note: legend does not correspond with NFHL)*

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also know as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

USFWS indicated that it would evaluate the potential impacts to the adjacent streams when the Draft Environmental Assessment is available.

2.7 Water Quality

The Department of Health (DOH), Water Quality Standards Map, indicates that the majority of the project area are designated inland Class "2" inland waters. The objective of Class "2" waters is "to protect their use for recreational purposes, the support and propagation of aquatic life, agricultural and industrial water supplies, shipping and navigation".

A National Pollution Discharge Elimination System (NPDES) Permit from the DOH Clean Water Branch will be required for construction of the Dowsett Highlands Relief Sewer Project because the disturbed area will be greater than one acre. As part of the permit requirements, Best Management Practices (BMP) will be incorporated which will control the discharge of storm water runoff and improve the quality of the effluent resulting from construction activities. The BMPs will be shown and described on the design plans and will be subject to approval from DOH. As most of the construction will be within state and CCH roadways, typical BMPs employed may include filter socks, check dams, silt fences and drain inlet inserts.

As required by the State Water Code, HRS Chapter 174C, the CWRM administers a statewide instream use protection program through the Stream Channel Alteration Permit (SCAP). A SCAP is required for any temporary or permanent activity within the stream bed or banks that may: 1) Obstruct, diminish, destroy, modify, or relocate a stream channel; 2) Change the direction of flow of water in a stream channel; 3) Place any materials or structures in a stream channel; or 4) Remove any material or structure from a stream channel. The Dowsett project includes five stream crossings previously shown on **Figure 1-4** and discussed in Section 1.4 potentially requiring a SCAP. A request for determination was submitted to CWRM on April 18, 2017 and in emails dated May 25, 2017, CWRM confirmed that a SCAP would not be required for any of the crossings.

2.8 Hazardous Materials

The DOH, Solid and Hazardous Waste Branch, Hawai‘i Leaking Underground Storage Tank Database listed three gasoline tanks on private properties in the vicinity of the project area, one each within the properties at addresses 42 Pū‘iwa Road, 1755 Nu‘uanu Avenue and 1602 Nu‘uanu Avenue. The database indicated the status of the tanks as permanently out of use in 1989, permanently out of use in 1993 and currently in use, respectively, and that site cleanup actions were undertaken in 1999 and 2000. The DOH, Hazard Evaluation and Emergency Response Office records listed one incident in the vicinity of the project area. Records indicated that total petroleum hydrocarbons (TPH) and tetrachloroethylene (PCE) in soils above Industrial/ Commercial Tier I levels were found within the property at 1909 Nu‘uanu Avenue, however, noted that the necessary response action was completed in 2012. It is unlikely that excavation operations will encounter contaminated soil. However, in the event that contaminated soil is discovered, the Contractor will be responsible for notifying the appropriate agencies and coordinating remedial procedures.

Construction activities may involve small quantities of materials that could be considered hazardous such as petroleum and cleaning products, and resins. Measures will be taken to ensure that these materials are not discharged into the environment. Impacts are not anticipated.

2.9 Air Quality

The DOH, Clean Air Branch monitors ambient air for several air pollutants at 13 monitoring stations throughout O'ahu, Big Island and Maui. Station air quality is reported as an index value, with 0-50 Good, 50-100 Moderate, 100-150 Unhealthy or Sensitive Groups, 150-200 Unhealthy, 200-300 Very Unhealthy and 300-500 Hazardous. The closest station to the project area is located in Honolulu at the DOH building on Punchbowl Street across from Queen's Medical Center. The air quality at this station typically falls within the Good range. While air quality in the vicinity of the project area is not measured, the only existing sources of air pollution are emissions from motor vehicles traveling on adjacent roadways.

Short term impacts during the construction period may arise from construction activity. Emissions from construction vehicles may slightly increase air pollution; however, these will likely be dispersed by the prevailing trade winds. Fugitive dust arising from trenching activities and construction vehicles must comply with the provisions of HAR 11-60.1-33. The contractor will be encouraged to implement a dust control plan, which may include several measures, including using dewatering trucks and covering stockpiles of excavated material. Rehabilitation of existing sewers and installation of replacement sewers will utilize temporary flow bypass lines which will involve exposure of raw wastewater to open air only at manhole locations; therefore, odors are expected to be minimal. Resins used during the CIPP process emit odors that may affect nearby residents; however, significant impacts are not anticipated.

2.10 Noise

The predominant existing source of noise within the project area is vehicular traffic along adjacent roadways, notably the arterial roads, Nu'uanu Avenue and Pali Highway. HAR Title 11, Chapter 46 describes the regulations for community noise control and sets forth maximum noise tolerances by zoning district, which are to be administered by DOH, Indoor and Radiological Health Branch (IRH). Noise from construction activities will be short-term and localized, but will likely exceed these tolerances. An approved Community Noise Permit will be required for construction during the hours from 7:00 am to 6:00 pm Monday through Friday, and 9:00 am through 6:00 pm Saturdays. Due to the compressed construction schedule, it is likely that construction outside of these hours will be required; therefore an approved Community Noise Variance will be required from the DOH IRH Branch. All permits and variances will be secured prior to construction.

2.11 Archaeological and Cultural Resources

Cultural Surveys Hawai'i, Inc., was retained to conduct an archaeological literature review and field inspection (LRFI) study for use as a planning document for the Dowsett Highlands Relief Sewer Project. The final report, entitled *"Archaeological Literature Review and Field Inspection for the Dowsett Highlands Relief Sewer Project, Nu'uanu Ahupua'a, Honolulu District, O'ahu, TMKs: [1] 1-7, 1-8, 1-9, and 2-2 (various plats and parcels),"* was completed in November 2015.

Although the document does not fulfill the requirements of an archaeological inventory survey, it will serve to facilitate project planning and support the historic preservation review process by assessing if there are major archaeological concerns within the area. The LRFI documented previously identified historic properties through historical research within a study area encompassing the study area defined in the DAR; and identified new potential historic properties through pedestrian field inspection within a project area generally including the roadway right-of-ways comprising the Dowsett project area. The complete LRFI can be found in Appendix B.

Background research revealed a rich history for the Nuʻuanu area during both the pre-Contact and post-Contact periods, and that extensive archaeological work has been undertaken in the Nuʻuanu Valley over the last century, particularly in lower Nuʻuanu Valley, nearest to the urban areas of Honolulu. The LRFI listed 47 historic properties within 500 meters of the study area through review of 30 previous archaeological studies, and discussed heiau and other early recorded sites, historic residences, and sites identified in modern archaeological studies, including human remains and burials, artifacts and walls. Several studies were conducted at the Royal Mausoleum site along Nuʻuanu Avenue, which documented the recovery of human remains, traditional Hawaiian artifacts, and historic artifacts from the excavated trenches along the exterior wall of the chapel. Potential historic properties within or near the vicinity of the project area were identified during the field inspection as follows:

- Cut basalt curbstones were observed along major portions of Nuʻuanu Avenue makai (southwest) of the Pali Highway, Nuʻuanu Avenue, and the Wyllie Street cloverleaf.
- Several ditches (traditional Hawaiian ʻauwai) were encountered within the Dowsett Avenue area, two of which were observed extending in a northeasterly direction and appeared to cross under Dowsett Avenue.
- Historic cemeteries are located along Nuʻuanu Avenue and Wyllie Street. The Oʻahu Cemetery and Crematory, established in 1844, is located on both sides of Nuʻuanu Avenue. The plots within the cemetery appear to extend slightly askew from Nuʻuanu Avenue, and several gravestones are located right next to the wall along Nuʻuanu Avenue in the west section of the cemetery, suggesting the possibility that burials may extend into present day Nuʻuanu Avenue. Similarly, the Maʻemaʻe Chapel cemetery located at Wyllie and Maʻemaʻe streets may have extended beyond its present boundaries into Wyllie Street.
- Four historic bridges were observed, including the Pelekane Drive bridge (dating to 1930), the Wyllie Street Bridge (dating to 1931), and the Nuʻuanu Arch Bridge (dating to 1933) and the Laʻimi Road Bridge dating to 1920.
- Low basalt and mortar walls are found alongside the sidewalks throughout Nuʻuanu. These walls are typically cement-capped and consist of one to three courses of irregular vesicular basalt stones. Their ages often are indeterminate but in most cases are believed to be post-Contact but more than 50 years old.

The LRFI recommended that the Dowsett Highlands Sewer Relief Project be designed to avoid adverse impact to the bridges, the cut basalt curb stones on Nuʻuanu Avenue, and the traditional Hawaiian ʻauwai noted along Laʻimi Road and the Dowsett Avenue area. Because the Dowsett project area traverses a former traditional Hawaiian landscape of loʻi kalo, ʻauwai and home sites

and lies adjacent to a large number of previously identified historic properties, the LRFI further recommended that an archaeological monitoring program consistent with the standards of HAR §13-279 be developed, beginning with the preparation of an archaeological monitoring plan for the review and acceptance by the State Historic Preservation Division (SHPD) in advance of project related work.

The LRFI was transmitted to the SHPD on November 5, 2015 with the request for SHPD to make a Hawai‘i Administrative Rules (HAR) §13-275-3 historic properties determination for the proposed Dowsett Highland Relief Sewer Project. In letters dated February 17, 2017 and March 27, 2017, SHPD requested and clarified its request for the following:

- Completion of a Selective Reconnaissance Level Survey (RLS) of the project area prior to project work beginning in order to properly identify, document, and address potential effects to any surface historic properties within the project area. The RLS shall make a determination of eligibility and integrity assessment for individual historic properties and any potential historic district; and, if a potential district is present, the RLS must identify character defining features of the district, including significant architectural styles. The RLS also shall assess the significance of the rock walls found throughout the neighborhood. Prior to initiating the RLS, the SHPD architecture branch must be consulted to discuss the survey boundary and properties to be surveyed.
- An opportunity for SHPD to review 60% and 90% design plans to ensure the project is designed to avoid adverse impact to the bridges, the cut basalt curb stones on Nu‘uanu Avenue, and the traditional Hawaiian ‘auwai noted along La‘imi Road and the Dowsett Avenue area.
- Archaeological monitoring of all ground disturbing activity and an archaeological monitoring plan (AMP) meeting the requirements of HAR §13-279-4.
- Documentation of the potential historic properties identified during the LRFI be completed during the archaeological monitoring program, to include a written description, location maps, an assessment of significance, and mitigation recommendations (if appropriate).

SHPD indicated that the RLS and AMP must be accepted prior to initiation of project work. Fung Associates Inc. was retained to complete the RLS, and on May 5, 2017, provided a proposal for the following scope of work:

- Re- Survey Pelekane Drive, Wyllie Street, Nu‘uanu Arch, and La‘imi Road Bridges to confirm the findings documented in the LRFI.
- Provide eligibility assessments for potential historic districts or individually eligible properties within the district. This will be one report, with a few highlighted individual properties, but not an individual RLS form for each building.
- Provide minimal historic context of area, focusing on road development.
- Complete site number requests for eligible properties.
- Identify potential historic districts for future study of which the roads, bridges, curbs, etc. are contributing features if it is near the project area.

- Identify potential future studies in area.
- Written recommendations for the treatment of historic properties within the project area including, bridges, lava rock curbs, manhole covers, obelisks, and rock walls that was found in the LRFI.

A final draft RLS report is anticipated to be submitted to SHPD in August 2017.

In a letter dated May 26, 2017, SHPD reiterated its request, per Chapter 6E-8 of Hawai‘i Revised Statutes, for a completed RLS, an AMP meeting the requirements of HAR §13-279-4, and consultation with SHPD architectural branch to discuss survey boundaries and the properties to be surveyed (during archaeological monitoring) prior to project initiation. SHPD further indicated that the proposed project will require review under the National Historic Preservation Act (NHPA) Section 106 due to the use of federal funding. This process is further described in Section 3.9.1.

The proposed project will be designed to avoid the cut basalt curbstones, traditional Hawaiian ‘auwai, rock walls and other historic properties discussed in the LRFI. The RLS is expected to provide guidance on the treatment of the historic properties and to propose mitigation measures should impacts be unavoidable. SHPD will be consulted throughout the project development which will ensure that any potential impacts to archaeological and cultural resources have been adequately addressed. Additionally, the development of an Archaeological Monitoring Plan, to be approved by SHPD, will ensure that the appropriate procedures for reporting, preservation and mitigation will be followed in the event that any significant items or sites discovered during construction.

2.12 Socio-Economic Characteristics

According to the U.S. Census Bureau, the population, percent non-Caucasian, and median household income of the communities within the project area are as follows:

Table 2-1: Selected Socio-Economic Data

Census Designated Place	Population[1]	% Minorities[2]	Median Household Income[2]
Urban Honolulu	345,130	82.1	$61,442

[1]Source: U.S. Census Bureau American Community Survey (ACS), 2010-2014 via State of Hawai‘i Data Book 2015
[2]Source: U.S. Census Bureau American Community Survey (ACS), 2011-2015

Table 2-2: Resident Population for O‘ahu Neighborhoods

Neighborhood Area	Population
Nu‘uanu/Punchbowl	16,303
Liliha/Kapalama	19,766

Source: City and County of Honolulu, Department of Planning & Permitting, Planning Division, via State of Hawai‘i Data Book 2015

The University of Hawai‘i, Economic Research Organization (UHERO) prepared a county economic forecast in May 2017. The study concludes that chances of continued growth in all four counties are good, albeit at a slower pace than in recent years. Expansion of tourism can endure; however, future gains will be limited by capacity constraints. Construction is peaking for this cycle, and coupled with tight labor markets, will lead to slower growth across other sectors. The common risk to all four counties primarily is continuing uncertainty regarding federal policies. The predictions relevant to O‘ahu are as follows:

- Tourism continues to reach new heights, and there will be additional but slight gains. Domestic consumer confidence will support domestic travel; however, the outlook for international markets is more mixed, which will be especially important for O‘ahu. Visitor numbers are expected to rise, yet spending will be inhibited by still-weak currencies. Although the room stock will experience some growth, occupancy rates will remain high, which will support higher room rates.
- Construction is now at or approaching the peak for this cycle. Home building on O‘ahu is well below levels that will be needed to meet projected household formation. As a result, concerns persist about housing shortages and affordability. As the pace of local income growth slows and interest rates rise, activity in the sector will ease back slowly.
- Healthy labor markets have been reestablished, but job growth will be more limited going forward with unemployment now at low levels. Although the adverse effects of the recession on personal income have been slow to ease, widespread gains have occurred over the past several years. Household purchasing power will increase more slowly now that the economy is slowing and inflation is ascending.
- All four counties face common uncertainties, both for specific industries and generally. Eventual changes to the Affordable Care Act will undoubtedly affect health care. The level and composition of total federal spending are unknown. State and county fiscal pressures will pose challenges, and changes to travel regulations could adversely impact tourism. For O‘ahu, rail remains a big uncertainty.

The proposed project is not expected to have any long-term economic impacts; however, it will have minor positive short-term impacts associated with construction. These impacts include the creation of jobs for the anticipated duration of construction, assuming the project is awarded to a local contractor; and indirect economic stimulus from those workers spending their income on goods and services.

2.13 Utilities

Existing utilities within the project area other than sanitary sewers include electrical, telephone, gas, cable television, storm water management and potable water. There are also traffic signal conduits at certain intersections. Storm water management infrastructure includes 12-inch to 48-inch storm drains and catch basins. Potable water service is provided by the Honolulu Board of Water Supply, and infrastructure includes 1-inch to 24-inch waterlines and an above ground storage tank. Electrical service is provided by Hawaiian Electric Company (HECO), telephone service is provided by Hawaiian Telcom, gas service is provided by Hawai‘i Gas and cable television service is provided by Oceanic Time Warner Cable.

Several precautions will be taken during design and construction of the sewer lines to minimize the potential for conflicts with the existing utilities. The sewer alignment and profile design will adhere to minimum clearances from existing waterlines as required by the CCH Wastewater Design Standards. Utility companies will be provided plans for review during the design stage, and contractors will be required to coordinate field toning of the infrastructure prior to construction.

2.14 Transportation

Construction of the proposed project will involve work within several state and CCH roadway right-of-ways, most notably Pali Highway and Nu‘uanu Avenue, and also including School Street, Dowsett Avenue, Nu‘uanu Pali Drive, Wyllie Street, Jack Lane, Ahi Place, La‘imi Road and Pelekane Drive. Within the project area, Pali Highway is generally a two-way, six-lane, divided major arterial state roadway with a posted speed limit of 35 MPH. Pali Highway is also part of the National Highway System (NHS), and serves as the main connection between Kailua to Honolulu. It also provides access to Nu‘uanu residential areas, schools, churches and foreign consulates. Within the project area, Nu‘uanu Avenue is generally a two-way, four-lane, undivided county collector roadway with a posted speed limit of 25 MPH. It provides access to residential and commercial areas, schools and cemeteries. On-street parking is allowed at various locations along the roadway. Both roadways also provide transport for the TheBus, operated by O‘ahu Transit Services (OTS), which has several routes running in both directions: 4 University – Moiliili, 10 Alewa Heights, 55 Honolulu – Ala Moana Center, 56 Honolulu – Ala Moana Center, 57 Honolulu – Ala Moana Center, 57A Honolulu – Ala Moana Center, 65 Downtown – Bishop Street. There are nine (9) signalized intersections within the project area at the following locations: Pali Highway/Nu‘uanu Pali Drive/Waokanaka Street, Pali Highway/Country Club Road/ Pū‘iwa Road, Pali Highway/Ahi Place/La‘imi Road, Pali Highway/Jack Lane/‘Akamu Place, Nu‘uanu Avenue/Wyllie Street, Nu‘uanu Avenue/Judd Street, Nu‘uanu Avenue/Pauoa Road, Nu‘uanu Avenue/Kuakini Street, Nu‘uanu Avenue/School Street.

Design and construction of the Dowsett Highlands Relief Sewer Project will be coordinated with all projects in the vicinity with overlapping schedules and potential shared traffic impacts. The following three such projects were known at the time of this Draft EA:

1. *Pali Highway Resurfacing, Waokanaka Street to Kamehameha Highway and Pali Highway Lighting Replacement, Vineyard Boulevard to Kamehameha Highway (Department of Transportation, Highways Division, Federal Aid Project Number NH-061-1(035))* – This project will involve road resurfacing and installation of new LED lighting, guardrails, signs, pavement markings and median improvements along Pali Highway. The estimated construction schedule is September 2017 – May 2019; therefore, construction is expected to overlap with the first 12 months of the Dowsett project. The Honolulu-bound lanes along Pali Highway will be temporarily realigned and narrowed with median modifications to establish three (3) traffic lanes and a shoulder lane in the Honolulu-bound direction. This realignment will remain in-place generally from Dowsett Avenue to the Nu‘uanu Avenue off-ramp throughout construction of the Dowsett project in those areas. No roadway changes will be made to Pali Highway in the Kailua-bound direction.

2. *Pali Highway Resurfacing, Vineyard Boulevard to Waokanaka Street (Department of Transportation, Highways Division, Federal Aid Project Number NH-061-1(036))* – This project will only involve road resurfacing along Pali Highway. The construction schedule for this project has not yet been set however is expected to occur after construction of the Dowsett project is complete.
3. *Nu'uanu Avenue Repaving and Complete Streets Improvements (City and County of Honolulu)* – This project will involve road resurfacing from South School Street to Wyllie Street and improvements along Nu'uanu Avenue from Kuakini Street to Craigside Place to reshape the street into a safer, multi-modal corridor encouraging pedestrian and bicycle activities. The estimated design start date is June 2018 with an estimated 12 – 18 months to complete the design. The construction schedule will be coordinated to follow completion of the Dowsett project.

Austin, Tsutsumi & Associates, Inc. (ATA) was retained to complete a transportation management plan (TMP) for the Dowsett project with a primary focus of reducing and minimizing the traffic impacts resulting from temporary lane closures along Nu'uanu Avenue, Pali Highway, Nu'uanu Pali Drive, Dowsett Avenue and Wyllie Street. The draft report, entitled *"Transportation Management Plan, Dowsett Highlands Relief Sewer,"* was completed on May 5, 2017. The complete TMP can be found in Appendix C.

The TMP utilized 24-hour traffic count data to determine favorable potential lane closure hours. The data was collected by DOT along Wyllie Street in 2014 and Pali Highway in 2015, and by ATA along Nu'uanu Avenue and Dowsett Avenue in 2017. The TMP also utilized turning movement counts collected in 2009 and 2014 to predict 2017 traffic conditions at the project intersections and utilized turning movement counts collected at selected project intersections in 2017 to predict peak turning movement counts at those intersections. The TMP used a threshold of 1,000 passenger cars per lane per hour (pc/ln/hr) to determine the capacity of each roadway. This threshold was based on criteria in the 2007 DOT Transportation Management Plan Guidelines and the Work Zone Safety and Mobility Process, which considered a significant project to be where the existing traffic volume exceeds 1,000 pc/ln/hr. The TMP provided analysis and recommended acceptable lane closure times for the project roadway segments as described below:

Pali Highway between Dowsett Avenue (South) and Coelho Way

Construction of sanitary sewers will be completed in the Honolulu-bound direction. As discussed previously this section, realignment of the Honolulu-bound direction for the DOT Pali Highway roadway resurfacing and lighting project will establish three lanes and a shoulder lane. Construction activity for the Dowsett project will occur in the right-most lane and the shoulder lane, and accordingly, only two (2) lanes will be available for traffic. Analysis revealed that traffic volumes along Honolulu-bound Pali Highway only exceeded the threshold during the AM commuter peak hour; therefore, single-lane closure was found to be acceptable between the hours of 9:00 AM and 7:00 PM.

Pali Highway between Dowsett Avenue (North) and Nu'uanu Pali Drive

Construction of sanitary sewers will be completed in the Kailua-bound direction. During construction, the right-most Kailua-bound lane will be closed, and only two (2) lanes will be available for traffic. Analysis revealed that traffic volumes along Kailua-bound Pali

Highway do not exceed the threshold; therefore, a single-lane closure was found to be acceptable between the hours of 9:00 AM and 7:00 PM.

Nu‘uanu Avenue
Construction of sanitary sewers by open trench will require one or two lane closures total in the Honolulu-bound and/or the Kailua-bound direction of Nu‘uanu Avenue. In the event that both Honolulu-bound lanes must be closed, contraflow may be performed on one Kailua-bound lane to provide one lane in each direction. On-street parking will not be allowed along the roadway during construction. Assuming the worst case scenario of two lane closures with one lane operational in each direction, analysis revealed that traffic volumes along Nu‘uanu Avenue exceeded the threshold during the AM commuter peak hour of traffic and also exceeded the threshold during the PM commuter peak hour between Muliwai Lane and Pauoa Road. Therefore, a two-lane closure along Nu‘uanu Avenue was found to be acceptable between the hours of 8:30 AM and 4:30 PM.

Dowsett Avenue
Construction of sanitary sewers by open trench will reduce Dowsett Avenue to a two-way, one-lane operation which will require flaggers to direct traffic. Because the roadway provides exclusive access to residences, it cannot be fully restricted during construction. As a residential roadway, low traffic volumes along Dowsett Avenue will not exceed the threshold. However, construction hours should avoid, if possible, the commuter peak hours of traffic to minimize the negative effects of lane closures on residents. Two-way, one-lane operations along Dowsett Avenue were found to be acceptable between the hours of 9:00 AM and 5:00 PM.

Wyllie Street
Construction of sanitary sewers by open trench will reduce Wyllie Street to a two-way, one-lane operation which will require flaggers to direct traffic. Because the roadway provides exclusive access to residences, Nu‘uanu Fire Station and Ma‘ema‘e Elementary School, it cannot be fully restricted during construction. Analysis revealed that traffic volumes along Wyllie Street exceeded the threshold during the PM commuter peak hour of traffic and came close to exceeding the threshold during the AM peak hour. Therefore, lane closures shall avoid the AM and PM commuting hours. Two-way, one-lane operations along Wyllie Street were found to be acceptable between the hours of 7:30 AM and 3:30 PM.

The TMP also evaluated the impacts of turning movement restrictions at seven (7) locations affected by the Dowsett project. Due to the relatively low volume of vehicles likely to be impacted by turning movement restrictions, the TMP concluded that traffic operations in the study area are expected to remain at acceptable levels during allowable work hours. These restrictions must be coordinated with emergency services (fire, police and ambulance) prior to implementation and acceptable detour routes will need to be provided. The turning movement restrictions are listed below:

- Pali Highway Honolulu-bound left-turn into La‘imi Road – will be temporarily closed during construction on Pali Highway.

- Pali Highway Honolulu-bound left-turn into Pūʻiwa Road – will be temporarily closed during construction on Pali Highway.
- Pali Highway left- and-right turns into Dowsett Avenue (South) – the Honolulu-bound left-turn lane and the Kailua-bound right-turn lane will be temporarily closed during open trench construction on Pali Highway and Dowsett Avenue.
- Pali Highway left- and-right turns into Dowsett Avenue (North) – the Honolulu-bound left-turn lane and the Kailua-bound right-turn lane will be temporarily closed during open trench construction on Dowsett Avenue.
- Pali Highway left- and right-turns into Nuʻuanu Pali Drive – the Honolulu-bound left-turn lane and the Kailua-bound right-turn lane will be temporarily closed during open trench construction on the Kailua-bound side of Pali Highway and Nuʻuanu Pali Drive.
- Nuʻuanu Avenue Off-Ramp from Pali Highway – will be temporarily closed during open trench construction along Pali Highway and Nuʻuanu Avenue.
- Kailua-bound Nuʻuanu Avenue left-turn into School Street – the left-turn will be temporarily restricted during construction of the underground connection of the sewer line to the existing sewer tunnel under School Street.

The lane closures and restrictions discussed above are anticipated to be implemented only as necessary when construction is ongoing in the immediate vicinity. Vehicles rerouted through residential areas during turning movement restrictions are not expected to have a significant impact on existing traffic due to the limited existing traffic volumes in those areas. The TMP further recommended that access to driveways and intersections should be maintained during construction where possible, and roadways that provide exclusive access to and driveways that connect to business and residences cannot be fully restricted during construction.

Temporary traffic control devices to be utilized during construction include temporary signs, electronic message boards, channelizing devices, flaggers and uniformed traffic control officers, barricades and portable barriers. An approved traffic control plan will be developed and will form part of the Contract Documents for the Dowsett project.

Several agencies, including the Department of Education (DOE), the Honolulu Police Department (HPD) and the CCH Department of Transportation Services (DTS) expressed concern regarding traffic impacts during construction. Specifically, DOE indicated concern about how school traffic and operations would be impacted at various locations and requested communication with the principal of each school prior to construction. DTS requested that the Neighborhood Board, as well as the area residents, businesses, emergency personnel (fire, ambulance and police), Oʻahu Transit Services, Inc. (TheBus and the Handi-Van), etc., be kept apprised of the details of the proposed project and the impacts that the project may have on the adjoining local area street network. Early planning and coordination with the affected agencies by the design team and the contractor will help mitigate traffic impacts. These agencies include Oʻahu Transit Services/DTS, HPD, Honolulu Fire Department (HFD), Hawaiʻi Transportation Association, CCH Department of Emergency Management, and emergency services.

An effective public communication program will further ease the impacts of construction. Hastings and Pleadwell LLC (HP) has been retained to help with public relations for the Dowsett project. Public awareness strategies include community outreach to neighborhood boards and public hearings, resident notification such as direct mail, flyers and electronic newsletters, and collection of contact information for those interested in project-related notifications, news media, and implementation of a project informational website. HP has initiated contact and communications with local politicians. Additionally, a basic story has been created for release to the public describing the background and intent of the Dowsett project, its relationship to the DOT Pali Highway roadway resurfacing and lighting projects, and informing the public of the combined impacts on local residents, commuters and the general public.

2.15 Police Protection

The nearest Honolulu Police Department (HPD) station is the Downtown Substation located south of the project area on Hotel Street. There is also an HPD station located west of the project area on Kamehameha IV Road in Kalihi. In a letter dated April 28, 2017, HPD expressed concern regarding the safe flow of vehicular traffic during the construction phase of the project. As discussed in Section 2.14, a Transportation Management Plan has been developed for the Dowsett project, and extensive coordination and outreach will be established during the design and construction phases to minimize impacts.

2.16 Fire Protection

There are two Honolulu Fire Department stations within the project area. The Nu‘uanu Fire Station is located along Wyllie Street at Nu‘uanu Avenue, and the Kuakini Fire Station is located along North Kuakini Street west of Liliha Street. During construction, measures will be taken to maintain access to fire hydrants. Additionally, as discussed in Section 2.14, early coordination will apprise HFD and other emergency services of any lane reductions or turning movement restrictions well in advance; therefore, impacts to fire protection services will be minimized.

2.17 Educational Facilities

There are several schools in the vicinity of the project area within the Department of Education Roosevelt Complex, including Prince David Kawānanakoa Middle School, Ma‘ema‘e Elementary School and Nu‘uanu Elementary School. Also in the vicinity of the project area are private schools Queen Emma Preschool, Hawai‘i Baptist Academy Elementary School and Hawai‘i Baptist Academy High School. As discussed in Section 2.14, in a letter dated April 28, 2017, DOE expressed concern about how the project would impact school traffic and operations at various locations. The Transportation Management Plan (TMP) indicated that the schools located along the project corridors are major trip generators, and that peak pedestrian volumes would likely correspond with school start and end times. The TMP recommended that care should be taken to preserve pedestrian crossing routes and sidewalks affected by the project, and that alternative pedestrian routes must be provided should sidewalks or crosswalks need to be closed. As indicated in the TMP, the schools are key contributors to traffic volumes in the area, and hence will be an integral part of the public outreach program. Early coordination and outreach will minimize the impacts of construction on the nearby schools.

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CHAPTER 3. RELATIONSHIP TO FEDERAL, STATE AND COUNTY PLANS AND POLICIES

3.1 Hawai‘i State Plan

The Hawai‘i State Plan, Chapter 226 of the Hawai‘i Revised Statutes, was first adopted in 1978. It serves as a guide for the future long-range development of the state through identification of goals, objectives, policies, and priorities. The objectives and policies relevant to the proposed project are described below:

§226-11 Objectives and policies for the physical environment—land-based, shoreline, and marine resources.

(a) Planning for the state's physical environment with regard to land-based, shoreline, and marine resources shall be directed towards achievement of the following objectives:
  (1) Prudent use of Hawai‘i's land-based, shoreline, and marine resources.
  (2) Effective protection of Hawai‘i's unique and fragile environmental resources.

(b) To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of this State to:
  (2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.
  (3) Take into account the physical attributes of areas when planning and designing activities and facilities.
  (4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.

§226-12 Objective and policies for the physical environment—scenic, natural beauty, and historic resources.

(a) Planning for the state's physical environment shall be directed towards achievement of the objective of enhancement of Hawai‘i's scenic assets, natural beauty, and multi-cultural/historic resources.

(b) To achieve the scenic, natural beauty, and historic resources objectives, it shall be the policy of this state to:
  (1) Promote the preservation and restoration of significant natural and historic resources.
  (2) Provide incentives to maintain and enhance historic, cultural, and scenic amenities.
  (3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.
  (4) Protect those special areas, structures, and elements that are an integral and functional part of Hawai‘i's ethnic and cultural heritage.
  (5) Encourage the design of developments and activities that complement the natural beauty of the islands.

§226-13 Objective 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 Hawai'i's land, air, and water resources.

(b) To achieve the land, air, and water quality objectives, it shall be the policy of this state to:
  (2) Promote the proper management of Hawai'i's land and water resources.
  (3) Promote effective measures to achieve desired quality in Hawai'i's surface, ground, and coastal waters.

§226-14 Objectives and policies for facility systems—in general.

(a) Planning for the state's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.

(b) To achieve the general facility systems objective, it shall be the policy of this state to:
  (1) Accommodate the needs of Hawai'i's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.
  (2) Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.
  (3) Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.
  (4) Pursue alternative methods of financing programs and projects and cost-saving techniques in the planning, construction, and maintenance of facility systems.

§226-15 Objectives and policies for facility systems—solid and liquid wastes.

(a) Planning for the state's facility systems with regard to solid and liquid wastes shall be directed towards the achievement of the following objectives:
  (1) Maintenance of basic public health and sanitation standards relating to treatment and disposal of solid and liquid wastes.
  (2) Provision of adequate sewerage facilities for physical and economic activities that alleviate problems in housing, employment, mobility, and other areas.

(b) To achieve solid and liquid waste objectives, it shall be the policy of this state to:
  (1) Encourage the adequate development of sewerage facilities that complement planned growth.
  (2) Promote re-use and recycling to reduce solid and liquid wastes and employ a conservation ethic.
  (3) Promote research to develop more efficient and economical treatment and disposal of solid and liquid wastes.

The proposed project is in compliance with the aforementioned goals and objectives.

3.2 State Land Use Law

Chapter 205 of the Hawai‘i Revised Statutes, the State Land Use Law, classifies four major land use districts in which all lands are placed and establishes a framework of land use management and regulation for these lands. The four land use districts are: Rural, Urban, Agricultural and Conservation. The State Legislature established the Land Use Commission (LUC) to administer the State Land Use Law.

The Conservation District is regulated by the Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL), and is divided into five subzones: Protective, Limited, Resource, General and Special. The first four subzones are arranged in a hierarchy of environmental sensitivity, ranging from the most to the least sensitive; the Special subzone is applied in special cases specifically to allow a unique land use on a specific site. As established in Hawai‘i Administrative Rules (HAR) Chapter 13-5, Subchapters 2 and 3, these subzones define a set of "identified land uses" which may be allowed by discretionary permit or some sort of approval from the DLNR. Major permits are required for land uses which have the greatest potential impact, and an EA and/or an EIS and potentially Public Hearing are required; minor permits are required for land uses which may have fewer impacts.

The project area is entirely within the Urban land use district. See **Figure 3-1**. HRS Section 205-2(b) states that “Urban districts shall include activities or uses as provided by ordinances or regulations of the county within which the urban district is situated”. Therefore, guidance regarding the Urban district is deferred to the City and County of Honolulu.

3.3 City and County of Honolulu General Plan

The City and County of Honolulu General Plan, a requirement of the City Charter, is a broad but comprehensive statement of objectives and policies which sets forth the long-range aspirations of O‘ahu's residents and the strategies of actions to achieve them within an approximate 20-year planning horizon. The Department of Planning and Permitting strives to maintain the dynamic nature of the General Plan; the current edition was released in 1992, and amended in 2002, and a second public review draft of proposed revisions was released in February 2017. It is the focal point of a comprehensive planning process that, together with the regional development plans, provides a direction and framework to addresses physical, social, economic and environmental concerns affecting the City and County of Honolulu. This planning process serves as the coordinative means by which the City and County government provides for the future growth of the metropolitan area of Honolulu.

There are eleven (11) areas of concern outlined in the General Plan:

(1) population;
(2) economic activity;
(3) the natural environment;
(4) housing,
(5) transportation and utilities;
(6) energy;

(7) physical development and urban design;
(8) public safety;
(9) health and education;
(10) culture and recreation; and
(11) government operations and fiscal management

The General Plan does not define specific land uses or area.

The policies and objectives for Transportation and Utilities, Section 5, relevant to the proposed project, are as follows:

Objective B: To meet the needs of the people of Oʻahu for an adequate supply of water and for environmentally sound systems of waste disposal.

Policy 5: Provide safe, efficient and environmentally sensitive waste-collection and waste-disposal systems.

Objective C: To maintain a high level of service for all utilities.

Policy 1: Maintain existing utility systems in order to avoid major breakdowns.

Policy 2: Provide improvements to utilities in existing neighborhoods to reduce substandard conditions.

Policy 3: Plan for the timely and orderly expansion of utility systems.

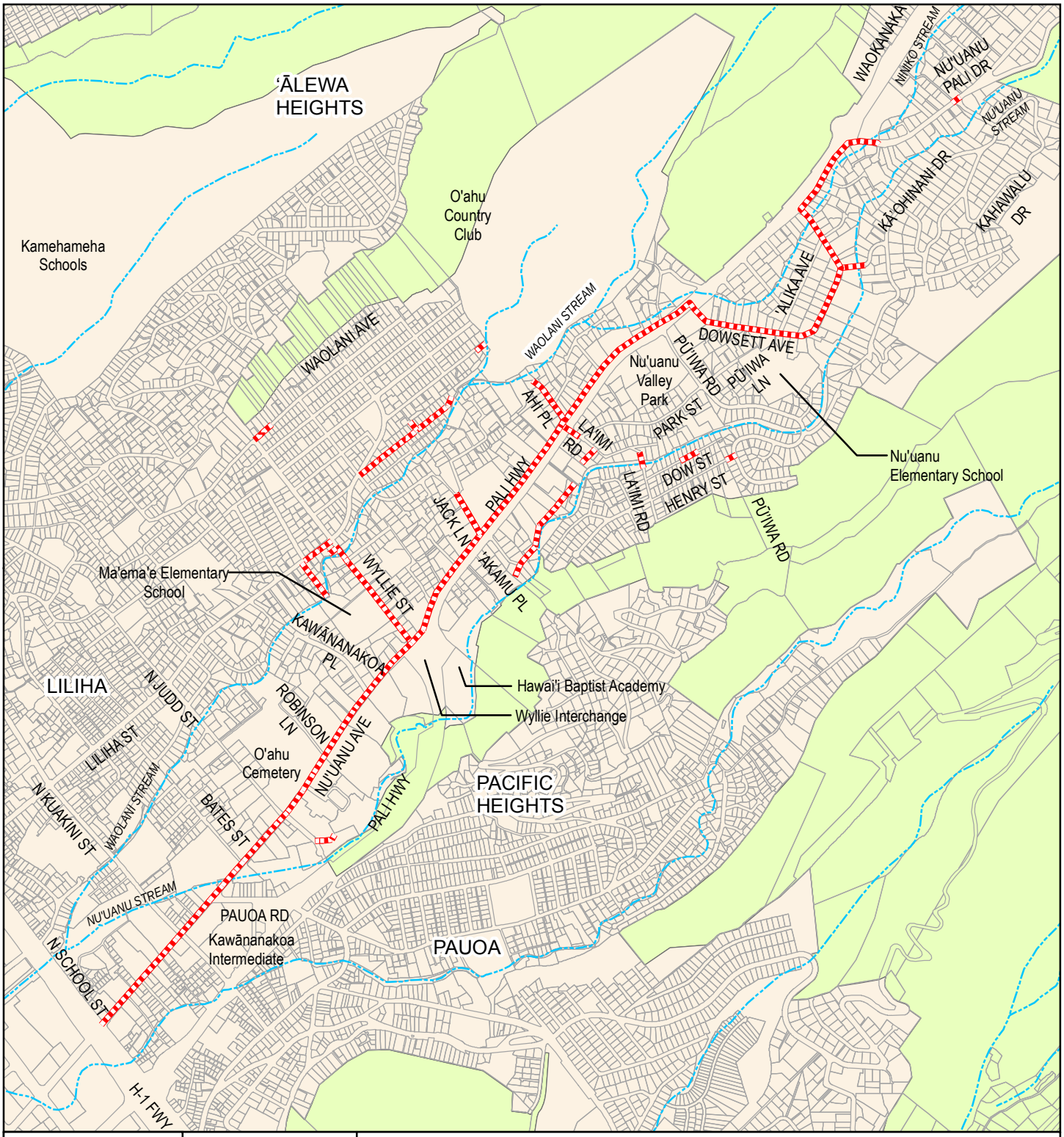
Objective D: To maintain transportation and utility systems which will help Oʻahu continue to be a desirable place to live and visit.

Policy 1: Give primary emphasis in the capital- improvement program to the maintenance and improvement of existing roads and utilities.

The proposed project is consistent with the aforementioned policies.

3.4 Primary Urban Center Development Plan

Chapter 24 of the Revised Ordinances of Honolulu (ROH) sets out the requirement for the preparation of development plans, which are community-oriented plans intended to help guide public policy, investment, and decision-making through a planning horizon over a 20± year timeframe. Each of these plans covers a geographic planning region on Oʻahu, addressing the specific conditions and community values of each region. Two of the eight planning regions, ʻEwa and the Primary Urban Center (PUC), were areas to which major growth in population and economic activity were anticipated to be directed over the next 20 years and beyond, and the remaining six planning regions were envisioned to remain relatively stable. The plans for the former regions were titled "Development Plans," and the plans for the latter regions were titled "Sustainable Communities Plans". The PUC extends from Pearl City in the west to Waiʻalae-Kāhala in the east, including the core of downtown Honolulu, and extends to the Koʻolau Range in the north. The function of the Primary Urban Center Development Plan (PUCDP) is to serve as the policy guide for the development decisions and actions required to support that growth.



Dowsett Highlands Relief Sewer
Draft Environmental Assessment

STATE LAND USE MAP

FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers

Figure 3-1

These plans were adopted and revised by ordinance and are required to implement objectives and policies set forth in the General Plan.

The 2004 Primary Urban Center Development Plan is incorporated into Ordinance 04-14 by reference. Review of each of the plans begins five years after adoption to revalidate and adjust as necessary vision elements, policies, and guidelines, and evaluate how implementation can be improved. Review of the PUCDP is expected to begin in 2017. The 2004 PUCDP is organized in five chapters addressing the role of the PUC in O‘ahu’s development pattern; the vision for the PUC’s future; land use and transportation; infrastructure and public facilities; and implementation. Consistent with the provisions of the General Plan, the PUC is expected to accommodate a significant proportion of O‘ahu’s projected growth in residential population and jobs during the 20-year timeframe of the plan. The vision for the PUC describes the Honolulu of 2025, with an emphasis on retaining the qualities that attract both residents and visitors, while encouraging growth and redevelopment to accommodate the projected increases in jobs and residential population. The key elements of the vision reflect the size and importance of the PUC.

Section 4.2 of the PUCDP deals specifically with the PUC’s wastewater system and points to its aging collection system as a major obstacle to the orderly development of the City of Honolulu in part due to inadequate sewer capacity. The policies and guidelines relevant to this project state the following:

Policy: Implement wastewater collection system improvements to provide adequate service and sound facilities to existing neighborhoods and timely increases in system capacity to areas planned to undergo improvement or change in use.

Guideline: Complete current projects needed to correct currently identified service or facility inadequacies for neighborhoods where change in service demand is not anticipated.

The proposed project will facilitate achievement of this policy and guideline for the PUC’s wastewater system and therefore is in conformance with the principles and objectives outlined in the PUCDP.

3.5 Primary Urban Center Watershed Management Plan

The Honolulu Board of Water Supply (HBWS), in collaboration with the City and County of Honolulu, Department of Planning and Permitting (DPP), is in the process of updating the O‘ahu Water Management Plan (OWMP) in accordance with the State Water Code and the Hawai‘i Water Plan, and CCH Ordinance 90-62 that established the OWMP. HBWS will develop eight district-specific plans that together will form the updated O‘ahu Water Management Plan, each providing watershed management guidance over a 20-year timeframe.

The overall goal of these plans is to formulate an environmentally holistic, community-based, and economically viable watershed management plan to provide short-, mid-, and long-range guidance for a balance between: (1) the preservation and restoration of O‘ahu’s watersheds, and (2)

sustainable ground water and surface water use and development to serve present and future generations. The five major objectives are as follows:

Objective #1: Promote sustainable watersheds

Objective #2: Protect and enhance water quality and quantity

Objective #3: Protect Native Hawaiian rights and traditional and customary practices

Objective #4: Facilitate public participation and education, and project implementation

Objective #5: Meet future water demands at a reasonable cost

The Primary Urban Center Watershed Management Plan is currently in development by HBWS.

3.6 City and County of Honolulu Land Use Ordinance

Chapter 21 of the Revised Ordinances of Honolulu (ROH), Land Use Ordinance (LUO), regulates Honolulu's land use in a manner that will encourage orderly development in accordance with adopted land use policies while providing reasonable development and design standards. Section 21.3 sets forth CCH's zoning district classifications and prescribes the permitted land uses and activities within those designations. The proposed project is within the A-1, A-2 and A-3 Agricultural districts, the B-2 Community Business district, P-2 General Preservation district, and the R-5, R-7.5 and R-10 Residential districts. See **Figure 3-2**. The LUO states the following regarding these districts:

Sec. 21-3.40 Preservation districts--Purpose and intent.

(a) The purpose of the preservation districts is to preserve and manage major open space and recreation lands and lands of scenic and other natural resource value.

(d) Should lands be removed from either the state-designated conservation district or from federal jurisdiction, all uses, structures and development standards shall be as specified for the P-2 general preservation district.

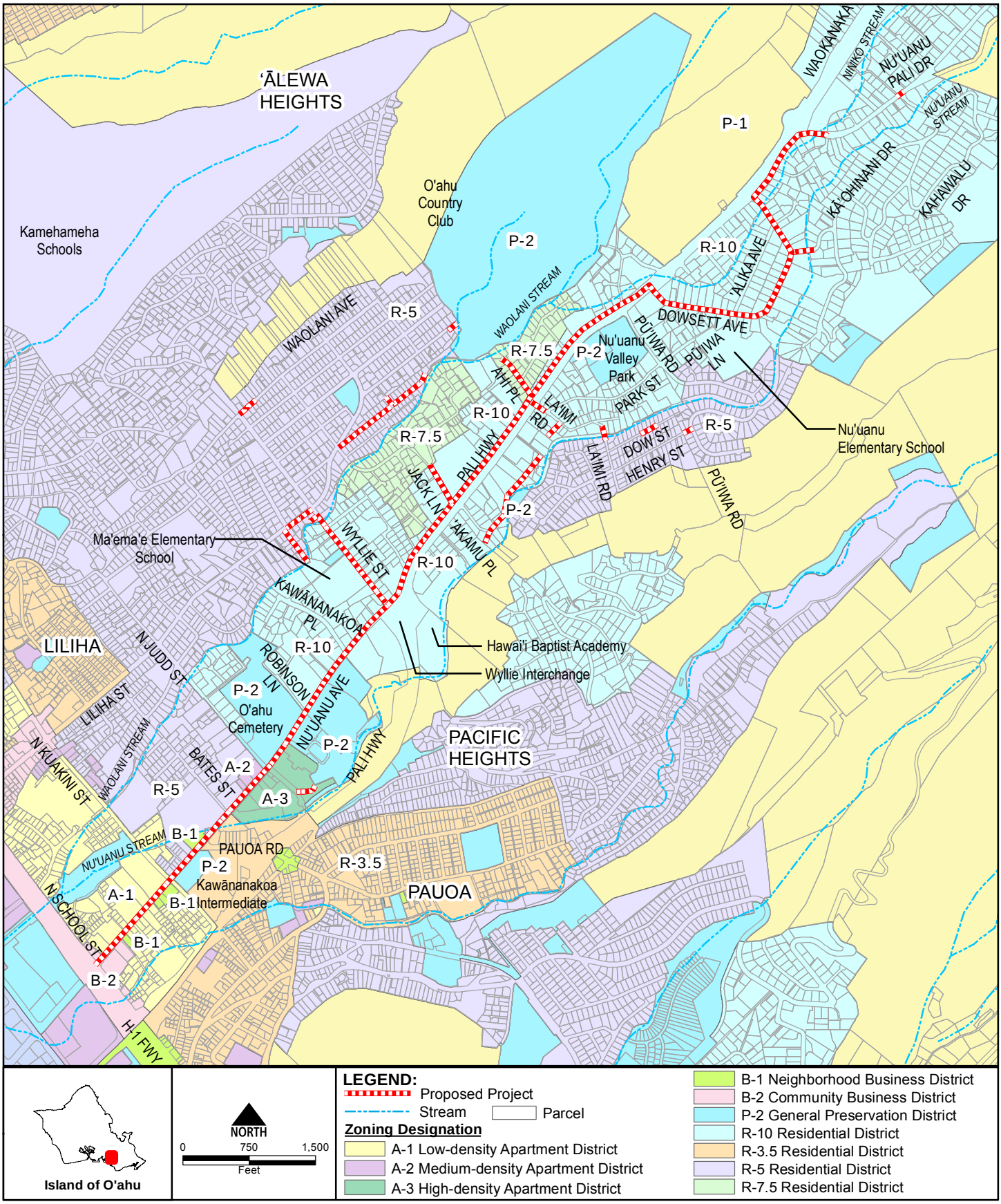
(e) It is also the intent that lands designated urban by the state, but well suited to the functions of providing visual relief and contrast to the city's built environment or serving as outdoor space for the public's use and enjoyment be zoned P-2 general preservation district. Areas unsuitable for other uses because of topographical considerations related to public health, safety and welfare concerns shall also be placed in this district.

Sec. 21-3.40-1 Preservation uses and development standards.

(c) Within the P-2 general preservation district, permitted uses and structures shall be as enumerated in Table 21-3.

Sec. 21-3.70 Residential districts--Purpose and intent.

(a) The purpose of the residential district is to allow for a range of residential densities. The primary use shall be detached residences. Other types of dwellings may also be allowed, including zero lot line, cluster and common wall housing arrangements. Nondwelling uses which support and complement residential neighborhood activities shall also be permitted.



Dowsett Highlands Relief Sewer
Draft Environmental Assessment

CITY & COUNTY OF HONOLULU ZONING MAP

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Consulting Engineers

Figure 3-2

(b) The intent of the R-20 and R-10 districts is to provide areas for large lot developments. These areas would be located typically at the outskirts of urban development and may be applied as a transitional district between preservation, agricultural or country districts and urban districts. They would also be applied to lands where residential use is desirable but some development constraints are present.
(c) The intent of the R-7.5, R-5 and R-3.5 districts is to provide areas for urban residential development.

Sec. 21-3.70-1 Residential uses and development standards.
(a) Within the residential districts, permitted uses and structures shall be as enumerated in Table 21-3.

Sec. 21-3.80 Apartment districts--Purpose and intent.
(a) The purpose of the apartment districts is to allow for a range of apartment densities and a variety of living environments. The predominant uses include multifamily dwellings, such as common wall housing, walkup apartments and high-rise apartments. Uses and activities that complement apartment use are permitted, including limited social services.
(b) The intent of the A-1 low density apartment district is to provide areas for low density, multifamily dwellings. It may be applied as a buffer between residential districts and other more intense, noncompatible districts. It would be applicable throughout the city.
(c) The intent of the A-2 medium density apartment district is to provide areas for medium density, multifamily dwellings. It is intended primarily for concentrated urban areas where public services are centrally located and infrastructure capacities are adequate.
(d) The intent of the A-3 high density apartment district is to provide areas for high density, high-rise, multifamily dwellings. It is intended for central urban core areas where public services and large infrastructure capacities are present.

Sec. 21-3.80-1 Apartment district uses and development standards.
(a) Within the apartment districts, permitted uses and structures shall be as enumerated in Table 21-3.

Sec. 21-3.110 Business districts--Purpose and intent.
(a) The purpose of the business districts is to set aside areas for commercial and business activities to meet and support the economic growth of the city. The districts provide for the buying and selling of goods and services, the transportation and distribution of commodities and other complementary economic activities. Other uses which are supportive of or compatible with business activities are also permitted. These districts help to ensure a favorable business climate and support the economic and social well-being of city residents.
(c) The intent of the B-2 community business district is to provide areas for community-wide business establishments, serving several neighborhoods and offering a wider range of uses than is permitted in the B-1 district. The intent is to apply this district to areas conveniently accessible by vehicular and pedestrian modes and served by adequate public facilities. Typically, this district would be applied to lots along major streets and in centrally located areas in urban and urban fringe areas.

Sec. 21-3.110-1 Business uses and development standards.
(a) Within the business districts, permitted uses and structures shall be as enumerated in Table 21-3.

Per 21-3.40-1(a), 21-3.70-1(a), 21-3.80-1(a) and 21-3.110-1(a), within general preservation, residential, apartment and business districts, respectively, permitted uses and structures shall be as enumerated in Table 21-3. This table, the "Master Use Table", indicates that for all zoning districts, under Social and Civic Service, public uses and structures are permitted uses.

Underground public sanitary sewers certainly fall under these categories. Development standards for each of the listed zoning districts are related to development of land area and height of structures, which are not applicable to the proposed project.

Section 21.9 of the LUO sets forth the requirements for development within Honolulu's special districts with the purpose of guiding development to protect and/or enhance the physical and visual aspects of communities in need of restoration, preservation, redevelopment or rejuvenation. Part of the proposed project is within the Punchbowl Special District. In a letter dated May 5, 2017, the CCH, Department of Planning and Permitting, indicated that the project scope of work will primarily consist of below-grade infrastructure improvements and the restoration of elements within the public rights-of-way, which are considered exempt activities within the Punchbowl Special District and do not require a Special District Permit. The DPP further noted that any tree removal that is six inches or more in trunk diameter along Nu'uanu Avenue would require a Special District Permit Minor.

The proposed project is in conformance with the City and County of Honolulu LUO.

3.7 Coastal Zone Management Program

Hawai'i's Coastal Zone Management (CZM) Program was approved in 1977 though HRS Chapter 205A subsequent to the passage of the federal CZM Act in 1972. The program was enacted to provide a common focus for state and county actions dealing with land and water uses and activities. It is administered by the State Department of Business, Economic Development and Tourism (DBEDT), Office of Planning; however, each county has been delegated local authority and is responsible for issuing permits for activities within its lands. The CZM establishes two areas in which special controls and rules are applied, the Special Management Area (SMA) and the Shoreline Setback. The SMA is a land area extending inland from the shoreline as delineated by the maps developed through the CZM program in which development is regulated, and the Shoreline Setback serves to protect and preserve the natural shoreline, public pedestrian access and open space by regulating any structure or activity within this shoreline area. Permit requirements are set forth in ROH Chapter 25 and Chapter 23, respectively, and are under the jurisdiction of the DPP.

The project area is not within the SMA or the shoreline; therefore, neither an SMA permit nor a Shoreline Setback variance will be required.

Chapter 205A also requires legal and operational compliance with CZM objectives and policies as described in §205A-2. These objectives and policies applicable to the proposed project are indicated in **Table 3-1**.

Table 3-1: Coastal Zone Management Progam Objectives

Objective	Description	Applicable
Recreational resources	Provide coastal recreational opportunities accessible to the public.	No
Historic resources	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.	Yes
Scenic and open space resources	Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.	No
Coastal ecosystems	Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.	No
Economic uses	Provide public or private facilities and improvements important to the state's economy in suitable locations.	No
Coastal hazards	Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.	No
Managing development	Improve the development review process, communication, and public participation in the management of coastal resources and hazards.	No
Public participation	Stimulate public awareness, education, and participation in coastal management.	No
Beach protection	Protect beaches for public use and recreation.	No
Marine resources	Promote the protection, use, and development of marine and coastal resources to assure their sustainability.	No

The policy relevant to the proposed project are as follows:

§205A-2(c)(2) Historic Resources:

(A) Identify and analyze significant archaeological resources;
(B) Maximize information retention through preservation of remains and artifacts or salvage operations;
(C) Support state goals for protection, restoration, interpretation, and display of historic resources.

As discussed in Section 2.11, an archaeological literature review and field inspection (LRFI) was completed which documented existing and potential historic properties; a Selective Reconnaissance Level Survey (RLS) will be completed to identify, document and protect historic properties; and an archaeological monitoring plan (AMP) will be developed. SHPD continues to

be involved throughout this process. The proposed project is in conformance with the aforementioned policy.

3.8 Department of the Army

The mission of the U.S. Army Corps of Engineers (USACE) is to protect the aquatic resources of the United States. The USACE has jurisdiction over waters of the United States, which include navigable waters and wetlands, and assumes authority through issuance of permits for activities above, below or within these waters. The USACE is responsible for administration of Department of the Army (DA) permits under the following legislative acts:

- Rivers and Harbors Act 1899§10: Section 10 of the Rivers and Harbors Act of 1899 requires prior authorization to complete any work in or over, or which affects the course, location, condition or capacity of navigable waters of the United States.
- Clean Water Act – §401 and §404: Section 401 of the Clean Water Act requires that an applicant for a Federal license or permit to conduct any activity which may result in a discharge into the navigable waters, shall provide certification that any such discharge will comply with the Clean Water Act. Section 404 of the Clean Water Act requires approval prior to discharging dredged or fill material into the waters of the United States.
- Coastal Zone Management Act – §307: Section 307 of the Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1458(c)), requires the applicant and State certify that the project is in compliance with an approved State Coastal Zone Management Program.
- Endangered Species Act – §7: Section 7 of the Endangered Species Act of 1973 requires certainty that any Federally funded or authorized action will likely not jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of their critical habitat. The Corps consults with the United States Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration (NOAA) Fisheries to assess the potential of a project to affect listed species.
- National Historic Preservation Act – §106: Section 106 of the National Historic Preservation Act requires the Corps to take into account the effect of a project on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The Corps is required to consult with the DLNR, State Historic Preservation Division (SHPD), in order to determine a project's potential to impact resources of historic or cultural significance.

The Nu‘uanu, Waolani and Niniko Streams are considered waters of the U.S. and are under the jurisdiction of the USACE. As discussed in Section 1.4, the proposed project will involve new or replacement sewer pipelines crossing these streams in five locations. These pipelines will be either attached to the underside of the bridges, or installed underground either beneath box culverts or between the pavement and the top of the arch culvert. An existing sewer pipeline crossing is proposed to be rehabilitated by cured-in-place pipe, which would involve lining the inside of the pipe and would not affect the exterior. Construction is proposed to take place from street level and is not expected to involve heavy equipment within the streams or result in the discharge of fill

in the streams. It is not anticipated that a DA permit will be required; however, the USACE will be consulted for a determination.

3.9 Federal Cross-Cutter Authorities

This project may be funded by low-interest loan funding through the State of Hawai‘i’s Clean Water State Revolving Fund (SRF) Program, which will require the project to meet Hawai‘i SRF program requirements. Because the SRF receives some federal funding, SRF loan applicants are required to certify compliance with all the Federal Cross-Cutter regulations which are determined applicable to the SRF program. The Clean Water State Revolving Fund (CWSRF) program was established by U.S. Congress in 1987 under the Water Quality Act. The intent of the CWSRF is to assist the construction of publicly owned wastewater treatment works, the implementation of a nonpoint source pollution control management program, and the implementation of an estuary conservation and management program.

3.9.1 Archaeological & Historic Preservation Act, National Historic Preservation Act

The Archaeological & Historic Preservation Act, 16 U.S.C. §469a-1, deals with the threat of loss or destruction of significant data by federal construction projects; notification and request for preservation of data; and survey of sites, preservation of data and compensation. The National Historic Preservation Act (NHPA), 16 U.S.C. §470, requires the consideration of the effect of any project on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places. Section 106 of the NHPA mandates a review process for all federally funded and permitted projects to assess the potential impacts on significant archaeological or historic sites, and allows interested parties an opportunity to comment on such impacts.

The use of federal funding for the Dowsett Highlands Relief Sewer Project, from the Department of Health’s CWSRF program, triggers review by the State Historic Preservation Officer (SHPO) under the NHPA Section 106 and its implementing regulation 36 CFR 800. In its May 26, 2017 letter, SHPD indicated the following steps that must be addressed under NHPA Section 106:

1. Name of the federal and state funding or licensing agency/agencies involved with this project. The State Historic Preservation Officer is required to respond to the federal agency or to the agency’s designated authority. Consultants contracted to prepare information, analyses, or recommendations are not recognized as a federally-delegated authority. Every project subject to section 106 has a federal funding, licensing, or permitting agency. Please include the name, address, and telephone number of the contact person/s at the federally delegated authority. A federal agency or federally delegated authority contact is mandatory pursuant to 36 CFR §800.2(a);
2. A delegation letter from the federal agency that identifies the activities and responsibilities they have delegated to you on their behalf;
3. Information documenting that the agency has evaluated and determined that the project constitutes an undertaking as defined in 36 CFR 800.16(y);

4. Information indicating that a reasonable and good faith effort to identify historic properties (architectural, archaeological, or traditional cultural properties) within the area of potential effect (APE) pursuant to 36 CFR §800.4(a) and 4(b) has been completed. The identification effort must include consultation efforts with Native Hawaiian Organizations (NHOs) [36 CFR §800.4(a)(4)] and consultation with individuals, organizations and the public with a demonstrated interest in the undertaking [36 CFR §800.2(c)] and should include documentation of the nature of the consultation, the names of the consulted parties, and their comments/concerns; and
5. A determination of eligibility and significance for any properties or potential historic districts within the APE [36 CFR§800.4(c)]; assessment of project effect [36 CFR §800.4(d)]; and if necessary resolution of adverse effects [36 CFR §800.6] for any sites located with the APE.

SHPD subsequently clarified that the federal agency's designated authority will be the Department of Health (DOH). Per discussion with SHPD, the Section 106 review process will run concurrently with completion of the Selective Reconnaissance Level Survey (RLS) described in Section 2.11; however, SHPD noted that some interested parties may request review of the RLS upon completion. As discussed, the literature review and field inspection (LRFI) documented existing and identified potential historic properties within the area, and the Selective Reconnaissance Level Survey (RLS) will properly identify, document, and address potential effects to any surface historic properties. Based on these studies, the proposed project will be designed and constructed to avoid or mitigate impacts to historic properties. Furthermore, implementation of an approved Archaeological Monitoring Plan will ensure that any significant items or sites discovered during construction are properly reported and preserved. Therefore, significant impacts to archaeological and cultural resources are not anticipated.

3.9.2 Clean Air Act

The Clean Air Act, 42 U.S.C. §7506(c), requires each state to develop a State Implementation Plan (SIP) delineating how federal air quality standards will be attained and how this will be verified. The DOH, Clean Air Branch, Air Quality program is defined by HAR Chapter 11-60 and is a SIP approved by EPA.

As discussed in Section 2.9, the ambient air quality in the vicinity of the project is typically very good. The closest DOH station monitors only for sulfur dioxide, carbon monoxide and fine particulate matter. Construction activities may slightly increase airborne particulate matter and may cause temporary odors in the immediate vicinity; however, levels at the nearby monitoring stations should not be affected. Long-term operation of the sewer system will not produce any of the pollutants on the DOH monitoring list. The DOH, Clean Air Branch, will be provided a copy of the Draft Environmental Assessment for its concurrence.

3.9.3 Coastal Barrier Resources Act

The Coastal Barrier Resources Act, 16 U.S.C §3501, designated various undeveloped, unprotected coastal barriers on the Atlantic Ocean and Gulf of Mexico coasts, and is not applicable to the State of Hawai‘i.

3.9.4 Coastal Zone Management Act

As discussed in Section 3.7, HRS Chapter 205A sets forth Hawai‘i’s CZM Program, which is in compliance with the Coastal Zone Management Act, 16 U.S.C. 1456(c)(1). HRS §205A-2 describes the CZM program, its objectives, and policies.

Section 3.7 describes how the proposed project is in conformance with the objectives and policies of Hawai‘i’s CZM Program, thus this project is in conformance with this act. The DBEDT, Office of Planning, will be provided a copy of the Draft Environmental Assessment for its concurrence.

3.9.5 Endangered Species Act, Fish & Wildlife Coordination Act, Essential Fish Habitat

The Endangered Species Act, 16 U.S.C. §1536(a)(2) and (4), is administered by the United States Fish & Wildlife Service (USFWS) and NOAA, National Marine Fisheries Service. The USFWS has primary responsibility for terrestrial and freshwater organisms, while NOAA is mainly responsible for marine wildlife. NOAA is also the agency consulted under the Essential Fish Habitat consultation process under the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. §1801. The Fish and Wildlife Coordination Act (FWCA), 16 U.S.C. §662(a), provides the basic authority for USFWS involvement in evaluating impacts of proposed water resource development projects on fish and wildlife, and requires federal agencies to take actions to prevent or mitigate loss or damage to wildlife resources.

As discussed in Section 2.6, the United States Fish and Wildlife Service (USFWS) indicated that there is no designated critical habitat within the vicinity of the proposed project area; however, the endangered Hawaiian hoary bat may be present within the proposed project area, and to minimize impacts, woody plants greater than 15 feet tall should not be disturbed, removed, or trimmed during the bat birthing and pup rearing season (June 1 through September 15).

USFWS will be provided a copy of the Draft Environmental Assessment to assist its evaluation of the potential impacts to the adjacent streams.

3.9.6 Environmental Justice Executive Order

Executive Order 12898 was signed in 1994. It directs federal agencies to identify and address disproportionately high adverse human health or environmental effects of its activities on minority and low-income populations.

The percentage of minorities in the Urban Honolulu CDP is 82.1 percent, which is significantly higher than the national average of 27.0 percent; however, the 2001-2015 median household income of $61,442 in the Urban Honolulu CDP was generally higher than the national average of $53,889. Negative long or short-term health or environmental impacts associated with this project are very unlikely; rather, positive health impacts will be realized through an improved wastewater collection and transmission system which will carry a lower risk of sanitary sewer overflows.

3.9.7 Farmland Protection Act

The Agriculture and Food Act (Public Law 97-98) was passed in 1981 and contained the Farmland Protection Policy Act (FPPA), Subtitle I of Title XV, Section 1539-1549. The intent of the FPPA was to minimize the impacts of federal programs on prime farmland, unique farmland, and other land of statewide or local importance. It is administered by the United States Department of Agriculture (USDA), National Resources Conservation Service (NRCS). The three categories of farmland described in FPPA are translated to the Department of Agriculture, Agricultural Lands of Importance to the State of Hawai‘i (ALISH) classifications of “Prime”, “Unique”, and “Other” agricultural lands.

As indicated in Section 2.3.3, the project area is entirely within lands not considered for classification under ALISH as agricultural lands; therefore, this act is not applicable to the proposed project. The NRCS will be provided a copy of the Draft Environmental Assessment for its concurrence.

3.9.8 Floodplain Management Executive Order

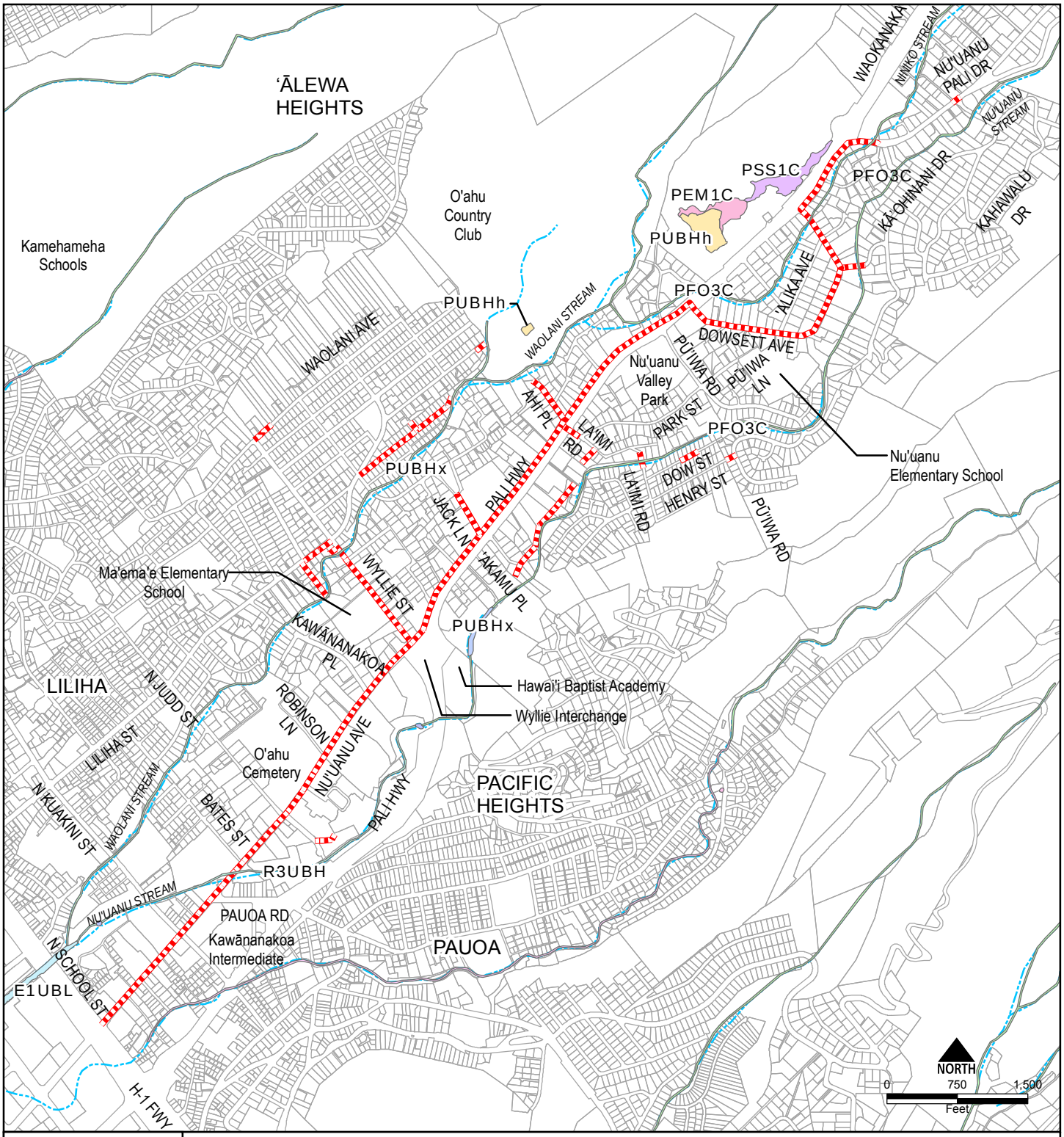
The objective of Executive Order 11988 is to avoid to the extent possible the adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. To accomplish this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities.”

As discussed in Section 2.4, nearly all of the proposed project is located in Zone X, which is an area determined to be outside of the 500-year flood plain and less than 1 foot depth in a 100-year flood event. A very small section of the project area in the vicinity of Nu‘uanu Stream is located in Zones XS and AE. Zones X and XS are low-to-moderate risk flood zones, and Zone AE is within the 100-year flood plain. Within Zone AE, the sewer will be installed underground beneath Nu‘uanu Avenue and above the existing arch culvert, hence, will not have any effect on the flood plain.

3.9.9 Protection of Wetlands Executive Order

The purpose of Executive Order 11990 is to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands". Federal agencies, to meet these objectives, in planning their actions are required to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland is unavoidable. The procedures require the determination of whether or not the proposed project will be in or will affect wetlands.

The wetlands in the vicinity of the proposed project are shown in **Figure 3-3**. Construction activities will involve excavation of trenches and shafts within state and CCH roadway right-of-ways, which are relatively contained. As discussed in Section 2.7, an NPDES permit will be



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WETLANDS MAP

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Figure 3-3

required from the DOH. This will ensure that storm water runoff is adequately controlled and treated through the implementation of BMPs prior to discharging from the project area. In the event that storm water runoff reaches a wetland, adverse effects are very unlikely.

3.9.10 Safe Drinking Water Act

The Safe Drinking Water Act (SDWA), 42 U.S.C. §300f, was established to protect the quality of all waters actually or potentially designed for drinking use from both underground and above-ground sources. The SDWA authorizes EPA to establish minimum standards to protect potable water with which all owners or operators of public water systems must comply; to oversee the agencies which can be approved to implement these rules on EPA's behalf, such as state governments; and to encourage attainment of secondary standards (nuisance-related). The SDWA also establishes the Sole Source Aquifer Program, under which EPA also may evaluate federal-funded projects to determine whether they have the potential to contaminate a sole source aquifer.

At present, there are two such aquifers in the State of Hawai'i: the Southern O'ahu Basal Aquifer, and the Molokai Aquifer. The former encompasses an area including the entire Pearl Harbor Aquifer Sector Area; part of the Central Aquifer Sector Area; and approximately half of the Honolulu Aquifer Sector Area, including the Nu'uanu, Kalihi and Moanalua Aquifer System Areas. The project area is within the Southern O'ahu Basal Aquifer.

Potable water for drinking use in Urban Honolulu is provided by the Honolulu Board of Water Supply (HBWS) and the sources of this water are exclusively ground water wells. The nearest such wells to the project area are along Beretania Street near the HBWS headquarters, three-quarters of a mile from the intersection of Nu'uanu Avenue and School Street, and nearly three miles from the northern end of the project along Nu'uanu Pali Drive. Due to this distance, it is extremely unlikely that project activities could contaminate the drinking water supply. Although the potential for sanitary sewer overflows to contaminate the Southern O'ahu Basal Aquifer is already low, the improvements to be completed through the proposed project will even further lower the risk of sanitary sewer overflows by facilitating a more reliable sewer system.

3.9.11 Wild & Scenic Rivers Act

The Wild and Scenic Rivers Act, 16 U.S.C. 1271-1287, declares to be the policy of the United States that certain selected rivers with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historical, cultural, or other similar values, shall be preserved in their free-flowing condition.

There are no such rivers designated in the State of Hawai'i; therefore, the act is not applicable to this project.

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CHAPTER 4. ALTERNATIVES CONSIDERED

4.1 No Action

Under the No Action alternative, the City and County of Honolulu (CCH) would be in violation of the Global Consent Decree after June 30, 2020 and would potentially face penalties from the U.S. Environmental Protection Agency (EPA). The hydraulic capacity inadequacy in the Waolani Stream Trunk Sewer and the Nu‘uanu Stream Trunk Sewer would remain, and the risk of sanitary sewer overflows (SSO) during storm events would increase. Any such overflows and the resulting wastewater discharges into the environment could be a threat to public health. The CCH could also face increasing operation and maintenance (O&M) responsibilities as the local sanitary sewers with issues would remain. The CCH could suffer economic losses due to these O&M challenges in addition to potential to fines levied by EPA and/or DOH.

For these reasons, the No Action alternative was not considered to be a viable alternative.

4.2 Alternatives Analysis

The Dowsett Highlands Relief Sewer Design Alternatives Report (DAR) developed and evaluated several alternatives to meet its stated objective. These alternatives mainly focused on different relief sewer routes and depths within state or city right-of-ways, storage options, replacement sewers and basin-wide sewer rehabilitation. Nine (9) alternatives were developed. Factors considered in their evaluation were as follows:

a. Constructability – sewer depths, soil conditions, dewatering requirements, interference with other utilities, space available for construction operations, etc.

b. Operations and Maintenance – post construction O&M conditions.

c. Permits and Clearances – greater number of permits and clearances typically increases the uncertainties associated with the project in terms of design requirements, project duration and project costs.

d. Hydraulic Impact – hydraulic performance, e.g. improvement on SSO and impact to the downstream wastewater facilities.

e. Environmental Impacts – short term impacts during construction (e.g. traffic congestion, noise, surface runoff, etc.)

f. Land Acquisition – new sewer lines and/or facilities constructed within non-CCH owned properties or streets will require acquisition of easements or condemnation from land owners, which will typically add time and cost to the project.

g. Cost – planning level estimates, including contingencies to cover uncertainties and unforeseen conditions, were prepared for comparison purposes.

h. Implementation Plan and Schedule – construction phasing and completion date.

i. Risk Considerations – impact of unknown conditions on constructability, project schedule and cost; high risk alternatives may need to include higher contingency allowances/reserves.

4.2.1 Alternative A

Alternative A would implement shallow relief sewers up to 21-inch diameter along Pali Highway, part of Dowsett Avenue, and Nu‘uanu Avenue. See **Figure 4-1**. The new relief sewers would accept peak flow diversions of 3.21 MGD from the Waolani Stream Trunk Sewer, 6.57 MGD from the Nu‘uanu Stream Trunk Sewer, and additional flows along Nu‘uanu Avenue for a total of 11.0 MGD. These diversions would be the minimum amount of wastewater flow necessary to avoid upsizing hydraulically inadequate trunk sewer sections generally located upstream of Ahi Place and La‘imi Road. However, minor surcharge conditions would still exist on the Waolani Stream Trunk Sewer below Wyllie Street and Nu‘uanu Stream Trunk Sewer below South Judd Street. Alternative A includes branch relief sewers along Wyllie Street and additional relief sewers within the Liliha sewer system. While Alternative A would feature the shallowest depth of sewers of all the alternatives, it would also involve the longest alignment along Pali Highway, from Nu‘uanu Pali Drive to the Nu‘uanu off-ramp.

4.2.2 Alternative B

Alternative B would implement shallow relief sewers up to 24-inch diameter along Pali Highway, Dowsett Avenue, and Nu‘uanu Avenue. See **Figure 4-2**. The new relief sewers would accept peak flow diversions of 4.33 MGD from the Waolani Stream Trunk Sewer, 6.57 MGD from the Nu‘uanu Stream Trunk Sewer, and additional flows along Nu‘uanu Avenue for a total of 12.1 MGD. These diversions would eliminate the surcharge condition along the Waolani Stream Trunk Sewer. Alternative B includes branch relief sewers along Wyllie Street, Jack Lane, Ahi Place and La‘imi Road, and the alignment of the main relief sewer would avoid an approximately 1,500 linear foot section of Pali Drive between the north and south intersections with Dowsett Avenue. The shallow sewer depths would likely avoid construction in rock conditions.

4.2.3 Alternative C

Alternative C would implement relief sewers up to 24-inch diameter at shallow depths along Pali Highway between Nu‘uanu Pali Drive and Dowsett Avenue; depths up to 50 feet below grade along Dowsett Avenue, Pū‘iwa Lane, Park Street, La‘imi Road, Pali Highway and Nu‘uanu Avenue; and at shallow depths along Nu‘uanu Avenue between Robinson Lane and School Street. See **Figure 4-3**. The new relief sewers would accept peak flow diversions of 4.33 MGD from the Waolani Stream Trunk Sewer, 6.57 MGD from the Nu‘uanu Stream Trunk Sewer, and additional flows along Nu‘uanu Avenue for a total of 12.7 MGD. These diversions would allow the Waolani Stream Trunk Sewer and the Nu‘uanu Stream Trunk Sewer to be downgraded to local collector sewers. Alternative C includes branch relief sewers along Wyllie Street, Jack Lane, Ahi Place, La‘imi Road, Pū‘iwa Road, ‘Akamu Place, Kawānanakoa Place and Robinson Lane, and the alignment of the main relief sewer would avoid an approximately 3,400 linear foot section of Pali Drive between the north intersection with Dowsett Avenue and La‘imi Road. Construction of the deep sewer sections would likely encounter rock conditions, which would necessitate installation

by microtunneling requiring large entry and exit shafts and minimum 30-inch sewer pipes, and geotechnical uncertainties on soil conditions would involve higher risk. Initial construction costs would be high.

4.2.4 Alternative D

Alternative D would implement relief sewers up to 24-inch diameter along Pali Highway, Dowsett Avenue, and Nu‘uanu Avenue along the same alignment as Alternative B, but utilizing deeper relief sewers along Pali Highway between Pū‘iwa Road and Wyllie Interchange and along Nu‘uanu Avenue from the Wyllie Interchange to Bates Street; and shallow relief sewers along the remainder of the alignment. See **Figure 4-4**. The new relief sewers would accept peak flow diversions of 4.33 MGD from the Waolani Stream Trunk Sewer, 6.57 MGD from the Nu‘uanu Stream Trunk Sewer, and additional flows along Nu‘uanu Avenue for a total of 12.7 MGD. These diversions would allow the Waolani Stream Trunk Sewer and the Nu‘uanu Stream Trunk Sewer to be downgraded to local collector sewers. Alternative D includes branch relief sewers along Wyllie Street, Jack Lane, Ahi Place, La‘imi Road, ‘Alika Avenue, Pū‘iwa Road, the Wyllie Interchange, Kawānanakoa Place and Robinson Lane, and the alignment of the main relief sewer would avoid an approximately 1,500 linear foot section of Pali Drive between the north and south intersections with Dowsett Avenue. Construction of the deep sewer sections would likely encounter rock conditions, which would necessitate installation by microtunneling requiring large entry and exit shafts and minimum 30-inch sewer pipes, and geotechnical uncertainties on soil conditions would involve higher risk. Initial construction costs would be high.

4.2.5 Alternative E

Alternative E would implement 15-inch diameter shallow flow diversion sewers along Pali Highway and Dowsett Avenue to intercept flows from the Waolani Stream and Nu‘uanu Stream Trunk Sewers. Intercepted flows would enter an underground storage tank at Nu‘uanu Valley Park only during wet weather flow conditions, and would be gradually released back to Nu‘uanu Stream Trunk Sewer, after wet weather flow conditions pass, via a discharge sewer along Pū‘iwa Road. See **Figure 4-5**. The storage capacity of the tank would be 2.03 MG, with the ability to reduce peak flows by 5.23 MGD. Minor surcharge conditions would still exist at the Waolani Stream Trunk Sewer near Wyllie Street. Alternative E also includes a 12-inch relief sewer to upgrade the existing 18-inch trunk sewer along Nu‘uanu Avenue from Pauoa Road to School Street, and additional relief sewers within the Liliha sewer system. The alignment of the influent and discharge sewer lines to and from the storage tank would require significantly less construction along Pali Highway and Nu‘uanu Avenue than Alternatives A through D. However, the expected frequent usage of the tank would necessitate high operation and maintenance requirements; an automated logic control and monitoring system would be required to regulate storage volumes; odor control and tank coating would also be required. The combined cost of these would diminish the cost savings of this alternative.

4.2.6 Alternative F

Alternative F would implement 15-inch diameter shallow flow diversion sewers along Pali Highway and Dowsett Avenue to intercept flows from the Waolani Stream and Nu‘uanu Stream

Trunk Sewers. Intercepted flows would enter a 9-foot diameter underground storage tunnel along Pali Highway only during wet weather flow conditions and would be gradually released back to Nuʻuanu Stream Trunk Sewer, after wet weather flow conditions pass, via two discharge sewers along Pūʻiwa Road and at the Wyllie Interchange. See **Figure 4-6**. The storage capacity of the tunnel would be 2.03 MG, with the ability to reduce peak flows by 5.23 MGD. Minor surcharge conditions would still exist at the Waolani Stream Trunk Sewer near Wyllie Street. Alternative F also includes a 12-inch relief sewer to upgrade the existing 18-inch trunk sewer along Nuʻuanu Avenue from Pauoa Road to School Street, and additional relief sewers within the Liliha sewer system. The alignment of the storage tunnel and its influent and discharge sewer lines would require less construction along Nuʻuanu Avenue than Alternatives A through D; additionally, construction of deep shafts would not be required as for Alternatives C and D; however, installation of the storage tunnel would require large tunneling equipment. The expected frequent usage of the tunnel would necessitate high operation and maintenance requirements, and an automated logic control and monitoring system would be required to regulate storage volumes. Initial construction cost to install the large diameter tunnel would be very high.

4.2.7 Alternative G

Alternative G would implement 15-inch dimeter shallow flow diversion sewers along Pali Highway and Dowsett Avenue to intercept flows from the Waolani Stream and Nuʻuanu Stream Trunk Sewers, a 6-foot diameter in-line underground storage tunnel along Pali Highway between Pūʻiwa Road and the Wyllie Interchange, and a 15-inch diameter relief sewer along Nuʻuanu Avenue. The alignment would be the same as Alternative B; see **Figure 4-7**. The diversion sewers and in-line storage tunnel would accept peak flow diversions of 11.6 MGD. Minor surcharge conditions would still exist at the Waolani Stream Trunk Sewer near Wyllie Street. Alternative G includes branch relief sewers along Wyllie Street, the Wyllie Interchange, Kawānanakoa Place and Robinson Lane and additional relief sewers within the Liliha sewer system. Construction of deep shafts would not be required as for Alternatives C and D; however, installation of the in-line storage tunnel would require large tunneling equipment. Initial construction cost to install the large diameter in-line tunnel would be very high.

4.2.8 Alternative H

Alternative H would replace and/or relieve hydraulically inadequate sections of the Waolani Stream and Nuʻuanu Stream Trunk Sewers with larger diameter sewers up to 24-inch diameter, and would implement access improvements for sewers located within easements to facilitate O&M activities. See **Figure 4-8**. Although construction along Pali Highway would be avoided completely, and along Nuʻuanu Avenue greatly reduced, construction would be predominantly within easements on private properties alongside and crossing streams, which would be extremely difficult. Permit requirements, easement acquisition and/or land condemnation for new sewers would further complicate the design and construction process and add great uncertainties.

4.2.9 Alternative I

Alternative I would involve basin-wide sewer rehabilitation of sewer mains, manholes and the lateral connections to reduce wet weather inflow and infiltration (WWI/I) to levels that would

eliminate the hydraulic capacity inadequacy within the Waolani Stream and Nu‘uanu Stream Trunk Sewers. Based on the CCH wastewater system hydraulic model runs for a 2-year, 24-hour design storm event, most of the capacity inadequacies are removed with a 30% peak reduction in WWI/I. See **Figure 4-9**. Alternative I would include smoke testing to determine inflow sources and address private I/I, and pre- and post-rehabilitation flow monitoring with six meters and one rain gauge for 30 months to evaluate the I/I reduction progress. Rehabilitation work would involve 88,680 feet of 6-inch to 21-inch diameter sewer mains, 724 sewer manholes, and 791 lateral connections at sewer mains; however, construction along Pali Highway and Dowsett Avenue would be avoided completely, and along Nu‘uanu Avenue greatly reduced. Depending on the success of the WWI/I peak reduction, capacity upgrades may still be required for some sewer mains.

4.3 Alternative Ranking and Recommendation

A matrix system was developed by DDC to rank the alternatives based on the evaluation factors discussed in Section 4.2. Each alternative was scored based on a point scale for each evaluation factor with a maximum possible point total of 100. The matrix is presented in **Table 4-1**.

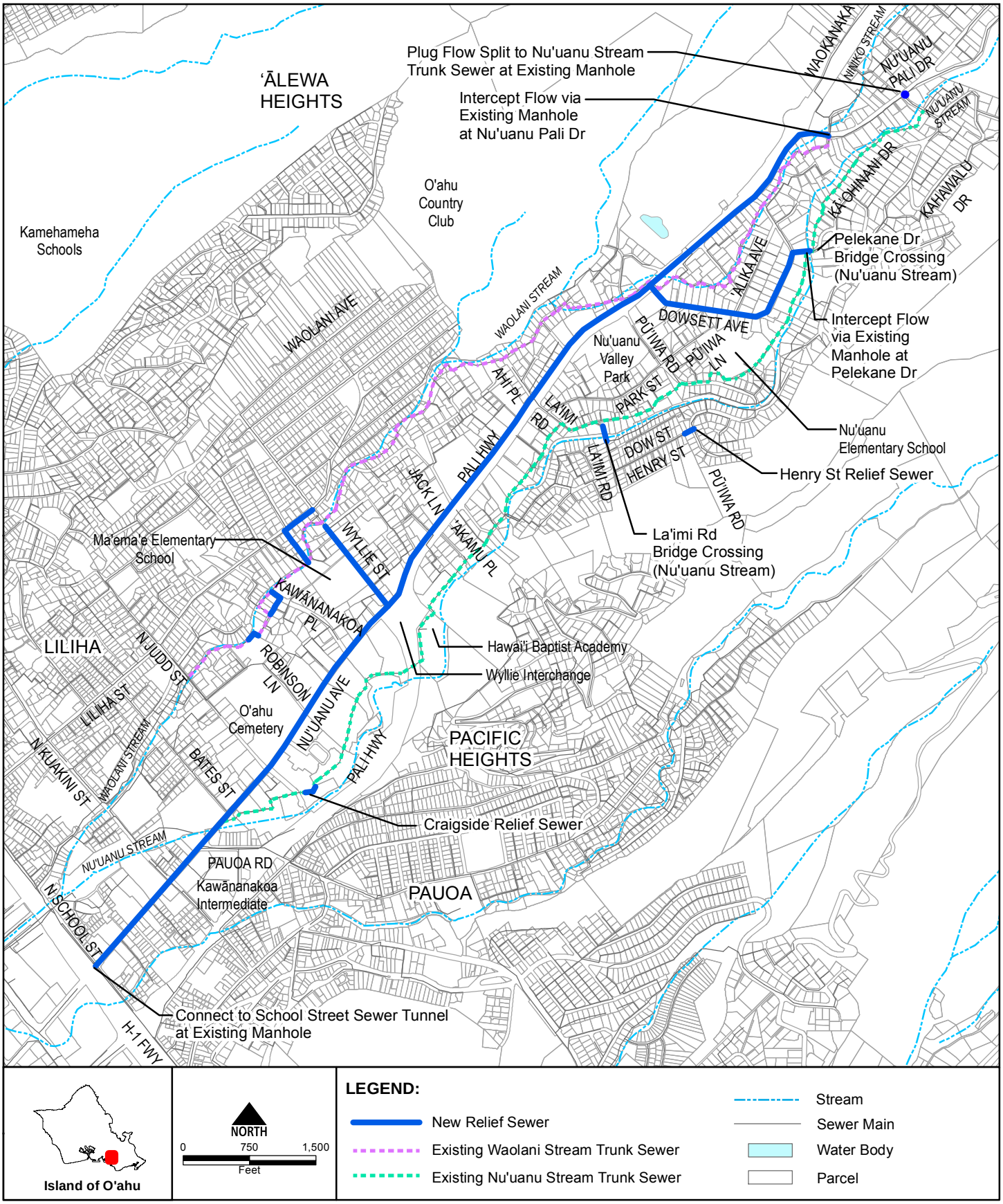
Table 4-1: Alternative Ranking Matrix

Evaluation Factors	Max	Alternative								
		A	B	C	D	E	F	G	H	I
Constructability	20	16	12	4	4	16	4	8	8	20
Operations and Maintenance	5	4	4	3	3	1	1	2	1	1
Permits and Clearances	4	2	2	2	2	3	2	2	1	4
Hydraulic Impact	15	6	12	15	15	6	6	6	9	6
Environmental Impact	4	4	3	2	2	2	2	3	1	4
Easement Requirements and Land Acquisition	2	1	1	1	1	2	1	1	1	1
Cost	30	18	18	0	0	18	0	0	0	24
Implementation Plan and Schedule	5	2	2	1	1	3	1	1	2	4
Risk Considerations	15	12	12	3	3	9	3	6	3	3
Total Points	100	64	66	31	31	60	20	29	26	67
Overall Ranking		3	2	5	6	4	9	7	8	1

Alternative I is ranked the highest due to its low cost, but is ranked low in O&M and Hydraulic Impact and Risk. The success of this alternative depends on the proposed sewer rehabilitation program obtaining the targeted 30% reduction in WWI/I peak, which is met with a great deal of uncertainty. If this reduction is not achieved, sewer pipes that are still under-capacity will need to be addressed, likely through construction of replacement or relief sewers.

Alternative B is the third lowest in terms of cost, but allows diversion of a greater amount of wastewater flow from the Waolani Stream and Nu‘uanu Stream Trunk Sewers than Alternative A, and provides a greater increase in system capacity than Alternative I. Alternative B was selected as the preferred alternative and the basis for the proposed project for its long-term benefits and feasibility, to:

1. Increase the system level of service to 5-year;
2. Add extra system capacity for potential new connections;
3. Allow easy access for operation and maintenance activities; and
4. Provide potential for eliminating the two existing trunk sewers along streams in the future.

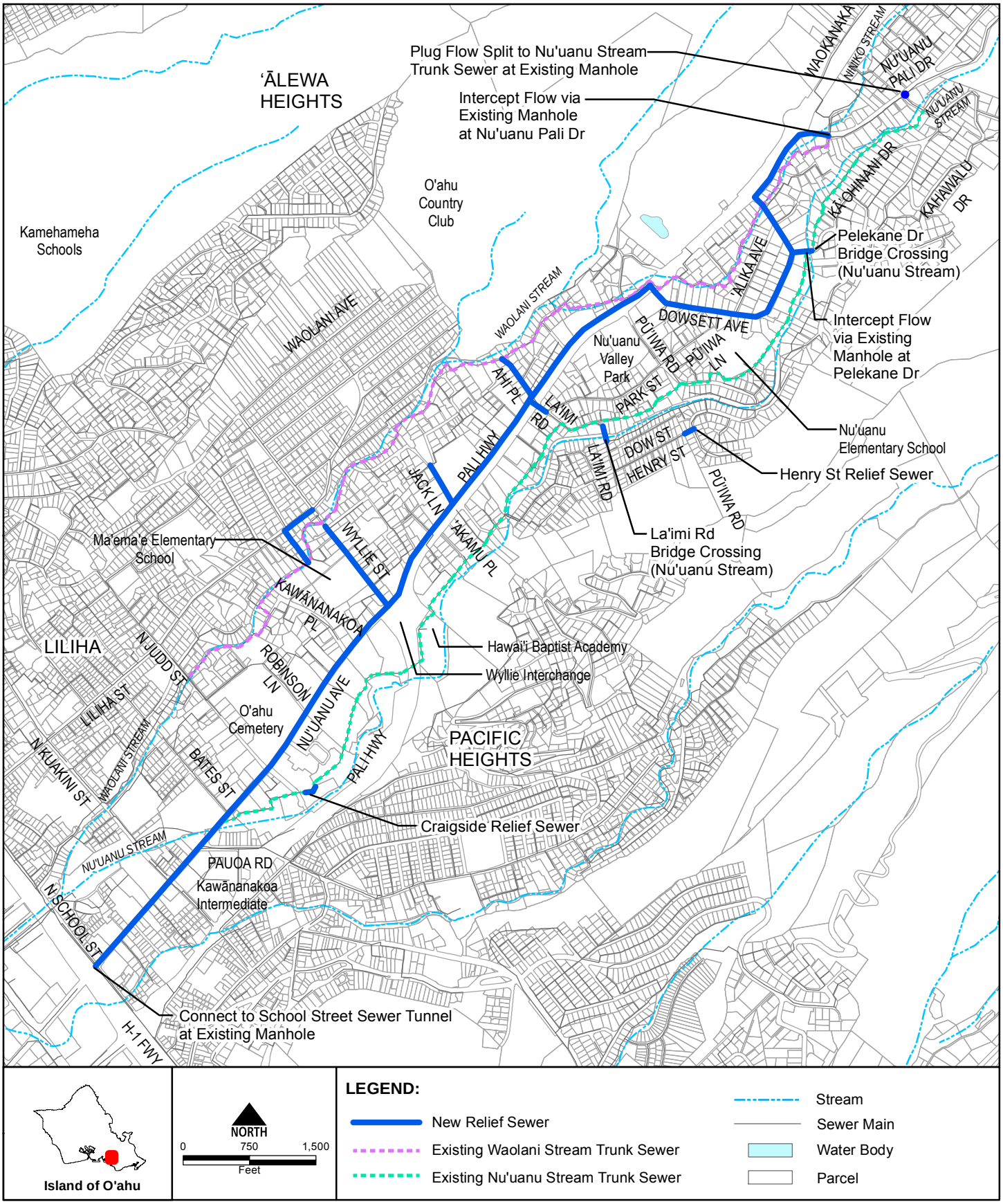


Dowsett Highlands Relief Sewer
Draft Environmental Assessment

ALTERNATIVE A PLAN

FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers

Figure 4-1

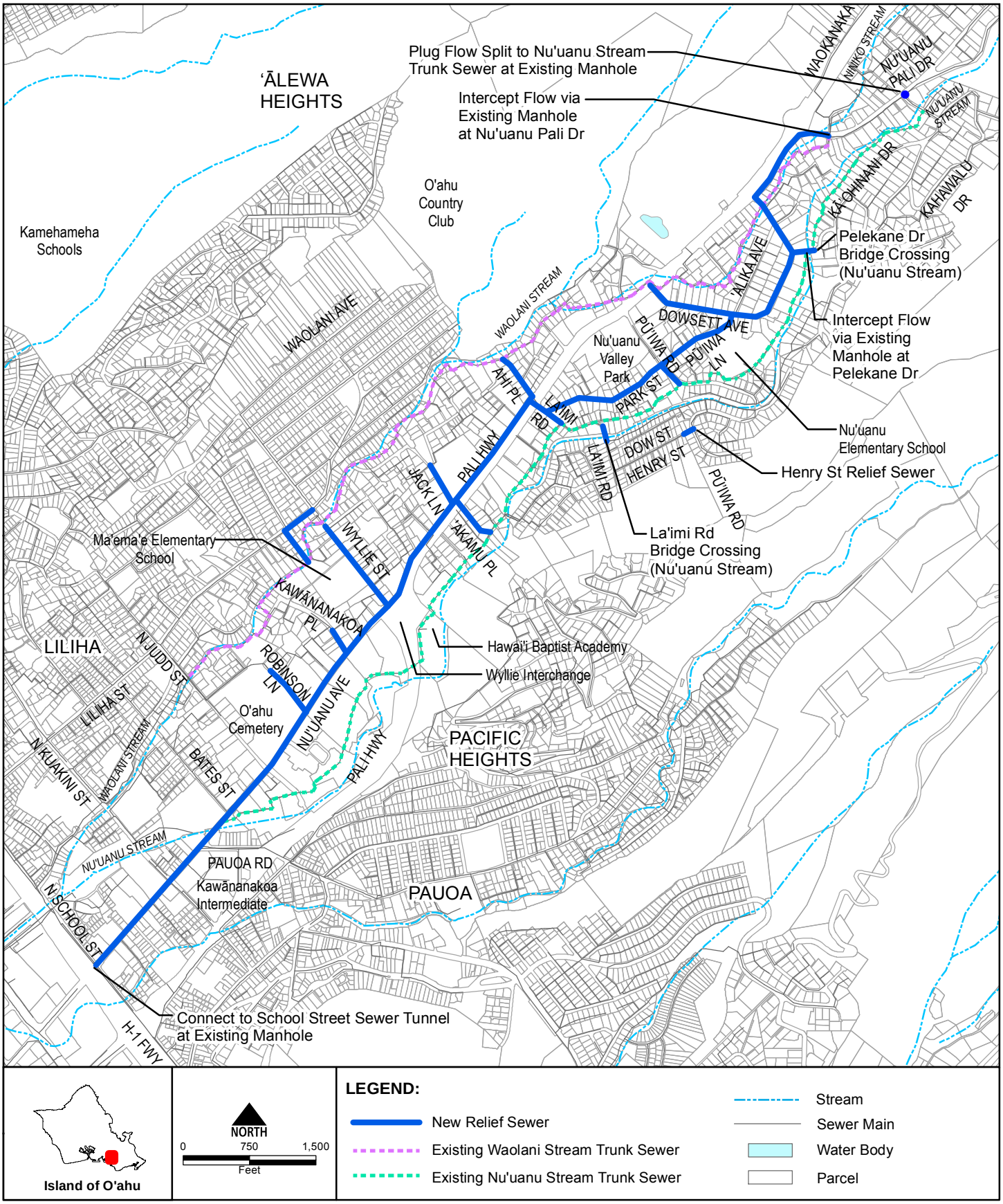


Dowsett Highlands Relief Sewer
Draft Environmental Assessment

ALTERNATIVE B PLAN

FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers

Figure 4-2

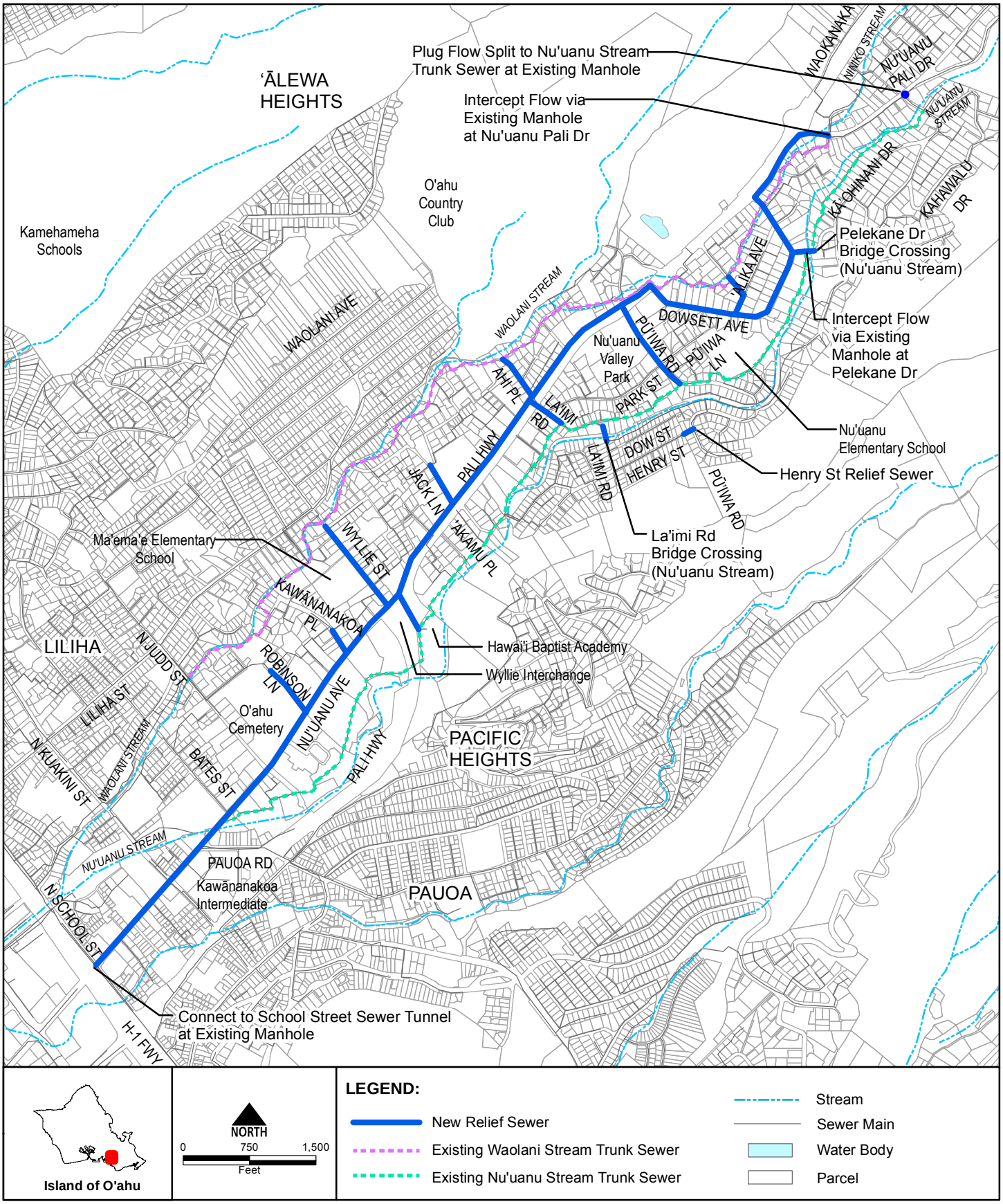


Dowsett Highlands Relief Sewer
Draft Environmental Assessment

ALTERNATIVE C PLAN

FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers

Figure 4-3

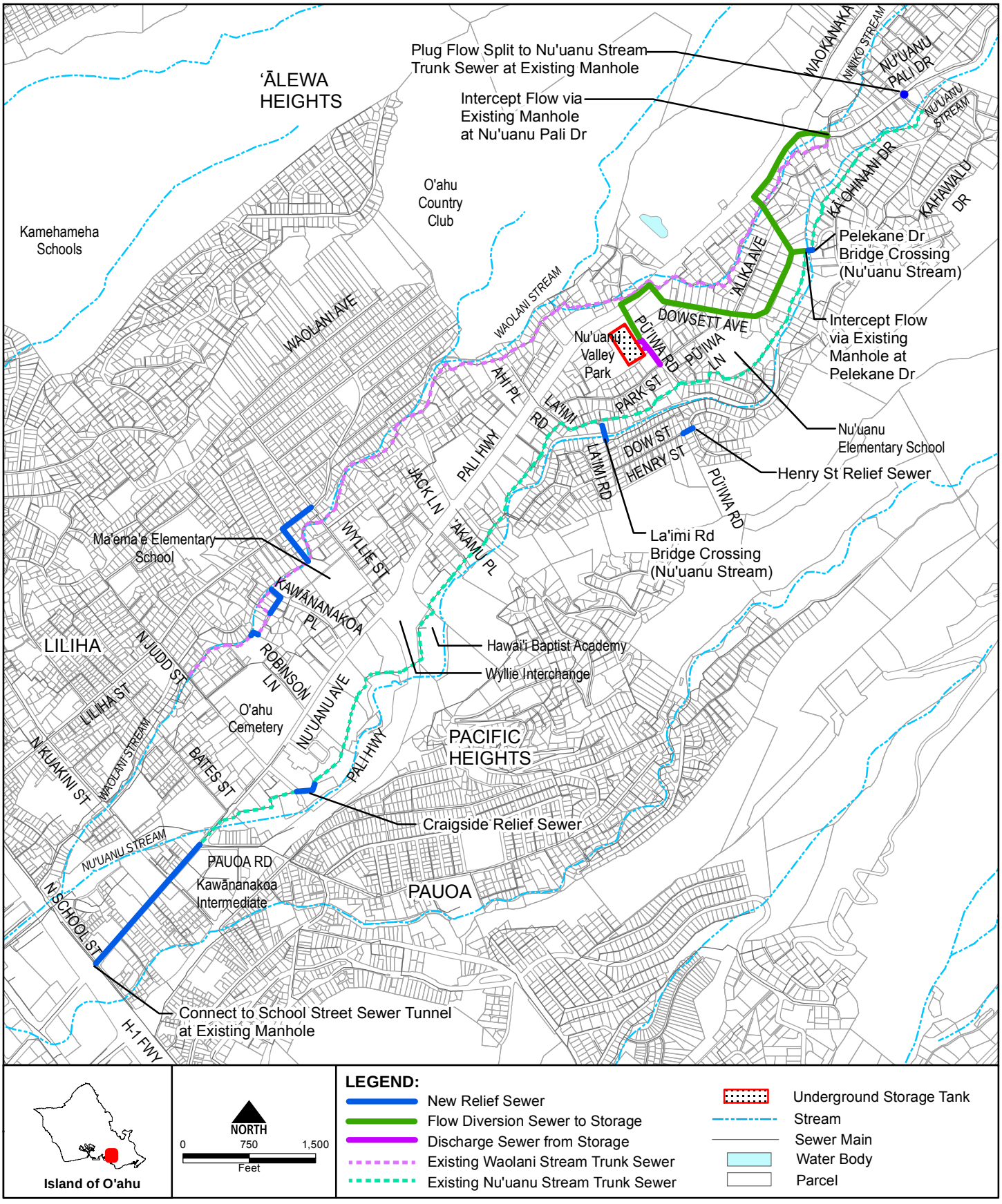


Dowsett Highlands Relief Sewer
Draft Environmental Assessment

ALTERNATIVE D PLAN

FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers

Figure 4-4

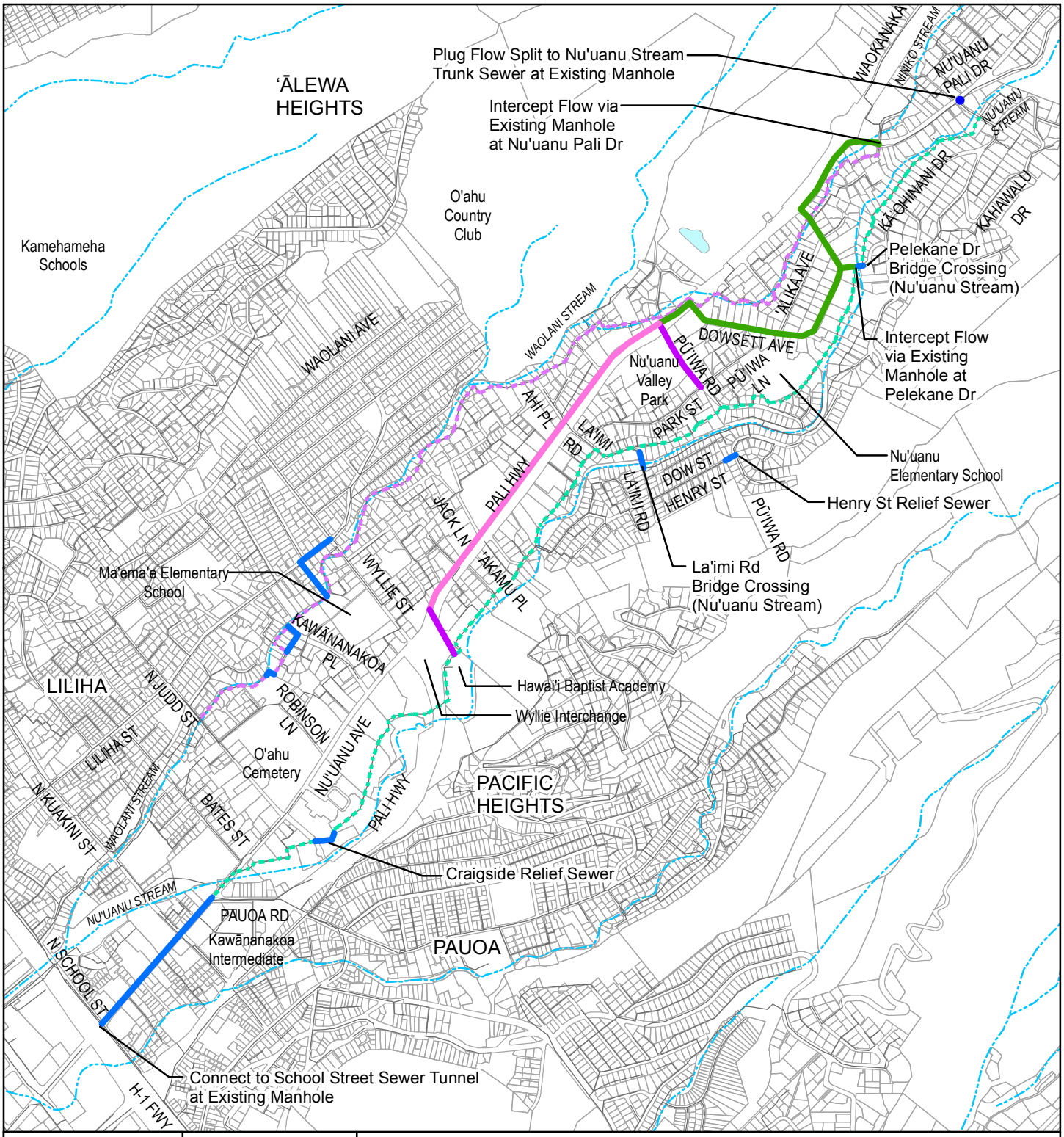


Dowsett Highlands Relief Sewer
Draft Environmental Assessment

ALTERNATIVE E PLAN

FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers

Figure 4-5

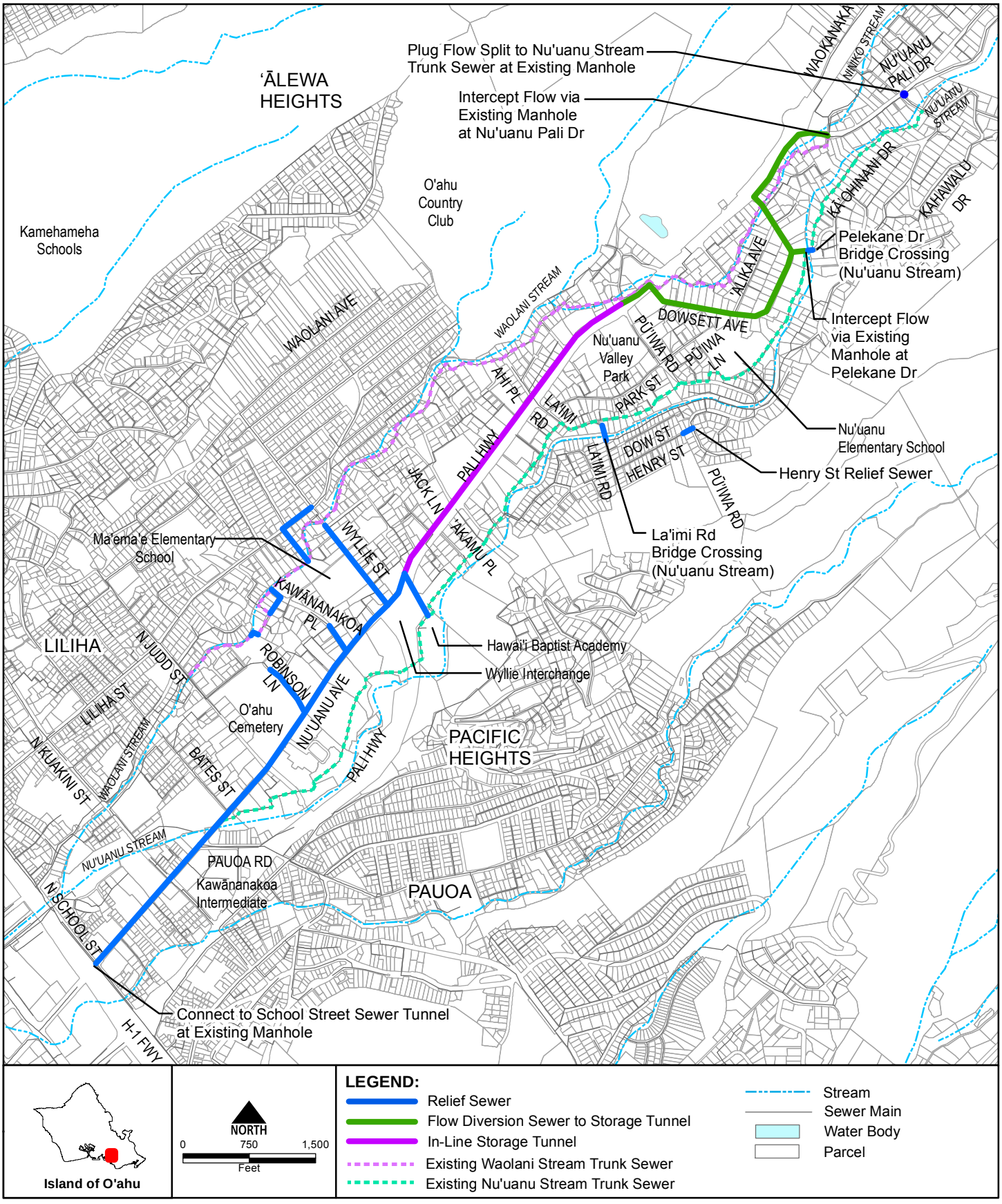


Dowsett Highlands Relief Sewer
Draft Environmental Assessment

ALTERNATIVE F PLAN

FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers

Figure 4-6

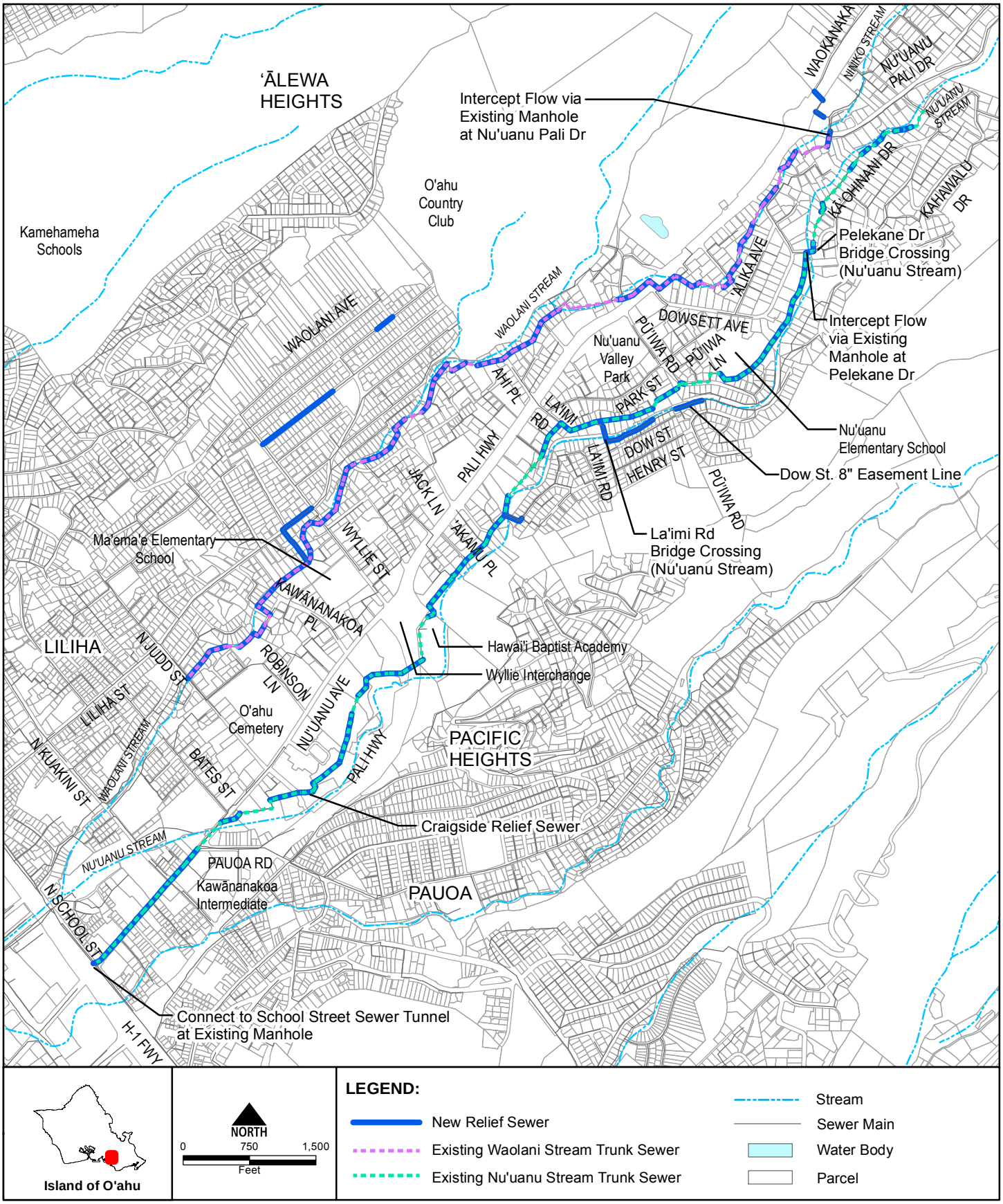


Dowsett Highlands Relief Sewer
Draft Environmental Assessment

ALTERNATIVE G PLAN

FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers

Figure 4-7

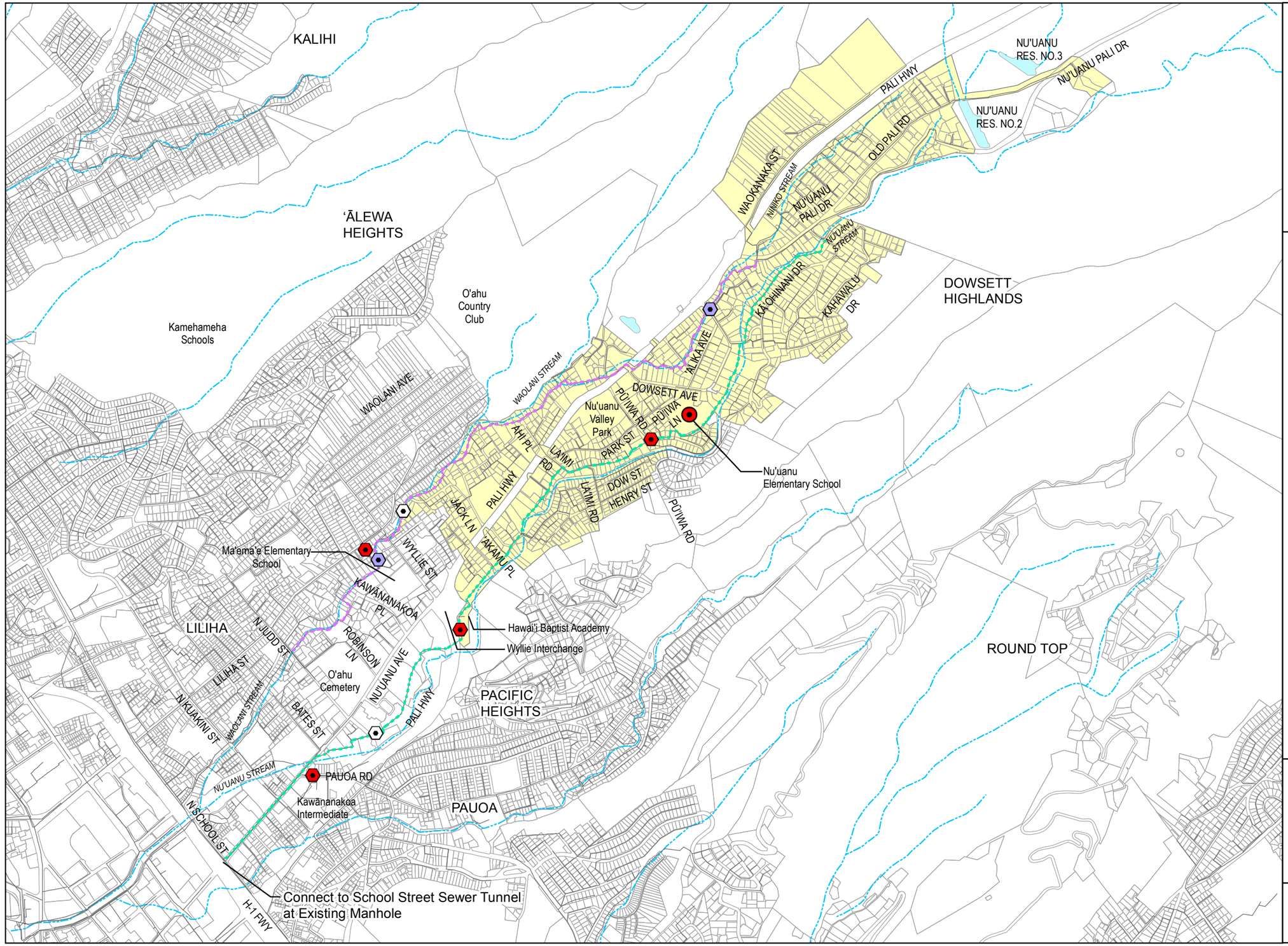


Dowsett Highlands Relief Sewer
Draft Environmental Assessment

ALTERNATIVE H PLAN

FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers

Figure 4-8



LEGEND:

- Historic Flow Monitoring Site
- Historic Flow Monitoring Site (Reinstall)
- Proposed Flow Monitoring Site
- Proposed Rain Gauge Site
- Existing Waolani Stream Trunk Sewer
- Existing Nu'uanu Stream Trunk Sewer
- Stream
- Sewer Main
- Basin-Wide Sewer Rehabilitation
- Water Body
- Parcel

Dowsett Highlands Relief Sewer
Draft Environmental Assessment

ALTERNATIVE I PLAN

Figure 4-9

FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers

CHAPTER 5. DETERMINATION

In accordance with Hawai‘i Administrative Rules §11-200-12, the potential effects of the proposed project are evaluated for the significance criteria which are summarized as follows:

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource:* As discussed in Sections 2.11 and 3.9.1, archaeological studies documented existing historic properties within the project area and will properly identify, document and recommend measures to protect new historic properties. Using this information, design and construction of the proposed project will avoid or mitigate impacts to these properties, and implementation of an approved Archaeological Monitoring Plan will ensure that any unforeseen historic items discovered during construction will be properly reported and preserved. Therefore, the proposed project will not cause a loss to or destruction of any natural or cultural resource.

2. *Curtails the range of beneficial uses of the environment:* Construction of the proposed project and its intended uses will not impact any activities occurring in the area and therefore will not curtail the beneficial uses of the environment.

3. *Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders:* The proposed project will conform to Chapter 344, HRS. All permits and approvals in accordance with state and county rules and regulations will be obtained.

4. *Substantially affects the economic welfare, social welfare, and cultural practices of the community or state:* The proposed project is not anticipated to significantly affect the cultural practices of the community or state. The proposed project will have a positive impact on the economic and social welfare of the community by creation of jobs for the anticipated duration of construction.

5. *Substantially affects public health:* The proposed project will improve public health by providing an improved and more reliable wastewater collection and transmission system, which will lower the risk of wastewater spills.

6. *Involves substantial secondary impacts, such as population changes or effects on public facilities:* The proposed project will not trigger a population increase nor appreciably affect public facilities or utilities.

7. *Involves a substantial degradation of environmental quality:* The scale of the proposed project is small and it will not degrade environmental quality.

8. *Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions:* As discussed in Section 2.14, the proposed

project is being coordinated with the Department of Transportation's Pali Highway roadway resurfacing and lighting projects. Per the Transportation Management Plan, the cumulative traffic impacts of both projects will not exceed the capacity of any of the affected roadways. Therefore, the cumulative effect of the projects will not have a considerable negative effect on the environment.

9. *Substantially affects a rare, threatened, or endangered species, or its habitat:* The proposed project is not expected to substantially affect a rare, threatened, or endangered species, or its habitat, as discussed in Section 2.6.

10. *Detrimentally affects air or water quality or ambient noise levels: The proposed project will not permanently affect air or water quality or ambient noise levels:* Minor short term impacts associated with construction involving air quality and noise will be mitigated by appropriate measures required in the construction contract. Department of Health regulations for community noise will be followed. Permanent impacts are not anticipated.

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:* As discussed in Section 2.4, the proposed project is not in an area prone to natural hazards and is not located within an environmentally sensitive area.

12. *Substantially affects scenic vistas and viewplanes identified in county or state plans or studies:* The proposed project involves the installation of underground sewer mains and will not affect scenic vistas and viewplanes.

13. *Requires substantial energy consumption:* Both construction and operation and maintenance of the proposed project will involve minimal energy consumption.

This Environmental Assessment has henceforth determined that the proposed project will not have significant adverse impacts on the environment, and therefore, an Environmental Impact Statement (EIS) is not warranted. A Finding of No Significant Impact (FONSI) is anticipated for the proposed project.

CHAPTER 6. CONSULTED PARTIES

A pre-Environmental Assessment consultation letter was sent to various agencies and interested parties for the opportunity to provide preliminary comments prior to completing this Draft Environmental Assessment. The agencies and interested parties are listed below. Comments received are incorporated in Appendix A.

Agency or Interested Party	**Pre-Con Letter Sent**	**Response with comments**	**Response w/no comments**
Federal Agencies			
U.S. Department of Agriculture, National Resources Conservation Service	x		
U.S. Department of the Army, Army Corps of Engineers	x	x	
U.S. Department of the Interior, Fish & Wildlife Service	x	x	
State Agencies			
Department of Accounting and General Services	x		x
Department of Agriculture	x		x
Department of Business, Economic Development, and Tourism, Office of Planning	x	x	
Department of Education	x	x	
Department of Hawaiian Home Lands	x		
Department of Health, Clean Air Branch	x		
Department of Health, Clean Water Branch	x	x	
Department of Health, Environmental Planning Office	x	x	
Department of Health, Indoor and Radiological Health Branch	x	x	
Department of Health, Safe Drinking Water Branch	x		x
Department of Health, Solid and Hazardous Waste Branch	x		
Department of Health, Wastewater Branch	x		
Department of Land and Natural Resources, Land Division	x		

Agency or Interested Party	**Pre-Con Letter Sent**	**Response with comments**	**Response w/no comments**
Department of Land and Natural Resources, Division of Aquatic Resources	route	x	
Department of Land and Natural Resources, Division of Engineering Division	route	x	
Department of Land and Natural Resources, Division of Forestry and Wildlife	route		
Department of Land and Natural Resources, Commission on Water Resource Management	route		
Department of Land and Natural Resources, Land Division – Oʻahu District	route	x	
Department of Land and Natural Resources, State Historic Preservation Division	x	x	
Department of Transportation, Director	x	x	
Office of Hawaiian Affairs	x	x	
City and County of Honolulu Agencies			
Board of Water Supply	x	x	
Department of Design and Construction	x	x	
Department of Environmental Services	x		
Department of Facility Maintenance	x		x
Department of Parks and Recreation	x		x
Department of Planning and Permitting	x	x	
Department of Transportation Services	x	x	
Honolulu Fire Department	x		x
Honolulu Police Department	x	x	
Utility Companies			
Hawaiian Telcom, Inc.	x		
Hawaiian Electric Company, Inc.	x	x	

Agency or Interested Party	**Pre-Con Letter Sent**	**Response with comments**	**Response w/no comments**
Oceanic Time Warner Cable	x		
Hawai‘i Gas	x	x	
Other Individuals/Organizations			
Senator Karl Rhoads, District 13, Hawai‘i State Legislature	x		
Representative Sylvia Luke, District 25, Hawai‘i State Legislature	x		
Councilmember Carol Fukunaga, District 6, Honolulu City Council	x		
University of Hawai‘i, Environmental Center	x		

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CHAPTER 7. REFERENCES

"2015 State of Hawai‘i Data Book," prepared by State of Hawai‘i, Department of Business, Economic Development and Tourism.

"Archaeological Literature Review and Field Inspection for the Dowsett Highlands Relief Sewer Project, Nu‘uanu Ahupua‘a, Honolulu District, O‘ahu, TMKs: [1] 1-7, 1-8, 1-9, and 2-2 (various plats and parcels)," prepared for Fukunaga & Associates, Inc.; by Cultural Surveys Hawai‘i, Inc., November 2015

City and County of Honolulu, Department of Emergency Management

City and County of Honolulu, Department of Planning and Permitting

"Dowsett Highlands Relief Sewer, Design Alternatives Report, Final Submittal," prepared for prepared for City and County of Honolulu, Department of Design and Construction, Wastewater Division; by Fukunaga and Associates, Inc., November 2016.

"Final Sewer I/I Plan," prepared for City and County of Honolulu, Department of Design and Construction; by Fukunaga and Associates, Inc., December 1999.

"Follow-Up Report to the Spill Reduction Action Plan, 1991-1995 Spill Analysis Report," prepared for City and County of Honolulu, Department of Environmental Services; by Division of Planning and Service Control, December 1996.

"General Plan, Objectives and Policies," prepared by City and County of Honolulu, Department of General Planning, 1992 amended October 3, 2002.

"Gravity Sewer Assessment Program, Draft Preliminary Sewer Assessment Report for Liliha Area," prepared for City and County of Honolulu, Department of Environmental Services; by HDR Consultants, November 2, 2012.

"Gravity Sewer Assessment Program, Draft Preliminary Sewer Assessment Report for Nu‘uanu Area," prepared for City and County of Honolulu, Department of Environmental Services; by HDR Consultants, November 5, 2012.

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"Hawai‘i Stream Assessment: A Preliminary Appraisal of Hawai‘i's Stream Resources, Report R84," prepared for State of Hawai‘i, Commission on Water Resource Management; by National Park Service, Hawai‘i Cooperative Park Service Unit, December 1990.

Honolulu Board of Water Supply.

"Honolulu Complete Streets, Implementation Study Location Report, Nuuanu Avenue from Kuakini Street to Craigside Place (FINAL)," prepared for City and County of Honolulu, Department of Transportation Services; by SSFM International, May 2015.

"Noise Reference Manual, Oahu Edition," prepared by State of Hawai'i, Department of Health, Indoor and Radiological Health Branch, February 2008.

"Oahu General Plan, Second Public Review Draft, With Proposed Changes Shown," prepared for City and County of Honolulu, Department of Planning and Permitting; by Helbert Hastert & Fee Planners, Inc., February 2017.

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"Primary Urban Center Development Plan," prepared by City and County of Honolulu, Department of Planning and Permitting, June 2004.

Revised Ordinances of Honolulu

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"State of Hawai'i, Annual Summary, 2009, Air Quality Data," prepared by State of Hawai'i, Department of Health, September 2010.

State of Hawai'i, Department of Health

State of Hawai'i, Department of Land and Natural Resources, Commission on Water Resource Management

State of Hawai'i, Department of Land and Natural Resources, State Historic Preservation Division

State of Hawai'i, Office of Planning, Hawai'i Statewide GIS Program

"Transportation Management Plan – Dowsett Highlands Relief Sewer, Draft," prepared for Fukunaga & Associates, Inc.; by Austin, Tsutsumi & Associates, Inc., May 5, 2017.

"UHERO County Forecast," prepared by University of Hawai'i, Economic Research Organization, May 2017.

U.S. Census Bureau

U.S. Census American Community Survey

U.S. Department of Homeland Security, Federal Emergency Management Agency

U.S. Department of the Interior, National Park Service

U.S. Environmental Protection Agency

"Water Resource Protection Plan," prepared for State of Hawai'i, Commission on Water Resource Management; by Wilson Okamoto Corporation, June 2008.

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APPENDIX A

Pre-Environmental Assessment
Comments and Responses

Lance Fukumoto

From: Frager, Rebecca M CIV USARMY CEPOH (US) <Rebecca.M.Frager@usace.army.mil>
Sent: Friday, May 12, 2017 5:45 AM
To: Lance Fukumoto
Subject: RE: POH-2017-00074 (Dowsett Highlands Relief Sewer, Island of Oahu, Hawaii)

Aloha Mr. Fukumoto,

This is a courtesy email to let you know that I have received your proposed project as listed in the subject above. I will be traveling until May 22, but will look at your project after I return.

Thank you for your cooperation with the Honolulu Regulatory Office. I look forward to working with you more soon.

Sincerely,
Becca Frager
Biologist
U.S. Army Corps of Engineers
Honolulu District Regulatory Office
Building 230
Fort Shafter, HI 96858-5440
808-835-4307

-----Original Message-----
From: Tatum, Alton L CTR (US)
Sent: Tuesday, May 09, 2017 5:55 PM
To: lfukumoto@fukunagaengineers.com
Cc: Frager, Rebecca M CIV USARMY CEPOH (US) <Rebecca.M.Frager@usace.army.mil>
Subject: POH-2017-00074 (Dowsett Highlands Relief Sewer, Island of Oahu, Hawaii)

Mr. Lance Fukumoto,

Your project has been assigned Department of the Army File No. POH-2017-00074 and is currently assigned to Ms. Rebecca Frager (PROJECT MANAGER). You may contact her at (808) 835-4307 or via email at Rebecca.M.Frager@usace.army.mil.

If you have not received a response from the above project manager within 30 days, please contact our main office (808) 835-4303 or email at CEPOH-RO@usace.army.mil.

ALTON L. TATUM
Administrative Assistant, Regulatory Office USACE-Honolulu District Bldg 252 Fort Shafter, HI 96858-5440
Phone: (808)-835-4303
Fax: (808)-835-4126

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
01EPIF00-2017-TA-0227

ORIGINAL

MAY 19 2017

Mr. Lance Fukumoto
Project Engineer
Fukunaga & Associates, Inc.
1357 Kapiolani Blvd.
Honolulu, Hawaii 96814

Subject: Technical Assistance for the Proposed Dowsett Highlands Relief Sewer Project Nuuanu, Oahu

Dear Mr. Fukumoto:

The U.S. Fish and Wildlife Service (Service) received your letter, dated April 21, 2017, requesting preliminary comments for the preparation of a Draft Environmental Assessment for the proposed Dowsett Highlands Relief Sewer project in Nuuanu, Oahu. The City and County of Honolulu is requesting to upgrade and make improvements through a combined project to develop hydraulic capacity improvements to alleviate flow surcharge conditions which may potentially cause sanitary sewer overflows during wet weather events. The proposed project will include installation of 14,500 feet of new gravity sewer line with the main alignment proposed along Nuuanu-Pali Drive, followed along the Pali Highway, Dowsett Avenue, Pali Highway and Nuuanu Avenue, and ending at School Street. The Service offers the following comments to assist you in your planning process so that impacts to trust resources can be avoided. Our comments are provided under the authorities of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C 1531 *et seq.*).

Based on the information in our database and records, including data provided by the Hawaii Biodiversity and Mapping Program, the following are known threatened or endangered species that may occur or transit through the vicinity of your proposed project area: the federally endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*). There is no designated critical habitat present in the vicinity of the proposed project area. We offer the following comments for your consideration:

Hawaiian hoary bat

The endangered Hawaiian hoary bat may be present within the proposed project area. The Hawaiian hoary bat roosts in both exotic and native woody vegetation and will leave young unattended in "nursery" trees and shrubs when they forage. If trees or shrubs suitable for bat roosting are cleared during the pupping 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 tall should not be disturbed, removed, or trimmed during the bat birthing and pup rearing season (June 1 through September 15).

Aquatic Resources

The Aquatic Ecosystems Conservation Program within our office will need additional time to evaluate the potential impacts to the adjacent streams when the Draft Environmental Assessment is available. Nadiera Sukhraj, Marine Biologist (phone: 808-792-9400, email: nadiera_mccarthy@fws.gov) with the Aquatic Ecosystem Conservation Program is the contact for aquatic resource concerns.

This project will require an evaluation under the Fish and Wildlife Coordination Act (FWCA). This request may be made to our office; however the evaluation is conducted separately from the section 7 ESA consultation request. The FWCA provides the basic authority for the Secretary of the Interior, through the Service, to assist and cooperate with Federal, state and public or private agencies and organizations in the conservation and rehabilitation of wildlife. Whenever the waters or channel of a body of water are modified by a Federal agency, or by any other entity where a Federal permit is required, adequate and equal consideration must be made for the conservation, maintenance, and management of wildlife resources and habitat. The National Marine Fisheries Service (NMFS) provides similar assistance and cooperation for wildlife species under the management responsibilities of the Department of Commerce. Consultation under the FWCA is to be conducted with the Service, NMFS as appropriate, and the agency administering the wildlife resources of the State in which the project is located. The Service is the lead agency and has the responsibility of ensuring that concerns and recommendations of the other resource agencies are considered fully in FWCA reviews.

If additional information becomes available, or it is determined that the proposed project may affect federally listed species, we recommend you coordinate with our office early in the planning process so that we may further assist you with ESA compliance. We thank you for your efforts to conserve listed species and native habitats. Please contact Stacey Lowe, Fish and Wildlife Biologist (phone: 808-792-9400, email: stacey_lowe@fws.gov) should you have any questions pertaining to this response or require further guidance. When referring to this project, please include this reference number: 01EPIF00-2017-TA-0227.

Sincerely,

Aaron Nadig
Island Team Manager
Oahu, Kauai, Northwestern
Hawaiian Islands, and American Samoa

DAVID Y. IGE
GOVERNOR

RODERICK K. BECKER
Comptroller

AUDREY HIDANO
Deputy Comptroller

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

APR 25 2017

(P)1178.7

Mr. Lance Fukumoto, P.E.
Fukunaga and Associates, Inc.
1357 Kapiolani Blvd., Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukumoto:

Subject: Pre-Consultation for Draft Environmental Assessment
Dowsett Highlands Relief Sewer
Nuuanu, Oahu, Hawaii

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

If you have any questions, your staff may contact Mr. Kimo Marion of the Planning Branch at 586-0491.

Sincerely,

KEITH S. KOGACHI
Acting Public Works Administrator

KM:lnn

DAVID Y. IGE
Governor

SHAN S. TSUTSUI
Lt. Governor

SCOTT E. ENRIGHT
Chairperson, Board of Agriculture

PHYLLIS SHIMABUKURO-GEISER
Deputy to the Chairperson

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 South King Street
Honolulu, Hawaii 96814-2512
Phone: (808) 973-9600 FAX: (808) 973-9613

April 24, 2017

Mr. Lance Fukumoto, P.E.
Fukunaga & Associates, Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukunaga:

RE: Pre-Consultation Notice
for Draft Environmental Assessment
Dowsett Highlands Relief Sewer
City and County of Honolulu, Department of Design and Construction
Nuuanu, Oahu, Hawaii

Thank you for the opportunity to comment on the *Dowsett Highlands Relief Sewer* project in Nuuanu, Hawaii. The Hawaii Department of Agriculture has no comments on the proposed action at this time.

If there are any changes to the project scope or location, please include us on your list for review of the draft Environmental Assessment. Should you have any questions, please contact Ms. Janice Fujimoto of our Agricultural Resource Management Division at 973-9493.

Sincerely,

BRIAN KAU, P.E.
Administrator and Chief Engineer
Agricultural Resource Management
Division

Island Fresh

OFFICE OF PLANNING
STATE OF HAWAII

DAVID Y. IGE
GOVERNOR

LEO R. ASUNCION
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://planning.hawaii.gov/

Ref. No. P-15584

April 28, 2017

Mr. Lance Fukunaga, P.E.
Project Engineer
Fukunaga & Associates, Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukunaga:

Subject: Pre-Assessment Consultation Notice for Draft Environmental Assessment, Dowsett Highlands Relief Sewer, City and County of Honolulu, Department of Design and Construction, Nuuanu, Oahu, Hawaii

Thank you for the opportunity to provide comments for this pre-assessment consultation request for the Dowsett Highlands Relief Sewer project. The early consultation review material was transmitted to our office via letter dated April 17, 2017.

It is our understanding the City and County of Honolulu, Department of Design and Construction proposes the development of a new gravity relief sewer to serve the Nuuanu area of Honolulu. The intent of this project is to address the existing capacity deficiencies of the trunk sanitary sewerline along Waolani and Niniko Streams and the trunk sanitary sewer near Nuuanu Stream. The main goal of this project is to develop hydraulic capacity improvements to alleviate sewer overflows during heavy storm events.

The sewerline upgrade is expected to produce long-term benefits to the sewer infrastructure for Nuuanu. The long-term benefits include the increase the system level of service to five-years; added capacity for new sewer line connections; easy access for maintenance and operations; and may eliminate two existing sewers along the neighboring streams.

The Office of Planning (OP) has reviewed the transmitted material and has the following comments to offer:

1. Pursuant to Hawaii Administrative Rules (HAR) § 11-200-10(4) – general description of the action's technical, economic, social, and environmental characteristics; this project must demonstrate that it is consistent with a number of state environmental, social, economic goals, and policies for land use. Hawaii Revised Statutes (HRS) Chapter 226, the Hawaii State Planning Act, provides goals, objectives, policies, State Functional Plans, and priority guidelines for growth, development, and the allocation of resources throughout the state in areas of state interest.

The analysis on the Hawaii State Planning Act should include a discussion on the project's ability to meet all of the goals, objectives, policies, and priority guidelines or clarify where it is in conflict with them. If any of these themes are not applicable to the project, the Draft Environmental Assessment (Draft EA) should affirmatively state such determination followed by discussion paragraphs.

2. The coastal zone management (CZM) area is defined as "all lands of the State and the area extending seaward from the shoreline to the limit of the State's police power and management authority, including the U.S. territorial sea" (see HRS § 205A-1).

   HRS Chapter 205A-5(b) requires all state and county agencies to enforce the CZM objectives and policies. The Draft EA should include an assessment as to how the proposed action conforms to each of the goals and objectives of the Hawaii CZM program as listed in HRS § 205A-2. Compliance with HRS § 205A-2 is an important component for satisfying the requirements of HRS Chapter 343.

3. Pursuant to HAR § 11-200-10(6) – identification and summary of impacts and alternatives considered; this project seeks to upgrade sewer infrastructure to safeguard the Waolani, Niniko, and Nuuanu Streams from sanitary sewer overflows caused by intense storm runoff. In order to ensure that the surface water resources and the downstream marine ecosystem remain protected, the negative effects of stormwater inundation to the project area and its surroundings should be evaluated in the Draft EA.

   The Draft EA should examine potential negative impacts resulting from this project on water resources during construction and its effectiveness from preventing sewer overflows. Issues that may be examined include, but are not limited to, project site characteristics in relation to flood and erosion prone areas, open spaces, streams and wetlands, and soil absorption characteristics. These items should be considered when developing mitigation measures for the protection for surface water resources and the coastal ecosystem, pursuant to HAR § 11-200-10(7) – propose mitigation.

   This project may benefit from the use of OP's Stormwater Impact Assessment. This document can be used to identify and evaluate information on hydrology, stressors, sensitivity of aquatic and riparian resources, and management measures to control runoff. This guidance may also assist in formulating mitigation goals, and strategies, as well as integrating stormwater impact mitigation within the planning and environmental review process. This document can be viewed at http://files.hawaii.gov/dbedt/op/czm/initiative/stomwater_imapct/final_stormwater_impact_assessments_guidance.pdf.

If you have any questions regarding this comment letter, please contact Joshua Hekekia of our office at (808) 587-2845.

Sincerely,

Leo R. Asuncion
Director

DAVID Y. IGE
GOVERNOR

KATHRYN S. MATAYOSHI
SUPERINTENDENT

STATE OF HAWAI`I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI`I 96804

OFFICE OF SCHOOL FACILITIES AND SUPPORT SERVICES

April 27, 2017

Mr. Lance Fukumoto
Fukunaga & Associates, Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814

Re: Pre-Consultation Notice for Draft Environmental Assessment
Dowsett Highlands Relief Sewer
City and County of Honolulu, Department of Design and Construction
Nuuanu, Oahu, Hawaii

Dear Mr. Fukumoto:

The Department of Education (DOE) appreciates the opportunity to comment on the pre-consultation notice for the Draft Environmental Assessment for the sewer relief project. The DOE has reviewed the project description and offers the following comments:

The DOE is concerned about how this project will impact school traffic and operations at various locations along the proposed project. The DOE would appreciate an opportunity to meet with the project manager or consultant to discuss the development of sewer improvements and traffic, dust and noise control plans. Please contact the principals for each school located close to the relief sewer work.

We appreciate the opportunity to provide comments. If you have any questions, please call Heidi Meeker with the Planning Section of the Facilities Development Branch, at 784-5095.

Respectfully,

For

Kenneth G. Masden II
Public Works Manager
Planning Section

KGM:jmb

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
EMD/CWB

05014PNN.17

May 5, 2017

Mr. Lance Fukumoto, P.E.
Project Engineer
Fukunaga & Associates, Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukumoto:

SUBJECT: Comments on the Pre-Consultation Notice for the Draft Environmental Assessment - Dowsett Highlands Relief Sewer Nuuanu, Island of Oahu, Hawaii

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated April 17, 2017, 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://health.hawaii.gov/epo/files/2013/05/Clean-Water-Branch-Std-Comments.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 National Pollutant Discharge Elimination System (NPDES) permit coverage for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55).

For NPDES general permit coverage, a Notice of Intent (NOI) form must be submitted at least 30 calendar days before the commencement of the discharge. 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 applicable form ("CWB Individual NPDES Form" or "CWB NOI Form") through the e-Permitting Portal and the hard copy certification statement with the respective filing fee ($1,000 for an individual NPDES permit or $500 for a Notice of General Permit Coverage). Please open the e-Permitting Portal website located at: https://eha-cloud.doh.hawaii.gov/epermit/. 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 appropriate form. Follow the instructions to complete and submit the form.

3. If your project involves work in, over, or under waters of the United States, it is highly recommended that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 835-4303) 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 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.

5. It is the State's position that all projects must reduce, reuse, and recycle to protect, restore, and sustain water quality and beneficial uses of State waters. Project planning should:

   a. Treat storm water as a resource to be protected by integrating it into project planning and permitting. Storm water has long been recognized as a source of irrigation that will not deplete potable water resources. What is often overlooked is that storm water recharges ground water supplies and feeds streams and estuaries; to ensure that these water cycles are not disrupted, storm water cannot be relegated as a waste product of impervious surfaces. Any project planning must recognize storm water as an asset that sustains and protects

natural ecosystems and traditional beneficial uses of State waters, like community beautification, beach going, swimming, and fishing. The approaches necessary to do so, including low impact development methods or ecological bio-engineering of drainage ways must be identified in the planning stages to allow designers opportunity to include those approaches up front, prior to seeking zoning, construction, or building permits.

b. Clearly articulate the State's position on water quality and the beneficial uses of State waters. The plan should include statements regarding the implementation of methods to conserve natural resources (e.g., minimizing potable water for irrigation, gray water re-use options, energy conservation through smart design) and improve water quality.

c. Consider storm water Best Management Practice (BMP) approaches that minimize the use of potable water for irrigation through storm water storage and reuse, percolate storm water to recharge groundwater to revitalize natural hydrology, and treat storm water which is to be discharged.

d. Consider the use of green building practices, such as pervious pavement and landscaping with native vegetation, to improve water quality by reducing excessive runoff and the need for excessive fertilization, respectively.

e. Identify opportunities for retrofitting or bio-engineering existing storm water infrastructure to restore ecological function while maintaining, or even enhancing, hydraulic capacity. Particular consideration should be given to areas prone to flooding, or where the infrastructure is aged and will need to be rehabilitated.

If you have any questions, please visit our website at: http://health.hawaii.gov/cwb, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

Alec Wong

ALEC WONG, P.E., CHIEF
Clean Water Branch

NN

c: DOH-EPO [via e-mail Noella.Narimatsu@doh.hawaii.gov only]

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
File:

EPO 17-093

May 16, 2017

Mr. Lance Fukumoto, P.E.
Fukunaga & Associates, Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814
Email: office@fukunagaengineers.com

Dear Mr. Fukumoto:

SUBJECT: Pre-Consultation for Draft Environmental Assessment (PC DEA) for Dowsett Highlands Relief

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your PC DEA to our office on April 20, 2017.

In the development and implementation of all projects, EPO strongly recommends regular review of State and Federal environmental health land use guidance. State standard comments and available strategies to support sustainable and healthy design are provided at: http://health.hawaii.gov/epo/landuse. Projects are required to adhere to all applicable standard comments. EPO has recently updated the environmental Geographic Information System (GIS) website page. It now compiles various maps and viewers from our environmental health programs. The eGIS website page is continually updated so please visit it regularly at: http://health.hawaii.gov/epo/egis

EPO also encourages you to examine and utilize the Hawaii Environmental Health Portal at: https://eha-cloud.doh.hawaii.gov. This site provides links to our e-Permitting Portal, Environmental Health Warehouse, Groundwater Contamination Viewer, Hawaii Emergency Response Exchange, Hawaii State and Local Emission Inventory System, Water Pollution Control Viewer, Water Quality Data, Warnings, Advisories and Postings.

We suggest you review the requirements of the Clean Water Branch (Hawaii Administrative Rules {HAR}, Chapter 11-54-1.1, -3, 4-8) and/or the National Pollutant Discharge Elimination System (NPDES) permit (HAR, Chapter 11-55) at: http://health.hawaii.gov/cwb. If you have any questions, please contact the Clean Water Branch (CWB), Engineering Section at (808) 586-4309 or cleanwaterbranch@doh.hawaii.gov. If your project involves waters of the U.S., it is highly recommended that you contact the Army Corps of Engineers, Regulatory Branch at: (808) 835-4303.

Please note that all wastewater plans must conform to applicable provisions (HAR, Chapter 11-62, "Wastewater Systems"). We reserve the right to review the detailed wastewater plans for conformance to applicable rules. Should you have any questions, please review online guidance at: http://health.hawaii.gov/wastewater and contact the Planning and Design Section of the Wastewater Branch (WWB) at (808) 586-4294.

Any construction waste generated by the project needs to be disposed of at a solid waste disposal facility that complies with the applicable provisions (HAR, Chapter 11-58.1 "Solid Waste Management Control"). The open burning of any of these wastes, on or off site, is strictly prohibited. Additional information is accessible at: http://health.hawaii.gov/shwb. For specific questions call (808) 586-4226.

You may also wish to review the draft Office of Environmental Quality Control (OEQC) viewer at: http://eha-web.doh.hawaii.gov/oeqc-viewer. This viewer geographically shows where some previous Hawaii Environmental Policy Act (HEPA) {Hawaii Revised Statutes, Chapter 343} documents have been prepared.

To better protect public health and the environment, the U.S. Environmental Protection Agency (EPA) has developed a new environmental justice (EJ) mapping and screening tool called EJSCREEN. It is based on nationally consistent data and combines environmental and demographic indicators in maps and reports. EPO encourages you to explore, launch and utilize this powerful tool in planning your project. The EPA EJSCREEN tool is available at: http://www.epa.gov/ejscreen.

We request that you utilize all this information on your proposed project to increase sustainable, innovative, inspirational, transparent and healthy design. Thank you for the opportunity to comment.

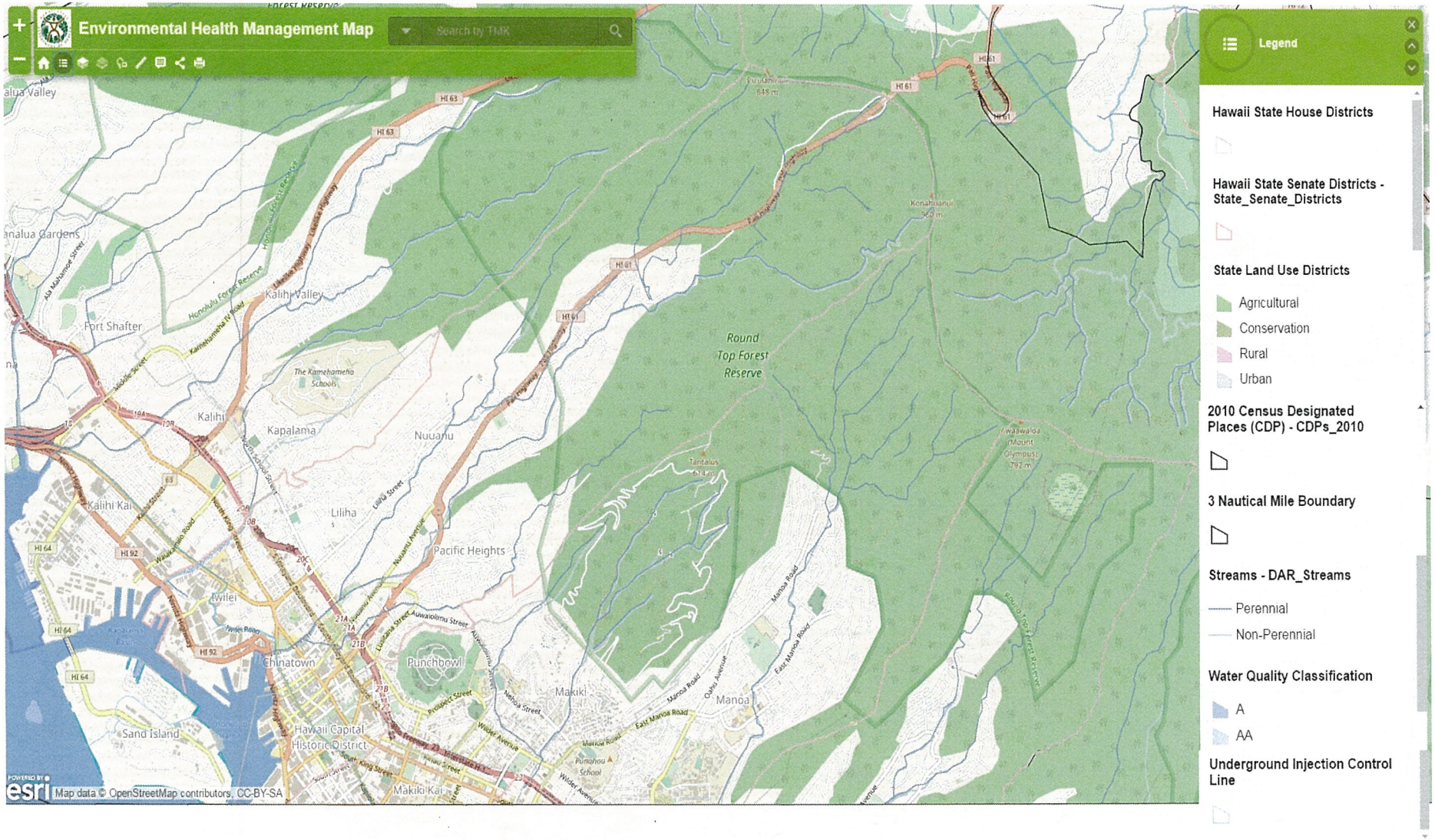
Mahalo nui loa,

Laura Leialoha Phillips McIntyre, AICP
Program Manager, Environmental Planning Office
LM:nn

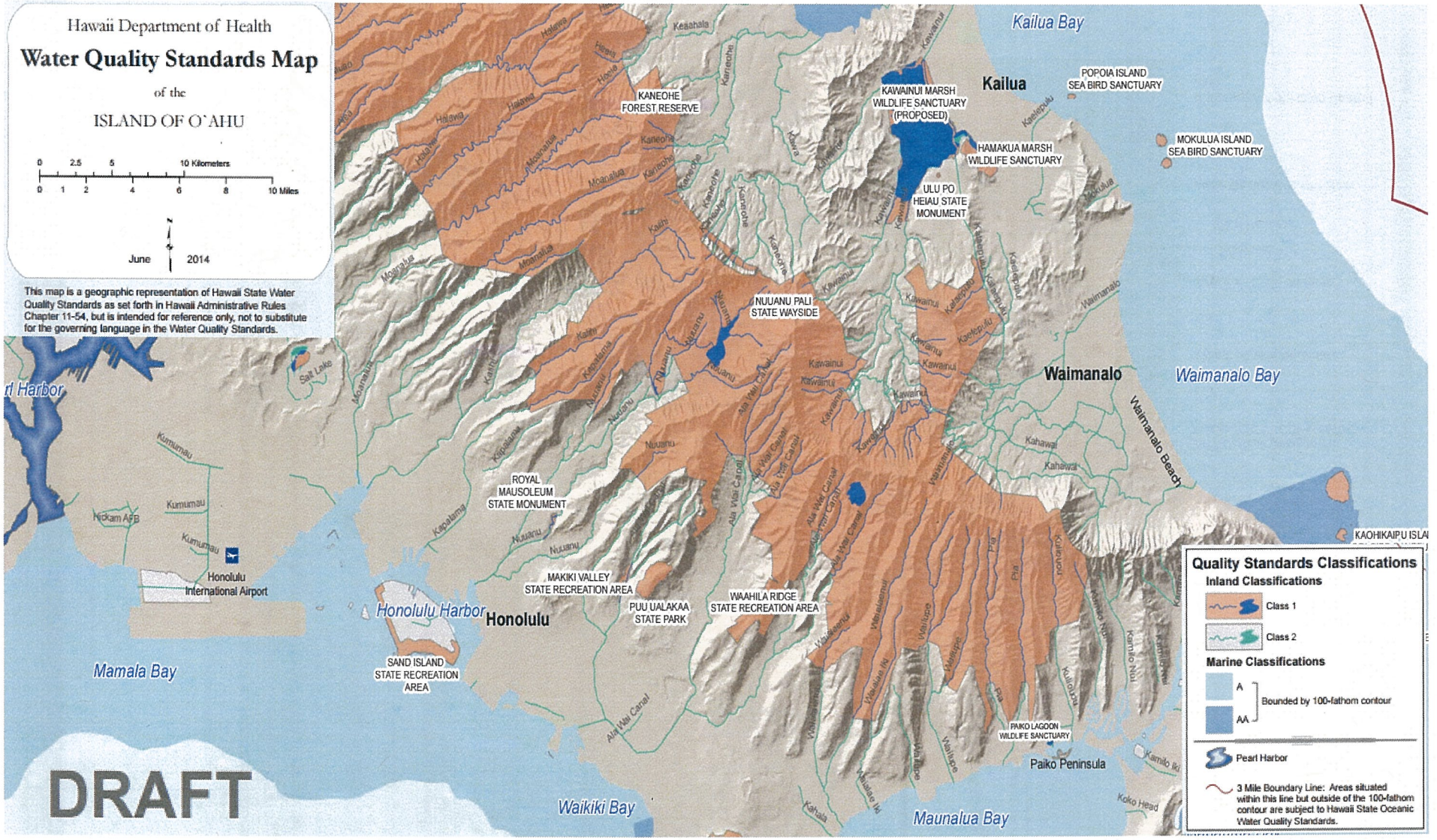
Attachment 1: Environmental Health Management Web App Snipit of Project Area: http://health.hawaii.gov/epo/egis
Attachment 2: Clean Water Branch: Water Quality Standards Map
Attachment 3: Wastewater Branch: Act 120 Cesspool Tax Credit Web App Snipit of Project Area
Attachment 4: OEQC viewer (of some past EA's, EIS's in area)
Attachment 5: U.S. EPA EJSCREEN Report for Project Area

c: DOH: CWB, WWB {via email only}

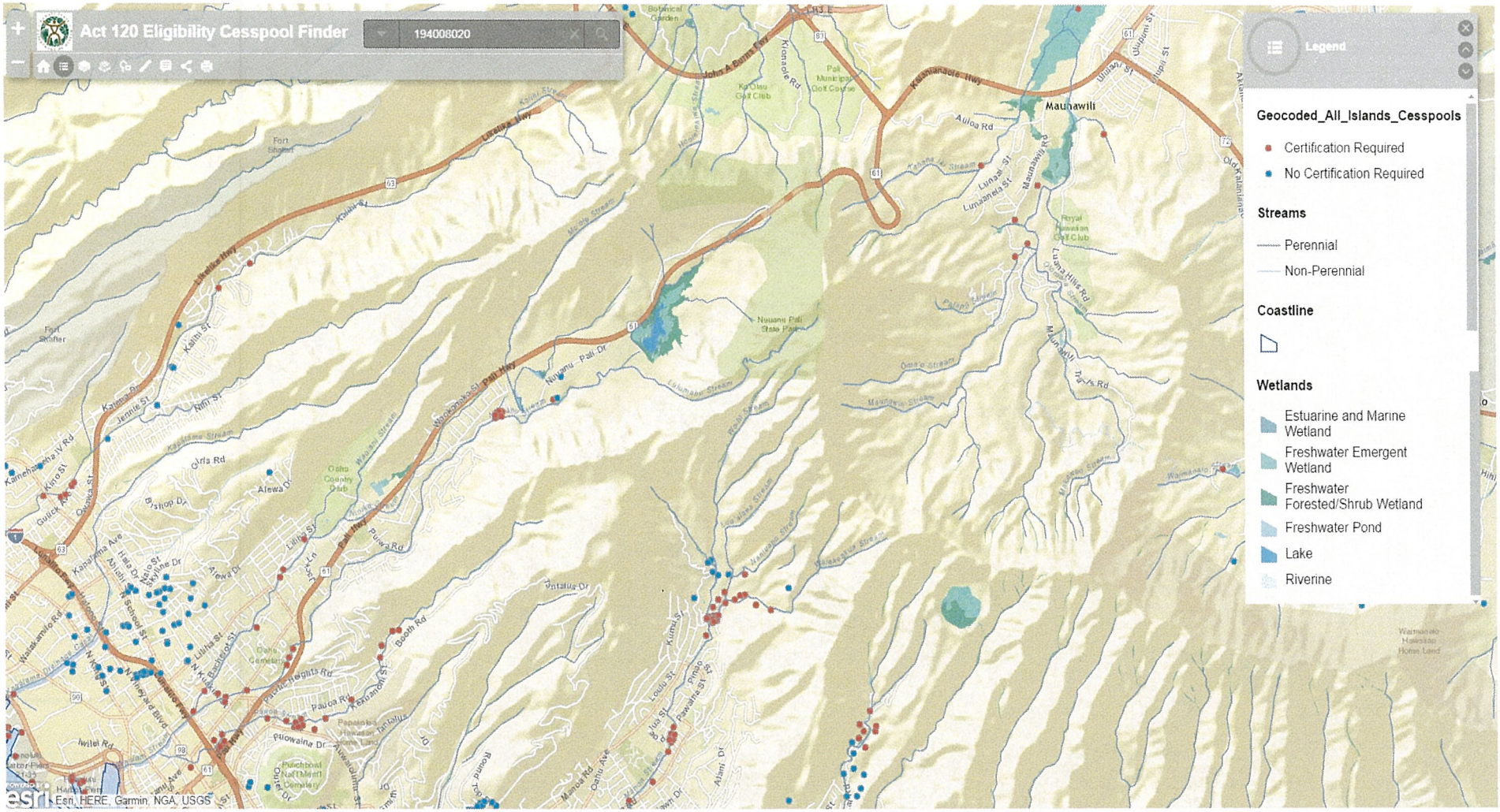
Attachment 1: Environmental Health Management Web App Snipit of Project Area: http://health.hawaii.gov/epo/egis



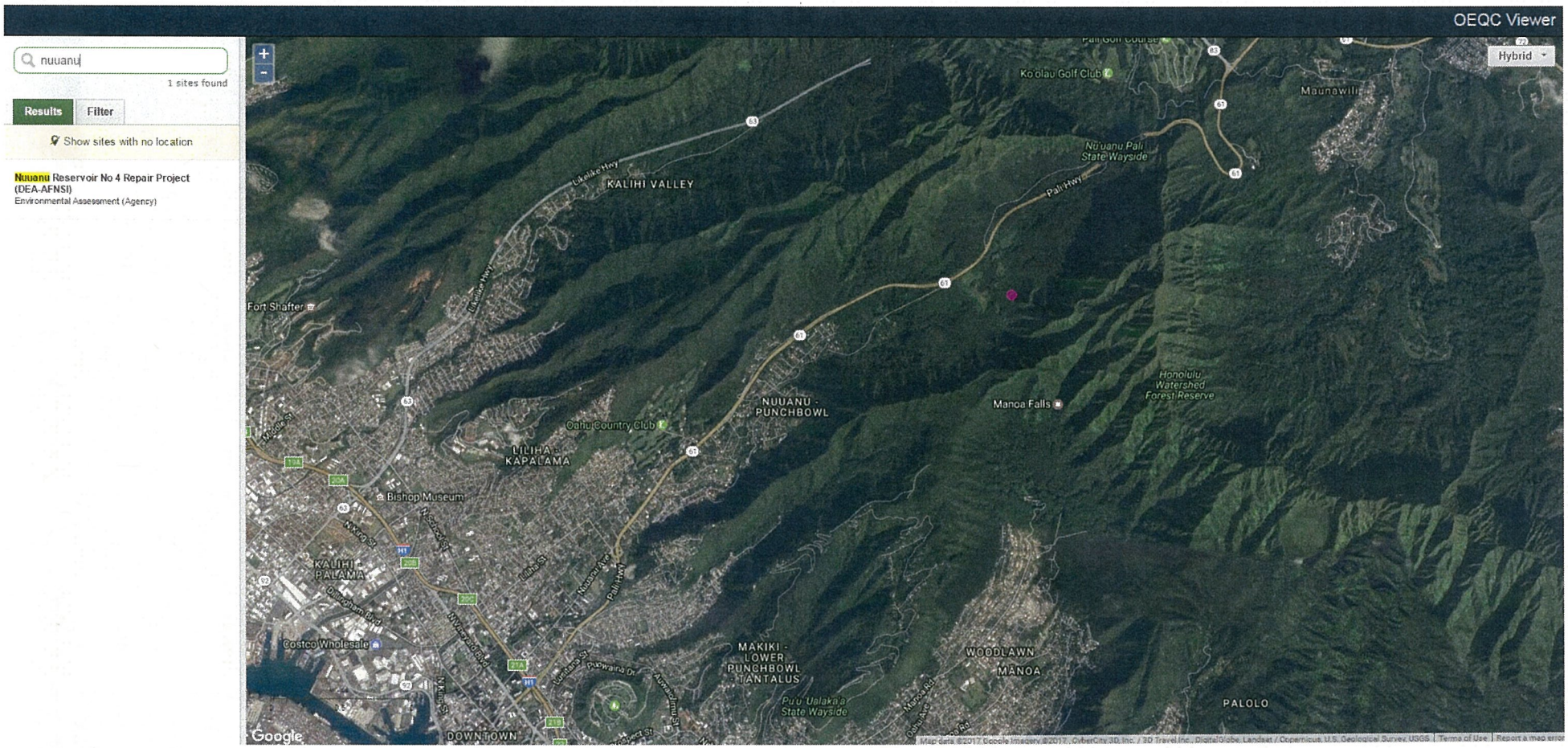
Attachment 2: Clean Water Branch: Water Quality Standards Map



Attachment 3: Wastewater Branch: Act 120 Cesspool Tax Credit Web App Snipit of Project Area



Attachment 4: OEQC viewer (of some past EA's, EIS's in area)



Attachment 5: U.S. EPA EJSCREEN Report for Project Area

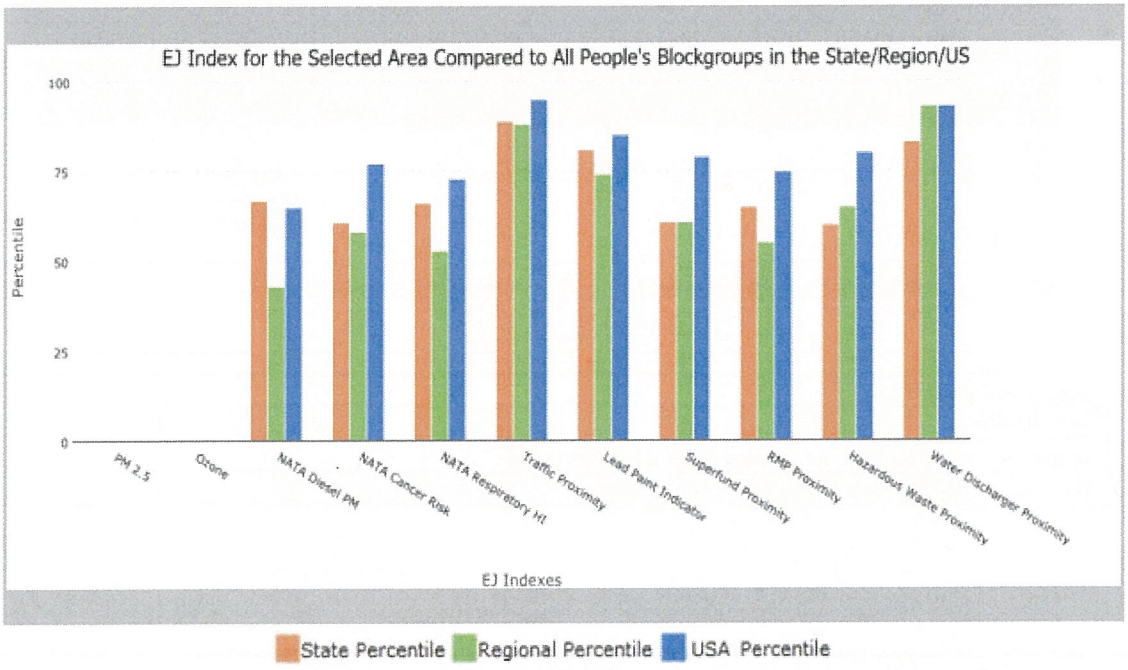
EJSCREEN Report (Version 2016)

1 mile Ring Centered at 21.323141,-157.846729, HAWAII, EPA Region 9

Approximate Population: 32,089

Input Area (sq. miles): 3.14

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	N/A	N/A	N/A
EJ Index for Ozone	N/A	N/A	N/A
EJ Index for NATA* Diesel PM	67	43	65
EJ Index for NATA* Air Toxics Cancer Risk	61	58	77
EJ Index for NATA* Respiratory Hazard Index	66	53	73
EJ Index for Traffic Proximity and Volume	89	88	95
EJ Index for Lead Paint Indicator	81	74	85
EJ Index for Superfund Proximity	61	61	79
EJ Index for RMP Proximity	65	55	75
EJ Index for Hazardous Waste Proximity*	60	65	80
EJ Index for Water Discharger Proximity	83	93	93



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJSCREEN Report (Version 2016)

1 mile Ring Centered at 21.323141,-157.846729, HAWAII, EPA Region 9

Approximate Population: 32,089

Input Area (sq. miles): 3.14

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0
National Pollutant Discharge Elimination System (NPDES)	0

EJSCREEN Report (Version 2016)

1 mile Ring Centered at 21.323141,-157.846729, HAWAII, EPA Region 9

Approximate Population: 32,089

Input Area (sq. miles): 3.14

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m³)	N/A	N/A	N/A	9.37	N/A	9.32	N/A
Ozone (ppb)	N/A	N/A	N/A	51	N/A	47.4	N/A
NATA* Diesel PM (µg/m³)	0.145	0.149	70	0.978	<50th	0.937	<50th
NATA* Cancer Risk (lifetime risk per million)	37	34	73	43	<50th	40	<50th
NATA* Respiratory Hazard Index	1.2	1	74	2	<50th	1.8	<50th
Traffic Proximity and Volume (daily traffic count/distance to road)	2800	990	90	1100	88	590	95
Lead Paint Indicator (% Pre-1960 Housing)	0.35	0.16	81	0.24	68	0.3	65
Superfund Proximity (site count/km distance)	0.064	0.098	57	0.15	46	0.13	51
RMP Proximity (facility count/km distance)	0.15	0.19	70	0.57	35	0.43	44
Hazardous Waste Proximity+ (facility count/km distance)	0.099	0.14	60	0.14	60	0.11	67
Water Discharger Proximity (facility count/km distance)	0.68	0.34	86	0.2	95	0.31	89
Demographic Indicators							
Demographic Index	56%	52%	66	47%	64	36%	78
Minority Population	89%	77%	66	58%	81	37%	89
Low Income Population	24%	26%	51	36%	35	35%	36
Linguistically Isolated Population	10%	6%	81	9%	66	5%	84
Population With Less Than High School Education	13%	9%	76	17%	50	14%	59
Population Under 5 years of age	5%	6%	35	7%	35	6%	38
Population over 64 years of age	24%	15%	86	13%	90	14%	89

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

+ The hazardous waste environmental indicator and the corresponding EJ index will appear as N/A if there are no hazardous waste facilities within 50 km of a selected location.

For additional information, see: www.epa.gov/environmentaljustice

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
File:

May 08, 2017

Mr. Lance Fukumoto, P.E.
Fukunaga & Associates, Inc.
1357 Kapiolani Blvd, Suite 1530
Honolulu, HI 96814

Dear Mr. Fukumoto:

Thank you for your submittal requesting comments to the Pre-Consultation Notice for Draft Environmental Assessment Dowsett Highlands Relief Sewer, City and County of Honolulu, Department of Design and Construction, Nu'uanu, Oahu, Hawaii.

Project activities shall comply with the following Administrative Rules of the Department of Health:

- Chapter 11-46 Community Noise Control

Should you have any questions, please contact me at (808) 586-4700.

Sincerely,

for Jeffrey M. Eckerd
Program Manager
Indoor and Radiological Health Branch

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
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
DowsettHighlandsReliefSewer01.docx

April 21, 2017

Mr. Lance Fukumoto
Project Engineer
Fukunaga & Associates, Inc.
1357 Kapiolani Blvd., Suite 1530
Honolulu, Hi 96814

Dear Mr. Fukumoto:

SUBJECT: Pre-Consultation Notice for Draft Environmental Assessment
Dowsett Highlands Relief Sewer
City and County of Honolulu, Department of Design and Construction
Nu`uanu, O`ahu, Hawai`i

The Safe Drinking Water Branch (SDWB) has reviewed the subject document and has no comments.

If there are any questions, please call Mr. Michael Cummings of the SDWB Engineering Section at 586-4258.

Sincerely,

for
JOANNA L. SETO, P.E., CHIEF
Safe Drinking Water Branch

MJC:cw

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
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

May 8, 2017

Fukunaga & Associates, Inc.
Attention: Mr. Lance Fukumoto, P.E.
1357 Kapiolani Blvd., Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukumoto:

SUBJECT: Pre-Consultation Notice for Draft Environmental Assessment for Dowsett Highlands Relief Sewer

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 the (a) Engineering Division, (b) Land Division – Oahu District, and (c) Division of Aquatic Resources on the subject matter. Should you have any questions, please feel free to call Lydia Morikawa at 587-0410. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

'17 APR 21 PM 12:44 ENGINEERING

SUZANNE D. CASE
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 21, 2017

MEMORANDUM

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

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Pre-Consultation Notice for Draft Environmental Assessment for Dowsett Highlands Relief Sewer
LOCATION: Nuuanu, Island of Oahu; TMK: (1) various
APPLICANT: City and County of Honolulu, Department of Design and Construction

Transmitted for your review and comment is information on the above-referenced project. We would appreciate your comments on this project. Please submit any comments by **May 5, 2017**.

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 Lydia Morikawa at 587-0410. Thank you.

Attachments

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

Signed: _____

Print Name: Carty S. Chang, Chief Engineer
Date: 4/24/17

cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/Russell Y. Tsuji
Ref: Pre-Consultation Notice for Draft Environmental Assessment for Dowsett Highlands Relief Sewer

COMMENTS

The rules and regulations of the National Flood Insurance Program (NFIP), Title 44 of the Code of Federal Regulations (44CFR), are in effect when development falls within a designated Flood Hazard.

The owner of the project property and/or their representative is responsible to research the Flood Hazard Zone designation for the project. Flood Hazard Zone designations can be found using the Flood Insurance Rate Map (FIRM), which can be accessed through the Flood Hazard Assessment Tool (FHAT) (http://gis.hawaiinfip.org/FHAT).

Be advised that 44CFR reflects the minimum standards as set forth by the NFIP. Local community flood ordinances may take precedence over the NFIP standards as local designations prove to be more restrictive. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

- Oahu: City and County of Honolulu, Department of Planning and Permitting (808) 768-8098.
- Hawaii Island: County of Hawaii, Department of Public Works (808) 961-8327.
- Maui/Molokai/Lanai County of Maui, Department of Planning (808) 270-7253.
- Kauai: County of Kauai, Department of Public Works (808) 241-4846.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: 4/24/17

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
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 21, 2017

MEMORANDUM

RECEIVED
LAND DIVISION
2017 APR 27 AM 6:09
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

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

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Pre-Consultation Notice for Draft Environmental Assessment for Dowsett Highlands Relief Sewer
LOCATION: Nuuanu, Island of Oahu; TMK: (1) various
APPLICANT: City and County of Honolulu, Department of Design and Construction

Transmitted for your review and comment is information on the above-referenced project. We would appreciate your comments on this project. Please submit any comments by **May 5, 2017**.

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 Lydia Morikawa at 587-0410. Thank you.

Attachments

Any improvements on lands under the juristiction of the Land Board needs a land disposition from the Board of Land & Natural Resources.

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

Signed: Darlene Bryant-Takamatsu
Print Name: Darlene Bryant-Takamatsu
Date: 4/24/17

cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
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 21, 2017

MEMORANDUM

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

JK
RO

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Pre-Consultation Notice for Draft Environmental Assessment for Dowsett Highlands Relief Sewer
LOCATION: Nuuanu, Island of Oahu; TMK: (1) various
APPLICANT: City and County of Honolulu, Department of Design and Construction

Transmitted for your review and comment is information on the above-referenced project. We would appreciate your comments on this project. Please submit any comments by **May 5, 2017**.

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 Lydia Morikawa at 587-0410. Thank you.

Attachments

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

Signed: Alton Miyasaka
for Bruce S. Anderson, Ph.D., DAR Administrator
Print Name:
Date: 5-2-17

cc: Central Files

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF AQUATIC RESOURCES
1151 PUNCHBOWL STREET, ROOM 330
HONOLULU, HAWAII 96813

May 2, 2017

DAR # 5523

MEMORANDUM

TO: Bruce Anderson, Administrator

DATE: 5-2-17

FROM: Glenn Higashi, Aquatic Biologist

SUBJECT: Request for Comments: Pre-Consultation Notice for Draft Environmental Assessment for Dowsett Highlands Relief Sewer

Comment	Date Request	Receipt	Referral	Due Date
	04/21/17	04/21/17	04/24/17	05/05/17

Requested by: Russell Y. Tsuji, Land Administrator
Land Division

Summary of Proposed Project

Title: Pre-Consultation Notice for Draft Environmental Assessment for Dowsett Highlands Relief Sewer

Project by: City and County of Honolulu, Department of Design and Construction

Location: Nuuanu, Oahu; Tax Map Key: (1) various

Brief Description:

The applicant, City and County of Honolulu, Department of Design and Construction is proposing two wastewater hydraulic capacity upgrade projects, which were initially recommended in the 1999 CCH 20-Year Capital Improvement Projects (CIP) Program and later re-evaluated in the CCH Sewer Infiltration and Inflow (I/I) Assessment and Rehabilitation Program Update per the Environmental Protection Agency's (EPA) 2010 Global Consent Decree (GCD). The primary intent of the two projects was to address the existing hydraulic capacity deficiencies of the trunk sanitary sewer along Waolani Stream and Niniko Stream, and the trunk sanitary sewer along Nuuanu Stream. Per the GCD Subparagraphs 18.f and 18.g, construction of these two projects must be completed by June 30, 2020.

The main objective of the combined project is to develop hydraulic capacity improvements to alleviate flow surcharge conditions which may potentially cause sanitary sewer overflows (SSOs) during wet weather events.

The recommended improvements include the design and construction of approximately 14,500 linear feet of 8-inch to 24-inch diameter new gravity sanitary sewers. The main alignment is proposed to begin along Nuuanu-Pali Drive, follow along Pali Highway, Dowsett Avenue, Pali Highway and Nuuanu Avenue and end at School Street. Branch sewers intercepting flows from existing mains are proposed along Wyllie Street, Laimi Road, Pelekane Drive, Jack Lane and Ahi Place. Other improvements include localized relief and/or replacement sewers to address existing sewers with hydraulic capacity deficiencies not fully addressed by the proposed main relief sewer; these include short segments of sewers next to South Judd Street along Craigside, and the Pelekane Drive and Laimi Road sanitary sewer bridge crossings. See the attached figure for the proposed alignment of the new sanitary sewers. The improvements labeled as Non-GCD are not subject to the GCD deadline.

Construction of the new relief sewers is expected to utilize a combination of trenchless technologies and open-trench excavation. Construction along Pali Highway may utilize trenchless technologies wherever possible to minimize disruption; however, the contractor may be given the option to utilize open-trench excavation if it allows for faster construction. Generally, open-trench excavation is preferred for sections of sewer construction at shallow depths. Pilot-tube microtunneling (PTMT) is the most likely trenchless methodology to be employed, and utilization of PTMT may be maximized in areas with displaceable soils.

Comments:

The proposed project is not expected to have adverse impacts on the aquatic environment. Construction of the new relief sewers utilizing trenchless technologies wherever possible will help to minimize disruption of the soil, particularly in sections where the new relief sewer crosses the stream channel. Open trench excavation for sewer construction even at shallow depths will expose the displaceable soils. Therefore the Division recommends the following Best Management Practices (BMPs) be incorporated to minimize the potential for erosion, siltation and pollution of the aquatic environment particularly at sites adjacent to the stream channel.

1) Lands denuded of vegetation should be planted or covered as quickly as possible to prevent further erosion and soil from falling or flowing into the stream environment;
2) Scheduling site work (particularly the open-trench excavation and relief sewer construction) during periods of minimal rainfall; and,
3) Prevent construction materials, petroleum products, debris and landscaping products, etc. from falling, blowing or leaching into the aquatic environment.

Thank you for providing DAR the opportunity to review and comment on the proposed project. Should there be any changes to the project plans, DAR requests the opportunity to review and comment on those changes.

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

May 26, 2017

IN REPLY REFER TO:
Log No. 2017.00760
Doc. No. 1705GC08
Archaeology

Russell Y. Tsujii, Administrator
Land Division, Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Tsujii:

SUBJECT: **Chapter 6E-8 and National Historic Preservation Act (NHPA) Section 106 Review – Pre-Assessment Consultation for Draft Environmental Assessment for the Dowsett Highlands Relief Sewer Project**
Nu‘uanu Ahupua‘a, Honolulu (Kona) District, Island of O‘ahu
TMK: (1) 1-7, 1-8, 1-9, and 2-2

Thank you for the opportunity to consult and provide comments on this pre-consultation for a draft environmental assessment (DEA) for the Dowsett Highlands Relief Sewer Project. The State Historic Preservation Division (SHPD) received this submittal on April 27, 2017. The submittal indicates that preparation of the DEA is ongoing. The proposed project combines two City and County of Honolulu (CCH) wastewater hydraulic capacity upgrades. The combined project is to develop hydraulic capacity improvements to alleviate flow surcharge conditions which may potentially cause sanitary sewer overflow during wet weather events. The submittal specifies that this project will also receive federal funding, under the State of Hawaii, Department of Health (DOH), Clean Water State Revolving Fund Program (CWSRF).

The project improvements are described as follows: design and construction of approximately 14,500 linear feet of 8-inch to 24-inch diameter new gravity sanitary sewers. The main alignment is proposed to begin along Nu‘uanu-Pali Drive, follow along Pali Highway, Dowsett Avenue, Pali Highway and Nu‘uanu Avenue, and end at School Street. Branch sewers intercepting from existing mains are proposed along Wyllie Street, Laimi Road, Pelekane Drive, Jack Lane and Ahi Place. Other improvements include localized relief and/or replacement sewers to address existing sewers with hydraulic capacity deficiencies not fully addressed by the proposed main relief sewer. These include short segments of sewers next to South Judd Street along Craigside Place, and the Pelekane Drive and Laimi Road sanitary sewer bridge crossings. Construction of the new relief sewers will utilize a combination of trenchless technologies (micro-tunneling) and open trenching.

On February 17, 2017, the SHPD reviewed a document titled, *Chapter 6E-8, Request for a Historic Properties Determination, City and County of Honolulu, Ref. No. WW.CSE 15-125, Dowsett Highlands & Relief Sewer Project* and an *Archaeological Literature Review and Field Inspection (LRFI) for the Dowsett Highland Relief Project*, prepared by Cultural Surveys Hawai‘i, Inc. (Belluomini et al., November 2015). The SHPD requested the following: (1) completion of an architectural reconnaissance level survey (RLS); (2) the opportunity for SHPD to review the 60% and 90% design plans of the project area; (3) completion of an archaeological monitoring plan (AMP); and (4) consultation with the SHPD prior to conducting the RLS. The SHPD accepted this document as supportive material designed to facilitate project planning and the historic preservation review process (February 17, 2017; Log No. 2015.04034, Doc. No. 1703SL09).

Per Chapter 6E-8 of Hawaii Revised Statutes, **SHPD requests** the following prior to project initiation:

- A completed RLS;
- An AMP meeting the requirements of HAR §13-279-4; and
- Consultation with SHPD architectural branch to discuss survey boundaries and the properties to be surveyed.

The **SHPD will notify you when** the required reports and plans have been accepted and project work may commence.

This submittal will require the State Historic Preservation Officer (SHPO) to review the proposed project under the National Historic Preservation Act (NHPA) Section 106 and it's implementing regulation 36 CFR 800. The use of federal funding, from the Department of Health's Clean Water State Revolving Fund Program (CWSRF), triggers the NHPA Section 106 process. **Attached are steps that the applicant needs to address** under NHPA Section 106:

(1) Name of the federal and state funding or licensing agency/agencies involved with this project. The State Historic Preservation Officer is required to respond to the federal agency or to the agency's designated authority. Consultants contracted to prepare information, analyses, or recommendations are not recognized as a federally-delegated authority. Every project subject to section 106 has a federal funding, licensing, or permitting agency. Please include the name, address, and telephone number of the contact person/s at the federally delegated authority. A federal agency or federally delegated authority contact is mandatory pursuant to 36 CFR §800.2(a);

(2) A delegation letter from the federal agency that identifies the activities and responsibilities they have delegated to you on their behalf;

(3) Information documenting that the agency has evaluated and determined that the project constitutes an undertaking as defined in 36 CFR 800.16(y);

(4) Information indicating that a reasonable and good faith effort to identify historic properties (architectural, archaeological, or traditional cultural properties [TCPs]) within the area of potential effect (APE) pursuant to 36 CFR §800.4(a) and 4(b) has been completed. The identification effort must include consultation efforts with Native Hawaiian Organizations (NHOs) [36 CFR §800.4(a)(4)] and consultation with individuals, organizations and the public with a demonstrated interest in the undertaking [36 CFR §800.2(c)] and should include documentation of the nature of the consultation, the names of the consulted parties, and their comments/concerns; and

(5) A determination of eligibility and significance for any properties or potential historic districts within the APE [36 CFR§800.4(c)]; assessment of project effect [36 CFR §800.4(d)]; and if necessary resolution of adverse effects [36 CFR §800.6] for any sites located with the APE.

Per 36 CFR 800, **SHPD looks forward to** receiving a request from the lead federal agency or their delegated authority to initiate NHPA Section 106 consultation with SHPD on the proposed undertaking.

Please contact Ms. Jessica L. Puff at (808) 692-8023 or at Jessica.L.Puff@hawaii.gov for any architectural questions or concerns; Kaʻāhiki Solis at (80-8) 692-8030 or at Sheleigh.Solis@hawaii.gov for questions or concerns regarding traditional Hawaiian cultural resources or consultation with NHOs, and Dr. Susan A. Lebo at (808) 692-8019 or at Susan.A.Lebo@hawaii.gov for questions or concerns regarding archaeological resources or this letter.

Aloha,

Alan S. Downer, PhD
Administrator, state Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Lydia Morikawa, DLNR-Land (Lydia.M.Morikawa@hawaii.gov)
Lance Fukumoto, Fukunaga & Associates (office@fukunagaengineers.com)
Shelle Silva, CCH-DDC (Shelle.Silva@honolulu.gov)
Sina Pruder, DOH (Sina.L.Pruder@doh.hawaii.gov)

DAVID Y. IGE
GOVERNOR

FORD N. FUCHIGAMI
DIRECTOR

Deputy Directors
JADE T. BUTAY
ROSS M. HIGASHI
EDWIN H. SNIFFEN
DARRELL T. YOUNG

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

IN REPLY REFER TO:
DIR 0564
HWY-CM 2.4788

May 22, 2017

Mr. Lance Fukumoto
Fukunaga & Associates, Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukumoto:

Subject: Pre-Consultation Notice for Draft Environmental Assessment
Dowsett Highlands Relief Sewer

Thank you for the opportunity to provide preliminary comments for the subject project.

A permit from the Department of Transportation, Highways Division, will be required for work in the State highway right-of-way. Please note that a 3-foot lateral and vertical clearance from existing utilities is required where the proposed sewer is installed with trenchless methods. Please submit construction plans for review and approval when available.

Should you have any questions, please call Mr. John Williams, Acting Engineering Program Manager, Construction and Maintenance Branch, Highways Division, at (808) 587-2183 or email at John.Williams@hawaii.gov.

Sincerely,

FORD N. FUCHIGAMI
Director of Transportation

PHONE (808) 594-1888

FAX (808) 594-1938

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
560 N. NIMITZ HWY., SUITE 200
HONOLULU, HAWAI'I 96817

HRD17-8181

May 11, 2017

Lance Fukumoto, P.E.
Project Engineer
Fukunaga & Associates, Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, HI 96814

Re: Request for Comments on a Pre-Consultation for Draft Environmental Assessment
Dowsett Highlands Relief Sewer
Nu'uanu Ahupua'a, Kona Moku, O'ahu Mokupuni

Aloha e Lance Fukumoto:

The Office of Hawaiian Affairs (OHA) is in receipt of your April 17, 2017 letter requesting comments on the pre-consultation for the draft environmental assessment (DEA) for the proposed improvements of the City and County of Honolulu, Dowsett Highlands Relief Sewer (project). The proposed project will develop hydraulic capacity improvements to alleviate flow surcharge conditions which may potentially cause sanitary sewer overflows during the wet weather season.

We understand that the project's recommended improvements include:

- The design and construction of approximately 14,500 linear feet of 8-inch to 24-inch diameter new gravity sanitary sewers;
- Main alignment is proposed to begin along Nu'uanu-Pali Drive to Pali Highway, Dowsett Avenue, Pali Highway and Nu'uanu Avenue and end at School Street;
- Branch sewers intercepting flows from existing mains are proposed along Wyllie Street, Laimi Road, Pelekane Drive, Jack Lane and Ahi Place; and
- Other improvements include localized relief and/or replacement sewers to address existing sewers with hydraulic capacity deficiencies not fully addressed by the proposed main relief sewer; which include short segments of sewers next to South

Judd Street along Craigside, and the Pelekane Drive and Laimi Road Sanitary sewer bridge crossings.

According to the DEA, the new relief sewers are expected to utilize a combination of trenchless technologies and open-trench excavation. Construction along the Pali Highway may utilize trenchless technologies to minimize disruption. Another option the contractor may use is the traditional open-trench excavation for faster construction. Your letter notes, open-trench excavation is preferred for sections of sewer construction at shallow depths.

As with all subsurface ground disturbances, we request assurances that should iwi kūpuna or Native Hawaiian cultural deposits be identified during ground altering activities, all work will immediately cease in the immediate area and the appropriate agencies, including OHA, will be contacted pursuant to applicable law.

Mahalo for the opportunity to provide comments. 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,

Kamana'opono M. Crabbe, Ph.D.
Ka Pouhana, Chief Executive Officer

KC:kk

**Please address replies and similar, future correspondence to our agency:*
Dr. Kamana'opono Crabbe
Attn: OHA Compliance Enforcement
560 N. Nimitz Hwy, Ste. 200
Honolulu, HI 96817

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843
www.boardofwatersupply.com

May 1, 2017

Mr. Lance Fukumoto, P.E.
Fukunaga & Associates, Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukumoto:

Subject: Your Letter Dated April 17, 2017 Requesting Comments on the Pre-Consultation Notice for Draft Environmental Assessment on the Proposed Dowsett Highlands Relief Sewer Project Along Pali Highway in Nuuanu

Thank you for the opportunity to comment on the proposed relief sewer project.

The construction plans should be submitted for Board of Water Supply (BWS) review and approval.

The construction schedule should be coordinated with BWS to minimize impacts on the water system.

If you have any questions, please contact Robert Chun, Project Review Branch of our Water Resources Division at 748-5443.

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

ROBERT J. KRONING, P.E.
DIRECTOR

MARK YONAMINE, P.E.
DEPUTY DIRECTOR

May 17, 2017

Fukunaga & Associates, Inc.
Attn: Lance Fukumoto, P.E.
1357 Kapiolani Blvd., Suite 1530
Honolulu, HI 96814

Mr. Fukumoto,

Subject: Pre-Consultation Notice for the Draft Environmental Assessment Dowsett Highlands Relief Sewer, City and County of Honolulu, Nu'uanu, Oahu, Hawaii

Thank you for the opportunity to review and comment. The Department of Design and Construction's Civil Division had some comments regarding this project and have enclosed their comments.

If there are any further questions, please contact Howard Koza of our Civil Division at 768-8403.

Sincerely,

Robert J. Kroning, P.E.
Director

RJK:ms(687369)

2. Phase 2 Pali Highway Repaving (State Department of Transportation)
    - Road resurfacing along Pali Highway (Vineyard Boulevard to Waokanaka Street)
    - Construction to follow completion of the Dowsett Highlands Relief Sewer project

3. Complete Streets (City and County of Honolulu) — Nuuanu Avenue Repaving and Improvements
    - Road resurfacing (South School Street to Wyllie Street)
    - Improvements along Nuuanu Avenue from Kuakini Street to Craigside Place to reshape the street into a safer, multi-modal corridor encouraging pedestrian and bicycle activities — Complete Streets
    - Estimated design start date: ~~December 2017~~ June 2018
    - Estimated design duration: 12 – 18 months
    - Construction schedule will be coordinated ~~with the Dowsett Highlands Relief Sewer project~~ to follow completion of the Dowsett Highlands Relief Sewer project.

4. Electrical Improvements (Hawaiian Electric Company)
    - Work in the Dowsett area in 2019 – 2020

5. Rehabilitation of Localized Streets, Phases 12B and 12C (City and County of Honolulu)
    - Road rehabilitation along various roadways in the Liliha/Puunui area
    - Adjusted scope to avoid conflict with the Dowsett Highlands Relief Sewer project

VI. FUNDING

This project is on the State Department of Health, Wastewater Branch, Clean Water State Revolving Fund Program (CWSRF) project priority list for 2017 to receive Federal funding.

PII,

DFM First Aid for Nuuanu Avenue

- Temporary road resurfacing (South School Street to Wyllie Street)
- Estimated construction schedule: July 2017 – September 2017

DEPARTMENT OF FACILITY MAINTENANCE

CITY AND COUNTY OF HONOLULU

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

KIRK CALDWELL
MAYOR

ROSS S. SASAMURA, P.E.
DIRECTOR AND CHIEF ENGINEER

EDUARDO P. MANGLALLAN
DEPUTY DIRECTOR

IN REPLY REFER TO:
DRM 17-294

May 17, 2017

Mr. Lance Fukumoto, P.E.
Project Engineer
Fukunaga & Associates, Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukumoto:

SUBJECT: Pre-Consultation Notice for Draft Environmental Assessment
Dowsett Highlands Relief Sewer
City and County of Honolulu, Department of Design and Construction
Nu'uanu, O'ahu, Hawai'i

Thank you for the opportunity to review and provide our input regarding your letter dated April 17, 2017, on the above-subject project.

We have no comments at this time. For your information, we plan to perform first aid pavement repairs on Nu'uanu Avenue from School Street to Wyllie Street during the summer of 2017.

If you have any questions, please call Mr. Kyle Oyasato of the Division of Road Maintenance at 768-3697.

Sincerely,

Ross S. Sasamura, P.E.
Director and Chief Engineer

DEPARTMENT OF PARKS & RECREATION

CITY AND COUNTY OF HONOLULU

1000 Uluohia Street, Suite 309, Kapolei, Hawaii 96707
Phone: (808) 768-3003 • Fax: (808) 768-3053
Website: www.honolulu.gov

KIRK CALDWELL
MAYOR

MICHELE K. NEKOTA
DIRECTOR

JEANNE C. ISHIKAWA
DEPUTY DIRECTOR

April 26, 2017

Mr. Lance Fukumoto, P.E.
Fukunaga & Associates, Inc.
1357 Kapiolani Blvd., Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukunaga, P.E.:

SUBJECT: Pre-Consultation Notice for Draft Environmental Assessment
Dowsett Highlands Relief Sewer
Nuuanu, Oahu, Hawaii

Thank you for the opportunity to review and comment at the pre-consultation stage of the Draft Environmental Assessment (DEA) for the proposed Dowsett Highlands Relief Sewer.

The Department of Parks and Recreation has no comment. As the proposed project will have no impact on any program or facility of the department, you may remove us as a consulted party to the balance of the DEA process.

Should you have any questions, please contact Mr. John Reid, Planner at 768-3017.

Sincerely,

Michele K. Nekota
Director

MKN:jr
(687412)

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

KIRK CALDWELL
MAYOR

KATHY K. SOKUGAWA
ACTING DIRECTOR

TIMOTHY F. T. HIU
DEPUTY DIRECTOR

2017/ELOG-831(JD)

May 5, 2017

Mr. Lance Fukumoto
Fukunaga & Associates, Inc
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukumoto:

SUBJECT: Request for Comments
Pre-Assessment for Draft Environmental Assessment (EA)
Dowsett Highlands Relief Sewer Project
Located along Nuuanu Avenue between Wyllie Street and School Street - Nuuanu

This responds to your request for comments, received April 20, 2017, on the forthcoming Draft EA. The Project is to construct approximately 14,500 linear feet of new gravity sanitary sewers, ranging from eight inches to 24 inches in diameter. The proposed alignment begins along Nuuanu-Pali Drive then follows along Pali Highway and Dowsett Avenue, and ends at School Street. We have reviewed the Project summary and have the following comments:

1. A portion of the Project is within the Punchbowl Special District. It is our understanding that the proposed sewer improvements will be within the paved roadway areas, and any disturbance to roadways, sidewalks, and other elements within the public rights-of-way, will be restored to preconstruction conditions. The scope of work will primarily consist of below-grade infrastructure improvements and the restoration of elements within the public rights-of-way. These are considered exempt activities within the Punchbowl Special District and do not require a Special District Permit. However, please note that since Nuuanu Avenue is a major street, any tree removal that is six inches or more in trunk diameter will require a Special District Permit Minor.

2. The Draft EA should discuss the consistency of the Project with the Oahu General Plan and the Primary Urban Center Development Plan.

3. The Draft EA should address any potential impacts that area flooding will have on the proposed improvements

4. The Draft EA should discuss flooding, drainage, and mitigative measures to prevent runoff from the Project site during construction.

Should you have any questions, please contact Jordan Dildy of our Zoning Regulations and Permits Branch at 768-8027 or by email at jdildy@honolulu.gov.

Very truly yours,

FOR: Kathy K. Sokugawa
Acting Director

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

WES FRYSZTACKI
DIRECTOR

JON Y. NOUCHI
DEPUTY DIRECTOR

TP4/17-687442R

May 5, 2017

Mr. Lance Fukumoto, P.E.
Project Engineer
Fukunaga & Associates, Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukumoto:

SUBJECT: Pre-Consultation Draft Environmental Assessment (DEA) for Dowsett Highlands Relief Sewer, Nuuanu, Oahu, Hawaii

In response to your letter dated April 17, 2017, we have the following comments:

1. The DEA should include a Traffic Management Plan, which discusses traffic impacts the project may have on any surrounding City roadways, including short-term impacts during construction with corresponding measures to mitigate these impacts.

2. There are bus stops located along the projects main alignment route. Therefore, construction notes should include the following note regarding transit services:

   "This project will affect bus operations, bus routes, bus stops, and para-transit operations. **At least two (2) weeks prior to construction**, the Contractor shall provide notification of the scope of work, location, detour, proposed closure of any street, traffic lane, sidewalk, or bus stop and duration of project to:

   Department of Transportation Services, Public Transit Division:
   768-8396 and TheBusStop@honolulu.gov
   Oahu Transit Services, Inc.:
   Bus Operations: 768-9520 and 848-4565 and
   Field_Operation_Mgr@thebus.org

Para-transit Dispatch and Operations:
454-5007 and 768-9852"

3. Any damage to the existing roadway, sidewalk and driveway areas caused by the project should be repaired to current City standards.

4. The area Neighborhood Board, as well as the area residents, businesses, emergency personnel (fire, ambulance and police), Oahu Transit Services, Inc. (TheBus and TheHandi-Van), etc., should be kept apprised of the details of the proposed project and the impacts that the project may have on the adjoining local street area network.

5. Construction materials and equipment should be transferred to and from the project site during off-peak traffic hours (8:30 a.m. to 3:30 p.m.) to minimize any possible disruption to traffic on the local streets.

6. A street usage permit from the City's Department of Transportation Services should be obtained for any construction-related work that may require the temporary closure of any traffic lane on a City street.

We reserve further comment pending review of the DEA.

Thank you for the opportunity to review this matter. Should you have any questions, please contact Renee Yamasaki of my staff at 768-8383.

Very truly yours,

Wes Frysztacki
Director

cc: Shelle Silva, P.E., Department of Design and Construction

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

May 12, 2017

Mr. Lance Fukumoto, P.E.
Project Engineer
Fukunaga and Associates, Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukumoto:

Subject: Preconsultation for Draft Environmental Assessment
Dowsett Highlands Relief Sewer
City and County of Honolulu, Department of Design and Construction
Nuuanu, Oahu, Hawaii

In response to your letter dated April 17, 2017, regarding the above-mentioned subject, the Honolulu Fire Department has no preliminary comments to offer at this time.

We do advise however, that you please contact Battalion Chief (BC) Sheldon Hao of our Fire Operations section at 723-7181 or shao@honolulu.gov to discuss possible road closures and alternate routes prior to the start of the project.

Should you have questions, please contact BC Wayne Masuda of our Fire Prevention Bureau at 723-7151 or wmasuda@honolulu.gov.

Sincerely,

Socrates D. Bratakos

SOCRATES D. BRATAKOS
Assistant Chief

SDB/JL:ps

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

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

KIRK CALDWELL
MAYOR

~~LOUIS M. KEALOHA~~
CHIEF

CARY OKIMOTO
JERRY INOUYE
DEPUTY CHIEFS

OUR REFERENCE MT-DK

April 28, 2017

Mr. Lance Fukumoto, P.E.
Project Engineer
Fukunaga & Associates, Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukumoto:

This is in response to your letter of April 17, 2017, requesting comments on a Pre-Consultation Notice, Draft Environmental Assessment, for the Dowsett Highlands Relief Sewer project.

The Honolulu Police Department (HPD) has reviewed the information provided and has concerns regarding the safe flow of vehicular traffic during the construction phase of this project.

This project may cause disturbances affecting the movement of traffic, especially during morning and afternoon commuting times. The HPD recommends that the developer implement traffic controls and management (e.g., flagmen, special duty officers, signs, cones, etc.) for the project area. This will ensure a safe means of traffic flow for construction vehicles, motorists, and pedestrians in the vicinity.

If there are any questions, please call Major Crizalmer Caarang of District 5 (Kalihi) at 723-8202.

Thank you for the opportunity to review this project.

Sincerely,

CARY OKIMOTO
Acting Chief of Police

By
MARK TSUYEMURA
Management Analyst VI
Office of the Chief

Serving and Protecting With Aloha

Lance Fukumoto

From: Fukunaga Office
Sent: Wednesday, May 10, 2017 7:56 AM
To: Lance Fukumoto
Subject: FW: Pre-Consultation Notice for Draft Environmental Assessment - Dowsett Highlands Relief Sewer

Thank you,

Jasmyn Honda
Fukunaga & Associates, Inc.
1357 Kapiolani Blvd., Ste. 1530
Honolulu, HI 96814
Phone: (808) 944-1821
Fax: (808) 946-9339
Email: jhonda@fukunagaengineers.com

From: Kuwaye, Kristen [mailto:kristen.kuwaye@hawaiianelectric.com]
Sent: Wednesday, May 10, 2017 7:22 AM
To: Fukunaga Office <office@fukunagaengineers.com>
Cc: Liu, Rouen <rouen.liu@hawaiianelectric.com>
Subject: RE: Pre-Consultation Notice for Draft Environmental Assessment - Dowsett Highlands Relief Sewer

Dear Mr. Lance Fukunaga,

Sorry we had a late submission, in our review we have noticed a fiber cable running on Vineyard Blvd. between Lusitania St. and Liliha St.

Thank you,
Kristen

From: Kuwaye, Kristen
Sent: Thursday, May 04, 2017 3:01 PM
To: 'office@fukunagaengineers.com'
Cc: Liu, Rouen
Subject: Pre-Consultation Notice for Draft Environmental Assessment - Dowsett Highlands Relief Sewer

Kristen Kuwaye on behalf of Rouen Liu

Dear Mr. Lance Fukunaga,

Thank you for the opportunity to comment on the subject project. Hawaiian Electric Company has no objection to the project. Should HECO have existing easements and facilities on the subject property, we will need continued access for maintenance of our facilities.
We appreciate your efforts to keep us apprised of the subject project in the planning process. As the proposed Dowsett Highlands Relief Sewer project comes to fruition, please continue to keep us informed. Further along in the design, we will be better able to evaluate the effects on our system facilities.
If you have any questions, please call me at 1-808-543-7245.

Sincerely,
Rouen Q. W. Liu
Permits Engineer
Tel: (808) 543-7245
Email: Rouen.liu@hawaiianelectric.com

HAWAIIGAS
THE CLEAN ENERGY COMPANY

April 26, 2017

Mr. Lance Fukumoto, P.E.
Fukunaga & Associates, Inc.
1357 Kapiolani Boulevard. Suite 1530
Honolulu, Hawaii 96814

Dear Mr. Fukumoto:

Subject: Pre-Assessment Consultation
Nu'uanu New Relief Sewer Improvements

Please be advised that Hawaii Gas maintains underground utility gas mains in the project vicinity, which serves commercial and residential customers in the area and is interconnected with the utility network in Honolulu. We would appreciate your consideration during the project planning and design process to minimize any potential conflicts with the existing gas facilities in the project area.

Enclosed are gas maps of the area, a copy of our construction notes for gas facilities which should be included as part of the final plans, and our gas line symbols for your information.

All information provided by Hawaii Gas, including but not limited to maps, prints, and site indications are approximations only of its facilities and its pipelines. The party receiving such information shall have sole responsibility for field verification to determine the actual locations of such facilities and pipelines.

Thank you for the opportunity to comment on the pre-assessment. Should there be any questions, or if additional information is desired, please call Jeremy Santiago at 594-5552.

Sincerely,

Hawaii Gas

Keith K. Yamamoto
Manager, Engineering

KKY:krs

Attachments

CONSTRUCTION NOTES FOR GAS FACILITIES

1. Hawaii Gas' pipelines in the project area are plastic coated and cathodically protected. The Contractor shall be extremely careful when working near these gas pipelines.

2. Written clearances must be obtained from Hawaii Gas, Maps and Records Department, 515 Kamakee Street, at least five (5) working days prior to starting excavation near these gas pipelines.

3. Since gas line locations on field maps are approximate, the Contractor, after obtaining written clearance, shall call Hawaii One Call Center a minimum of five (5) working days before starting excavation to arrange for field location of the existing gas pipelines. The telephone number is 811 or 1-866-423-7287.

4. The contractor shall excavate and backfill around gas pipelines in the presence of a representative of Hawaii Gas. All backfill within six inches of any gas pipeline shall be select cushion material approved by Hawaii Gas.

5. For relocation of any gas pipeline, the Contractor shall notify Hawaii Gas five (5) working days before starting work. The telephone number is 594-5574. The Contractor shall provide the necessary excavation and backfill, obtain traffic permits, and restore pavement, sidewalks, and other facilities. Any relocation of gas facilities shall be done by Hawaii Gas and paid for by the Contractor.

6. The Contractor shall notify Hawaii Gas immediately after any damage has been caused to existing gas pipelines, coatings, or its cathodic protection devices. The telephone number is 535-5933, 24 hours a day. The Contractor shall be liable for any damage to Hawaii Gas' facilities. Repair work on such damage shall be done by Hawaii Gas with payment for this work to be borne by the Contractor.

7. Minimum vertical and horizontal clearance between the gas pipelines and other pipelines, conduits, ductlines, or other facilities shall be 12 inches. Adequate support and protection for gas pipelines exposed in the trench shall be provided by the Contractor and approved by Hawaii Gas.

8. The Contractor shall work in an expeditious manner in order to keep the uncovered gas pipelines exposed for as short a period of time as possible.

Revised: 5/7/14

1.0 Gas Fittings, Valves, Tees, etc. Color Standards – (applies to Transmission, Supply, & Mains)

- **In-Service Asbuilt** state features and associated labels - PURPLE
- **PROPOSED** state features and associated labels - CYAN
- **Out of Service As-Built** state features and associated labels - DARK PINK
  - Out of Service As-Built definition – feature not connected, capped, available for future use.
- **Abandoned** state features and associated labels - LIGHT BROWN
  - Abandoned definition – feature not connected and NOT available for future use.

Service Fittings (all service connection types)

- No specific symbols are displayed to identify Service Fitting types
- Dots are used to note connection points along Service pipe segments.
- **In-Service Asbuilt** state Service Fittings - PURPLE dot
- **PROPOSED** state Service Fittings - CYAN dot

Pipe Line Standards – SEE SAMPLES BELOW

- Pipe segment line weights - adjusted to reflect different service duty (applies to all states).
  - Transmission is the thickest line weight
  - Supply is the 2nd thickest line weight
  - Distribution will the 3rd thickest line weight
  - Service will be the thinnest line weight
- Pipe segment characteristics
  - In-Service Asbuilt Transmission class pipes
    - Line style – **solid red line**
    - Labels – Size Material & Pipe Length – red
  - In-Service Asbuilt Supply class pipes
    - Line style – **solid blue line**
    - Labels – Size Material & Pipe Length – blue
  - In-Service Asbuilt Distribution class pipes
    - Line Style - solid line
    - Line Color - Determined by Pipe Material

      CS (Coated Steel) – green

      PE (Polyethylene) – black

      BS (Bare Steel) – orange

      UNKNWN – orange

- Labels – Size Material & Pipe Length noted – same color as material color.
  - In-Service Asbuilt Service class pipes
  - Line Style – Thin short dashed line
  - Line Color - Determined by Pipe Material
    - **CS (Coated Steel) – green**
    - **PE (Polyethylene) – black**
    - **BS, CI, or CT (Bare Steel, Cast Iron, or Copper Tubing) – orange**
    - **UNKNOWN - blue**
  - Labels –
    - Color same as pipe color
    - Pipe Size is automatically placed (repeated) along pipe segment
    - Material & Length labels are optional.

2.0 G Tech & G NetViewer – Feature Legend

- ***Pipe Segment Type Samples (all sizes are not shown)***

3.0 G Tech & G NetViewer – Feature Legend

VALVES – Transmission, Supply, & Distribution

Plug Valve

Ball Valve

Gate Valve

Insulated Plug Valve

Insulated Ball Valve

SEctionalizing **Valve** – type & valve ID number shown

SUpply **Valve** – type & valve ID number shown

Only In-Service As-Built
***Supply & Sectionalizing** Valves*
will be shown in RED.

REGULATOR STATION

Regulator Station –
- shown with Reg Station Name & ID #
- Always shown in RED

PREMISE NODE

Premise Node
Parenthesis shown near the Premise Node may contain the number of Orcom Premise #s connected to this node;
Future -- Meter #s connected to a Premise Node will be displayed next to Premise Node.

TANKS

Holder Tanks – Holder Name & Tank Size shown adjacent to symbol.

CPD

Cathodic Protection Devices

Test Station

Annode

4.0 G Tech & G NetViewer – Feature

MAIN FITTINGS - Two Fundamental Types

- Compression – joins Steel to Steel and Steel to PE
- Mechanical – joins PE to PE

NORMAC - *(This is a brand of a COMPRESSION fitting. TGC is no longer purchasing the Normac brand. Dresser is now being purchased).*

BUTT WELD – Steel to Steel

CLAMP – Length label (6") is typically added;

COUPLING & INSULATED COUPLING – Labels that show manufacturer can be displayed adjacent to couplings (eg., "Dresser", "Electro Fusion",etc.)

- Steel to Steel is threaded
- Lyco Coupling – PE to PE

DRIP – Typically shown with a 90 degree leader line indicating point of connection

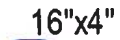
ELBOW – number within circle notes elbow angle. Angle text should always be horizontal (place @ 0 degrees).

FUSION WELD – PE to PE; neither compression nor mechanical

HOT TAP

LINE STOPPER

MECHANICAL & INSULATED MECHANICAL



PUMPKIN – Size description (16"x4") is typically added

TRANSITION – *(Type of mechanical fitting used for Steel to PE)*

UNKNOWN Fitting Type

WELD END INSULATOR

END CAP – required @ end of all in-service pipe segments that are terminated; flat side of symbol should always be connected to the pipe segment

REDUCER – the pointed right side of the symbol should be adjacent to smaller pipe segment to show direction of the pipe size reduction.

TEE – connects 3 pipe segments;

MAIN CROSS – connects 4 pipe segments

5.0 Work Instruction Revision Record

Revision	Date	Section and Paragraph	Description of Change

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APPENDIX B

Archaeological Literature Review and Field Inspection

Final
Archaeological Literature Review and Field Inspection for the Dowsett Highlands Relief Sewer Project Nu‘uanu Ahupua‘a, Honolulu District, O‘ahu TMKs: [1] 1-7, 1-8, 1-9, and 2-2 (various plats and parcels)

Prepared for
Fukunaga & Associates, Inc.

Prepared by
Scott A. Belluomini, B.A.,
Nicole Ishihara, B.A.,
David W. Shideler, M.A.
and
Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai‘i, Inc.
Kailua, Hawai‘i
(Job Code: NUUANU 11)

November 2015

O‘ahu Office
P.O. Box 1114
Kailua, Hawai‘i 96734
Ph.: (808) 262-9972
Fax: (808) 262-4950

www.culturalsurveys.com

Maui Office
1860 Main St.
Wailuku, Hawai‘i 96793
Ph.: (808) 242-9882
Fax: (808) 244-1994

Management Summary

Reference	Archaeological Literature Review and Field Inspection (LRFI) for the Dowsett Highlands and Relief Sewer Project, Nu‘uanu Ahupua‘a, Honolulu District, O‘ahu, TMKs: [1] 1-7, 1-8, 1-9, and 2-2 (various plats and parcels) (Belluomini et al. 2015)
Date	November 2015
Project Number(s)	Cultural Surveys Hawai‘i, Inc. (CSH) Job Code: NUUANU 11
Investigation Permit Number	CSH completed the LRFI fieldwork under archaeological permit numbers 14-04 and 15-03, issued by the Hawai‘i State Historic Preservation Division (SHPD) per Hawai‘i Administrative Rules (HAR) §13-13-282.
Agencies	SHPD; State of Hawai‘i; City and County of Honolulu
Land Jurisdiction	The project area is located on land owned by the State of Hawai‘i and the City and County of Honolulu.
Project Proponent	City and County of Honolulu, Department of Design and Construction
Project Funding	City and County of Honolulu
Project Location	The project encompasses the Pali Highway from Nu‘uanu Pali Drive to Nu‘uanu Avenue at the Wyllie Street Interchange, concluding near School Street. The project area is depicted on a portion of the 1998 Honolulu U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle, aerial photographs, and tax map plats.
Project Description	The project proposes to identify alternatives for a new relief sewer line which may be constructed by trench and/or trenchless technologies, depending on the geotechnical survey results.
Project Acreage	The project area includes approximately 43.0 acres.
Historic Preservation Regulatory Context	This archaeological LRFI study was completed for use as a planning document. The proposed project is subject to Hawai‘i State environmental and historic preservation review legislation (Hawai‘i Revised Statutes [HRS] §343 and HRS §6E-8/HAR §13-275, respectively). While this investigation does not fulfill the requirements of an archaeological inventory survey investigation (per HAR §13-276), it serves as a document to facilitate the proposed project’s planning and supports historic preservation review compliance by assessing if there are major archaeological concerns within the project area and to develop data on the general nature, density, and distribution of archaeological resources.
Fieldwork Effort	Fieldwork was accomplished on 11 November 2014 by Scott Belluomini, B.A., and David W. Shideler, M.A., under the general supervision of Principal Investigator Hallett H. Hammatt, Ph.D.

Results Summary	CSH archaeologists identified a number of potential historic properties within or near the vicinity of the project area including basalt curb stones, *‘auwai* (ditches), historic bridges, manhole covers, street markers, and cemetaries and parks. No potential historic properties were identified within the portion of the project area along the Pali Highway. Cut basalt curbstones were observed to be extant along major portions of Nu‘uanu Avenue. Several ditches were encountered within the Dowsett Avenue area. Two ditches observed running in a northeasterly direction appear to cross through the project area under Dowsett Avenue. Historic cemeteries are also located along Nu‘uanu Avenue and Wyllie Street. Burials associated with these cemeteries are potentially located outside the cemetery boundaries and within the project area.
Recommendations	This LRFI documented previously identified historic properties and new potential historic properties within or adjacent to the project area. An archaeological monitoring program consistent with the standards of HAR §13-279 should be developed, beginning with the preparation of an archaeological monitoring plan (AMP) for the review and acceptance of the SHPD in advance of project-related work.

Table of Contents

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Section 1 Introduction

1.1 Project Background

At the request of Fukunaga & Associates, Inc., Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this archaeological literature review and field inspection (LRFI) for the Dowsett Highlands Relief Sewer project, Nu‘uanu Ahupua‘a, Honolulu (Kona) District, O‘ahu. This project encompasses the Pali Highway from Nu‘uanu Pali Drive to Nu‘uanu Avenue at the Wyllie Street Interchange, concluding near School Street. The project area is depicted on a portion of the 1998 Honolulu U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), aerial photographs (Figure 2 and Figure 3), and tax map plats (Figure 4 through Figure 7). The proposed project involves identification of alternatives for a new relief sewer line which may be constructed by trench and/or trenchless technologies, depending on the geotechnical survey results.

1.2 Historic Preservation Regulatory Context and Document Purpose

This archaeological LRFI study was completed for use as a planning document. The proposed project is subject to Hawai‘i State environmental and historic preservation review legislation (Hawai‘i Revised Statutes [HRS] §343 and §6E-8/Hawai‘i Administrative Rules [HAR] §13-275, respectively).

While this investigation does not fulfill the requirements of an archaeological inventory survey investigation (per HAR §13-276), it serves as a document to facilitate the proposed project's planning and supports historic preservation review compliance by assessing if there are major archaeological concerns within the project area and to develop data on the general nature, density, and distribution of archaeological resources.

1.3 Scope of Work

Please note that the following scope of work does not satisfy the Hawai‘i state requirements for archaeological inventory surveys (HAR §13-276 and §13-275/284); however, this scope of work can satisfy the requirement for consultation/documentation to determine if historic properties are present within the project area. CSH's scope of work for this preliminary study includes the following:

1. Historical research to include study of archival sources, historic maps, Land Commission Awards, and previous archaeological reports to construct a history of land use and to determine if archaeological sites have been recorded on or near this property.
2. Limited field inspection of the project area to identify any surface archaeological features and to investigate and assess the potential for impact to such sites. This assessment will identify any sensitive areas that may require further investigation or mitigation before the project proceeds.
3. Preparation of a report to include the results of the historical research and the limited fieldwork with an assessment of archaeological potential based on that research, with recommendations for further archaeological work, if appropriate. It will also provide mitigation recommendations if there are archaeologically sensitive areas that need to be taken into consideration.

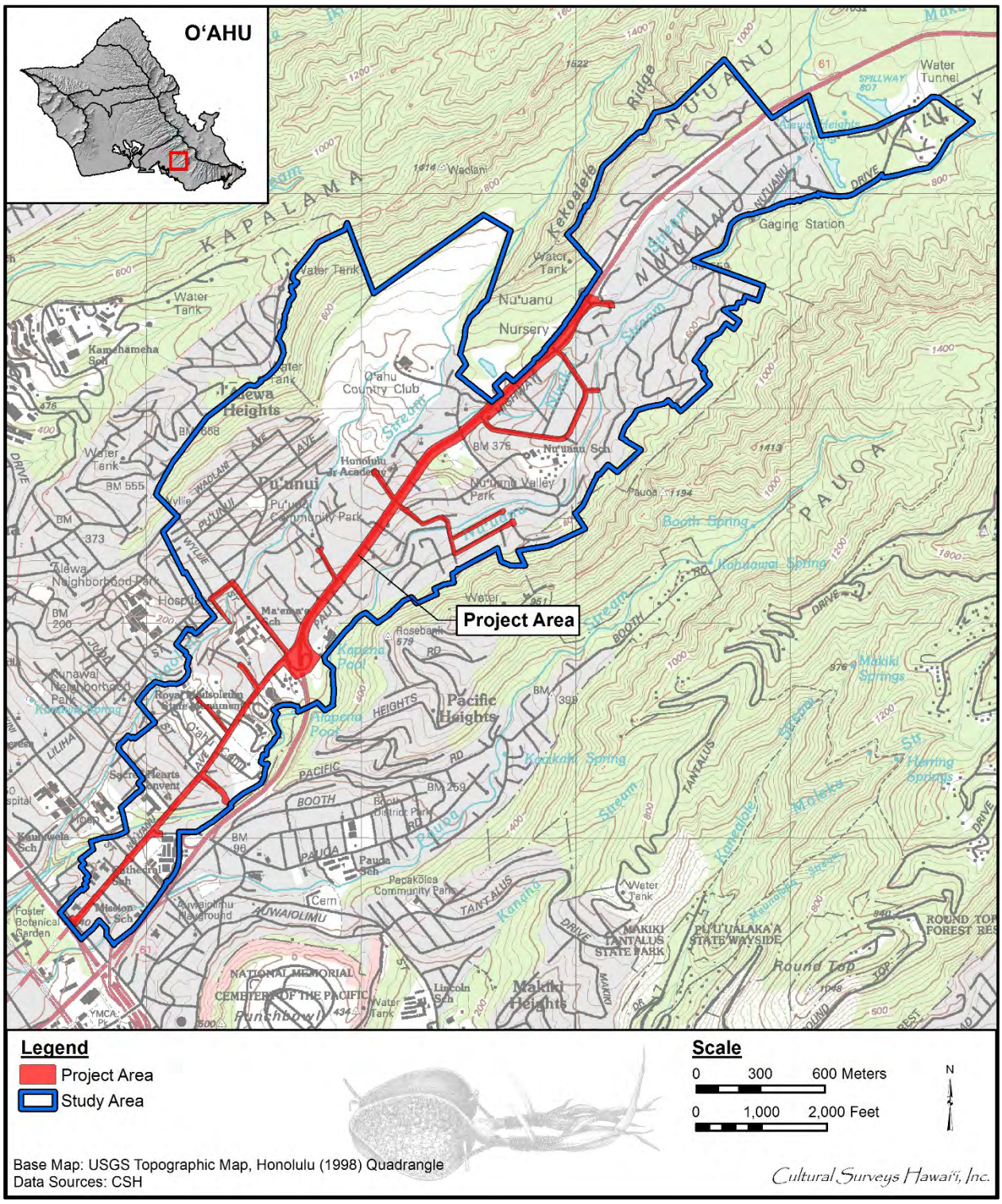

Figure 1. Portion of the 1998 Honolulu USGS topographic map depicting the project area and study area

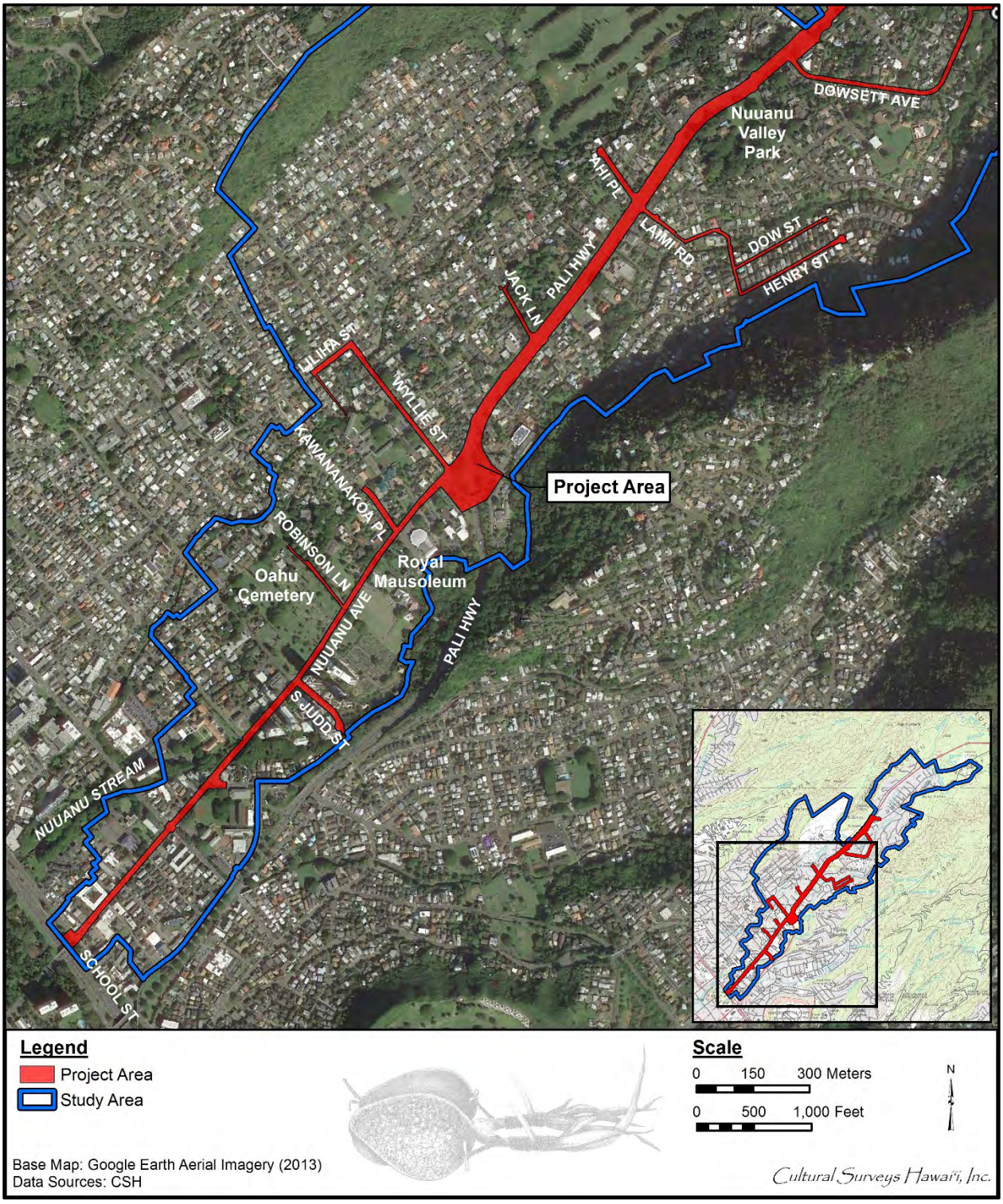

Figure 2. Aerial photo depicting the lower (SW) portion of the project area and study area (Google Earth 2013)

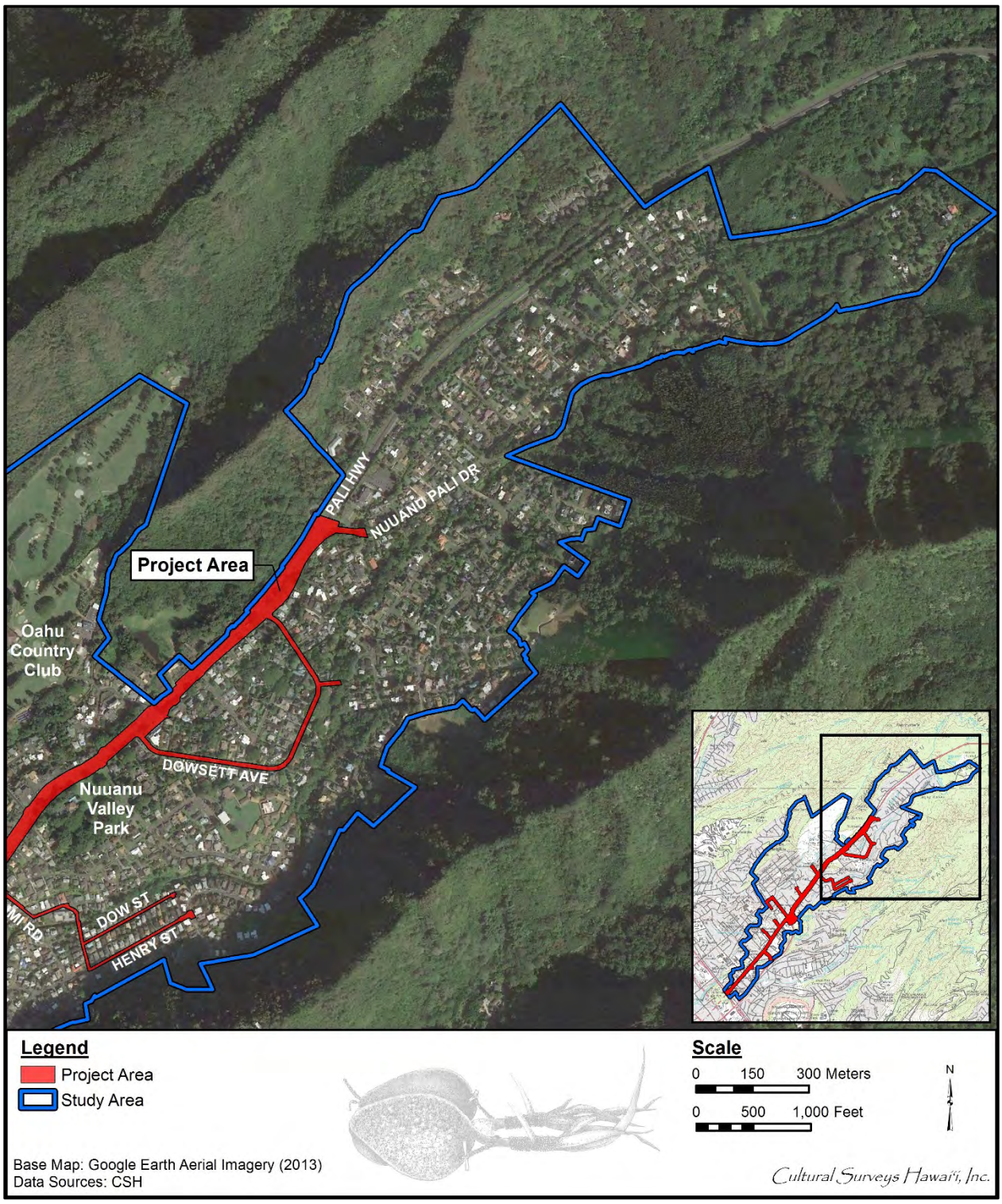

Figure 3. Aerial photo depicting the upper (NE) portion of the project area and study area (Google Earth 2013)

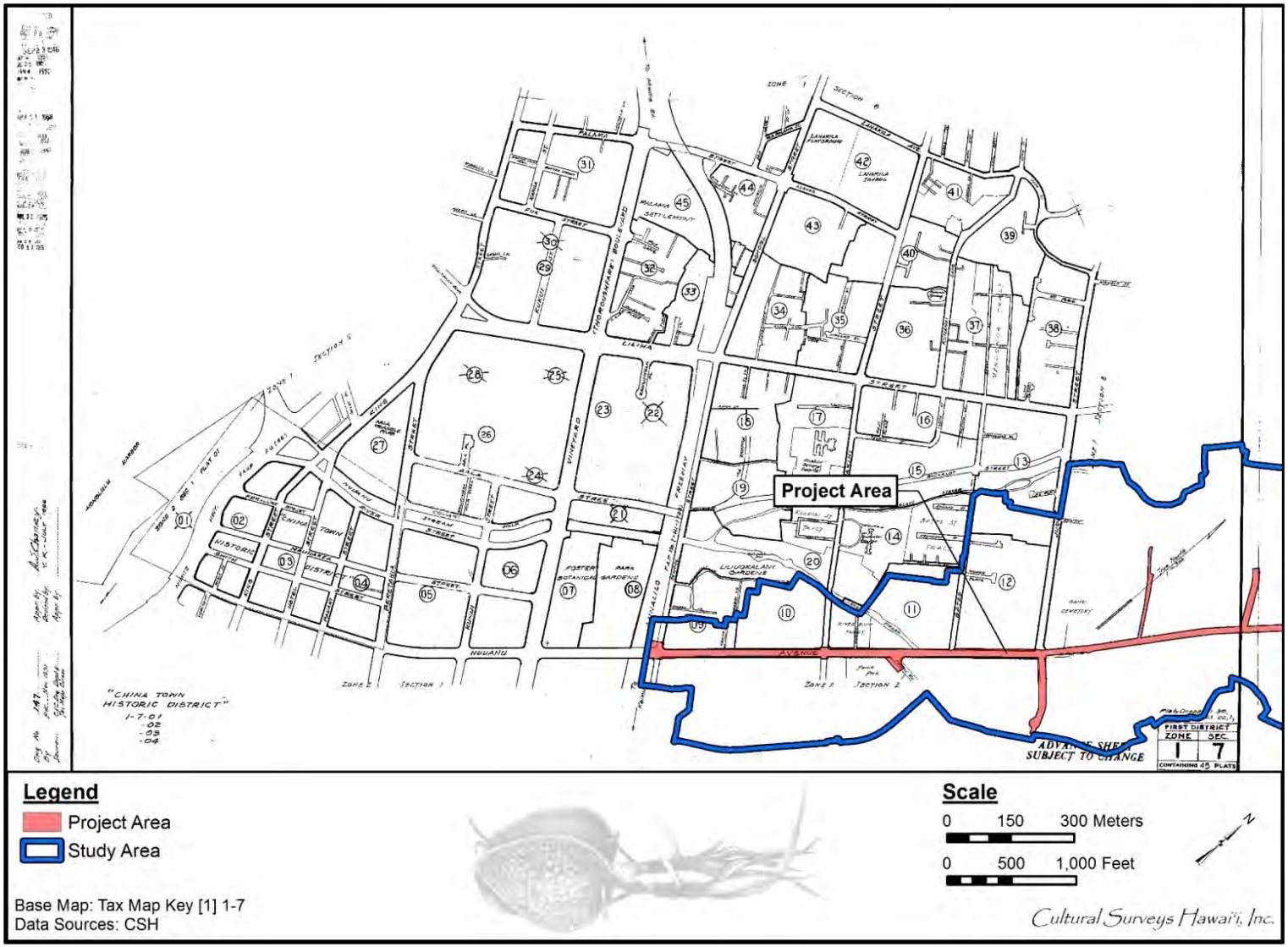

Figure 4. Tax Map Key (TMK) [1] 1-7 depicting the southwest portion of the project area and study area (Hawai‘i TMK Service 2014)

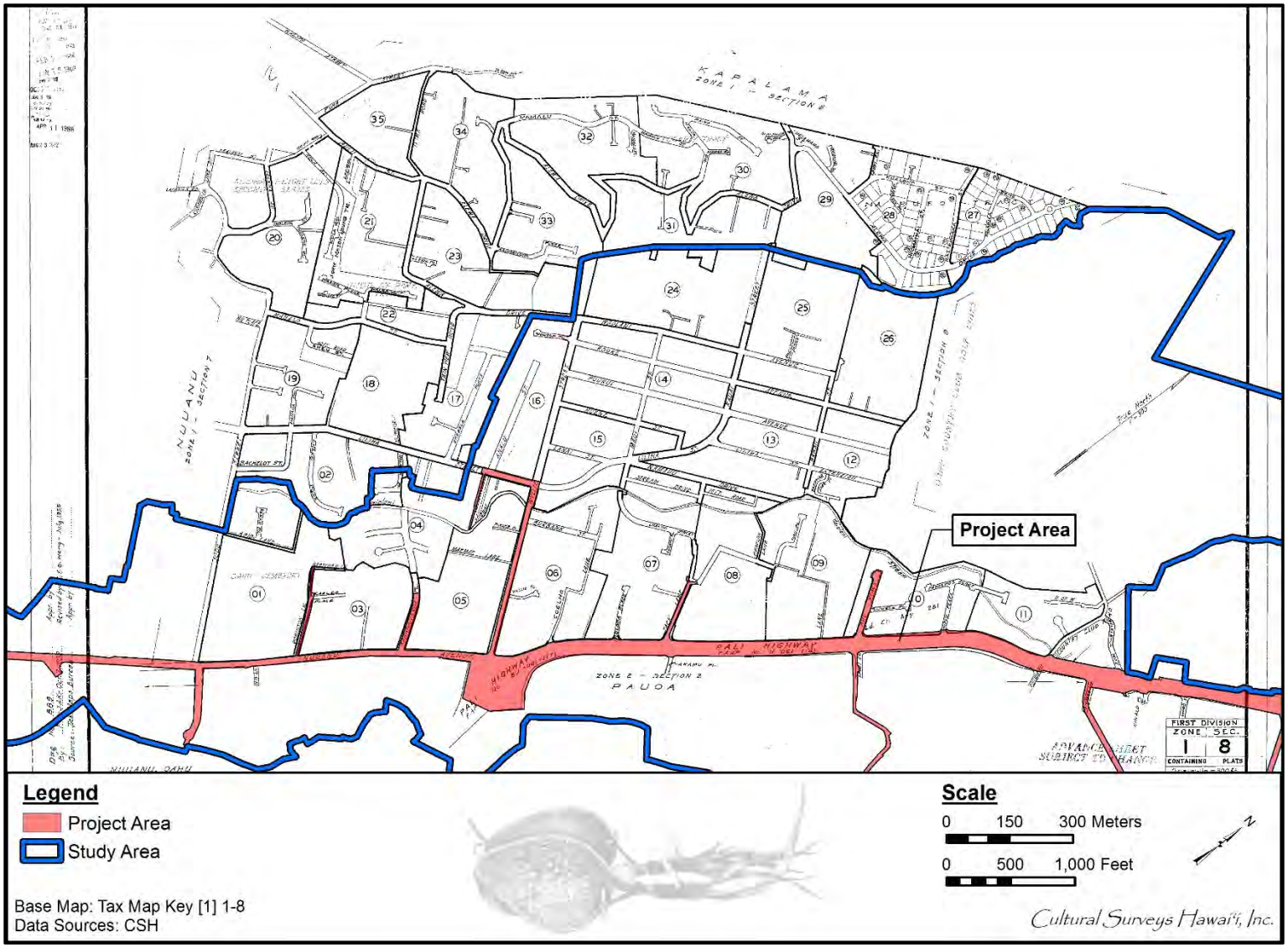

Figure 5. TMK: [1] 1-8 depicting the central portion of the project area and study area (Hawai‘i TMK Service 2014)

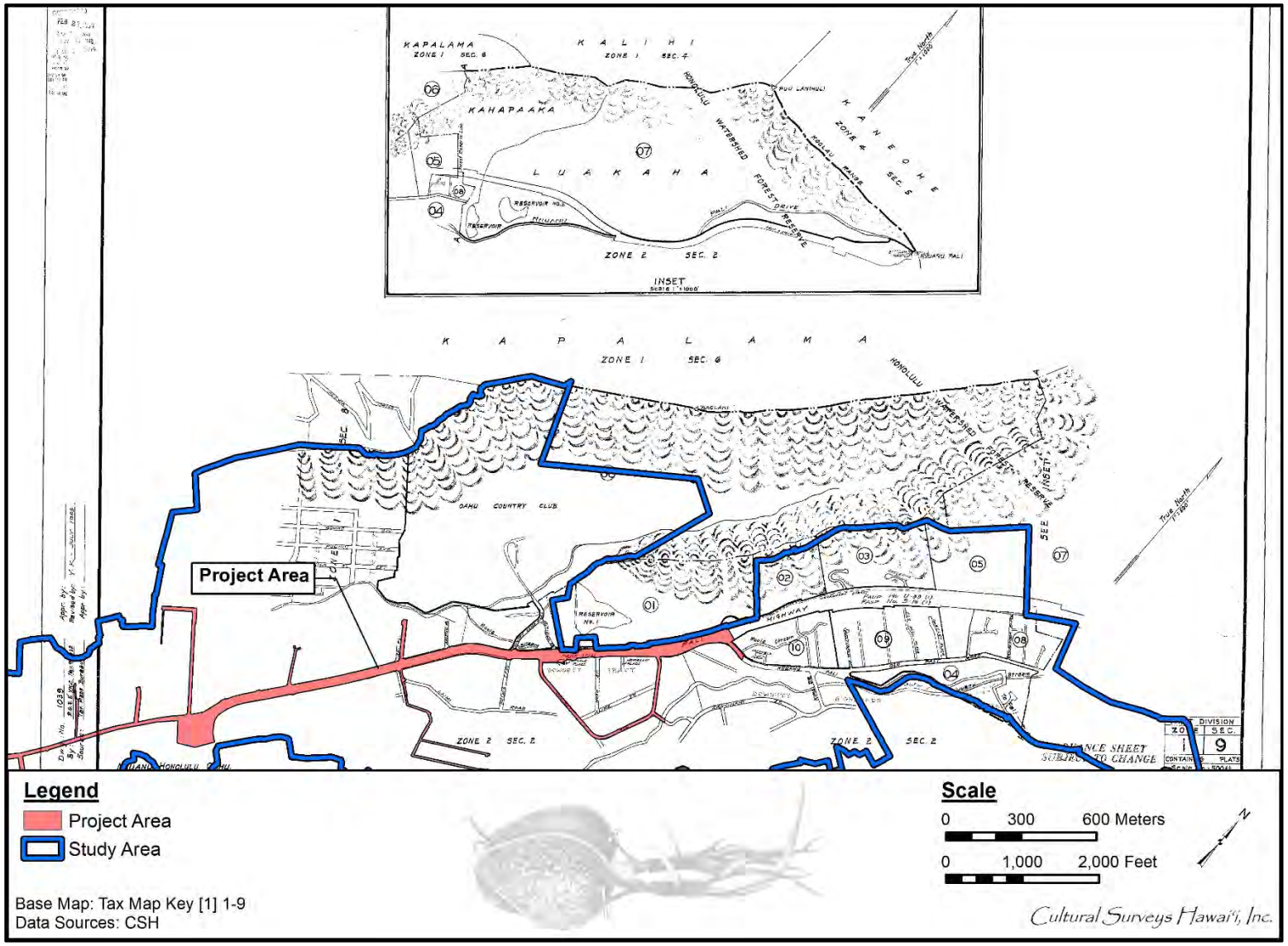

Figure 6. TMK: [1] 1-9 depicting the northeast portion of the project area and study area (Hawai‘i TMK Service 2014)

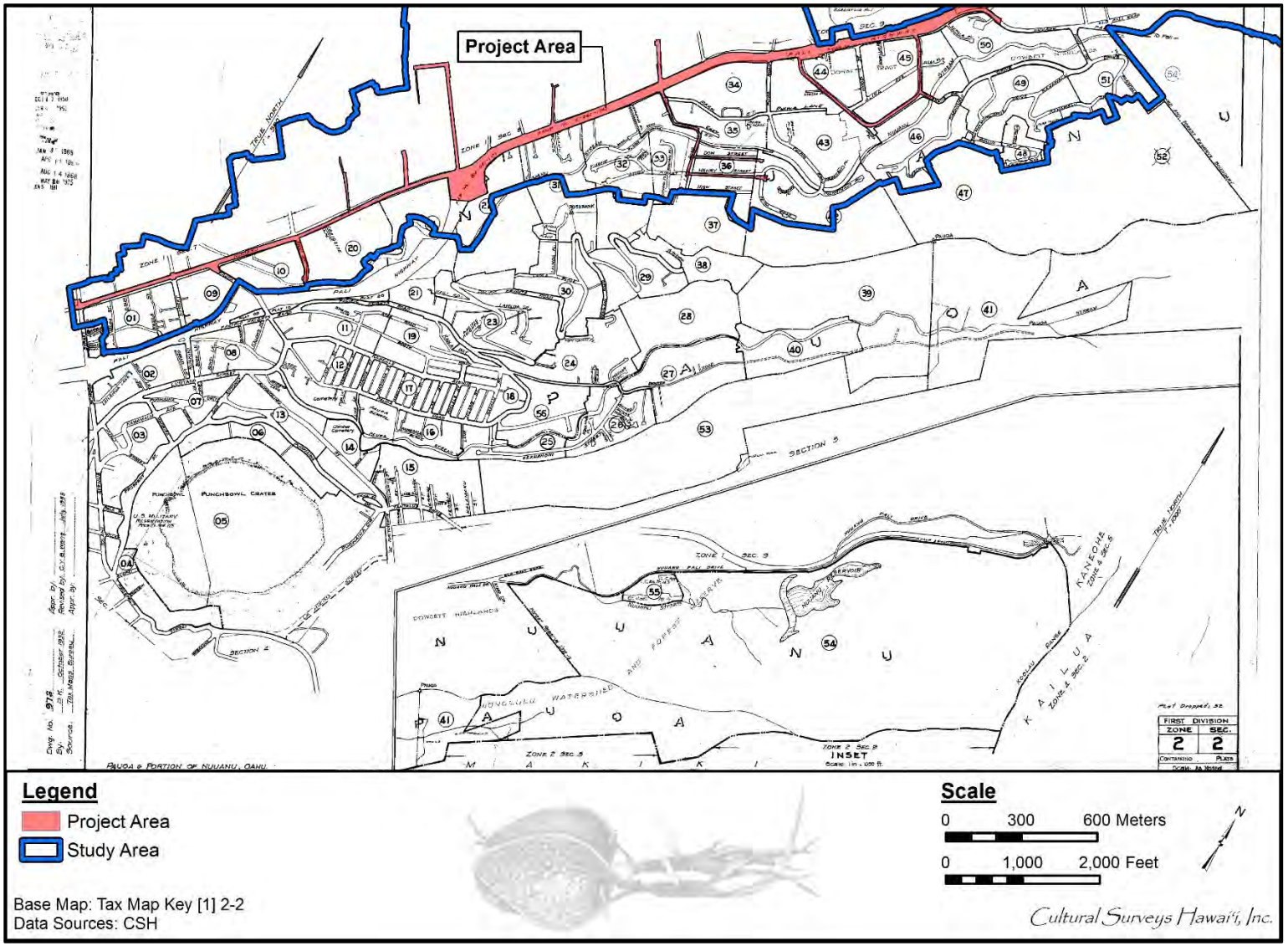

Figure 7. TMK: [1] 2-2 depicting the northeast portion of the project area and study area (Hawai‘i TMK Service 2014)

1.4 Environmental Setting

1.4.1 Natural Environment

The project area spans the majority of Nu‘uanu Valley. Nu‘uanu Valley is a semi-circular valley that flattens *makai* (toward the sea) into the Honolulu Plain. It is transected by the Pali Highway, which is a large part of the project area. Annual rainfall in this area is between 80 inches *mauka* (inland, toward the mountains) and 40 inches *makai* (Giambelluca et al. 1986). The project area receives terrestrial water from two primary streams, Nu‘uanu Stream and Waolani Stream, as well as their associated tributaries including Lulumahu, Makuku, Mo‘ole, Niniko, and Kauhipuna.

According to the U.S. Department of Agriculture (USDA) Soil Survey Geographic (SSURGO) database (2001) and Hawaiian Islands soil survey data gathered by Foote et al. (1972), 12 types of soils are present in the project area: Ewa stony silty clay, 6 to 12% slopes (EwC); Kaena clay, 2 to 6% slopes (KaB); Kaena clay, 6 to 12% slopes (KaC); Kaena stony clay, 12 to 20% slopes (KaeD); Kaena very stony clay, 10 to 35% slopes (KanE); Kawaihapai clay loam, 2 to 6% slopes (KlB); Kawaihapai stony clay loam, 2 to 6% slopes (KlaB); Lolekaa silty clay, 3 to 8% slopes (LoB); Lolekaa silty clay, 8 to 15% slopes (LoC); Lolekaa silty clay, 15 to 25% slopes (LoD); Lolekaa silty clay, 40 to 70% slopes (LoF); and Manana silty clay, 25 to 40% slopes (MpE). The other two components that make up the valley include Water (W) and Rock land (rRK). Figure 8 depicts the various soils found within and in the vicinity of the project area.

Foote et al. (1972) describes the Ewa Series as follows:

> . . . well-drained soils in basins and on alluvial fans on the islands of Maui and Oahu. These soils developed in alluvium derived from basic igneous rock. They are nearly level to moderately sloping. Elevations range from near sea level to 150 feet. The annual rainfall amounts to 10 to 30 inches. Most of it occurs between November and April. The mean annual soil temperature is 73° F. Ewa soils are geographically associated with Honouliuli, Mamala, Molokai, Pulehu, and Waiakoa soils. These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of fingergrass, kiawe, koa haole, klu, and uhaloa. [Foote et al. 1972:29]

The Kaena Series is described by Foote et al. as follows:

> This series consists of very deep, poorly drained soils on alluvial fans and talus slopes on the islands of Oahu and Kauai. These soils developed in alluvium and colluvium from basic igneous material. They are gently sloping to steep and are commonly stony. Elevations range from 50 to 150 feet. The annual rainfall amounts to 30 to 45 inches, most of which occurs between November and April. The mean annual soil temperature is 74° F. Kaena soils are geographically associated with Honouliuli, Lualualei, and Waialua soils.
>
> These soils are used for sugarcane, truck crops, pasture, and home sites. The natural vegetation consists of *kiawe*, klu, lantana, *koa haole*, and fingergrass. [Foote et al. 1972:49]

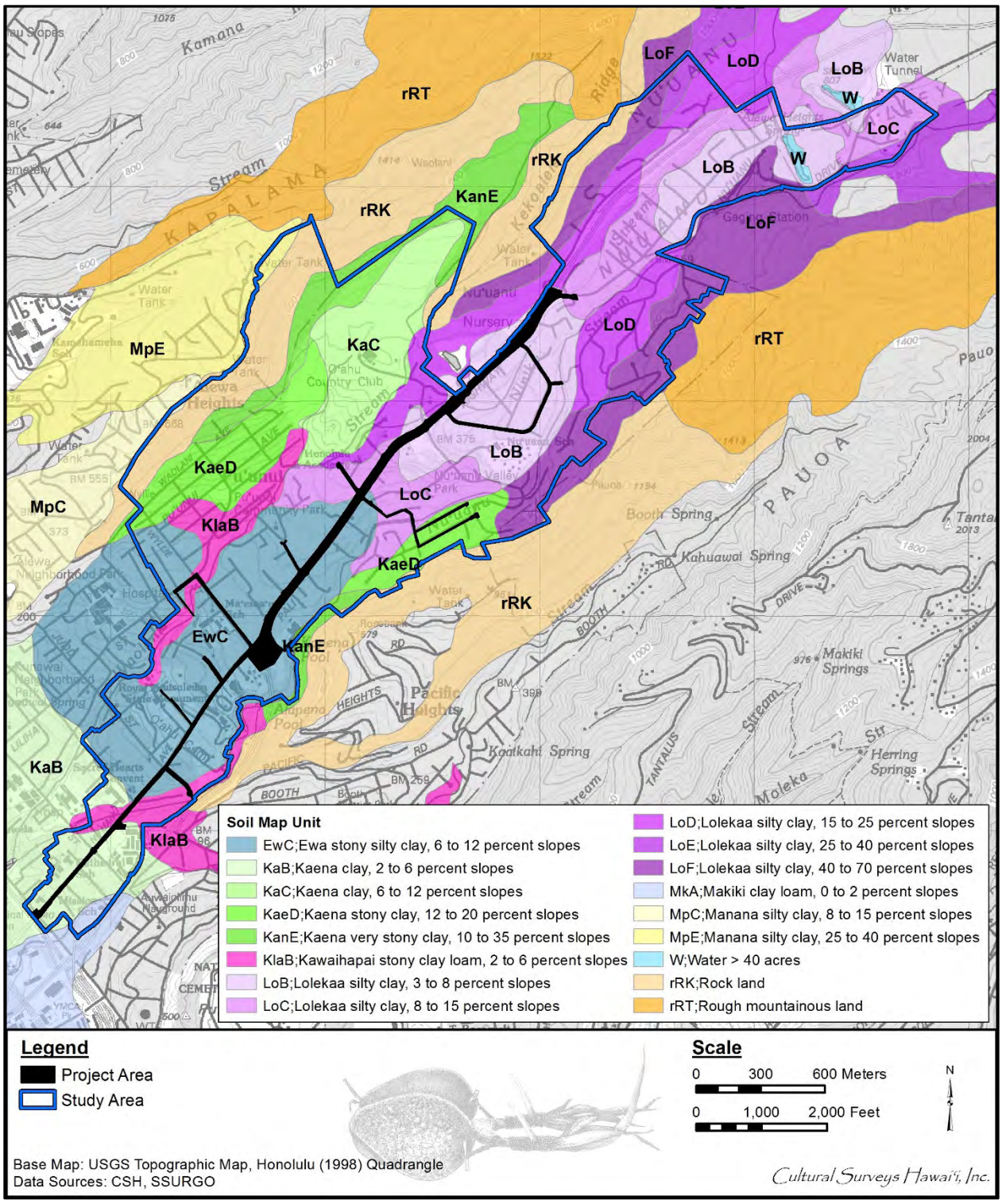

Figure 8. Portion of the 1998 Honolulu USGS topographic map with overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972), showing the soil types within the project area

The Kawaihapai Series is described by Foote et al. as follows:

> . . . well-drained soils in drainage-ways and on alluvial fans on the coastal plains on the islands of Oahu and Molokai. These soils formed from alluvium derived from basic igneous rock in humid uplands. They are nearly level to moderately sloping. Elevations range from nearly sea level to 300 feet. The annual rainfall amounts to 30 to 50 inches. The mean annual soil temperature is 73° F. Kawaihapai soils are geographically associated with Haleiwa, Waialua, and Jaucas soils. These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of kiawe, koa haole, lantana, and bermudagrass. [Foote et al. 1972:63-64]

The Lolekaa Series is described by Foote et al. as follows:

> This series consists of well-drained soils on fans and terraces on the windward side of the island of Oahu. These soils developed in old, gravelly colluvium and alluvium. They are gently sloping to very steep. Elevations range from nearly sea level to 500 feet. The annual rainfall amounts to 70 to 90 inches and is well distributed throughout the year. The mean annual soil temperature is 71° F. Lolekaa soils are geographically associated with Alaeloa and Waikane soils. These soils are used for pasture, homesites, orchards, and truck crops. The natural vegetation consists of guava, Christmas berry, California grass, hilo grass, and rice grass. [Foote et al. 1972:83]

The Manana Series is described by Foote et al. as follows:

> This series consists of well-drained soils on uplands on the island of Oahu. These soils developed in material weathered from basic igneous rock. They are gently sloping to steep. Elevations range from 500 to 1,200 feet. The annual rainfall amounts to 40 to 60 inches. It is well distributed throughout the year. The mean annual soil temperature is 70° F. Manana soils are geographically associated with Leilehua, Paaloa, and Wahiawa soils. These soils are used for sugarcane, pineapple, and pasture. The natural vegetation consists of Bermuda grass, Christmas berry, false staghorn fern, glenwood grass, guava, koa, ohia, and sedges. [Foote et al. 1972:94]

The Rock land is described by Foote et al. as follows:

> Rock land (rRK) is made up of areas where exposed rock covers 25 to 90 percent of the surface. It occurs on all five islands. The rock outcrops and very shallow soils are the main characteristics. The rock outcrops are mainly basalt and andesite. This land type is nearly level to very steep. Elevations range from nearly sea level to more than 6,000 feet. The annual rainfall amounts to 15 to 60 inches. Rock land is used for pasture, wildlife habitat, and water supply. The natural vegetation at the lower elevations consists mainly of kiawe, klu, pili grass, Japanese tea, and koa haole. Lantana, guava, Natal redtop, and molasses grass are dominant at the higher elevations. This land type is also used for urban development. In many areas, especially on the island of Oahu, the soil material associated with the rock outcrops is very sticky and very plastic. It also has high shrink-swell potential. Buildings on the steep slopes are susceptible to sliding when the soil is saturated. Foundations

and retaining walls are susceptible to cracking. (Capability classification VIIs, nonirrigated). [Foote et al. 1972:119]

1.4.2 Built Environment

The immediate project area, the Pali Highway, Nu‘uanu Avenue, and adjacent side streets extends from southwest to northeast traversing the *ahupua‘a* (land division usually extending from the uplands to the sea) of Nu‘uanu and the Nu‘uanu Valley portion of the Ko‘olau Mountain Range. A majority of the Pali Highwayportion of the project area is part of the Honolulu Watershed Forest Reserve, and is predominately surrounded by heavy vegetation including invasive trees and shrubs such as bamboo, banyan, and ironwood. The lower portion of the Pali Highway project area is flanked by residential homes, the Queen Emma Summer Palace, and various schools and businesses. The Nuùanu Avenue, southwest portion of the project area passes the Mauna Ala Royal Mausoleum and O‘ahu Cemetery

Section 2 Methods

2.1 Field Methods

CSH completed the fieldwork component of this LRFI under archaeological permit numbers 14-04 and 15-03, issued by the SHPD pursuant to HAR §13-13-282. Fieldwork was conducted on 11 November 2014 by CSH archaeologists Scott Belluomini, B.A., and David W. Shideler, M.A., under the general supervision of Principal Investigator Hallett H. Hammatt, Ph.D. This work required approximately 1 person-day to complete.

In general, fieldwork included 100% pedestrian inspection of the project area and GPS data collection with a handheld Garmin GPS unit.

2.2 Document Review

Background research included a review of previous archaeological studies on file at the State Historic Preservation Division (SHPD) of the Department of Land and Natural Resources (DLNR); a review of geology and cultural history documents at Hamilton Library of the University of Hawai‘i, the Hawai‘i State Archives, the Mission Houses Museum Library, the Hawai‘i Public Library, and the Bishop Museum Archives; study of historic photographs at the Hawai‘i State Archives and the Bishop Museum Archives; and a study of historic maps at the Survey Office of the DLNR. Information on Land Commission Awards (LCAs) was accessed through Waihona ‘Aina Corporation’s Māhele Database (Waihona ‘Aina 2000) and the Office of Hawaiian Affairs’ Papakilo Database (Office of Hawaiian Affairs 2014).

This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources studied were used to formulate a predictive model regarding the expected type and location of subsurface pre- and post-Contact historic properties in the project area.

Section 3 Traditional 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 AD 1650 (Kirch and Sahlins 1992:15). O‘ahu was divided into six *moku* (district)—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.

3.1 Place Names

A Hawaiian *wahi pana*, storied place, “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* (pre-Christian place of worship), *loko i‘a* (fishponds), *ala hele* (trails), *ilina* (grave) and *iwi kūpuna* (ancestral bone remains), land divisions, and natural geographic locations such as streams, peaks, rock formations, ridges, and offshore islands and reefs 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).

The *wahi pana* of Nu‘uanu link the *kama‘āina* (native born) and *kūpuna* (elders) to their past. The section below traces the *wahi pana* from the mountain peaks to the lowland valley. *Wahi pana* are cited from Pukui et al. (1974) unless otherwise noted; spelling and use of diacritics follow Pukui et al. (1974).

Pukui et al. (1974:167) give the definition of Nu‘uanu as “cool height,” but Curtis 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 and Elbert 1986:272–273). According to Thomas Thrum (1917:178) Nu‘uanu is “cool terrace” or a reference to a notch in the 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 Ko‘olau to the “*nuku o Nuuanu.*”

The lower portion of Nu‘uanu Valley is comprised of the *‘ili* (land division smaller than an *ahupua‘a*) of Kunawai (“pool of the eel”), Kaliu, Pu‘unui (“big hill”), Kaukahoku, Kawānanakoa (“the fearless prophecy”), Niolopa, La‘imu (“day [of] seeking”), Pū‘iwa (“the startled”), Waolani (“heavenly mountain area”), and Kahapa‘akai (“salt place”). The upper part of Nu‘uanu Valley is comprised of the forested *‘ili* of Luakaha (“place for relaxation”) (Lyons 1874).

Nu‘uanu Valley is watered by two main streams, Nu‘uanu Stream and Waolani Stream (once called Pūehuehu Stream), and by several tributary streams including Lulumahu, Makuku, Mo‘ole, Niniko, and Kauhipuna. Two waterfalls, Waipuilani (“water spout”) and Waipuhia (“blown water,” also called “Upside Down Falls”) (Figure 9) feed into Nu‘uanu Stream, which leads to another waterfall called Luakaha (Figure 10). Another waterfall, Lulumahu, feeds Lulumahu Stream. Pools along the various streams include Kahuailanawai (“site of tranquil water”),

Figure 9. Photo of Waipuhia, also known as “Upside Down Falls” (foreground) (CSH 2011)

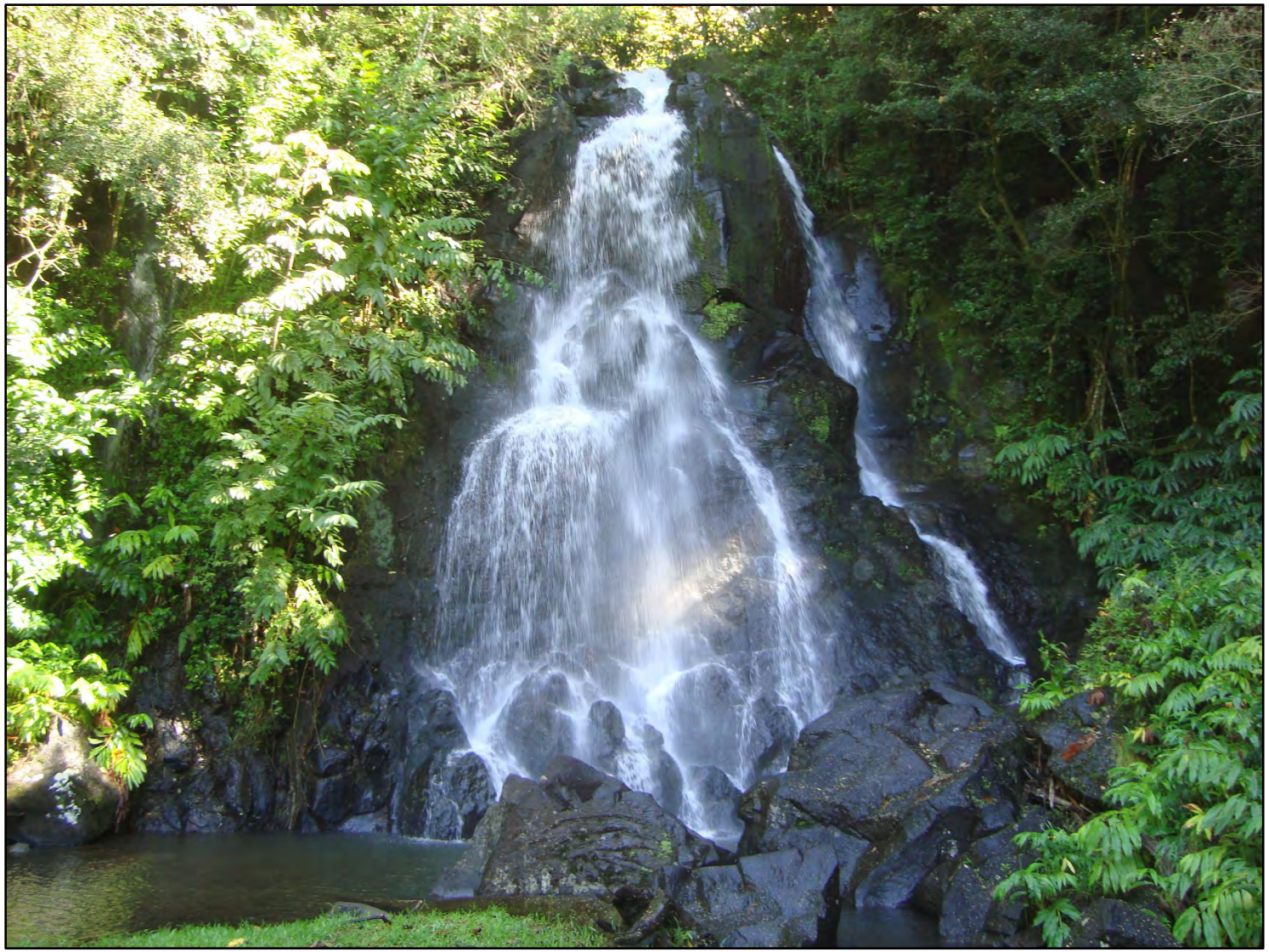

Figure 10. Photo of Luakaha Falls (CSH 2011)

Pueheuhu (“spray scattered”), Waihi, Waihaka, Kapena (“the package”), Alapena, ‘Alekoki (also Elekoke; “short ripples”), Kunawai, Waiakahalu‘u, and Kamanuwai (“the water bird”).

The mountainous section of Nu‘uanu Valley contains many *wahi pana* including the peak of Kōnāhuanui (“large fat innards”), the home of the gods Kāne and Kanaloa, which is the highest peak in the Ko‘olau Mountains. The name of the *pu‘u* (peak) refers to a story about a giant who threw his testicles (*kona hua nui*) at a woman who escaped from him (Pukui et al. 1974:117). Pu‘u Lanihulu (“where the heavens change”) describes the abrupt changes in the winds at the peak (Raphaelson 1925). Nestled between Kōnāhuanui and Lanihulu is Ka Nuku, the *nuku* (entrance) 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”) are on the east side of the valley. Makuku and Ahipu‘u (“hill fire”) are located in the central portion of the valley.

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 1933:83–84). *Mo‘olelo* (stories) 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) (Cummins in Sterling and Summers 1978:303).

In the *mauka* regions of Nu‘uanu Valley, there is a place called Kahaukomo, “the *hau* [*Hibiscus tiliaceus*; beach hibiscus] trees begin.” Bandits waited in these *hau* groves and 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, are the female guardians of the *nuku* of the Nu‘uanu Pali. They grant safe passage to travelers scaling the precipice (Hawaiian Ethnological Notes in Sterling and Summers 1978:313). In addition, Kahapa‘akai is the name of a place with a *ko‘a* (fishing shrine) and associated petroglyphs, as well as a nearby spring in the upper valley (Becket and Singer 1999:22).

3.2 Legends of Nu‘uanu

Nu‘uanu is one of the richest places in Hawai‘i in terms of legendary accounts. A synopsis of a selection of Nu‘uanu legends is offered here.

3.2.1 Legend of ‘Ai‘ai (*Ka‘ao no ‘Ai‘ai*)

‘Ai‘ai was a famous god of fishermen who traveled about the islands establishing fishing stations (*ko‘a*) and altars (*kū‘ula*) (Pukui and Elbert 1986:381). Fornander (1917:4:554) relates that ‘Ai‘ai lived with his father Kū‘ula (Kū‘ula-kai) and his mother Hina (Hina-puku-i‘a) in Niolopa, Nu‘uanu, said to be in the neighborhood of today’s Wyllie Street.

3.2.2 The Breadfruit Tree God of Nu‘uanu

There are many variations of the legend of Papa (or Haumea) living in a human form and saving her husband Wākea by escaping into a breadfruit tree—typically at Waikahalulu Pond.

Westervelt gives an account of a wonderful breadfruit tree that grew on the eastern bank of the rippling brook Puehuehu “near Nu‘uanu Street bridge” (Westervelt 1963:28). In this account Papa (an archetypal Hawaiian earth mother goddess) sees her husband Wakea (an archetypal Hawaiian

sky father deity) who has been captured by the servants of the ruling chief Lele-hoo-mao who are marching Wakea down Nu‘uanu Valley. Westervelt (1963:76) relates that ". . . one of the homes of Wakea and Papa was the splendid country around Nuuanu Valley and Honolulu."

When Papa (Haumea) was running to rescue her husband, she descended along Nu‘uanu Avenue toward Waikahalulu 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 him.
>
> He was alive, his hands bound behind him and his leaf clothing torn from his body. Wailing and crying that she must kiss him, she rushed to him and began pushing and pulling him, whirling him around and around.
>
> Suddenly the great bread-fruit tree opened and she leaped with him through the doorway into the heart of the tree. The opening closed in a moment. [Westervelt 1963:31]

Unbeknownst to the captors, Papa and her husband escaped out the other side of the tree. A famous wooden deity Kamehaikana who could aid worshippers in winning land and power was carved from the breadfruit tree.

J.M. Poepoe's account gives 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* (kava). 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, *Ka Na‘i ‘Aupuni*, 12 May 1906; 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 Pūehuehu to this day (Poepoe, *Ka Na‘i ‘Aupuni*, 13 May 1906; 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 bridge at Kuakini Street (Poepoe n.d.). 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" (M.K. Pukui, *Ka Na‘i ‘Aupuni*, 22 May 1906 in Sterling and Summers 1978:296).

Pukui (1994:137) relates the detail that “Crabs are sometimes seen at the edge of a little pool at Kilohana and seaweed and beach morning glory vines still grow where Papa dropped them as she ran to save Makea.”

3.2.3 Forest Spirits at Nu‘uanu

There are numerous accounts of forest spirits (typically referred to as *‘e‘epa* or *menehune* or both) at Nu‘uanu. “*E‘epa*” are defined as

> Extraordinary, incomprehensible, peculiar, as persons with miraculous powers; such persons. Many *‘e‘epa* characters in mythology were born in strange forms, as a plant, an animal, or a piece of rope. The *Menehune*, *Nāwā*, and *Nāmū* of Waolani in Nu‘uanu Valley were *‘e‘epa.* [Pukui and Elbert 1986:35]

Westervelt writes of

> Waolani,’the wilderness home of the gods, and now the home of Honolulu’s Country Club. This region belonged to the eepa people. These were almost the same as the ill-shaped, deformed or injured gnomes of European fairy tales. [Westervelt 1963:19]

A typical account emphasizing the collective labor of the *menehune* of Nu‘uanu is related in Westervelt’s account of Keaomelemele:

> Kane called the eepa and the menehune people and told them to make canoes to carry Kahanai to his parents.
>
> These boats were made in the forests of Waolani. When the menehunes finished their boat they carried it down Nuuanu Valley to Puunui. There they rested and many of the little folk came to help, taking the canoe down, step by step, to the mouth of the Nuuanu stream, where they had the aid of the river to the ocean.
>
> The menehunes left the boat floating in the water and went back to Waolani. Of the fairy people it was said: ‘No task is difficult. It is the work of one hand.’
>
> On the way down Nuuanu Valley the menehunes came to Ka-opua-ua (storm cloud). They heard the shouting of other people and hurried along until they met the Namunawa people, the eepas, carrying a boat, pushing it down. When they told the eepas that the chief had already started on his journey with double canoes, the eepas left their boat there to slowly decay, but it is said that it lasted many centuries. [Westervelt 1987:141–142]

The *menehune* of Nu‘uanu were proverbially quite numerous and worked collectively:

> The menehunes gathered in great multitudes at the call of Kane, who had seen the boats approaching.
>
> The menehune people ran down to lift up the boats belonging to the young chief. They made a line from Waolani to the sea. They lifted up the boats and passed them from hand to hand without any effort, shouting with joy. [Westervelt 1987:144]

3.2.4 Legend of Hanaaumoe (*Ka‘ao No Hanaaumoe*)

In the Legend of Hanaaumoe the protagonist Hanaaumoe is a “flattering spirit” (*akua malimali*) who urged voyagers to land on O‘ahu so that they could be killed and eaten by the spirits (*akua*). A group of Kaua‘i voyagers is tricked into landing with an offer of food and meat and women (*ka ai, i ka ia, i na wahine*) and is detained by a ruse that the offered treats will take a while to be produced as “the road from Nuuanu down is long” (“*he loihi ka ihona o Nuuanu …*”) (Fornander 1917:4:476–477). The voyaging party is devoured except for one clever survivor who lives to wreak revenge.

Another variant is that the delay is blamed on the steepness of the climb at the *pali* of Nu‘uanu (Fornander 1919:5:430–431).

3.2.5 Hauola and Hapu‘u

A *mo‘olelo* portrays two *mo‘o* (lizard), or “dragon-women,” Hauola and Hapu‘u, who live in Nu‘uanu as guardians of the Pali (Westervelt 1915 in Sterling and Summers 1978:313). People once buried the naval cords of their children under these *pōhaku* (rocks) to protect them from evil.

3.2.6 Kahalaopuna at Nu‘uanu

The most famous story of Mānoa is that of the young woman Kahalaopuna who is repeatedly beaten to death by a jealous suitor, Kauhi, as he abducts her across southern O‘ahu only to be resuscitated repeatedly by her guardian spirit (*‘aumakua*) an owl. Kauhi “…conducted her across the valley of Nuuanu to the ridge of Waolani, where he killed and buried her as he had done twice before, and the owl-god a third time removed the earth from the body and gave it life” (Kalākaua 1990:515).

Thrum (1907:124) provides the detail that their route “descended into Nuuanu Valley, at Kaniakapupu, and crossed over to Waolani ridge” suggesting a trail descending the ridge near Kaniakapupu.

Westervelt (1963:130) supplies the detail that the location was “by the Waolani Temple in Nuuanu Valley.”

3.2.7 Legend of Kaulu (*Ka‘ao no Kaulu*)

Kaulu was a miraculous child born from a piece of cord (*pauku kaula*). In one account Kaulu goes by way of Nu‘uanu to Ko‘olau to defeat Lonokaeho of the eight foreheads (Fornander 1919:5:370–371). On the one hand Nu‘uanu is just a route traversed, but it is a common theme that Nu‘uanu is a route traversed on the way to success.

3.2.8 Nu‘uanu and the Origin of Kapa Cloth

The origin of bark cloth (*kapa*) is often associated with a legendary figure named Maikoha, “the tapa-maker’s god” who is sometimes said to have had his “abode in the uplands of Nuuanu Valley” (Armitage and Judd 1944:140).

> Because he was so often chilled by the mountain winds himself, Maikoha pitied the lot of his companions who continually suffered from the cold and had nothing with which to clothe themselves.

> So sorrowful was he, that when he was on his deathbed, he summoned his daughters and bade them bury him beside the Nuuanu stream, saying that from his body a rare tree would spring, and from the inner bark of this tree, they could fashion warm clothes and bedding.
>
> The daughters did as they were bid and, just as their father had prophesied, a small spreading tree sprouted from his grave, the first of its kind to grow in Hawaii. [Armitage and Judd 1944:140]

Another version connects the dots explaining the spread of *wauke* tapa plants: "The branches took root wherever they fell or were washed by the stream. Soon all of Hawaii was blessed with the gift of the wauke tree, and Maikoha became the god of the tapa makers" (Metzger 1929:41)

Westervelt (1963:20) places the location of Maikoha's burial and the first *wauke* tree at Pu-iwa and adds the following:

> Maikoha became the chief aumakua, or ancestor-god, of the Hawaiian ka pa-makers, and has been worshipped for generations. When they planted the wauke branches, or shoots, prayers and incantations and sacrifices were offered to Maikoha. Before branches were cut and placed in bundles to be carried to a field set apart for kapa-making, the favor of Maikoha was again sought.
>
> One of the daughters of Maikoha, whose name was Lau-hu-iki, became the aumakua of all those who pounded the prepared bark, for to her was given the power of finding kapa in the bark of the wauke-tree, and she had the power of teaching how to pound as well as bless the labor of those who worshipped her.
>
> The other daughter, Laa-hana, was also worshipped as an aumakua by those who used especially marked clubs while beating the bark into patterns or marked lines, for they said she learned how to scratch the clubs with sharks' teeth so that marks would be left in the pounded sheets. She was also able to teach those who worshipped her to mark figures or patterns on the pounded kapa.
>
> Thus Maikoha and his daughters became the chief gods of the kapa-makers. [Westervelt 1963:65–66]

3.2.9 Kaupe and Poki the Dog *Kupua* of Nu‘uanu

One of the more famous traditions of Nu‘uanu is of the demi-god or *kupua* ("ghost") dog Kaupe.

> . . . 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]

Kaupe was potentially dangerous and would attack and kill travelers. Westervelt relates that Kaupe "became the ruling power between Nuuanu Valley and the sea . . . he was a cannibal, and many of the people were killed and eaten by him. He could appear at will either as a man or a dog" (Westervelt 1963:92–93).

He “had a heiau” in Nu‘uanu where he used to rest (Armitage and Judd 1944:69).

> But the ghost of Kaupe was not killed. He returned as a ghost-god to the highest part of Nuuanu Valley, where in his shadow body he can sometimes be seen in the clouds which gather around the mountain-tops or come down the valley. Sometimes his cloud-form is that of a large dog, and sometimes he is very small, but there his ghost rests and watches over the lands which at one time he filled with terror. [Westervelt 1963:95–96]

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 1963:91), 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 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. 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. This may mean the *heiau* was near the current project area.

Kamakau gives the location of Kaheiki when speaking of the building of Punchbowl Street. Several of these place names are on an 1897 map of Honolulu, missing only Kaheiki.

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 Kawānakoa (Kamakau 1992:291).

Following the place names of the 1897 map and the twists and turns of Punchbowl Street, 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. Sterling and Summers (1978:296–297) place Kaheiki Heiau in Nu‘uanu, but also discuss Pacific Heights 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 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 on one night. At the *heiau*, Kahānai-a-ke-akua placed his *kahu* (guardian) Kahilona, a wise *kahuna* (priest). Most versions of this legend (Westervelt 1963:90–96; Kamakau 1991:26–27) 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. He 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 1963:90–96).

A lesser known “wonder-dog of the mountains of Oahu” known as “Poki” was also associated with Nu‘uanu Valley (Westervelt 1963:88). This wonder dog was sometimes said to be the spirit of the chief Boki who disappeared at sea.

3.2.10 Kawelo at Nu‘uanu

Nu‘uanu Valley was the site of a fierce conflict between Kawelo, the strong man from Kaua‘i, assisted by two friends, and a band of robbers. In this battle torn-up trees figured as mighty war clubs. (Westervelt 1963:21).

In Cora Wells Thorpe’s account t(1924:169–171) the great fight is between Kawelo and his father-in-law Kalo who lives in Nu‘uanu. Kawelo hears Kalo’s disparaging remarks that have incensed his wife and challenges him, striking him with a war club and knocking him to the ground. There is a reconciliation and Kawelo moves on to other adventures.

3.2.11 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* (supernatural race) people lived” (Manu 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 publication (Manu 2002) of these collected articles has an English translation by Mary Kawena Pukui. Place names mentioned in this legend close to the current project area include Alekoki Pond (Elekoke), and the Ālele leaping point.

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; they 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 girl was taken to ‘Ōla‘a on Hawai‘i to live with an attendant named Waka (Manu 2002:104–107). The Westervelt account provides the detail that when the child was consecrated by Kāne, Kanaloa, and their sister Anuenue at the Waolani Temple “They consecrated the child, and cut off another part of the navel-cord. Kanaloa took it to the Nuuanu pali back of Honolulu, to the place called Kaipu- o-Lono” (Westervelt 1987:120).

The third child of Hina and Kū was also 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 began to have troubles. Kū yearned for Hi‘ilei, and the couple agree 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 Olopana as her husband. 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 Kaumailiula was given to Hina to raise.

These five children met 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 were 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.

At this family gathering 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 ‘Ōla‘a on Hawai‘i.

> *I ka pau ana o keia mau kukai olelo ana, ua ku 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 Haunama Bay, O‘ahu]. [Manu 2002:155]

3.2.12 Kekupa's Canoe

The account of Kekupa's canoe combines two common Nu‘uanu themes, that Nu‘uanu was a good source of *koa* logs for canoes and it also was a home of the *menehune*. This story is notable as the sought log is for a voyaging canoe to sail to Tahiti; also the search for an appropriate log was widespread before settling on Waolani in Nu‘uanu. The Kekupua, leader of the canoe-tree selection committee, slept in a cave at Waolani (Thrum 1907:114). The *menehune* completed a canoe and at Kekupa's direction:

> pull the canoe along the *nae*, [*na‘e* meaning easterly or windward] or farther side of the Puunui stream. By this course the canoe was brought down as far as Kaalaa, near Waikahalulu, where, when daylight came, they left their burden and returned to Waolani. The canoe was left in the ditch, where it remained for many generations, and was called Kawa-a-Kekupua (Kekupua's canoe), in honor of the servant of the chief Kakae. [Thrum 1907:116]

This account clearly overlaps that of the *mo‘o* named Kuna discussed below (Section 3.2.15).

3.2.13 The Kihapū at Waolani, Nu‘uanu

The "Kiha-pū" conch shell renowned for its wonderful sound was treasured by generations of Hawai‘i's ruling chiefs. "Waolani heiau was the place where the noted legendary musical shell 'Kiha-pu' had its first home—from which it was stolen by Kapuni and carried to its historic home in Waipio Valley, Hawaii" (Westervelt 1963:20).

Kapuni was a god of a temple in Waipi‘o Valley, Hawai‘i Island. He was traveling with two other gods when he heard the sound of the Kihapū conch shell at Pakaaluna Temple upon a hill above Waolani (also the home of a noted drum). (Westervelt 1963: 105–106). “When the stars arose in the heavens above Nuuanu and all were sound asleep he entered the temple and took the shell” (Westervelt 1963:107).

This act was memorialized through geographic associations in the tale: “Near Niolapa, on the eastern side of Nuuanu Valley, is the stone where Kapuni rested when he came after the shell known as the Kiha-pu” (Westervelt 1963:105).

3.2.14 History of Kūali‘i (*Mo‘olelo o Kūali‘i*)

Kūali‘i is described as “One of the last great chiefs . . . said to have subjugated first his own O‘ahu, and then the remainder of the Hawaiian Islands” (Pukui and Elbert 1986:389). While he is often discussed as a mortal chief he is also referred to as a supernatural figure, as a god (*akua*), and as “one who flies from heaven” (*ulele . . . mai ka lani*). The timeframe of Kūali‘i as a historical chief is unclear. Kamakau says he died in AD 1730 at the age of 175 (Fornander 1917:4:432–433).

In Fornander’s “History of Kualii” is a reference to Kūali‘i’s victory at the temple dedication of Kawaluna in upper Nu‘uanu:

He wai kaua o Ku no ke alii	An army of hosts, for Ku is indeed king.
He kaua na Ku,	A battle for Ku
E uhau ana iluna o Kawaluna.	Beating his enemy on the heights of Kawaluna.

[Fornander 1917:4:384–385]

Additional detail of this victory is presented as follows:

> The first battle on Oahu in which Kualii took part where a general war was had . . . fought on Kawaluna, the heights above Waolani, where a great slaughter took place that reddened the pili grass of Keanakamano.
>
> *O ka hoouka kaua mua a Kualii i hoomaka ai ke kaua nui ma Oahu, oi aka hoouka kaua ana iluna o Kawaluna maluna aku o Waolani, oi aka luku nui ana i ula pu ai ke pili o Keanakamano.* [Fornander 1917:4:408–409]

Fornander relates that while Kūali‘i was at Kalwehuawehe in Waikīkī his own attendants (*kahu pono ‘ī*) upbraided him about allowing other chiefs to degrade them. Kūali‘i rebelled (*kipi*), through the act of overstepping his authority in dedicating the temple on Kawaluna. The ruling chief, Lonoikaika and his army and an army from K o‘olau and an army from Waialua arrived at Keanakamano and surrounded the forces of Kūali‘i. Kūali‘i’s father urged him to escape but Kūali‘i was determined to stay and fight. Details of the battle follow when Kūali‘i’s father:

> Looked down the bottom of Waolani, one wing of the army was climbing Puuiwa; the army from Koolau was coming from Kaniakapupu, while one of the wings of the army from Koolau was already on the Kalihi cliffs, and still another wing from Kona was coming up soon to meet the army from Koolau, where Kualii would be entirely surrounded . . . The grass was so thickly covered with men that it was dried up from the trampling . . . [and Kūali‘i] entered the temple to pray.

> *. . . i kiei aku ka hana ia lalo o Waolani, e pii ana ke kahi maha o ke kaua i Puuiwa; e iho mai ana hoi ko Koolau kaua I Kaniakapupu, a o kekahi maha hoi o ko Koolau kaua mai aia ma ka pali o Kalihi, ke pii aku nei hoi kekahi maha o ko Kona aku nei kaua a hookui me ko Koolau kaua mai, alaila puni o Kualii . . . A makaukau ke kaua, ia manawa, nana aku la o Kualii e hoeu mai ana na kaua a pau, ua owela ka nahele... komo ae la oia I ka heiau e pule ai.* [Fornander 1917:4:410–411]

By virtue of the courage of Kūali‘i and his personal attendant the enemy retreated and

> The dead bodies were strewn around like logs of wood, so great was the number of those that were killed in this battle.
>
> *Ahu aku la na kanaka make me he pauku laau la, ka heana o ka poe make ia kaua ana.* [Fornander 1917:4:410-411]

Another adulatory chant in honor of Kūali‘i presents a long list of things Kūali‘i is “not like” (*‘a‘ole i like i …*”) including:

Aole i like i na liki	Not like the ti leaf—
I ka laki pala o Nuuanu	The yellow ti leaf of Nu‘uanu,
I heheia e ka ua e ka makani a helelei.	Softened by the rain and wind till it falls.

[Fornander 1917:4:392–393]

The nuance here is uncertain but the reference emphasizes the rain, wind, and verdure associated with Nu‘uanu and suggests the majesty of Kūali‘i endures against the inclement elements and defies time.

An account in the story of the culture hero Kalelealuaka tells a very different tale of the defeat of Kūali‘i at Nu‘uanu. Kalelealuaka, fighting on behalf of the chief Kākuhihewa, learns “that Kualii had an army at a place called Kahapaakai, in Nuuanu.” Kalelealuaka

> made a great slaughter among the soldiers of Kualii . . . This done, he returned to the battle, and went on slaying until he had advanced to the captain of Kualii's forces, whom he killed and spoiled of his feather cloak and helmet.
>
> When Kualii saw that his chief captain, the bulwark of his power, was slain, he retreated and fled up Nuuanu Valley, pursued by Kalelealuaka, who overtook him at the head of the valley. Here Kualii surrendered himself, saying: ‘Spare my life. The land shall all go to Kakuhihewa, and I will dwell on it as a loyal subject under him and create no disturbance as long as I live.’ [Thrum 1907:102–103]

3.2.15 Kuna and the *Mo‘o* Traditions of Nu‘uanu

The mists, rains, and waters of Nu‘uanu made it a natural abode of “*mo‘o*” (“lizard, reptile of any kind, dragon, serpent, water spirit” [Pukui and Elbert 1984:233]). Westervelt (1963:90) writes of the men of the chief Kahanaiakeakua who fought with the *mo‘o* named Kuna for a canoe in Nu‘uanu Valley: “His priests went up Nuuanu Valley to a place on the side where forests covered a small valley running into the side hills of the larger and more open valley. Great koa-trees fit for canoe-making were found in this forest” (Westervelt 1963:101–102).

The *mo‘o* Kuna tried to halt the taking of his *koa* tree:

> He watched the ceremonies and listened to the incantations while the tree was being cut down. He tried to throw obstacles in the way of the men who were steadily breaking chips from the tree-trunk. He directed the force of the wind sweeping down the valley against them. He sent black clouds burdened with heavy driving rain. He made discouraging omens and sent signs of failure, but the priests persevered. [Westervelt 1963:103]

As the chief's men tried to haul the *koa* log down to the coast, the *mo‘o* "pulled back" and "made the canoe very heavy" and dried the bed of the river so the flowing water would not help the men.

It seems probable Nu‘uanu Valley was indeed a preferred locale for harvesting *koa* logs for canoe manufacture and that hauling the logs down the valley was always a very difficult task.

The upshot of the story was that the men hauled the log down to the coastal plain to a place called "Kaho‘okane" where the *mo‘o* redoubled his efforts wedging the log in the rocks. A rock formation at that location was long associated with the tradition.

Another account of a Nu‘uanu *mo‘o* is given in the story of Keaomelemele.

> Ke-ao-mele-mele told the dragon to go and stay on the mountain by the broken pali at the head of Nuuanu Valley. So she went to the precipice and became the watchman of that place. She was the first dragon on the islands. She watched with magic power. [Westervelt 1987:146–147]

3.2.16 Namaka, the Birdman at Nu‘uanu

Namaka was a culture hero of Kaua‘i of prodigious strength. In Nu‘uanu Valley he met the O‘ahu boxer Pakuanui.

> Toward the upper end of Nuuanu Valley, in a place Ka-hau-komo, where spreading hau trees cluster on both sides of the road, Namaka and Pakuanui had a contest . . . This man from Kauai appeared like a rainbow bending over the hau-trees, arched in the red rain, or in the mist cloud over the Pali, as he circled around Pakuanui. He was like the ragged clouds of Lanihuli, or the wind rushing along the top of the Pali. His hands were like the rain striking the leaves of the bushes of Malailua . . .
>
> Pakuanui was very much ashamed and angry because he could not do anything with Namaka, and planned to kill him when they should reach the Pali (precipice of Nuuanu Valley), to which they were going after the boxing contest.
>
> When they came to Kapili at the top of the Pali, a very narrow place, Pakuanui said to Namaka, 'You may go before me.'
>
> Namaka passed by on the outside and Pakuanui gave him a kick, knocking him over the Pali, expecting him to be dashed to pieces on the rocks at the foot of the precipice.
>
> But Namaka flew away from the edge of the Pali. The people who were watching said: 'He went off. He flew off from the Pali like an Io bird, leaping into the air of Lanihuli, spreading out his arms like wings. When the strong wind twisted and whirled, Namaka was lifted like a kite by the wind, and hung among the kukui

> branches below a little waterfall which is on the western side of the precipice where a rivulet starts on its way to the ocean.' [Westervelt 1963:122]

Namaka goes on to have many adventures before returning to Kaua‘i.

3.2.17 Legend of Peapea and Kahekili's Assault on Nu‘uanu (*Ka‘ao no Peapea*)

Peapea was a famed warrior for the Maui ruling chief Kahekili. When Kahekili's war fleet landed at Waikīkī to take O‘ahu from the ruling chief Kahahana, the Maui forces pressed the fighting toward Nu‘uanu. Kahahana's "main army was at Waolani, while the front was descending from Maemae" (*A o ko Kahahana aoao hoi, I Waolani ka poe, I Maemae ka maka mua e iho mai ana*). Peapea "went slaughtering until reaching Luakaha, in Nu‘uanu" (*Pela no kona hele luku ana a hiki i Luakaha, a Nu‘uanu*) (Fornander 1919:5:460–461).

3.2.18 Legend of Puniakaia (*He Ka‘ao no Puniakaia*)

The culture hero Puniakaia of Kāne‘ohe instructs travelers to "go up Nuuanu and when you get there look down to Kaneohe" (Fornander 1919:5:160–161). Nu‘uanu is often referred to for the view from the Nu‘uanu pali of the Ko‘olau coast.

3.2.19 Nu‘uanu as a Residence of the Gods

Westervelt (1963:37) relates that when Kū, Kāne, Kanaloa, and Lono first came to Hawai‘i "These gods settled for a time in Nuuanu Valley." Nu‘uanu "was the valley supposed to have been the first habitation of the gods, from which all life spread over the island group" (Westervelt 1963:62). While no details are supplied, the general role of Kāne and Kanaloa as "water-finders" and creators of springs suggests the many springs of Nu‘uanu were either attractive to Kāne and Kanaloa or were created by them.

3.3 Heiau

According to Samuel Kamakau (1992:130), Wākea, an ancestor and possible progenitor of the Hawaiians, built the earliest *heiau* on the island of O‘ahu in the valley of Waolani. Thrum (1906:44) mentions a *luakini* (sacrificial) class *heiau* in Waolani called Kawaluna similarly constructed by Wākea and consecrated by the *mō‘ī* (ruler) of O‘ahu, Kūali‘i, in 1685. According to a Hawaiian language newspaper, Kawaluna Heiau was located on the east ridge of Waolani Valley (*Ka Nai Aupuni* 1906 in Sterling and Summers 1978:304). In addition to being a *luakini*-class *heiau*, it was also a *po‘ohuna*, 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 of a larger 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, which was used for bringing rain. However, McAllister places Makuku in Waolani (McAllister 1933:86). *Mo‘olelo* recount a *heiau* called Kaheiki on the ridge between Nu‘uanu and Pauoa built by *menehune* (Westervelt 1915 in McAllister 1933:82).

Rayna Raphaelson (1925) lists 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; Koauananakoa, near the Royal Mausoleum; Ahipu‘u; and Puiua (also spelled Puiaa), near Hānaikamala (Queen Emma's Summer Palace) where Kamehameha's warriors rested. Two additional *heiau* were Kakanaiakeakea and Kawaluna. The final *heiau* was Kaniakapūpū ("the

singing of the land snails"). According to Charles Kenn, Kaniakapūpū is the place where people came for comfort and medical attention (Pacific Worlds 2003a). Kaniakapūpū was later used as a summer retreat for Kamehameha III.

*3.4 ‘Ōlelo No‘eau (*Proverbs*)*

Several *‘ōlelo no‘eau* (proverbs) poetically describe the winds and rains of Nu‘uanu Valley. The winds of Nu‘uanu are the subject of several Hawaiian poetical sayings, including:

> *Ka makani kā‘ili kapa o Nu‘uanu.*
> 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 1983:158–159]
>
> *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]
>
> *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:#101]
>
> *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:#1891]

The rains of Nu‘uanu merited an equal number of sayings, such as the following:

> *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:#1601]
>
> *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]

3.5 Battles in Nu‘uanu

Nu‘uanu was the site of several battles during the late pre-Contact and early post-Contact periods. Early 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. During the eighteenth century, Nu‘uanu was the site of three significant conflicts that ultimately decided the fate of O‘ahu.

3.5.1 Battles between Kākuhihewa and Kū‘ali‘i, ca. 1720-1740

Chief Kū‘ali‘i unified O‘ahu through a series of battles with the ‘Ewa and Kona chiefs between AD 1720 and 1740. The “Legend of Kalelealuaka” includes a series of battles between Kū‘ali‘i forces and those of Kākuihihewa. The hero of the legend, Kalelealuaka, fought for Kākuihihewa. He had the ability to fly from one point to another in the blink of an eye; each morning he flew from his home to join Kākuhihewa’s warriors, and flew home again each night when the fighting was done. Kalelealuaka was unequaled on the battle field; the legend records that “a man was plucked and torn in his hand as if he were but a leaf” (Thrum 1907:95). He routed the opposing warriors and defeated each of Kū‘ali‘i’s captains. The fourth battle was fought in Nu‘uanu. Kū‘ali‘i assembled his army in a place called Kahapaakai. Kalelealuaka flew to the battlefield and slew many of the warriors, including the chief captain of Kūali‘i’s forces. Kalelealuaka then pursued Kūali‘i up Nu‘uanu Valley. At the head of the valley, Kūali‘i sued for peace, agreeing to live as a subject under the dominion of Kākuihihewa (Thrum 1907:103).

Fornander recounts a second story of the battles in Nu‘uanu, where Kūali‘i battles the Kona chiefs, and emerges as 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]

3.5.2 Battles between Kahekili and Kahahana, 1783

Kahahana was the foster son of Kahekili, a chief of Maui. After his uncle Kumahana was deposed as O‘ahu’s ruler, a counsel of chiefs made Kahahana ruler over the island in 1773 (Kamakau 1992:128–129). Kahekili desired O‘ahu for himself, but did not act until ten years later. Kahekili assembled a great fleet of war canoes and invaded in 1783, landing at Waikīkī. At this time Kahahana resided at Kawānanakoa in upland Nu‘uanu (Kamakau 1992:135). After three indecisive battles, Kahekili marched to the valley of Nu‘uanu and met Kahahana near the small stream of Kaheiki. After the great battle, the waters of the stream “ran red with blood” and the corpses damned the waters (Becket and Singer 1999: 18; Fornander 1996 :224; Kamakau 1992:136). Kahahana’s army was thoroughly routed, and he and his wife Kekua-poi-ula fled to the mountains (Fornander 1996:224–225).

3.5.3 Battle between Kamehameha and Kalanikūpule, 1795

In 1795, the forces of Kamehameha and Kalanikūpule fought for control of O‘ahu. This most significant post-Contact conflict in the region is known as the “Battle of Nu‘uanu.” Kamehameha’s invasion fleet of 1,200 war canoes and an estimated 12,000 warriors landed at Kāhala/Wai‘alae and Waikīkī. The O‘ahu forces were severely outnumbered, comprising some 9,000 warriors (Dukas 2010:8). Instead of making a stand at Kalanikūpule’s residence in Waikīkī, Kalanikūpule chose to strategically position his warriors in Nu‘uanu Valley (Kamakau 1992:172–173). Defensive positions were established around Pūowaina, with a second defensive front up the Nu‘uanu Valley (Fornander 1996:347–348). Kamehameha’s forces advanced following nearly the same route Kahekili had followed some ten years earlier.

The battle commenced at the foot of Pūowaina, where Kalanikūpule’s forces were entrenched and possibly supported by artillery on the slopes of the crater. Fighting was fierce, and both sides sustained significant losses. Kalanikūpule was forced to abandon the position at Pūowaina and begin a calculated withdrawal, moving deeper into the well-defended confines of Nu‘uanu Valley (Dukas 2010:25, 39).

There were bloody skirmishes at ‘Elekōkī, the Kawānanakoa *heiau* at Mauna ‘Ala, La‘imi, and Ahipu‘u. Kaiana, who had once been an ally of Kamehameha, was killed at ‘Elekōkī. In Kalākaua’s (1990:407) account, Kaiana was “behind a stone wall stretching from one hill to the other of the narrowing gorge” with the main body of the defending army when he was mortally wounded by a shot from a field piece under the direction of John Young.

His death was followed by the loss of several other important captains, and even Kalanikūpule was gravely wounded at Mauna ‘Ala (Dukas 2010:42–47).

Thomas Thrum provides details regarding how the battle progressed:

> [T]he 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. [Thrum 1898:111]

Kalanikūpule’s forces regrouped at Pū‘iwa, using the *heiau* there as a defensive position. Kamehameha’s warriors broke through the defenses and pursued the remains of Kalanikūpule’s army higher into the valley as “the defeat of the Oahu forces became an accelerated rout and a promiscuous slaughter” (Fornander 1996:347–348). The dispersed army fled along a streambed to Luakaha wetlands, fighting a series of running battles (Dukas 2010:51–53).

Three hundred warriors made a final stand at Luakaha in front of Nu‘uanu Pali. They sacrificed themselves to allow their remaining comrades to escape by descending the Nu‘uanu Pali or climbing over the mountains to adjacent valleys (Pacific Worlds 2003a). The battle is called Kaleleka‘anae, which means “leaping *‘anae*” (mullet) and refers to the way many O‘ahu warriors of Kalanikūpule and some of their families chose 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).

Thomas Thrum describes the tragic events at the edge of the mountain:

> [T]hey 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 1898:111]

Fornander relates,

> In this battle the people of Oahu were massacred at the cliffs of Nuuanu. The people stepped upon each other, and the people that day were in heaps at the bottom of the cliffs of Nu‘uanu.
>
> *Ma keia kaua ana, ua luku ia na kanaka Oahu nei ma ka pali o Nuuanu, ua hehi kekahi maluna o kekahi, a ua lilo ke kanaka ma ia la I ahu no lalo o ka pali o Nuuanu.* [Fornander 1919:5:474–475]

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 amongst 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* (route or road) that wound through the valley.

Section 4 Subsequent Post-Contact Historic Background

4.1 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* (chief) 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 Kamehameha 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 3 January 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 affirmed the rights of 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 14 February 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 Nu‘uanu Ahupua‘a for properties in the lower valley (Pacific Worlds 2003b). Most of the *‘ili* of Luakaha became Crown Lands, including the royal residence of Kaniakapūpū. 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 11 and Figure 12 show the region where LCAs were often awarded and the specific boundaries of LCA parcels awarded in the project area. A total of 23 LCA parcels are found in the immediate project area (Table 1).

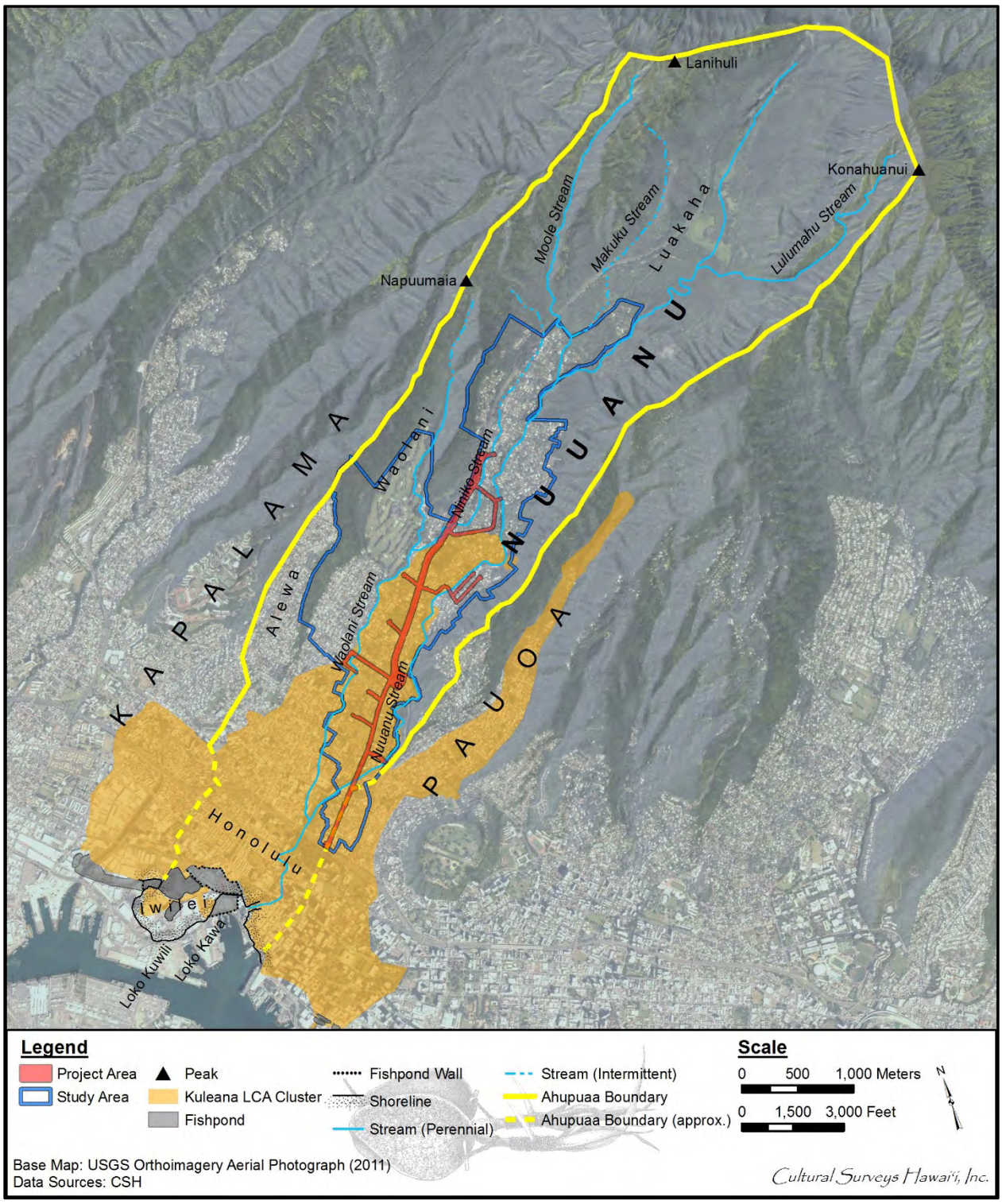

Figure 11. Traditional Hawaiian settlement in Nu‘uanu Valley (base map USGS orthoimagery aerial photograph 2011)

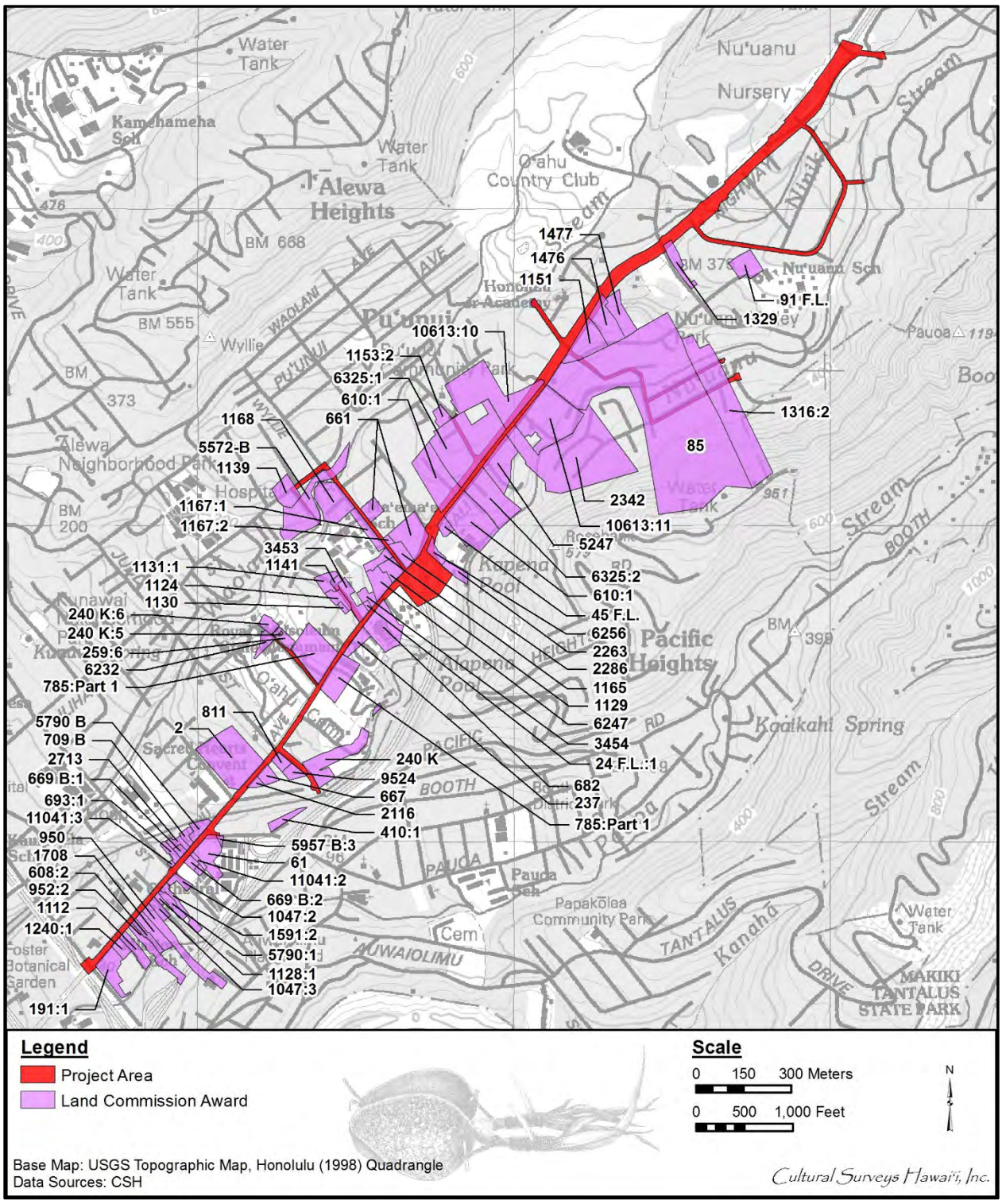

Figure 12. A portion of the 1998 Honolulu USGS 7.5-minute topographic map with overlay of LCAs in the immediate project area

Table 1. Land Commission Awards Granted in Nu‘uanu Ahupua‘a within the Project Area

LCA	Claimant	*‘Ili*	Land Use
2	Kilday, Robert	Koula, Pualoalo	*‘Āpana* 1: 1.96 acres *‘Āpana* 2: 7.46 acres
24FL	Kaanaana	Hauhaukoi	*‘Āpana* 1: .28 acres
45FL	Kawiliko	Niupaipai	*‘Āpana* (lot) 1: House lot
61FL	Kaholo	Kuwili	*‘Āpana* 1: .22 acres
85	Phillips, Thomas	Kaimuohena	*‘Āpana* 1: 51.25 acres
91FL	Kiniakua, Keawekuaila (son/heir)	Puiwa	*‘Āpana* 1: 1.36 acres
191	Kekauonohi, M., Haalelea, L.	King St., Merchant St., Queen St., Richards St.	
237	Kaauwai, Zorobabel	Kawānanakoa	*‘Āpana* 1: .85 acres
240K	Kinimaka	Kaaleo	Not available
259	Smith, Lowell; Kinimaka; Victoria Kamamalu	Maemae	*‘Āpana* 1: .55 acres
410	Kaanaana	Kaalaaluna	2 *‘āpana*: .91 acres
608	Paaluhi, Susania	‘Auwaiolimu	3 *‘āpana*: 1.46 acres
610	Rooke, Dr. T.C.B	Puunui, Niolopa	*Lo‘i kalo* (terraced pond field) and *kula* (pasture) in Puunui
661	Hawaii, Kaiapa	Waiolena, Kaolu, Laukalo	*‘Āpana* 1: House lot
667	Kauaua, wahine	Kahookane	1 *‘āpana*: .6 acres
669B	Kaehu, J.W.	Kaalaalalo	1 *‘āpana*: .63 acres
682	Kekuanaoa, M.	Kawānanakoa	1 *‘āpana:* 2.5 acres
693	Malihini	Kaalaalalo, Poholuhulu	*‘Āpana* 1: .34 acres *‘Āpana* 2: .49 acres
709B	Kaumupo	Kaalaalao, Nu‘uanu St.	1 *‘āpana*: .36 acres
785	Robinson, James	Nu‘uanu	*‘Āpana* 1: Land use not specified *‘Āpana* 2: House lot and *lo‘i kalo*
811	Kenahu, wahine	Kahookane	1 *‘āpana*: .49 acres
950	Laaumalo	‘Auwaiolimu	1 *‘āpana*: 2.03 acres

LCA	Claimant	*‘Ili*	Land Use
952	Paeimuai	‘Auwaiolimu	2 *‘āpana*: 2.17 acres
1047	Kahele	‘Auwaiolimu	3 *‘āpana*: 1.54 acres
1112	Hune	‘Auwaiolimu	1 *‘āpana*: 1.44 acres
1124	Kalahoouka	Kawānanakoa	1 *‘āpana*: .78 acres
1128	Keoho	‘Auwaiolimu	*‘Āpana* 1: .15 acres *‘Āpana* 2: .10 acres
1129	Heenalu	Kawaiolena	*‘Āpana* 1: Four *lo‘i*, *kula* *‘Āpana* 2: One *lo‘i*
1130	Kaili	Kawānanakoa	1 *‘āpana*: 1.03 acres
1131	Piilani	Kawānanakoa	1 *‘āpana*: .95 acres
1139	Holoua	Kawānanakoa, Palikea	1 *‘āpana*: 1.61acres 4 *‘āpana*: .38 acres
1141	Kapeleaumoku	Kawānanakoa	1 *‘āpana*: .24 acres
1151	Kuewa	Kauhakoi, Nu‘uanu	*‘Āpana* 1: Nine *lo‘I kalo*, house lot, and *kula mahi‘ai* (farm field)
1153	Pahili, wahine	Palikea, Pouhuluhulu	1 *‘āpana*: .57 acres 1 *‘āpana*: .1 acres
1165	Kanakanui	Kawaiolena	*‘Āpana* 1: House lot, seven *lo‘i* *‘Āpana* 2: One *lo‘i*
1167	Isaaka	Laukalo	3 *‘āpana*: 1.13 acres
1168	Makailuuwai	Kaaleo	*‘Āpana* 1: House lot *‘Āpana* 2: Does not specify land use
1240	Pahana	Kalawahine	1 *‘āpana*: .5 acres
1316	Moo	Punaalana	2 *‘āpana*: 8 acres
1320	Ukumailani, wahine	Kaloaloa	Not available
1329	Kaaa	Laimi, Punaalana	1 *‘āpana*: .65 acres 1 *‘āpana*: 1.26 acres
1476	Iwiula	Kaukahoku	*‘Āpana* 1: Ten *lo‘i kalo*, *kula ‘āina* (pasture land), and house lot with fence
1477	Kulele	Kaukahoku	*‘Āpana* 1: Ten *lo‘i kalo*, *kula ‘āina*, and house lot with fence
1591	Kaihe	‘Auwaiolimu	3 *‘āpana*: 1.34 acres
1708	Hina, Abia (wahine); Hina, Apia	‘Auwaiolimu	1 *‘āpana*: .29 acres 1 *‘āpana*: .45 acres 1 *‘āpana*: 1.06 acres
2116	Kumuhea	Kahookane	1 *‘āpana*: .28 acres
2263	Pikai	Kawānanakoa	1 *‘āpana*: .55 acres

LCA	Claimant	*‘Ili*	Land Use
2286	Kekapai	Kawānanakoa, Kaouli	Seven *lo‘i*, house lot
2342	Ruddocks, James	Laimi	1 *‘āpana*: 12.31 acres
2713	Hapee; Kaehu	Ka‘ala‘alalo	1 *‘āpana*: .42 acres
3453	Kalino	Nuuanu St., Kawānanakoa	1 *‘āpana*: .66 acres
3454	Keawe	Kawānanakoa, Kaolu	1 *‘āpana*: .57 acres
5247	Kuakini, J.A.	Niolopa	1 *‘āpana*: 2.5 acres
5572B	Kuluwailehua, S.	Kamoku	Not awarded
5790	Kuhiau; Pohaku	‘Auwaiolimu	1 *‘āpana*: 77.4 acres
5790B	Luli	Kaalaalalo	1 *‘āpana*: .61 acres
5957B	Kaholoau	Kaalaalun	1 *‘āpana*: .33 acres
6232	Kahula	Kaaleo	1 *‘āpana*: .55 acres and 730 fathoms
6247	Kanulu	Kawaiolena	Not available
6256	Kaanaana	Kawānanakoa, Kaolu	1 *‘āpana*: .49 acres
6325	Kekauonohi, M.	Niolopa	3 *‘āpana*: 15.02 acres
9524	Kaupena	Kaho‘okāne	1 *‘āpana*: .55 acres
10613	A. Pākī	Not available	1 *pauku* (section) at Laimi from M. Kekuaanoa
11041	Hilauea	Ka‘ala‘alalo	3 *‘āpana*: .48 acres

4.2 Royal Residences

The *ali‘i* of O‘ahu used Nu‘uanu Valley as a royal retreat. During the nineteenth century, both King Kamehameha III and Queen Emma established summer palaces in the upper valley. These second homes allowed them to escape court life, the noise and dust of Honolulu, and the stifling summer heat.

4.2.1 Hānaiakamalama, Queen Emma’s Summer Palace

The elegant house and grounds of Hānaiakamalama served as a summer palace for Queen Emma and Kamehameha IV from 1857 to 1885. Hānaiakamalama was built by H.A. Pierce in 1847 (Pukui e t a l. 197 4:40). J ohn Y oung II, t he s on of J ohn Y oung (who ha d s upported Kamehameha with artillery during the battle of Nu‘uanu), purchased the house in 1850-1851. He named Hānaiakamalama after the Young family home in Kawaihae on the island of Hawai‘i. (*Honolulu Advertiser*, 31 May 1953). The name means “the foster child of the moon, or the night.” Young willed it to his daughter, Queen Emma, and she inherited the property in 1857 following his death. The royal family used the summer home as both a retreat and for entertaining important guests (*Honolulu Advertiser*, 31 M ay 1953). The property was sold to the government in 1890, five years after her death. It was rented and eventually fell into disrepair. The property was taken

over by the Daughters of Hawai‘i in 1915 and is now the Queen Emma Museum (*Honolulu Advertiser*, 31 May 1953). Hānaiakamalama was added to the National Register of Historic Places (NRHP) in the 1970s.

4.2.2 Kaniakapūpū

Kaniakapūpū served as a royal retreat for Kamehameha III (Figure 13). It is located in Luakaha in Upper Nu‘uanu, an area set aside since pre-Contact times as a retreat for high *ali‘i* and royalty (C.H. Cooke in Sterling and Summers 1978:307). Kamehameha III may have resided at this site as early as 1835, but the current ruins date to 1843-1845 (Dixon et al. 1994:24). The house was not imposing and consisted of one large main room and two adjoining sleeping areas (Figure 14). In 1845, Dutchman Steen Bille described it as a “rather a large building with a surrounding porch, and does not distinguish itself by any architectural beauty . . . but if you pass to the rear of its garden you will see a seething fall cascading down from a height of more than 70 feet” (translation in Sterling and Summers 1978:307)

According to traditions concerning the Battle of Nu‘uanu, Kaniakapūpū was built on one of the places that Kamehameha I rested before he began the final push to victory at the Nu‘uanu Pali. It was also the scene of a historic feast in 1847 which commemorated the fourth anniversary of the kingdom’s restoration to Hawaiian rule (Sterling and Summers 1978:308–309). Kaniakapūpū was placed on the Hawai‘i Register of Historic Places (HRHP) in 1986. It has been the site of several archaeological investigations.

Figure 13. Photo of a plaque located at Kaniakapūpū, summer palace of Kamehameha III and Queen Kalama (CSH 2012)

Figure 14. Photo of remnant building foundations at Kaniakapūpū (CSH 2012)

4.3 The Pali Road

The *ala hele* once served to connect the various settlements throughout O‘ahu. A coastal route encircled O‘ahu while divergent trails traversed the mountain ranges and valleys. One of the most important connections between leeward and windward O‘ahu was the predecessor of the Pali Road. The trail wound up Nu‘uanu Valley toward the Pali and then traversed the sheer rock cliffs to reach windward O‘ahu. John Papa ‘Ī‘ī described the path of the trail ca. 1810:

> The trail to Nuuanu began at Kalanikahua and led north of Kaumakapili Church to below the little stream which flowed out of Kamanuwai pond. There the trail turned slightly to the right, went along the edge of the pond, and down into the water. Then, coming up on the bank onto Waiakemi, it led on to Waaakekupua, along the bank of taro patches, to the Pauoa stream, up to Pualoalo, and on to the gap at Nuuanu Pali. [‘Ī‘ī 1959:92]

Catherine Summers provided additional information on place names mentioned in the route (Sterling and Summers 1978:295). Kalanikahua, the *makai* terminus of the trail, was in downtown Honolulu between Hotel, Maunakea, Pauahi streets, and the Nu‘uanu Stream. The trail wound up through several locations in lower Nu‘uanu to Pualoalo, which was on Bates Street, between Liliha Street and Nu‘uanu Avenue.

There are a number of early Euro-American descriptions of the original *ala hele* from the first part of the nineteenth century. Hiram Bingham was the first known foreigner to descend the Pali; he led a group a missionaries over the pass in 1821 (Kailua Historical Society 2009: 19). Lord Byron, Commander of the HMS *Blonde*, remarked on the treacherous conditions of the Pali Trail in an 1825 ship’s log entry, writing “The descent to this plain . . . is the most fearful imaginable . . . where a false step would be inevitable destruction” (Byron in Sterling and Summers 1978:225).

4.3.1 Improvements to the Old Pali Trail

Chief Keanini was “the first to clear and widen the road and let in the light of the sun. He improved the road in order to draw lumber for building the Kawaiaha‘o church. The logs were cut in Ko‘olauloa, brought by canoe to Kāne‘ohe, and hauled over the Pali” (Kamakau 1992:291) According to Kamakau, the high chief Boki set workers to clearing a number of roads in the area in 1829. During the work he encountered a larger stone near Kaheiki Stream and attempted to remove it. A man approached and said,

> ‘Hear, O chief! leave that rock alone. The god made this rock a guardian for this place and his house is yonder (pointing upward to Kaheiki). It is a guardian for the house of the god and its name is Ho‘eu. The nature of this rock is that if you move it aside it will make you move to a foreign land and you will no longer live in Hawaii. Lucky for you if a year passes before you depart.’ (Kamakau 1992:292)

He was warned about removing a second rock while working on the road in Luakaha. It was long and pointed and reputed to have great *mana* (power). He ignored the advice, but his workers found it was too deep to remove and they abandoned the task (Kamakau 1992:292).

According to Rev. R. Tinker, a Boston merchant named Hinckley made the first attempt to improve the Pali Trail using modern methods in the 1830s, but it still proved too great a task. Tinker remarked that “much time was spent in digging, and much powder burned in blasting, and

then the undertaking was abandoned for want of means." (Thrum 1900:89). Significant progress was made in the late 1830s. Thrum translated an account of ongoing improvements first published in the *Kumu Hawaii* on 26 April 1837:

> I have a mind to relate certain changes in progress in Koolau, some of which are formidable. We are at work on the Pali road. Some projecting ledges have been cut away; some at Kapili and some at Ipuolono [bluffs]. On one side of the road a long iron railing is affixed to aid in one's ascending or descending. Men and women may now travel there without fear. Mr. Beers, a blacksmith, is engaged thereon. He is one of the recent missionary band that arrived on the Hamilton from the Columbia River. The workmen engaged on the Pali road are partly from Honolulu and partly from Koolau. Chiefs also are assisting; they paid the blacksmith for his services; eight days were consumed thereon, costing about $40. The work is not all done; there are a number of law-breakers of the land still engaged on it. [Thrum 1929:107]

In response to agricultural development in Kāne‘ohe and other *ahupua‘a* in windward O‘ahu, Kamehameha III secured funds to make the old Pali Trail accessible to horses. It was then widened to 6 ft, paved with stones, and the grade was lessened in most areas to 15% (Bishop in Devaney et al. 1982:165). The improvements were completed 17 June 1845. Kamehameha III opened the new road and was the first to ride down it on horseback, accompanied by his Premier John Young and his Minister of the Interior Dr. G.P. Judd. On 4 July, Dr. Judd posted notice that the Pali Road was now open to the free use of animal traffic to and from Ko‘olau. Maintenance proved to be a constant problem. An 1848 report noted that the road had suffered extensive damage during torrential rains (Kailua Historical Society 2009:20). In 1861-1862 Dr. Judd and Rev. Eli Corwin became the first people to descend in a carriage, which was considered quite a feat at the time (Thrum 1909:135).

4.3.2 The Development of the Pali Road

In the last decades of the nineteenth century, considerable effort and funds were spent improving the infrastructure around leeward O‘ahu. David Logan emphasized the dangers and complications of the narrow, cobbled Pali Trail:

> Long pack trains, with their motley conductors, carrying produce to market and purchases back, formed a daily picture. There was no small amount of traffic in saddle and on foot. Even wheeled vehicles have come and gone over, but when they did it was deemed worthy of bruiting about in the newspapers. Accidents were not rare, including the falling of stones upon hapless wayfarers. Horses would slip or stumble, mayhap take to bucking, and bring their riders sorrowfully into infidelity toward 'the noble animal.' The patient mule has even sustained more than his share of adverse criticism on the pali road. [Logan 1898:141]

Developing the Pali Trail into a serviceable road was one of several roadwork initiatives undertaken in the 1880s (Thrum 1889:98–103) (Figure 15). In 1882, construction began to widen the road to 20 ft and reduced the grade to 8%. This forced the road to wind back and forth on the side of the Nu‘uanu Pali rather than straight down. The road ultimately followed a route first proposed by Harry McIntosh, Superintendent of Public Works at the end of the 1880s and surveyed by W. Bruner in 1889 (Logan 1898:142).

Figure 15. Photo of the Old Pali Road traversing the Ko‘olau Mountain Range, ca. 1887 (Hawai‘i State Archives)

The project faced numerous labor problems. The workers were often discontent and the supervisors were poor managers. In 1890, disgruntled citizens of Kāne‘ohe wrote a letter of protest to L.A. Thurston, Minister of the Interior. They described two supervisors as constant drunks. The *haole* (Caucasian) supervisor used project funds to pay men to take care of him when he was drunk, take care of his house, and to buy liquor. The supervisor known as Kimo Kelley drank during work hours, used government funds for his own purposes, and got into drunken arguments with locals (Puhi in Kailua Historical Society 2009:20).

The laborious construction process was confounded by the rugged terrain. John H. Wilson, a young engineer with the Public Works Department, spent months surveying the steep terrain and forest of the Pali, but there were difficulties during construction such as "workers getting dynamited to oblivion and tumbling over the precipice . . . " (Chiddix and Simpson 2004:78). Logan (1898) described the hazardous process of demolition:

> Daring hands light one fuse after another and scamper for safety over the sharp mountain edge. Breath is held for a few seconds. Then the fated ledge belches out smoke and dust with a muffled roar. Cell after cell explodes, none missing fire or due effect. Great windrows of forest trees inverted, mingled with bowlders [*sic*] tons heavy, all involved in avalanches of red earth, rise and hurtle reluctantly a few yards high, then crash and roll down the abyss, the conglomeration piling itself an everlasting barricade across the ancient trail a thousand feet below. [Logan 1898:143]

Delays due to rain damage and high costs prevented the completion of the new Pali Road until 1897.

The Pali Road was an extension of Nu‘uanu Avenue, which had been one of Honolulu's premier residential thoroughfares. Daniel Logan provides a picturesque early description of the road up to the pass and the surrounding countryside:

> [T]he road begins a series of ascents, until at the Pali an elevation is attained of 1207 feet. On the right hand rises steeply a wooded mountain brow, cleaving the sky on comparatively even lines. Succulent pastures, studded with dairies, cover the narrow ground intervening, and townward suburban villas are increasing in number. On the left hand, the mountains are more broken in shape, and gardeners and graziers occupy little plateaus and sequestered vales. Close to the road, on either hand, are the city street lighting electric station and reservoirs of the water works from which the power for the dynamos is derived. Passing between jungles of tropical vegetation further along, which present the most outrageous tangle of crooked stem and jumbled tendril that could confound a dream, near the Pali is found the new public forest nursery with its thousands of seedlings. [Logan 1898:140]

4.3.3 Construction of the Windward Pali Road

In 1896, the legislature appropriated an additional $40,000 to finish the windward descent of the Pali Road. The $37,500 contract was awarded to Wilson & Whitehouse on 24 May 1897 and ground was broken on 26 May (Logan 1898:142–143). The total length of the new section was 7,620 ft. It began 600 ft on the leeward side of the Pali pass, and descended down the mountain to

where it joined the main roads out of Kāne‘ohe and Waimanalo (Figure 16). Logan described the windward portion of the road that extended from the pass to Kāne‘ohe:

> Here the way has hitherto conducted the traveler to a desperately steep, frightfully rugged and picturesquely zigzag road down to the plains below extending to the ocean. At the top you come abruptly to a stone wall over which you peer straight down over the precipice, but a dense jungle reaching nearly to the brink screens the depths completely. . . . the eye drops on green foothills and plains, with sugar and rice plantations, gardens and pastures. Kaneohe, the nearest sugar mill location and village, is four and a half miles away. [Logan 1898:140-141]

Construction of the windward leg of the Pali employed hundreds of laborers. The contractors recruited a large force of Chinese and Japanese laborers from local plantations by paying high wages, much to the consternation of the plantation managers (Kailua Historical Society 2009). The largest daily workforce assembled was on 30 September, when 224 men were engaged for work (Logan 1898:143). The Pali finally opened in late 1897 and was maintained for 55 years with occasional improvements.

Logan (1898) provides numerous details concerning the nineteenth century infrastructure of the historic road:

> •The roadbed was 20 ft (6.1 m) wide, while the thoroughfare was 16 ft (4.9 m) wide and 1.5 ft (0.46 m) deep.
>
> •Stone curbs held the superstructure in place.
>
> •A wooden railing ran along the outer edge of the road from the top of the Pali for 8,800 ft (2682 m).
>
> •A stone gutter ran the entire length of the new section. Ditches every 150 ft (45.7 m), provided drainage.
>
> •A 400 ft (122 m) long masonry retaining wall was constructed to hold the road embankment in place after the road rounded the pass. The new route was located twenty feet above the grade of the old road. This wall terminated where the road continues onto a narrow rock ledge.
>
> •A concrete extension on a projecting framework of steel girders was used to widen the rock ledge.
>
> •A 40 ft (12.2 m) masonry wall was constructed one hundred feet from the end of the concrete and steel extensions. The remaining length of the road was benched upon the face of the bluff, except in three locations.
>
> •A 5 ft (1.5 m) arched culvert was installed 2,500 ft (762 m) from the top of the pali, where the road crosses a mountain stream at the head of a waterfall.
>
> •A 80 ft (24.4 m) masonry wall was constructed where the road turns to wind down the bluff.
>
> •A wooden opening was constructed at the point the road re-crosses the mountain stream, 350 ft (106.7 m) immediately below the arched culvert. [Logan 1898:143–144]

Figure 16. Photo of picknickers at the *nuku* ca. 1898 (Hawaiian Historical Society)

It should be noted that during construction, laborers found an estimated 800 skulls, along with other bones at the bottom of the Nu‘uanu Pali. These were the remains of the warriors defeated by Kamehameha (*Island Call* 1953:1).

Harold Castle, born in 1886, recalled traveling down the Pali Road as a boy in a horse-drawn cart with hand-controlled brake. They tied the wheels and slipped part of the way. He remarked,

> Since then, the road has been periodically improved so that today the only resemblance is in the grade—the old road was narrow, rocky with a wood rail fence on the outside and the traffic, such as it was, consisted mostly of horses ridden or driven and pack trains that brought rice and taro to Honolulu. [Kailua Historical Society 2009:23]

The Pali Road was widened further in 1900, making it serviceable for both trucks and automobiles. A 1931 government survey indicated 2,000 cars used the Pali each day (Kailua Historical Society 2009:22). The Pali Road was considered an important strategic resource during World War II. The army drilled holes along the concrete road and filled them with dynamite. If the Japanese had successfully invaded the windward coast, the road would have been blown to prevent access to Pearl Harbor (Kailua Historical Society 2009:25).

Auloa Road in Maunawili is a remnant of the old Pali Road. It retains the old curb stones in places as well as bridges built in the 1930s, probably as part of Depression-era public works projects (Kailua Historical Society 2009:25).

4.3.4 Creation of Route 61, the Pali Highway

Following World War II, the windward coast population exploded as numerous servicemen moved their families to Hawai‘i. In 1952, work commenced on a new four-lane highway to replace the Pali Road. Initial construction included erecting new bridges and eliminating the original hairpin turn.

The plan called for two tunnels that would allow access through the mountain ridge under the *nuku* where Kalanikūpule fought Kamehameha’s forces (Devaney et al. 1982:172). The tunnel had been proposed at least a century earlier, when the *Polynesian* proclaimed “Oahu residents will never be satisfied till a tunnel is dug through the Pali, suitable for the passage of carts and wagons” (Chapin 2014). Talk of building a tunnel inspired the popular song “When They Build the Puka through the Pali” during the previous decade (Kailua Historical Society 2009:25).

A $1,979,059 contract to build the tunnels was awarded to J.M. Tanaka, which was at that point the largest contract ever granted by the Highway Department. Excavation began on 2 March 1955 (Figure 17). Spoil from the tunnels was dumped down the windward face of the Pali. Eight bridges were built to connect the tunnels to the highway. The first tunnel opened 11 May 1957 and the second on 1 August 1961 (Kailua Historical Society 2009: 25).

4.4 Residential Development of Nu‘uanu and the Project Area

The project area in lower Nu‘uanu was a premier residential area from pre-Contact times. As noted above, at the time of the invasion of Kahekili (ca. 1783) the ruling chief of O‘ahu, Kahahana was resident in Kawānanakoa in the vicinity of the central project area (see Figure 27 for the location of Kawānanakoa). Even though the project area sits at no great elevation (approximately 100 feet [ft] to 500 ft elevation above sea level) above the Honolulu plain it has

Figure 17. Photo of the Pali Road in 1952, photo taken by Werner Story (*Honolulu Advertiser*)

always had the reputation of being far cooler and more pleasant. This relates to the funneling of cooling trade winds through the *nuku* (mountain pass) of the Nu‘uanu *pali*, the very high rainfall gradient that greatly increases the rainfall in the project area above that of the Honolulu plain, and to the cooling shade of the riparian vegetation along Nu‘uanu and Waolani Streams that was in contrast to the dusty, treeless Honolulu plain. The same physical factors that drew Kahahana, Kamehameha III, and Queen Emma to reside in Nu‘uanu also drew the emerging mercantile and governmental aristocracy to reside in this area within a very short horse or buggy ride from the center of government and commerce in Honolulu town.

A series of maps illustrates the dramatic changes that occurred within and in the vicinity of the project area as residence related to western commercial interests supplanted the traditional Native Hawaiian way of life.

An 1855 LaPasse map of Honolulu depicts the lower region of the project area passing through a grouping of residences (Figure 18). A trail leading to the Nu‘uanu Pali, approximating the present project area, is labeled “*Route de Paly*” and is drawn in the lower region of the valley, however, it tapers off. Nothing appears to be in the upper regions of Nu‘uanu Valley.

An 1874 Lyons map of the Luakaha portion of Nu‘uanu (Figure 19) shows the Nu‘uanu Trail approximating *mauka* end of the project area along the Pali Highway but then following the “Old Pali Road” alignment further to the northeast. An *‘auwai* is depicted near the Pali Highway intersection with the Old Pali Road.

An 1870-1885 Brown map of Lower Nu‘uanu (Figure 20) shows taro lands adjacent to the project corridor just southwest of the intersection with a Proposed Road” which would become the present Kuakini Street. Land use was more intense closer to Nu‘uanu Stream to the northwest.

An 1887 W.A. Wall map of Honolulu shows the project area as a formal road called Nu‘uanu Avenue (Figure 21) and also shows Wyllie Street, named after Robert C. Wyllie (foreign minister under Kamehameha IV and Kamehameha V) whose home “Rosebank” was on Nu‘uanu Avenue opposite Wyllie Street. The lower region of the project area appears to be bordered by several homes. A reservoir, two cemeteries, the Royal Mausoleum (Mauna ‘Ala), Judd Street, and Kapena Falls are labeled in the lower region of Nu‘uanu. Further *mauka* of the project area is Queen Emma’s Summer Palace with a couple of other homes and side roads. Although the John T. Waterhouse home on Wyllie Street adjacent to the project area is understood to have been already built (in 1884), it is not depicted on this map.

An 1888 Bishop map of Nu‘uanu Valley (Figure 22) shows a rich patchwork of fields, *‘auwai* and houses along both sides of the project corridor. At least superficially the project area is still a traditional Hawaiian cultural landscape

An 1890 and 1891 Bishop map of Lower Nu‘uanu (Figure 23 and Figure 24) depicts a landscape in transition from a traditional Hawaiian scene of taro fields and traditional widely dispersed houses to larger, western-style house of Honolulu’s political and economic elite.

An 1893 W.A. Wall map of Honolulu shows more development in Nu‘uanu Ahupua‘a (Figure 25). In contrast to the 1887 Wall map, more homes appear to be constructed in the western portion and upper reaches of the valley. The northern portion of the project area appears to be surrounded by cultivated fields. A building labeled “Government Electric Works” appears in the upper reaches

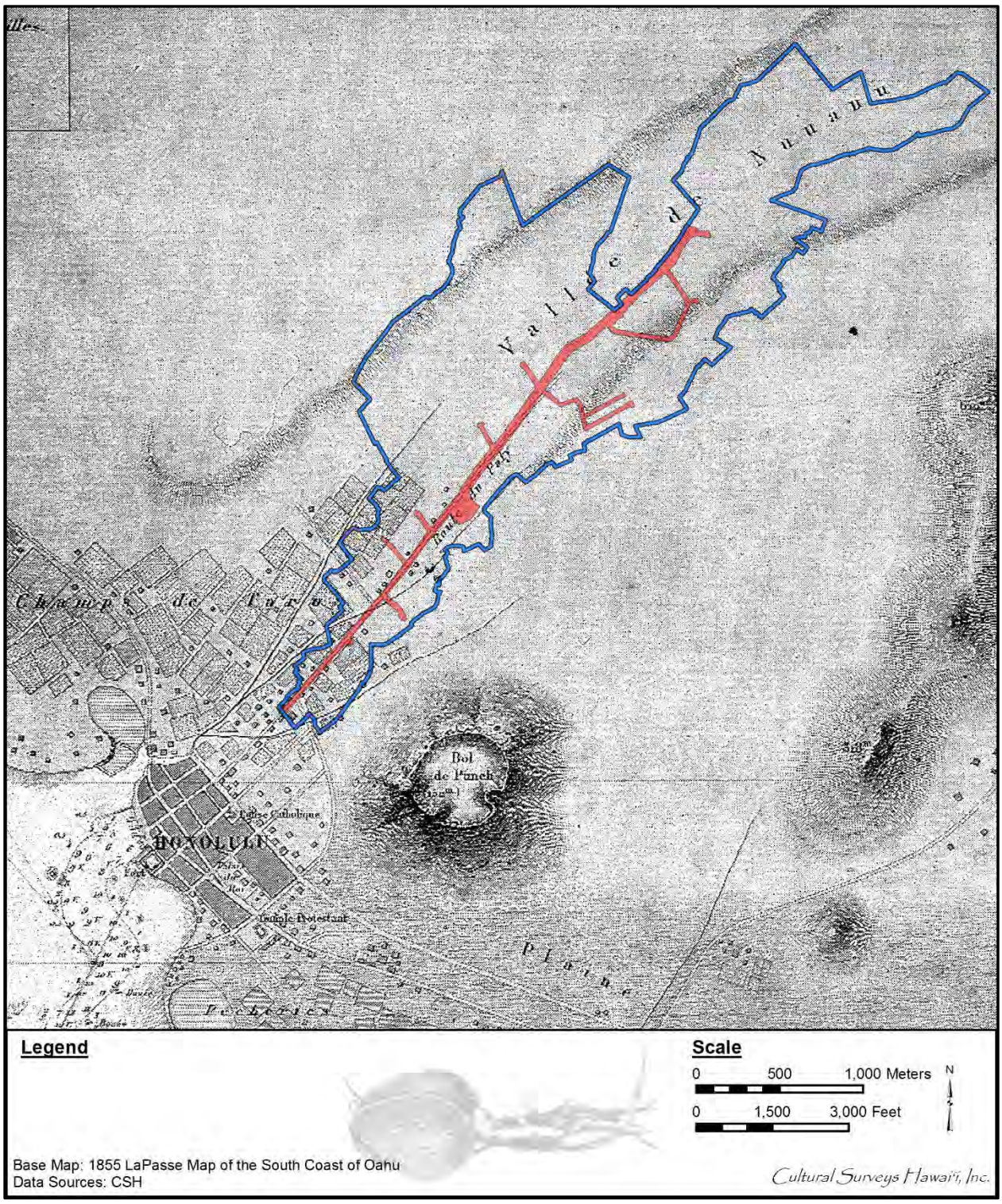

Figure 18. Portion of the 1855 LaPasse map of the South Coast of Oahu showing the project area

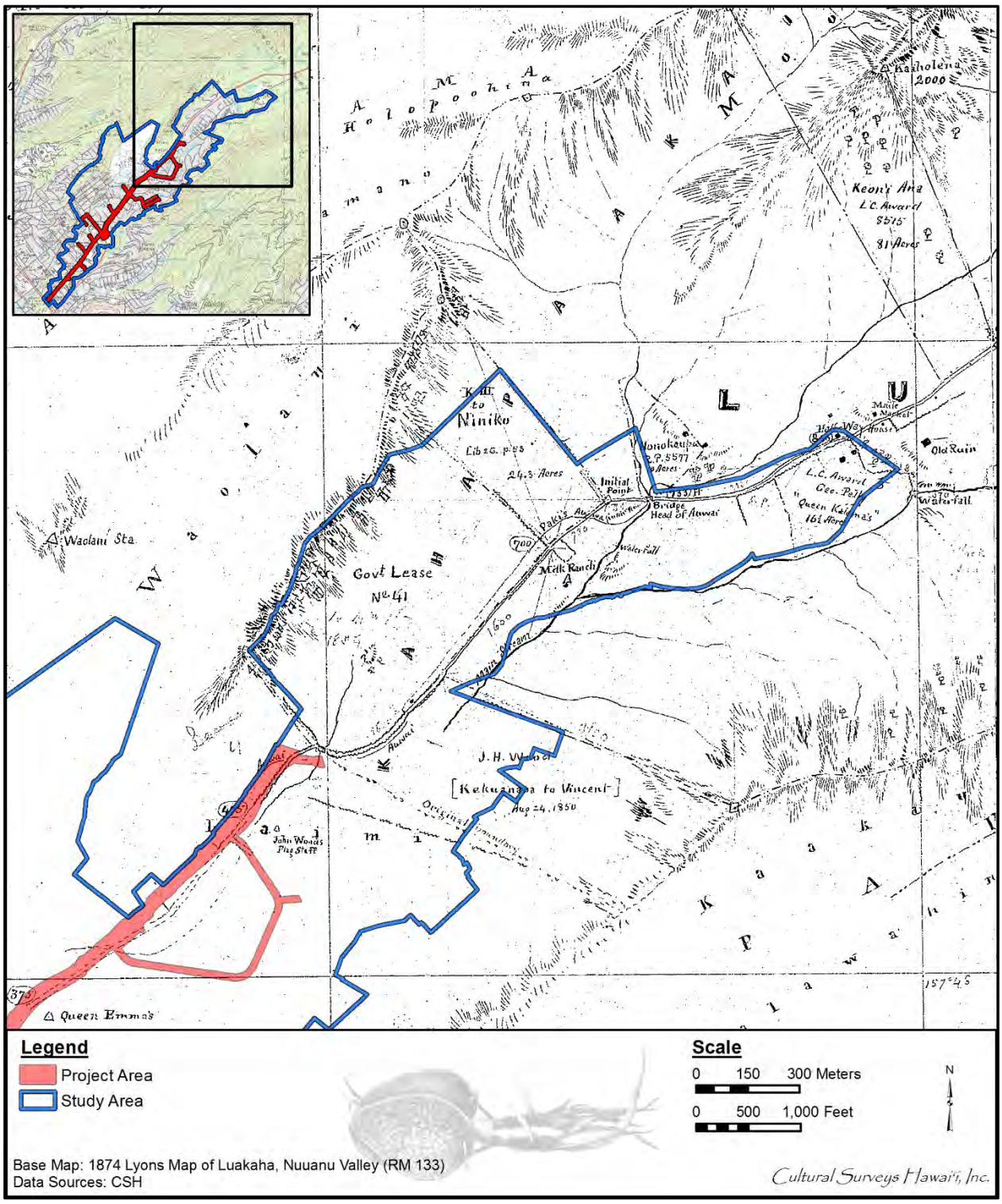

Figure 19. 1874 Lyons map of Luakaha, Nuuanu Valley showing the project area

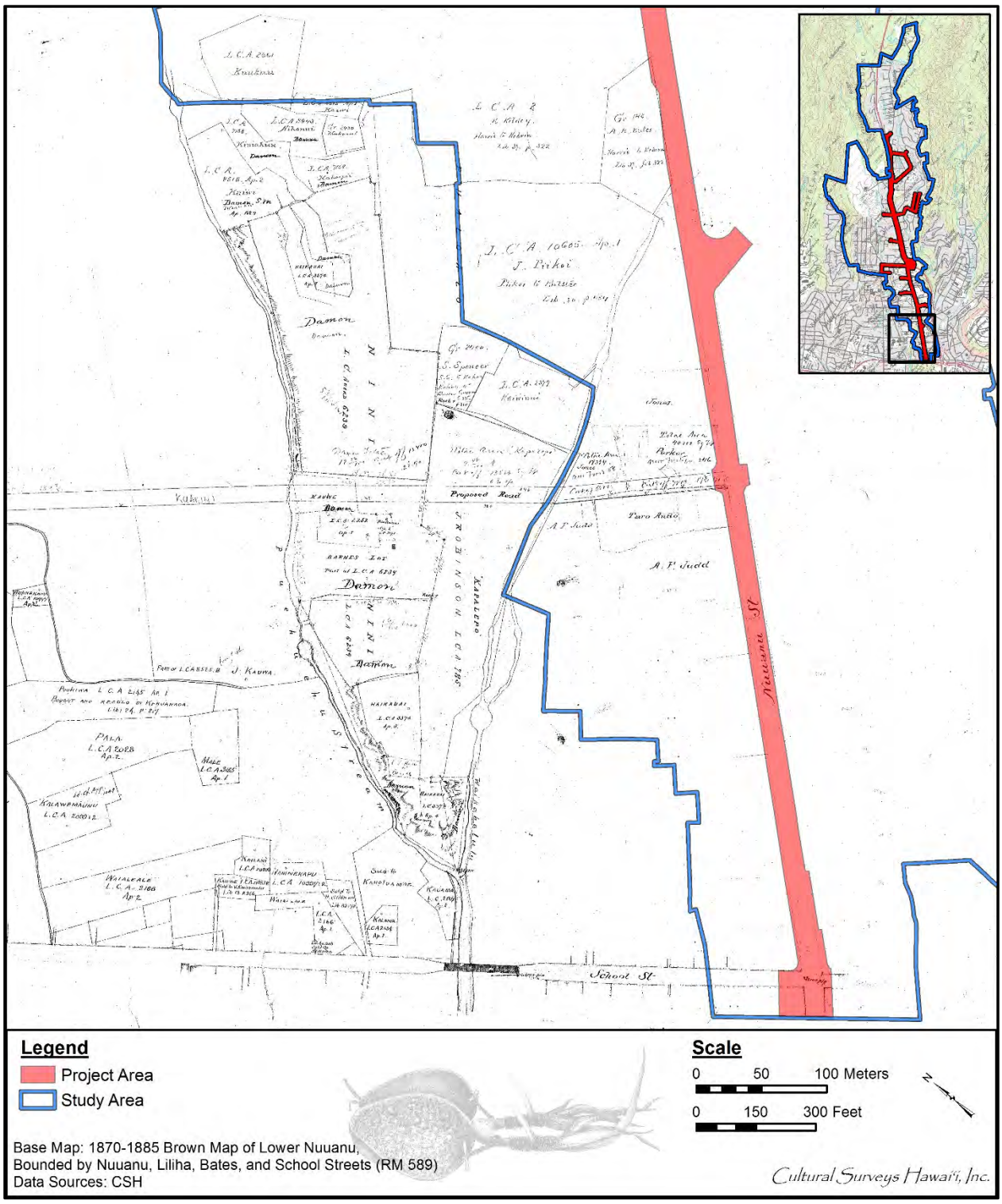

Figure 20. 1870-1885 Brown map of Lower Nu‘uanu, bounded by Nu‘uanu, Liliha, Bates, and School streets showing the project area

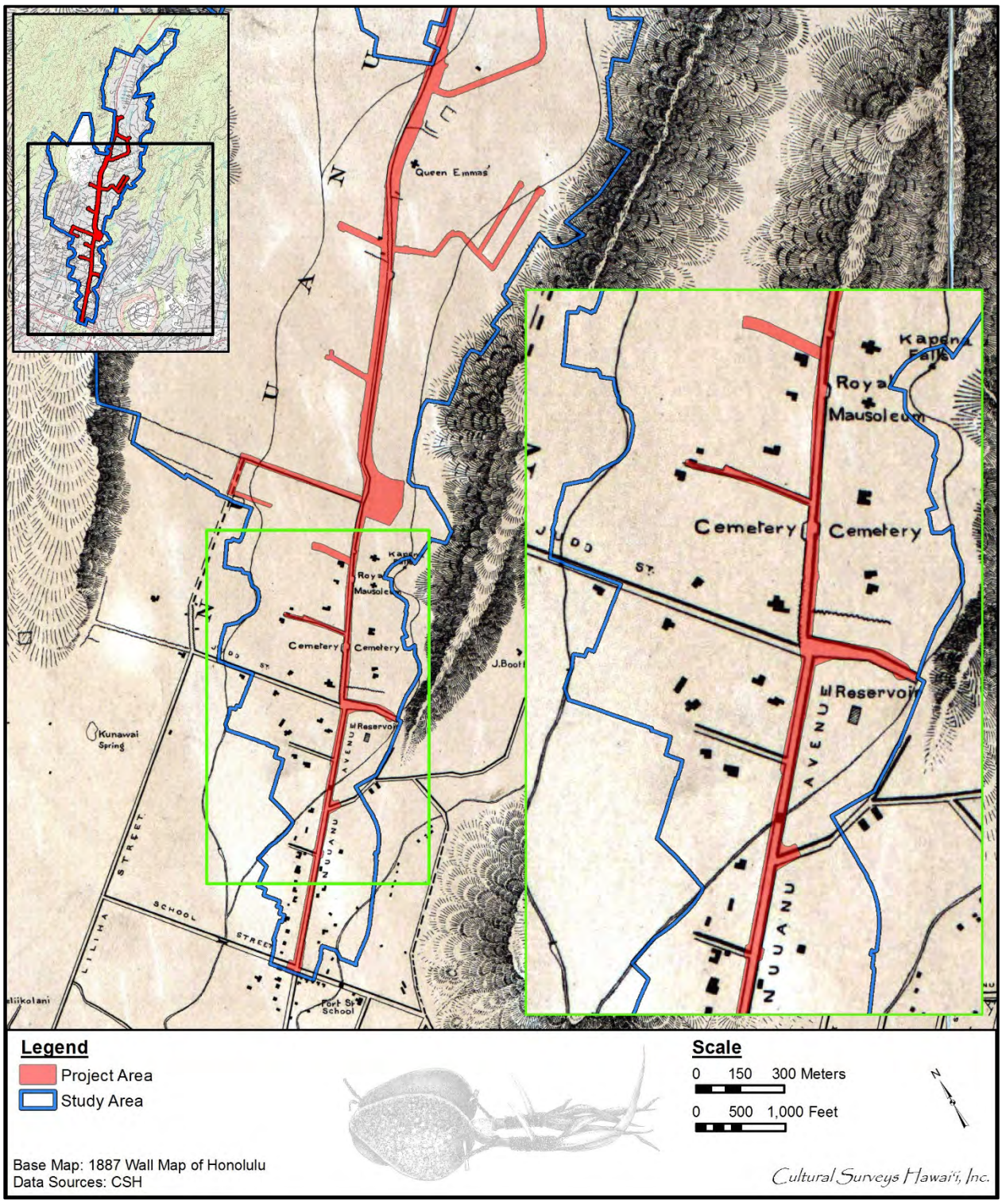

Figure 21. Portion of the 1887 Wall map of Honolulu showing the project area

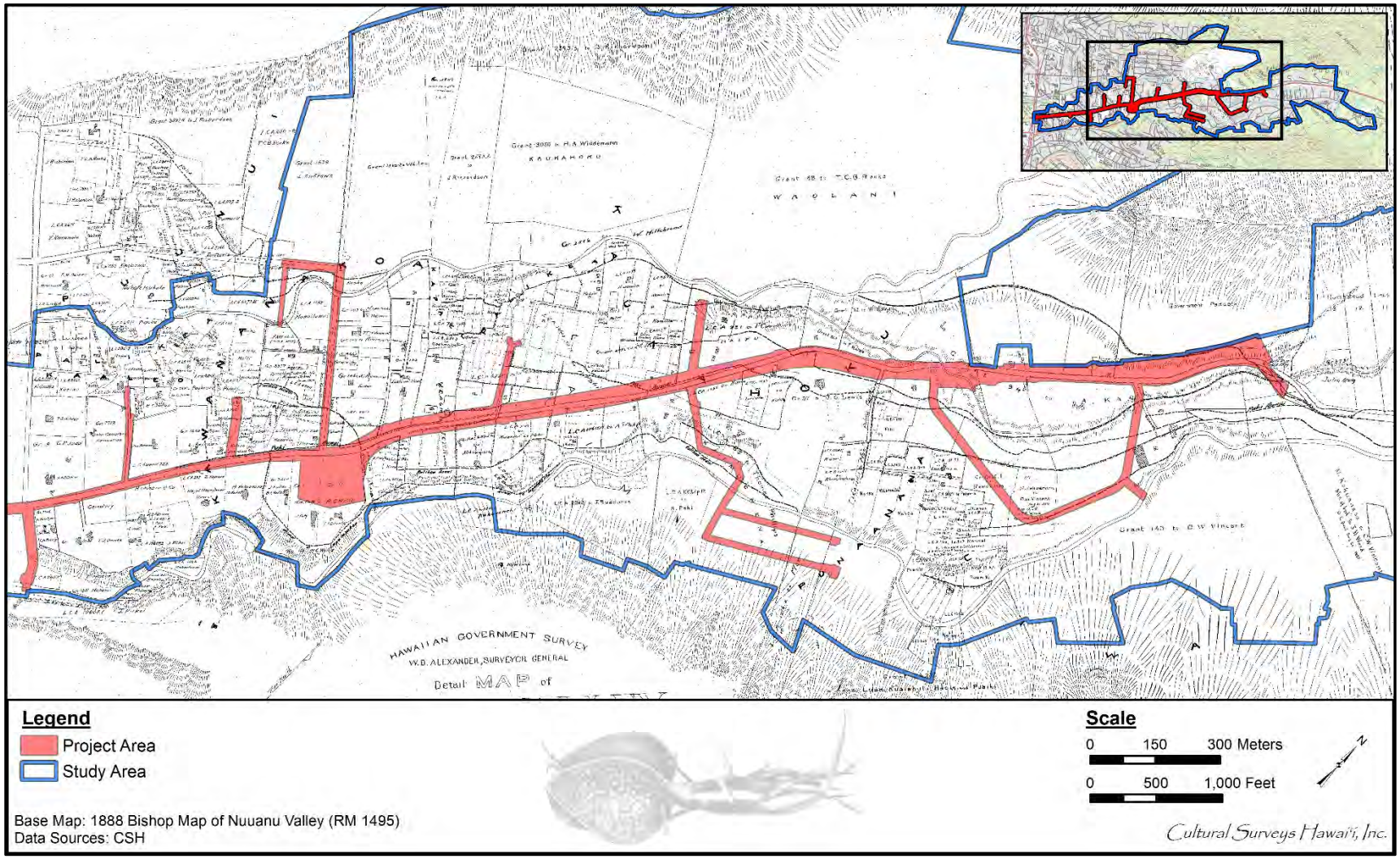

Figure 22. 1888 Bishop map of Nu‘uanu Valley showing the project area

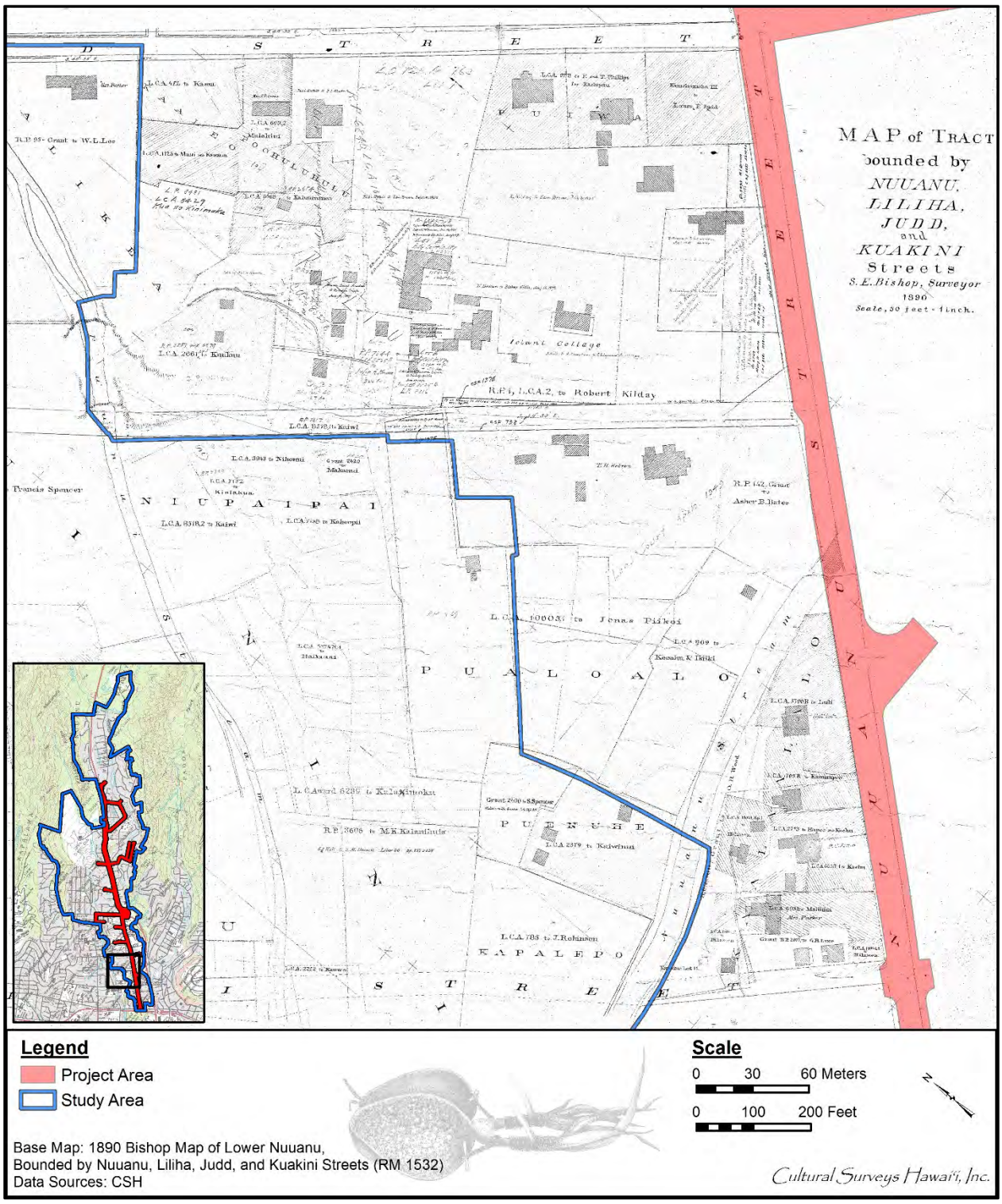

Figure 23. 1890 Bishop map of Lower Nu‘uanu bounded by Nu‘uanu, Liliha, Judd, and Kuakini streets showing the project area

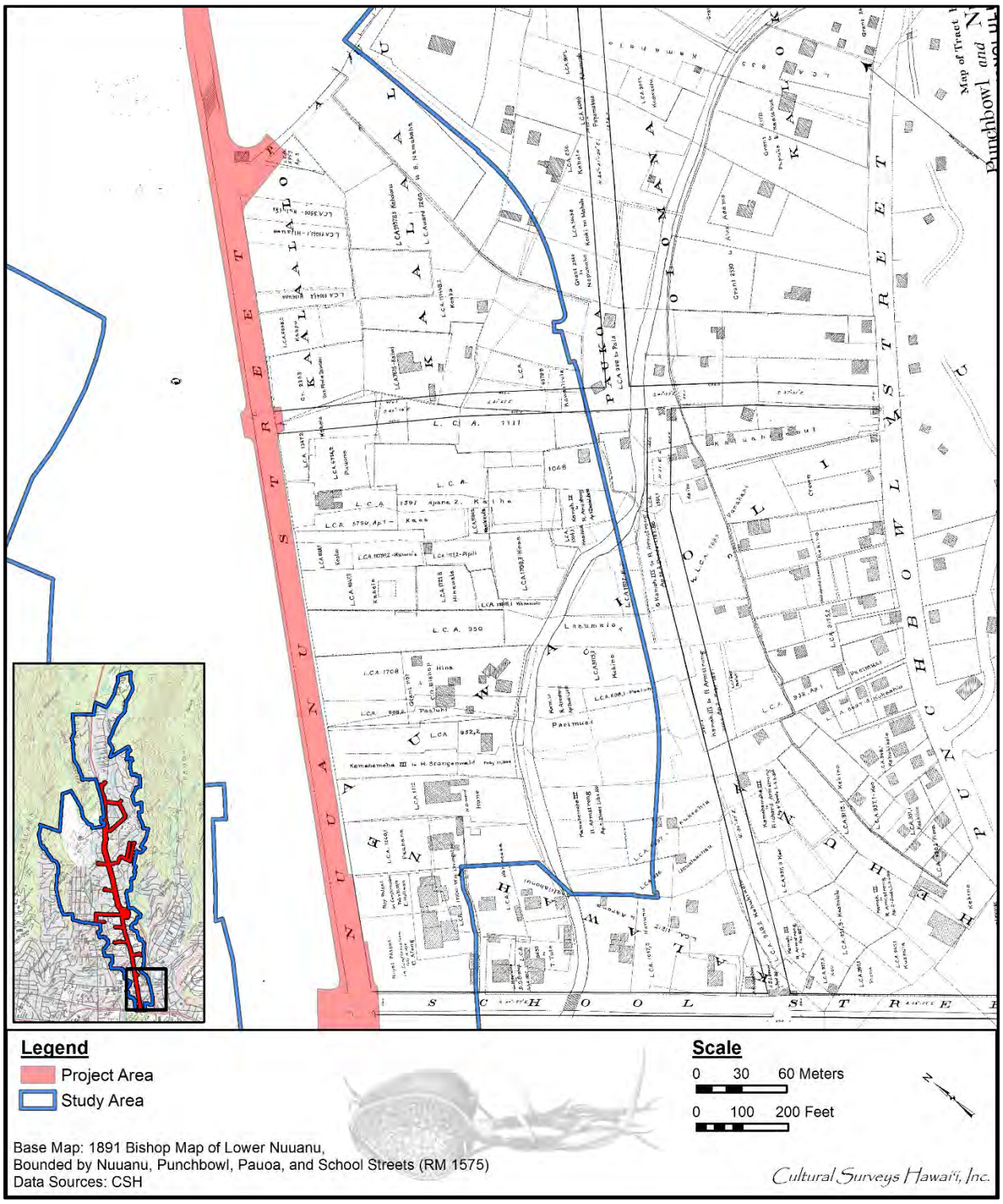

Figure 24. 1891 Bishop map of Lower Nu‘uanu, bounded by Nu‘uanu, Punchbowl, Pauoa, and School streets showing the project area

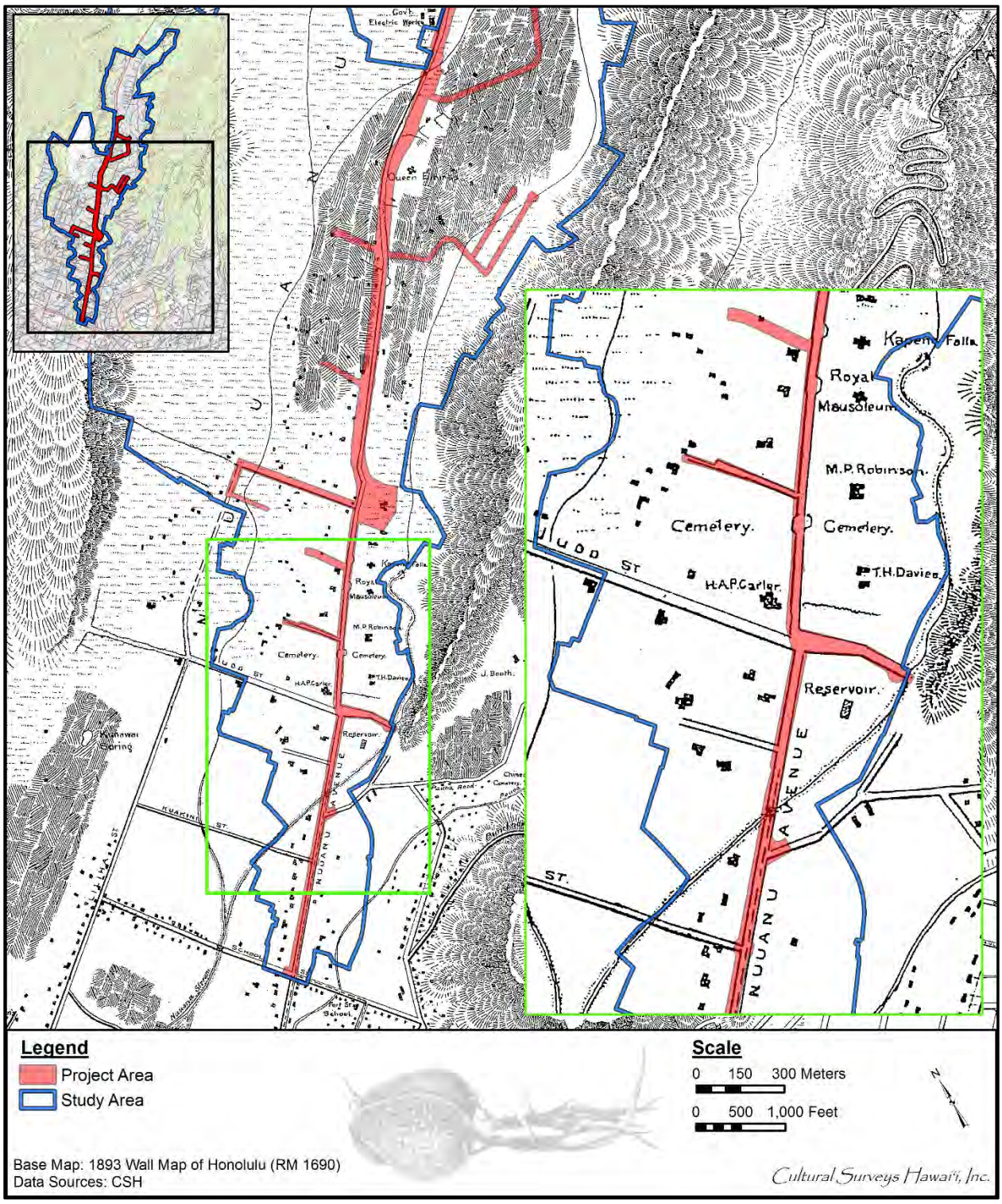

Figure 25. Portion of the 1893 Wall map of Honolulu showing the project area

of Nu‘uanu Ahupua‘a. While the construction of homes is clearly already moving up the valley there is still relatively little residential development. This landscape would soon rapidly change.

An 1893 Wall map of lower Nu‘uanu (Figure 26) shows the southern portion of the project area along Nu‘uanu Avenue in the vicinity of Bates Street and Judd Street. Large homes on large residential lots suggest high status suburban residences.

An 1897 M.D. Monsarrat map of Honolulu shows a densely populated Nu‘uanu Ahupua‘a (Figure 27). The lower region of the project area and the lands *makai* of the project area appear to be heavily populated with homes. The western portion of Nu‘uanu Valley has many side streets and neighborhoods. An extensive grid of streets has been laid out in the Puunui area north of Wyllie Street in the central western study area. The upper region of the project area has several homes near Queen Emma’s Summer Palace as well as a reservoir. The Government Electric Works building is still in the upper reaches of the valley. In addition, a reservoir and dairy are also nearby in the *mauka* reaches. The “Protestant Church” (Maemae Chapel with an associated cemetery is all that remains today) is depicted on the *makai* side of Wyllie Street. The boom in upper class residential construction was underway, primarily in the period from 1903 (when George Roderick of Hackfield and Company built the “H. Alexander Walker residence”) through 1927 (when Territorial Governor George R. Carter built his home). The 1897 map notes the residences of many bigwigs near the present project area including E.R. Bishop, George R. Carter, John A. Cummins, Theo H. Davies, C. Hobron, E.H. Jordan, Paty, M.P. Robinson, Frederick A. Schaefer, Sorenson, J.R. Walker, John T. Waterhouse, and C.L. Wright (Figure 27).

A 1919 U.S. Army War Department Fire Control map depicts a very heavily populated Nu‘uanu Ahupua‘a (Figure 28). The project area is still labeled Nu‘uanu Avenue. The lower portion of the project area is surrounded by homes and the Puunui grid of streets *mauka* of Wyllie Street is being filled in with homes but the mauka portion of Nuuanu Avenue is still sparsely populated. The inclusion of walls can be found east, west, and north of the project area.

A 1920 Monsarrat map of Honolulu (Figure 29) shows all of the streets of the project area as built with the exception of Kawānanakoa Place and Ahi Place. The indicated “proposed Circle Drive” on the west side of Nu‘uanu Avenue was never built. A “Country Club” (Oahu Country Club) is shown in Waolani Valley. Notably all of the several names of home owners indicated are *haole* (Euro-American). The traditional Hawaiian landscape has been almost entirely lost.

A 1933/36 U.S. Army War Department Fire Control map shows a heavily populated Nu‘uanu Ahupua‘a in both the lower and upper regions (Figure 30). The “Dowsett Tract” within the Dowsett Avenue loop at the north end of the project area now has many homes (compare with the 1919 map shown in Figure 28 which shows almost no residences in the Dowsett Tract). The Oahu Country Club is also labeled on the map to the west study area.

A 1943 U.S. Army War Department Fire Control map indicates a heavy population throughout Nu‘uanu Ahupua‘a (Figure 31). The Pacific Heights area between Nu‘uanu and Pauoa Ahupua‘a is filled with homes. All streets of the project area are now in place except for Ahi Place.

A 1953 USGS map (Figure 32) shows much the same scene but all streets of the project area are now in place with a re-alignment of Ahi Place.

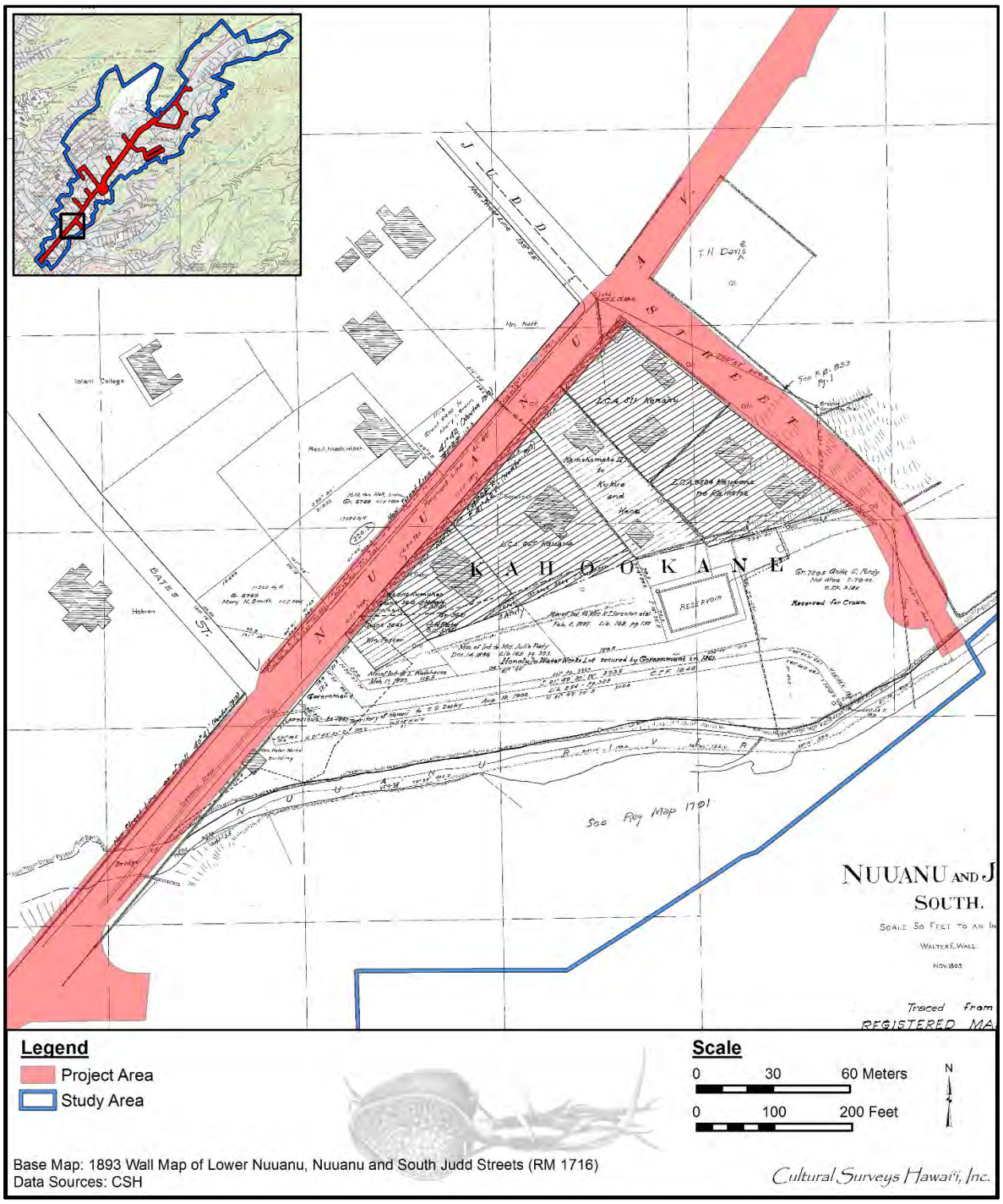

Figure 26. Portion of the 1893 Wall map of Lower Nu‘uanu, Nu‘uanu and south Judd streets showing the project area

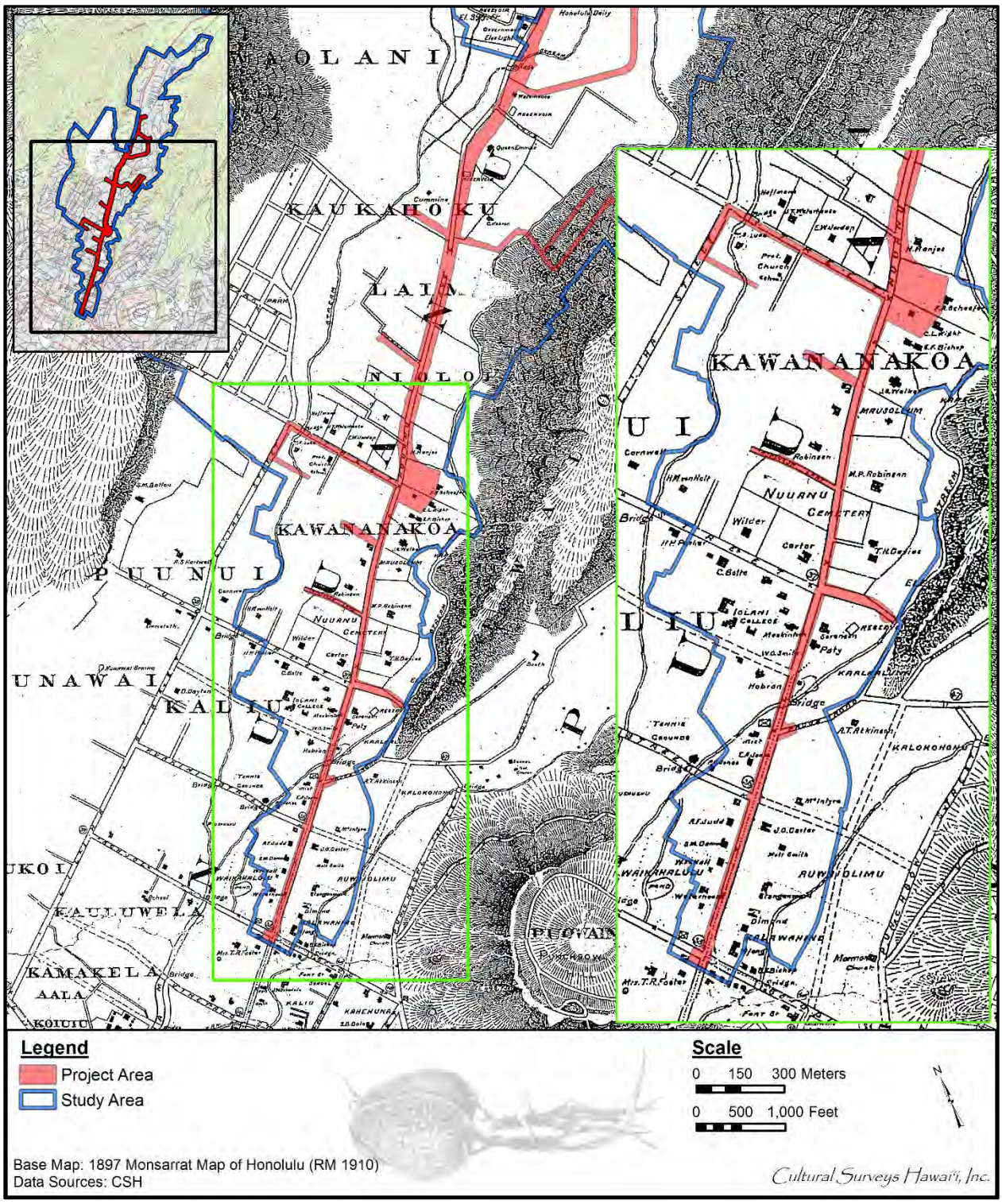

Figure 27. Portion of the 1897 Monsarrat map of Honolulu showing the project area

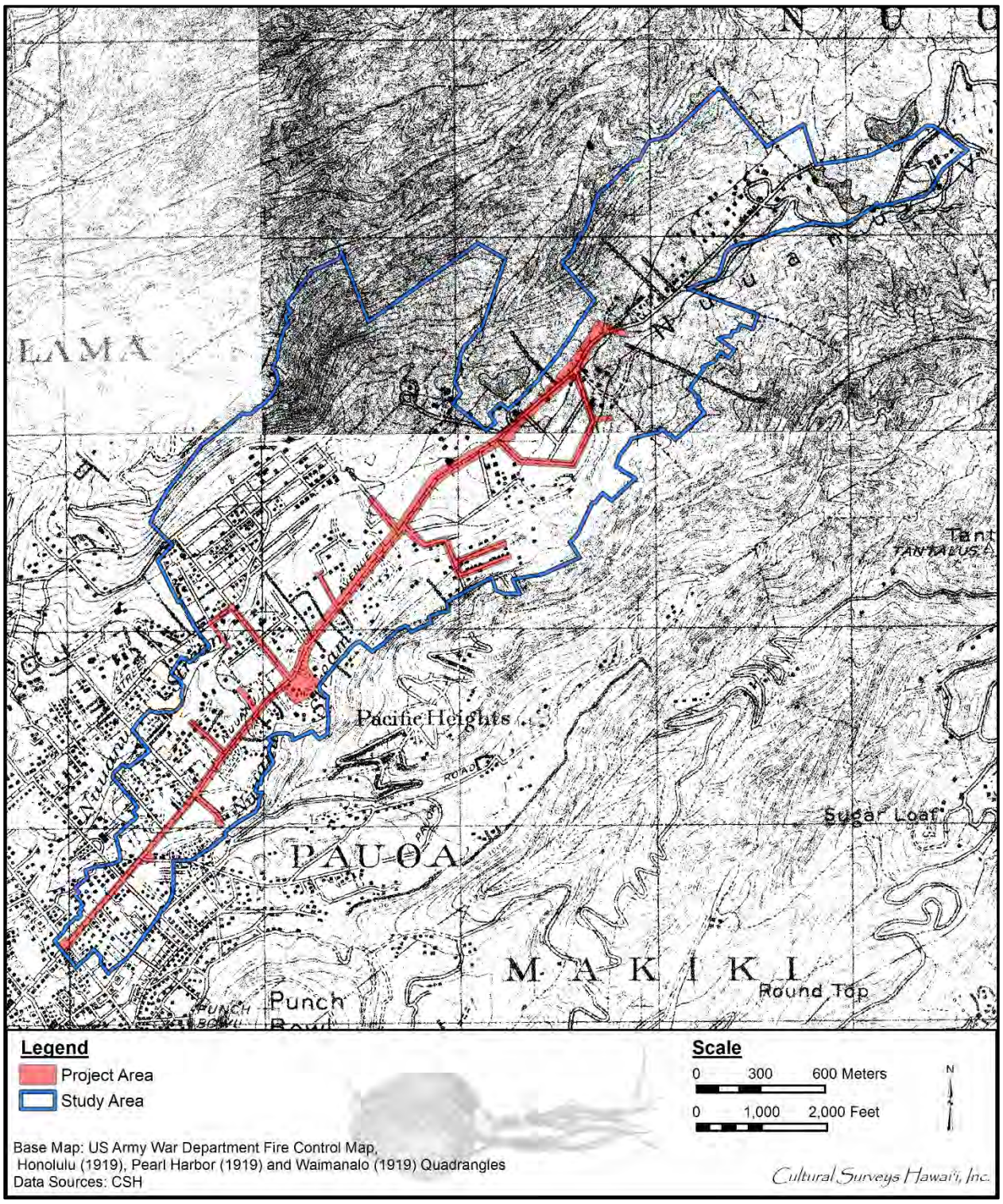

Figure 28. Portion of the 1919 U.S. Army War Department Fire Control map, Honolulu, Pearl Harbor, and Waimanalo quadrangles showing the project area

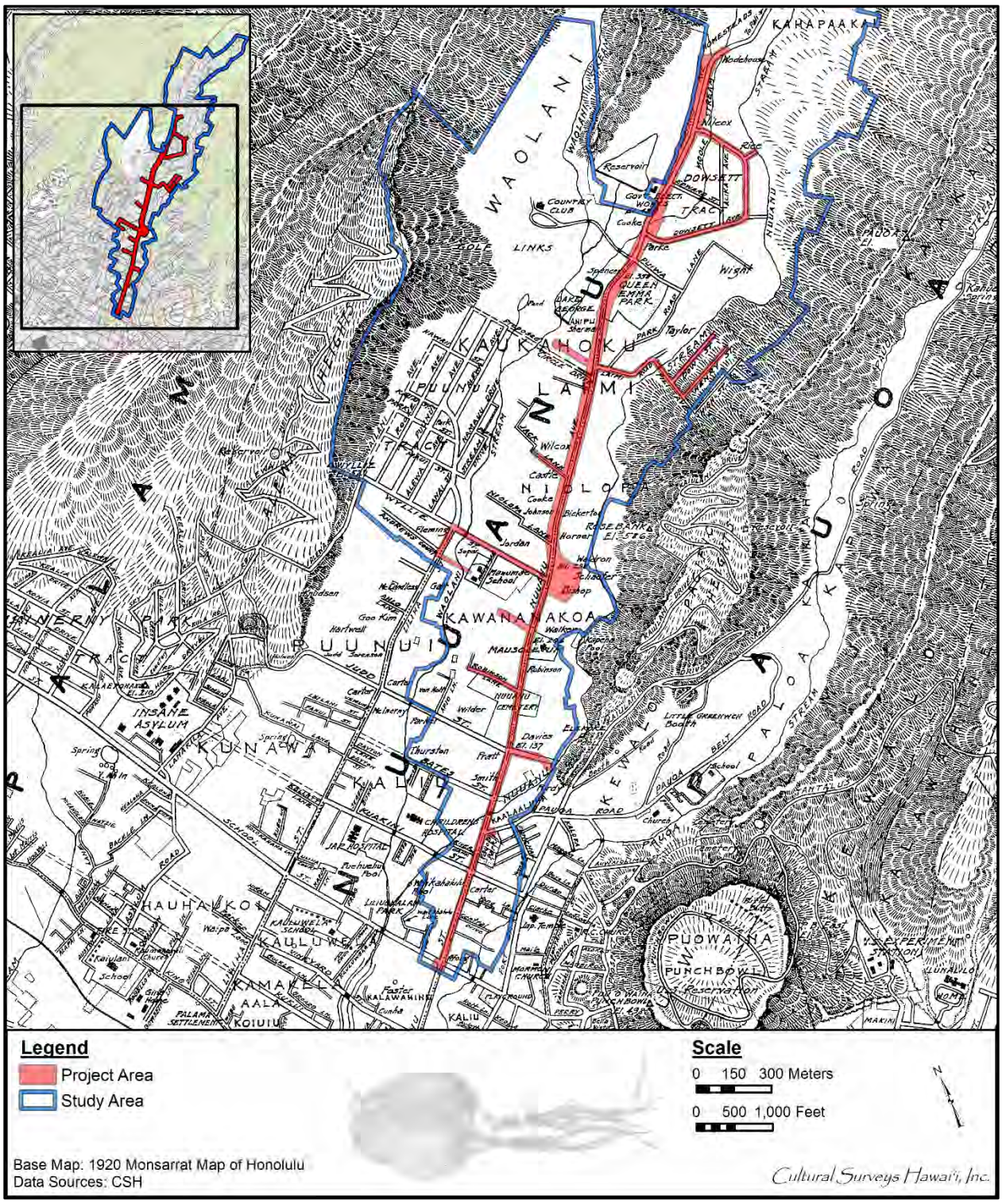

Figure 29. 1920 Monsarrat map of Honolulu showing the project area

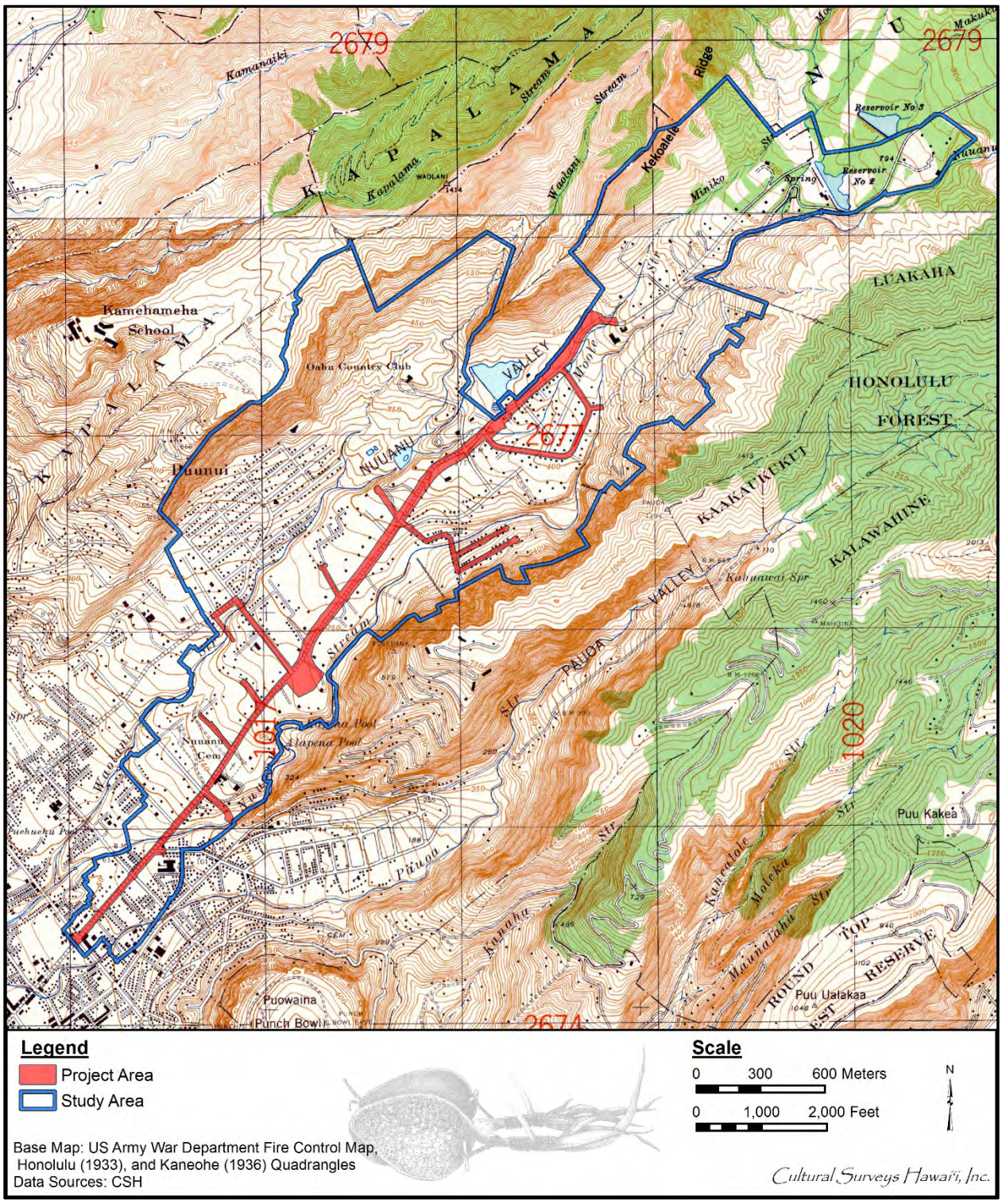

Figure 30. Portion of the 1933/1936 U.S. Army War Department Fire Control map, Honolulu (1933) and Kaneohe (1936) quadrangles showing the project area

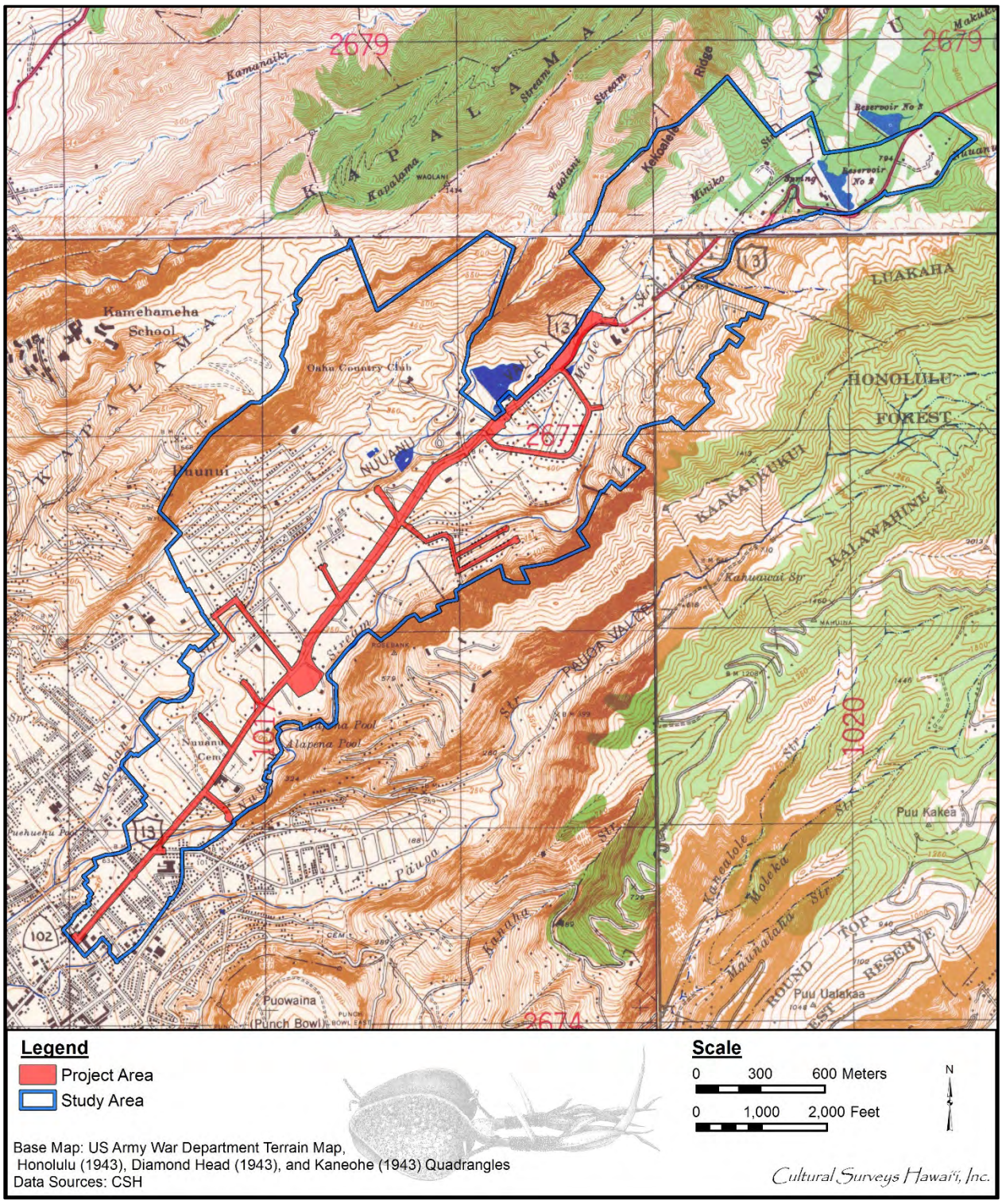

Figure 31. Portion of the 1943 U.S. Army War Department Terrain map, Honolulu, Diamond Head, and Kaneohe quadrangles showing the project area

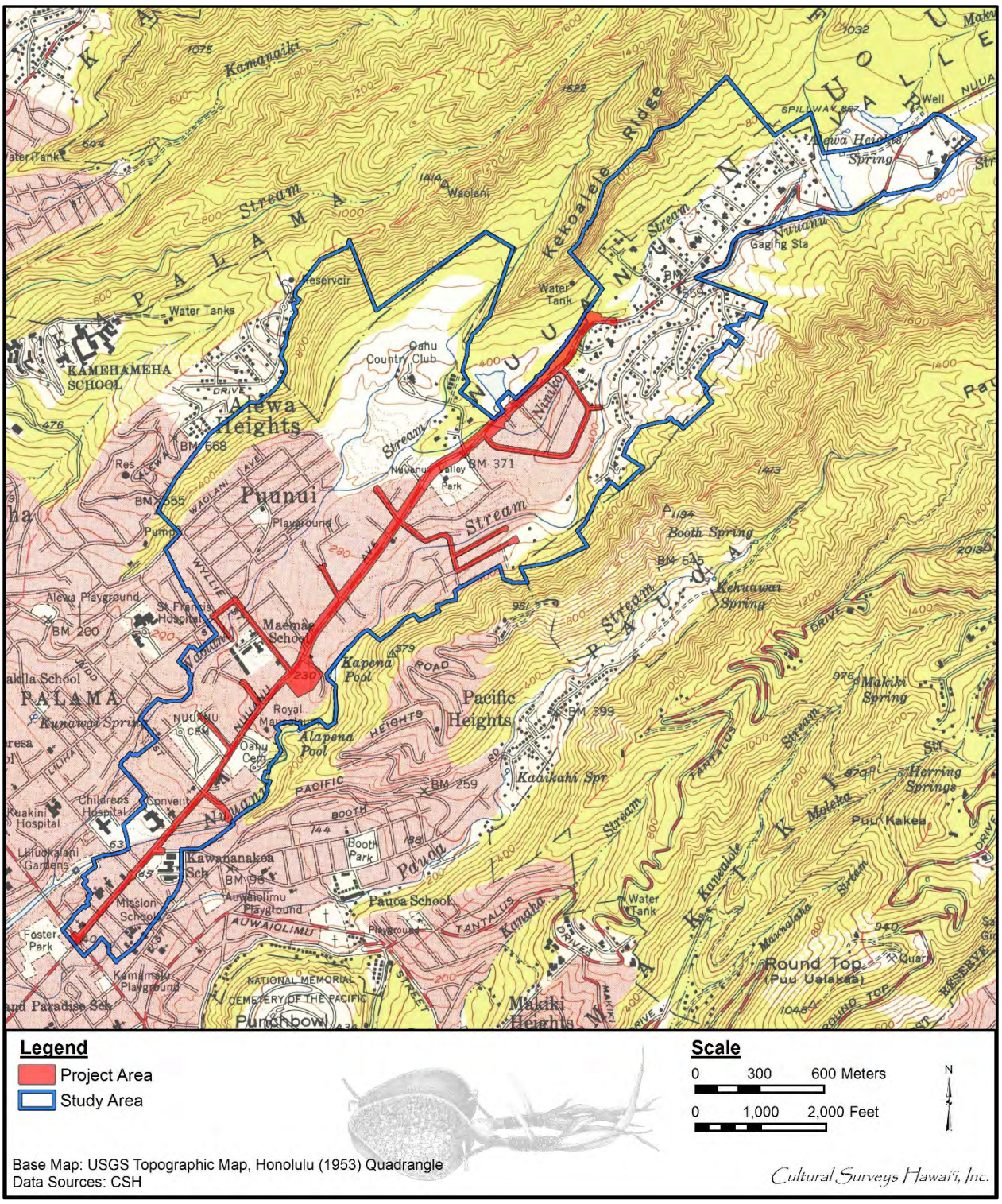

Figure 32. Portion of 1953 Honolulu USGS topographic quadrangle showing the project area

A 1959 aerial photograph (Figure 33) most notably shows the new “Pali Highway” established extending northeast (*mauka*) of the project area. The Pali highway southwest (*makai*) of Wyllie Street has not been built yet.

A 1963 USDA Aerial Survey photograph depicts a heavily populated Nu‘uanu and Pauoa Ahupua‘a (Figure 34). The entire Pauoa Valley consists of homes including the upper reaches. The Pacific Heights area is also heavily populated. The Pali Highway is visible and takes up the majority of the project area until it reaches the Wyllie Street Interchange where it now continues south of the project area. The Wyllie Street Interchange appears to still be under construction. Nu‘uanu Ahupua‘a now has many homes in the upper and lower reaches of the valley.

A 1968 USGS Aerial Survey photograph (Figure 35) shows few changes from the 1963 USDA Aerial Survey photograph (see Figure 34). The only difference is another road has been constructed west of ‘Ālewa Heights. The windy road snakes *mauka*.

A 1969 USGS map (Figure 36) and a 1978 aerial photograph (Figure 37) basically show the same configuration of streets and homes as prevails today.

Several homes of Honolulu’s gentry adjacent to the project area have been placed on the Hawai‘i Register of Historic Places (see Figure 40 and Figure 41) including (in order of construction) the John T. Waterhouse home (1884), the H. Alexander Walker residence (1903), the George Robert Ewart home (1906), the Thomas Alexander Burningham home (1910), the Thomas Victor King home (1918), the Richards/Goodale/Carter home (1921), the Isabelle Jones home (1924), the Louis and Marjorie Stephens home (1926), and the George R. Carter home (1927).

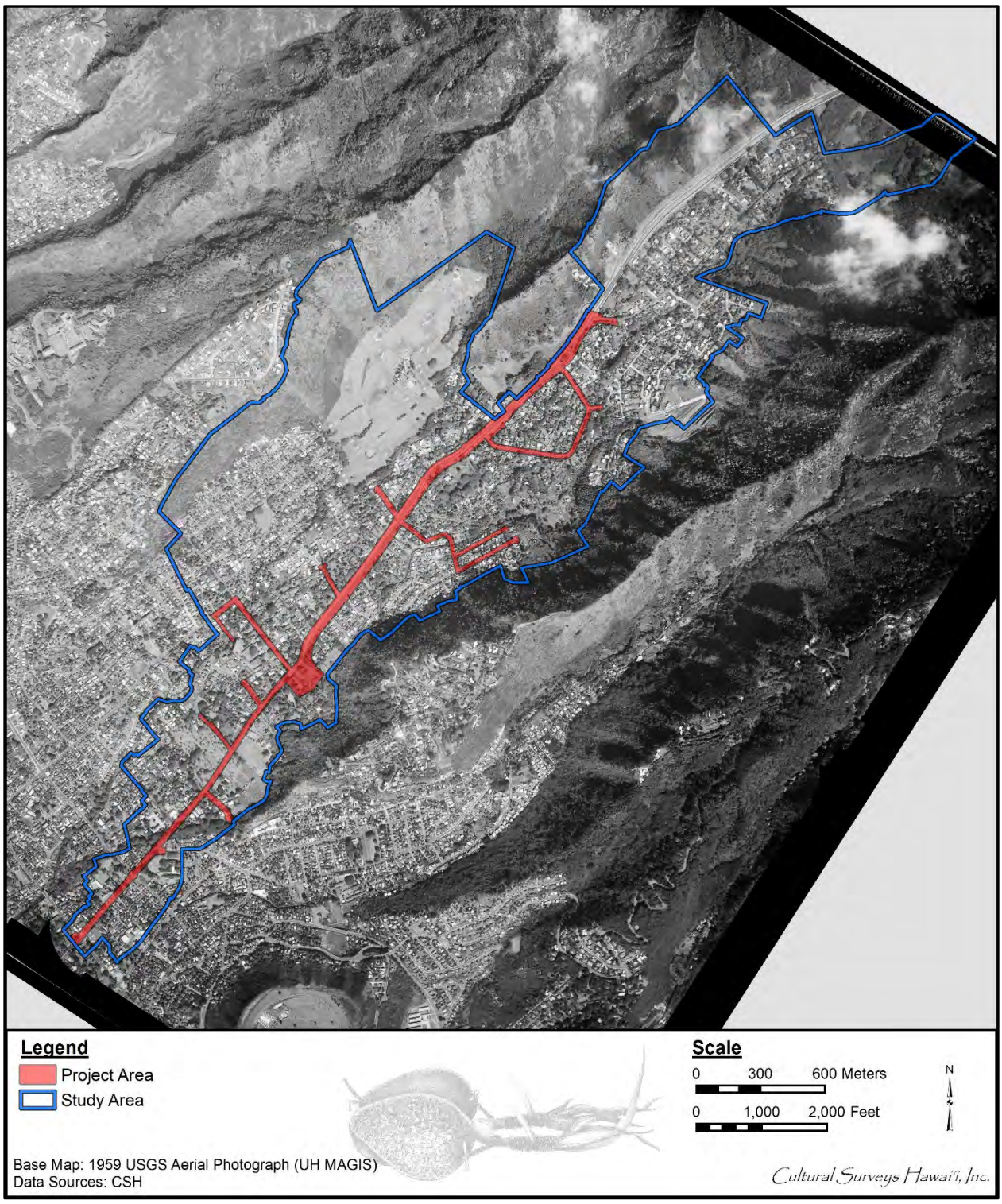

Figure 33. 1959 USGS aerial photograph (UH MAGIS) showing the project area

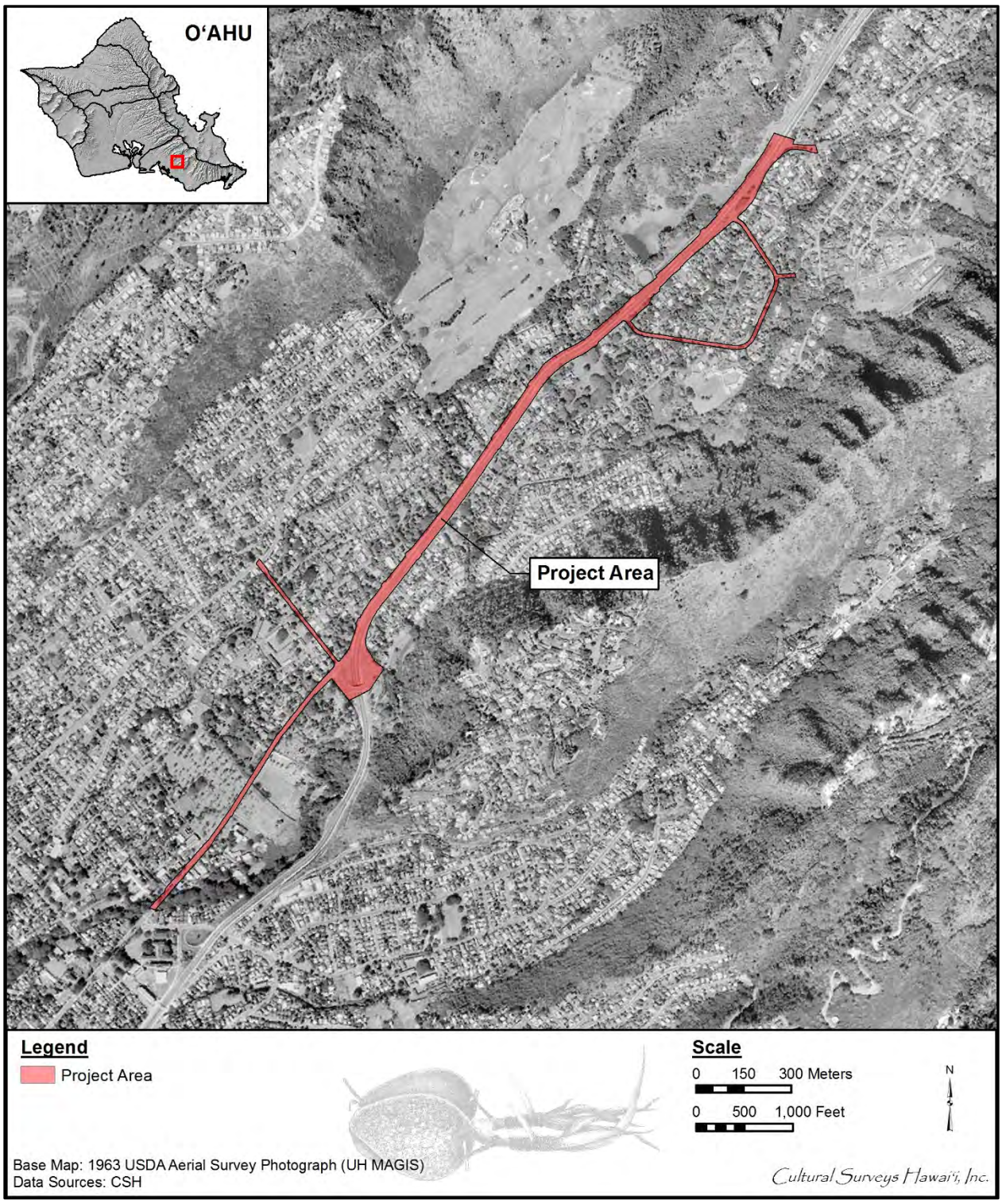

Figure 34. Portion of the 1963 USDA Aerial Survey photograph (UH MAGIS) showing the project area

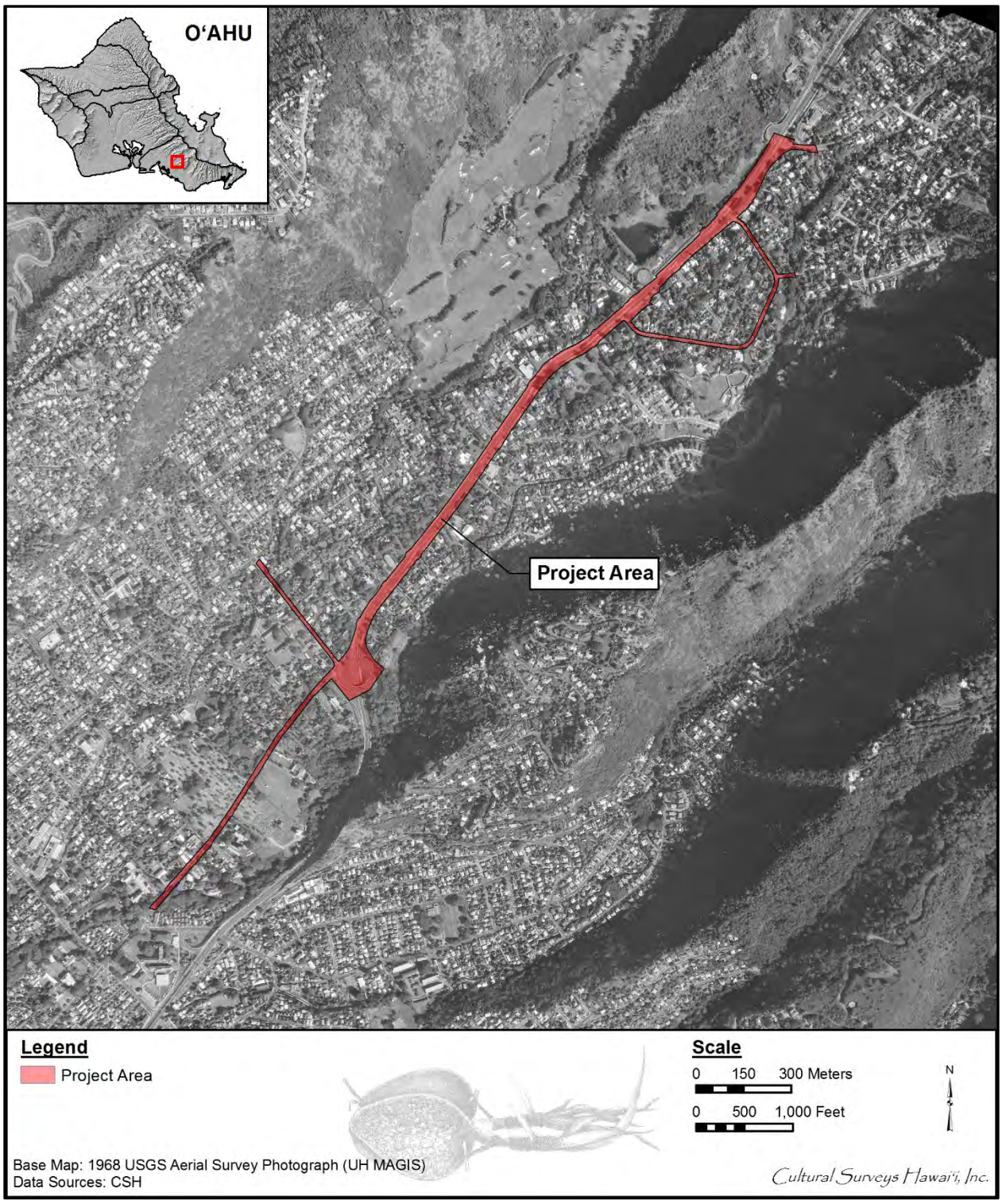

Figure 35. Portion of the 1968 USGS Aerial Survey photograph (UH MAGIS) showing the project area

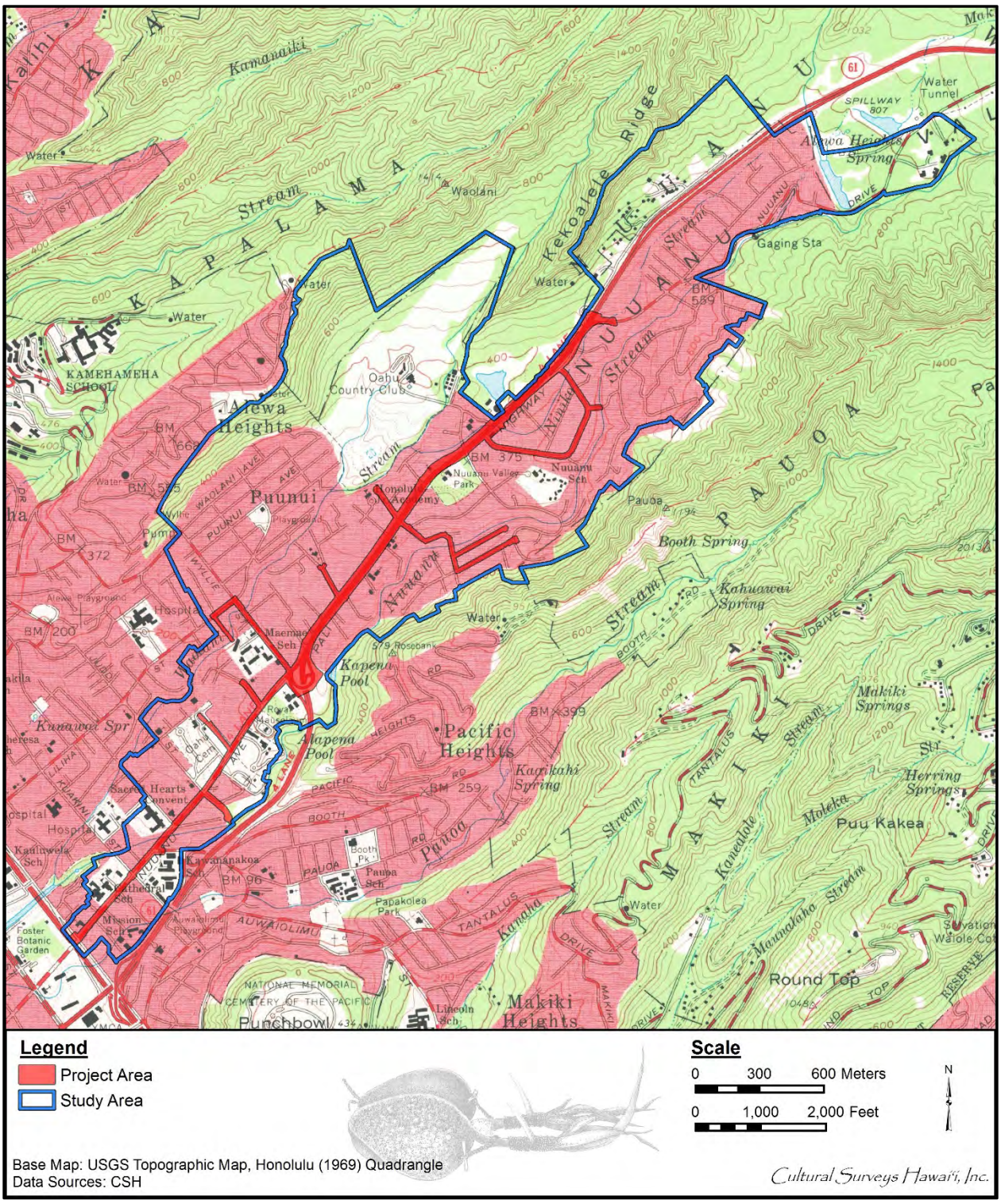

Figure 36. Portion of 1969 Honolulu USGS topographic quadrangle showing the project area

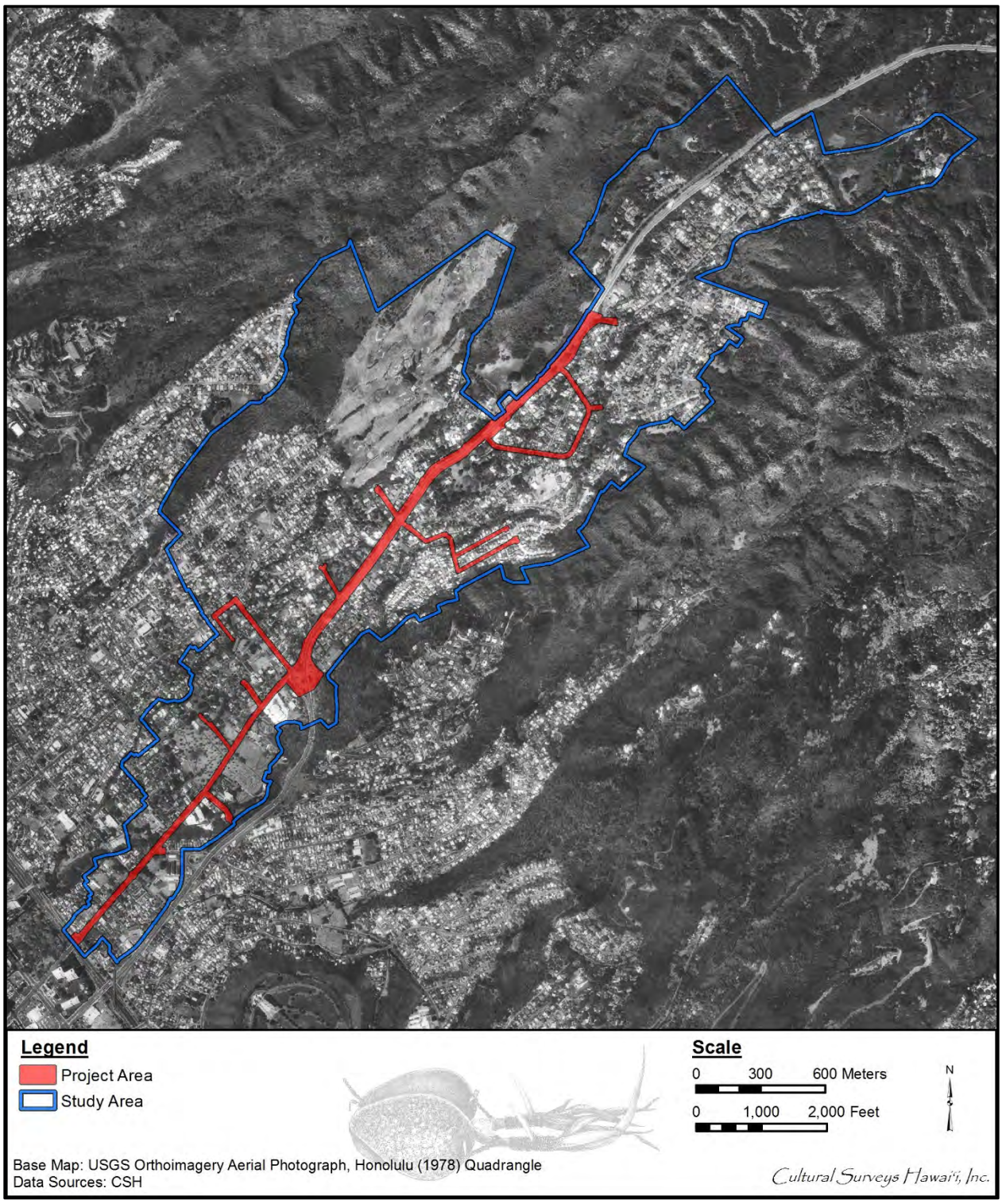

Figure 37. 1978 USGS Orthoimagery aerial photograph, Honolulu quadrangle showing the project area

Section 5 Previous Archaeological Research

Extensive archaeological work has been undertaken in Nu‘uanu Valley over the last century. Most of this work has been concentrated in lower Nu‘uanu Valley, nearest to the urban areas of Honolulu. Previous archaeological studies are depicted on Figure 38. Due to the large number of previously identified historic properties, only those within 500 m of the project area are discussed below. Archaeological sites and historic buildings within the project vicinity are depicted on portions of a USGS 7.5-minute topographic map (Figure 39). Previous archaeological studies are described in detail below and are summarized on Table 2.

5.1 *Heiau* and Other Early Recorded Sites in Nu‘uanu

Numerous *heiau* were once located in Nu‘uanu. Most have been lost or destroyed. Sources report varying numbers and the correlation between legendary accounts, traditional place names, historical reports, and archaeological sites is unclear. Kamakau (1992) mentions six *heiau*, four within Waolani Valley and two on the ridge surrounding the valley. Thrum (1906:45) mentions two *heiau*, one in Waolani Valley called Kawaluna and one in Nu‘uanu Valley called Makūkū. McAllister mentions two *heiau*, both in lower Nu‘uanu Valley, *makai* of Wyllie Street. Some individuals place the *heiau* of Kaheiki in Nu‘uanu, although most place it on Pacific Heights, in Pauoa Ahupua‘a (McAllister 1933:82).

Rayna Raphaelson’s (1925) account of the battle of Nu‘uanu (see Section 3.5) describes Kamehameha’s forces capturing or destroying seven *heiau* on their push to the ridge. 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 Pū‘iwa, the name of the surrounding *‘ili*), near Queen Emma’s Summer Palace, “Hānaiakamala,” where Kamehameha’s warriors rested. The opposing force under the O‘ahu chiefs were pushed back to a fifth *heiau*, at the mouth of Waolani Valley.

Raphaelson (1925) claimed there were at least two *heiau* in Waolani. The first was Kakanaiakeakea Heiau, which was named after the *ali‘i* for whom it was built. The other was Kawaluna, which was consecrated by Kuali‘i around 1685. The seventh and last *heiau* 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.

Some of the seven structures that Raphaelson mentions may have been hill forts rather than *heiau*. South of the country club there are two small hills called Ha‘ipu and Ahipu‘u, often described as *heiau*. A long-term resident of the area claimed the following:

> 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. [Hawaiian Ethnological Notes n.d.]

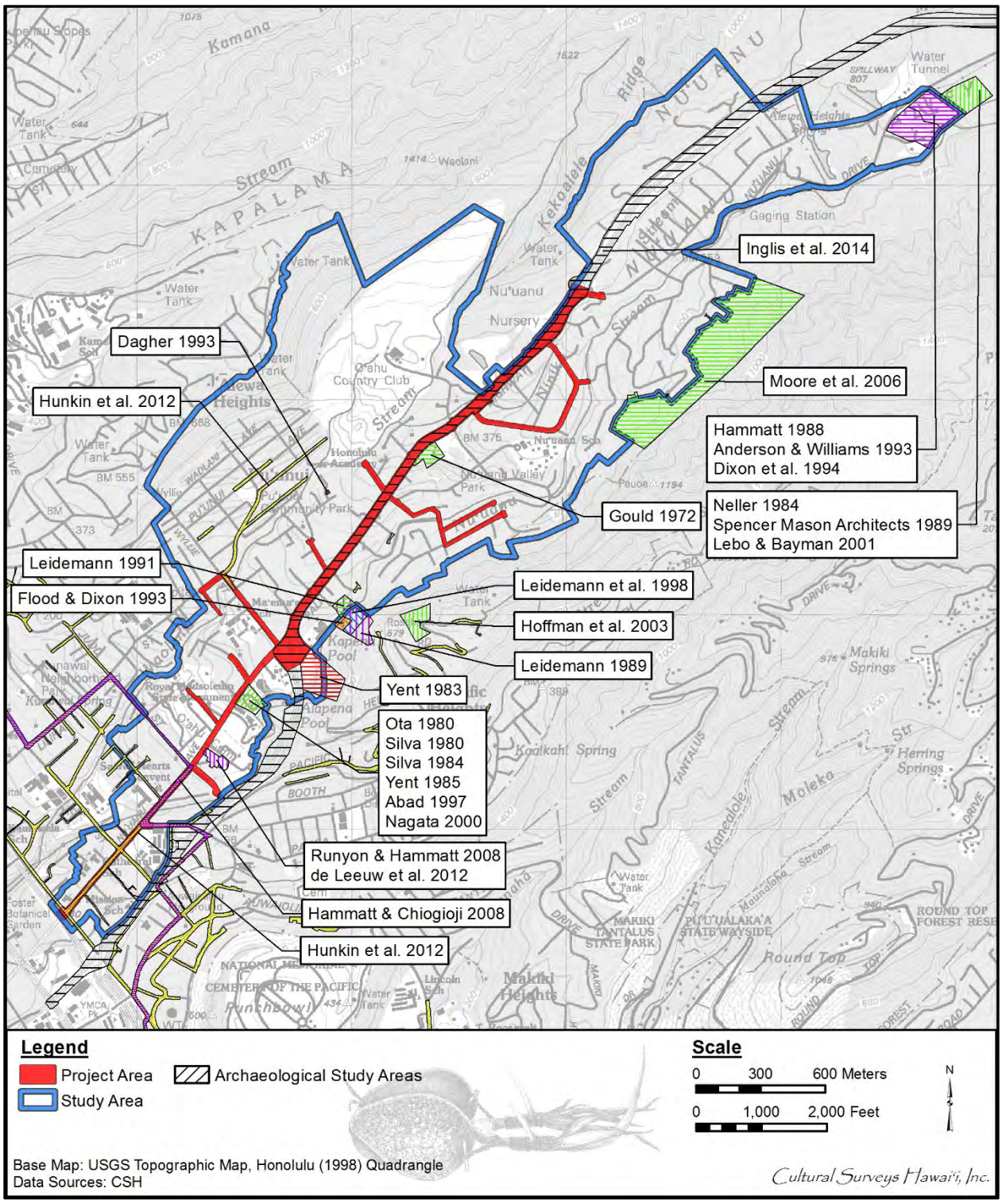

Figure 38. Portion of the 1998 USGS 7.5-minute topographic quadrangle depicting previous archaeological studies in the vicinity of the project area

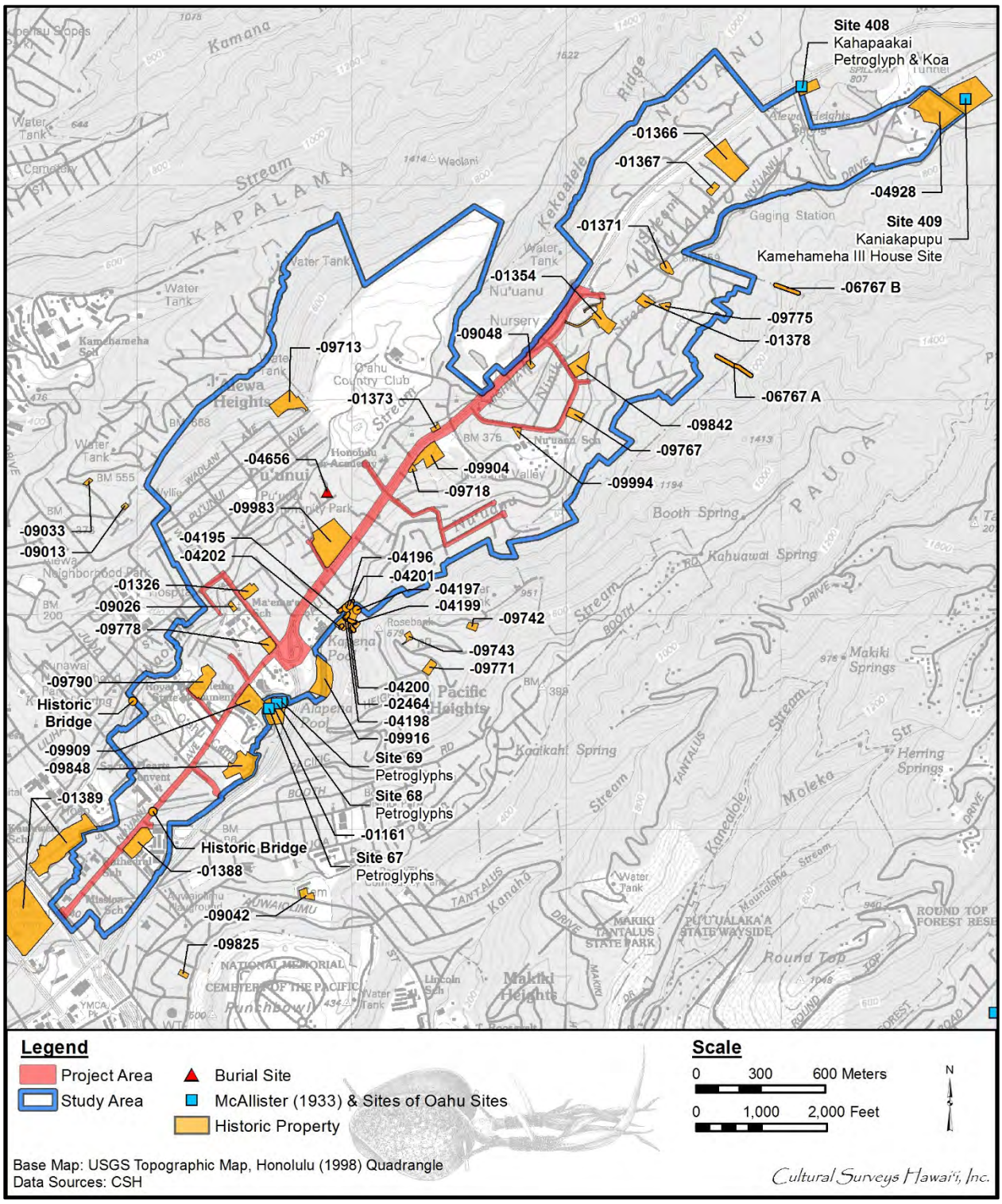

Figure 39. Portion of the 1998 Honolulu USGS 7.5-minute topographic quadrangle showing previously identified historic properties in the vicinity of the project area

Table 2. Descriptions of Previous Archaeological Studies within the Vicinity of the Project Area

Reference	Type of Study	Location	Results (SIHP # 50-80-14)
Thrum 1906	*Heiau* study	Kawaluna and Makuku Heiau	Two *heiau*, one in Waolani Valley and one in Nu‘uanu Valley
McAllister 1933	Island-wide archaeological survey	TMK: [1] 2-2-021:007; Nu‘uanu Petroglyph Complex along Pali Hwy	SIHP # -1161; McAllister Sites 67, 68, and 69; Nu‘uanu Petroglyph Complex; petroglyphs mainly human figures and some animal figures, probably dogs in three locations
		TMK: [1] 1-9-007:002 (por.); Kahapaakai Complex along Pali Hwy	SIHP # -0408; McAllister Site 408; Kahapaakai Complex includes a petroglyph and an enclosure
		TMK: [1] 2-2-054:001; Summer Palace of Kamehameha III	SIHP # -0409; McAllister Site 409; Kaniakapūpū, the summer place of Kamehameha III
Gould 1972	Archaeological field school notes	TMK: [1] 2-2-034:027; Queen Emma’s Summer Palace	SIHP # -9904; Hānaiakamalama, Queen Emma’s Summer Palace nominated to National Register in 1970; 1972 field school excavated two trenches on the property
Ota 1980	Archaeological monitoring	TMK: [1] 2-2-021:012; Royal Mausoleum, Mauna ‘Ala	SIHP # -9909; archaeological monitoring and subsurface work; human remains and traditional and historic artifacts found in trenches along exterior walls
Silva 1980	Archaeological reconnaissance	TMK: [1] 2-2-021:012; Royal Mausoleum, Mauna ‘Ala	SIHP # -9909; historical research on Mauna ‘Ala
Yent 1983	Archaeological reconnaissance	TMK: [1] 2-2-022:002; Clent Heath Estate, Waldron Home	SIHP # -9916; historic research and reconnaissance identified exotic plants around house built by Jack Waldron in 1910-1911
Neller 1984	Archaeological reconnaissance	TMK: [1] 2-2-054:001, Kaniakapūpū, Luakaha	This reconnaissance survey provided data for the Neller and Napoka (1986) National Register Nomination

Reference	Type of Study	Location	Results (SIHP # 50-80-14)
Silva 1984	Archaeological reconnaissance	TMK: [1] 2-2-021:012; Royal Mausoleum, Mauna ‘Ala	SIHP # -9909; archaeological monitoring and subsurface work; human remains and traditional and historic artifacts found in trenches along exterior walls
Yent 1985	Archaeological monitoring	TMK: [1] 2-2-021:012; Royal Mausoleum, Mauna ‘Ala	SIHP # -9909; archaeological monitoring during electrical trenching at Royal Mausoleum recorded presence of historic building materials, bottle glass, ceramics and food remains
Hammatt 1988	Archaeological reconnaissance	TMK: [1] 2-2-055:02 and 04	Nine test pits to depths of 80-90 cm yield no buried cultural material, no significant archaeological or historical remains present on the property
Leidemann 1989	Archaeological reconnaissance	TMKs: [1] 2-2-031:011 and 012; E and W banks of Nu‘uanu Stream	Bishop Museum conducted archaeological reconnaissance surveys of parcels along Nu‘uanu Stream; recorded eight sites: SIHP #s -4195 (Lapalapakea ‘Auwai); -4196 (a stone foundation); -4197 (C-shaped structure); -4198 (stone alignment); -4199 (stone wall); -4200 (stone wall); -4201 (a terrace); -4201; -4202 (modified outcrop)
Spencer Mason Architects 1989	Preservation investigation	Kaniakupupu, Kamehameha III Summer Palace	Documents site and its history
Leidemann 1991	Archaeological inventory survey	TMK: [1] 2-2-031:011; W bank of Nu‘uanu Stream	Bishop Museum survey of features identified in Leidemann 1989 (SIHP #s -4195, -4196, and -4201)
Anderson and Williams 1993	Archaeological assessment	TMK: [1] 2-2-055: 02 and 04, Luakaha	Potential historic properties should be reconsidered and significance of site reassessed
Dagher 1993	Burial treatment	TMK: [1] 1-8-009:021; 620 Jack Lane	SIHP # -4656; burial treatment with enclosed low concrete slab wall with historic grave marker
Flood and Dixon 1993	Archaeological inventory survey	TMK: [1] 2-2-031:032; E bank of Nu‘uanu Stream	SIHP # -2464; terraces, a nineteenth century habitation, and features associated with twentieth century plant nursery recorded

Reference	Type of Study	Location	Results (SIHP # 50-80-14)
Dixon et al. 1994	Archaeological inventory survey	TMK: [1] 2-2-055:04	SIHP # -4928; 20 cultural features identified; nineteen century finds include three retention walls, one possible boundary wall, one house foundation, one trash dump, and one stone bathhouse; twentieth century finds include seven terraces, one drainage system and two bridges, two trails, and one wall and associated stone alignments, and one low wall
Abad 1997	Burial treatment	TMK: [1] 2-2-021:012; Royal Mausoleum, Mauna ‘Ala	SIHP # -9909; burial treatment at John Young Grave Site Repair and Restoration project
Leidemann et al. 1998	Archaeological inventory survey	TMKs: [1] 2-2-013:011 and 012; E and W banks of Nu‘uanu Stream	SIHP # -2464; Bishop Museum archaeologists documented dryland agricultural terraces and a post-Contact habitation
Nagata 2000	Architectural inventory survey	TMK: [1] 2-2-021:012; Royal Mausoleum, Mauna ‘Ala	SIHP # -9909; State Parks archaeologists conducted test excavations at Mauna ‘Ala Royal Mausoleum; encountered fill, imported artifacts, and debris associated with caretaker’s house
Lebo and Bayman 2001	Archaeological field school	Kaniakapūpū	The site Kaniakapūpū (SIHP # -00409) is a part of a much larger complex of cultural features
Hoffman et al. 2003	Archaeological assessment	TMK: [1] 2-2-032:007; Farrington Residence, Pacific Heights, Nu‘uanu	Assessment of 3-acre parcel with twentieth century house and extensive landscaping
Moore et al. 2006	Architectural inventory survey	TMK: [1] 2-2-047:005; parcel on eastern ridge of Nu‘uanu Valley	SIHP # -6767; two post-Contact ranching boundary walls recorded
Hammatt and Chiogioji 2008	Architectural inventory survey	Portions of TMKs: [1] 1-6, 1-7, 2-1, 2-2; streets within Nu‘uanu and around Punchbowl	Survey identified two historic, masonry arch bridges crossing Waolani Stream and Judd St (between Liliha St and Nu‘uanu Ave) and masonry arch bridge crossing Nu‘uanu Stream 61 m E of Pauoa Rd and Nu‘uanu Ave intersection (no SIHP #s assigned)

Reference	Type of Study	Location	Results (SIHP # 50-80-14)
Runyon and Hammatt 2008	Archaeological assessment	TMK: [1] 2-2-020:021; 15 Craigside Pl	No significant finds
de Leeuw et al. 2012	Archaeological monitoring	TMK: [1] 2-2-020:021; 15 Craigside Pl	Archaeological monitoring resulted in no significant finds
Hunkin et al. 2012	Archaeological monitoring	Portions of TMKs: [1] 1-2, 1-3, 1-6, 1-7, 1-8, 2-2; roads within Kalihi, Kapālama, Nu‘uanu, Pauoa, and Makiki Ahupua‘a	No new historic properties identified during monitoring
Inglis et al. 2014	Literature review and field inspection	Pali Hwy, Nu‘uanu and Kailua Ahupua‘a	Previously identified historic properties included SIHP #s -4374 (Old Pali Rd), -1020 (enclosure/*heiau*), -1060 (*lo‘i*) that are part of -1174 (Pali Complex)

Table 3. Previously Identified Historic Properties in the Vicinity of the Project Area

SIHP # (50-80-14-)	Nature of Site	Source	Comment
-00408	Kahapaakai Complex	McAllister 1993	Petroglyph and koa enclosure
-00409	Kamehamhea III Summer Palace (Kaniakapūpū)	McAllister 1993	Summer Palace of Kamehamhea III
-01161	Nu‘uanu Petroglyph Complex	McAllister 1933	Encompasses Sites 67, 68, and 69; petroglyphs mainly human figures and some animals figures
-01326	John T. Waterhouse Residence, 420 Wyllie Street	Hawaii Register of Histoeric Places form 1975	This elegant old Hawaiian home was built for the prominent Honolulu businessman John Thomas Waterhouse Jr. sometime between 1884 and 1888, Also known as Borthwick Home
-01354	Lihiwai (George R. Carter House), 51 Kepola Place	National Register Nomination Form 1980	Significant for its architecture, landscape design, and association with Hawaii’s former Governor George Robert Carter
-01366	Clarence H. Cooke Residence (Marks Estate), 3860 Old Pali Road	National Register Nomination Form 1984	Built in 1932 and significant for its architecture and association with Clarence Hyde Cooke, a prominent businessman who became president of Bank of Hawaii in 1909 and was elected to the Territorial legislature in 1913.
-01367	Edgar & Lucy Henriques Home, 20 Old Pali Place	National Register Nomination Form 1984	Built in 1900 and is significant for its architecture and for its association with Lucy K. Peabody, and Edgar and Lucy Henriques who were from a high *ali‘i* family and descendants of Isaac Davis
-01371	James L. Coke Residence, 3649 Nu‘uanu Pali Drive	National Register Nomination Form 1985	Significant for its architecture and for its association with Chief Justice James L. Coke. Designed by architect C. W. Dickey
-01373	English Tudor/French Norman Cottages	National Register Nomination Form 1986	Part of Thematic Group including 15 residences built between 1923 and 1932 including the Ohrt Residence at 2958 Pali Highway
-01378	Robert M. Purvis Residence, 3346 Kaohinani Drive	National Register Nomination Form 1987	A good example of a 1920/1930s Spanish Mission Revival residence designed by architect C. W. Dickey

SIHP # (50-80-14-)	Nature of Site	Source	Comment
-01388	Kawānanakoa Playground	National Register Nomination Form 1988	Significant for its associations with the development of parks in the City and County of Honolulu in the 1930s and the playground movement.
-01389	Lili‘uokalani Botanical Gardens	National Register Nomination Form 1993	Queen Lili`uokalani purchased the property from the estate of Queen Kalama in 1884. For much of her life Lili`uokalani kept a small house on the property. In 1912 she donated the land to the Civic Federation of Honolulu to be used as a park.
-02464	Habitation Complex	Flood and Dixon 1993; Leidemann et al. 1998	Terraces, nineteenth century habitation
-04195	*‘Auwai*	Leidemann 1989, Leidemann 1991	Lapalapaka *‘auwai*
-04196	Stone foundation	Leidemann 1989, Leidemann 1991	An historic period construction, possibly a foundation for a small building.
-04197	C-shaped structure	Leidemann 1989	Constructed of basalt boulders and cobbles, 3 m by 3m
-04198	Alignment	Leidemann 1989	A boulder alignment which combines with a probably natural low cliff or outcrop to enclose a large. flat, semicircular area on the east side of the stream.
-04199	Wall	Leidemann 1989	A 51 m long wall running east-west, perpendicular to the stream
-04200	Wall	Leidemann 1989	Joins a steep cliff and runs about 35 m northwest
-04201	Terrace	Leidemann 1989, Leidemann 1991	A short, cobble facing composed of rounded and subrounded vesicular basalt, about five to six courses high, 4.6 m long, 80 cm high
-04202	Modified outcrop	Leidemann 1989	Either a natural rock outcrop or a short cultural extension of a natural rocky face.
-04656	Human burial	Dagher 1993	Burial treatment with enclosed concrete slab wall with historic grave marker

SIHP # (50-80-14-)	Nature of Site	Source	Comment
-04928	Historic house site	Dixon et al. 1994	Nineteenth century finds include retention walls, possible boundary wall, house foundation, one trash dump, and one stone bathhouse. Twentieth century finds include seven terraces, one drainage system and two bridges, two trails, and one wall and associated stone alignments, and one low wall.
-06767 A	Wall	Moore et al. 2006	Post-Contact ranching boundary walls
-06767 B	Wall	Moore et al. 2006	Post-Contact ranching boundary walls
-09013	Mary Lyman Residence, 1108 Kaumailuna Place	National Register Nomination Form 2004	Built between 1917 and 1919 for Frederick Snowden and Mary Babcock Lyman, the house is significant for its architecture as an example of a Shingle style home
-09026	Stuart and Elizabeth Thompkins Residence, 2339 Pikake Place	National Register Nomination Form 2007	A modest Colonial Revival style house constructed in the early 1930s
-09033	Mary and George Jennings Residence, 1176 Alewa Drive	National Register Nomination Form 2007	A Colonial Revival style house constructed in the 1920s
-09042	Uluhaimalama (royal flower garden of Lili‘uokalani)	National Register Nomination Form 2008	Uluhaimalama is significant in Hawaiian and United States history as a garden-cemetery for its associations relating to the overthrow of the Hawaiian Kingdom in 1893 and for its association with, its former owner, Queen Liliuokalani
-09048	Louis and Marjorie Stephens Residence, 3239 Pali Highway	National Register Nomination Form 2007	An example of a colonial bungalow style house constructed during the 1920s
-09713	George de S. Canavarro House, 2756 Rooke Avenue	National Register Nomination Form 1979	The house was .built by Mr. and Mrs Georges de Souza Canavarro; Canavarro was the son of the Consul-General of Portugal

SIHP # (50-80-14-)	Nature of Site	Source	Comment
-09718	Thomas Alexander Burningham Residence, 2849 Pali Highway	National Register Nomination Form 1988	Built in 1910 and significant as an early example of the use of the bungalow form in Hawaii.
-09742	Riley Allen Residence, 3275 Pacific Heights Road	National Register Nomination Form 1989	Built in 1931 the house is significant for its architecture as an example of a Spanish Mission Revival style house
-09743	George P. Castle Mountain Residence, 2998 Pacific Heights Road	National Register Nomination Form 1988	Constructed circa 1901 as a mountain retreat for the Castles, tt is significant for its architecture and its association with the development of Pacific Heights as a residential community
-09767	Thomas Victor King Residence, 155 Dowsett Avenue	National Register Nomination Form 1993	Represents the work of the locally-prominent architectural firm of Emory & Webb Architects
-09771	Joseph Pratt House, 2911 Pacific Heigghts Road	National Register Nomination Form 1993	Significant as one of the earliest houses built in the area and for the Late Victorian Queen Anne style of architecture
-09775	W.W. Goodale Moir Residence, 3311 Kahawalu Drive	National Register Nomination Form 1994	An example of the residential work of architect Louis E. Davis who designed many structures in the popular Spanish Colonial Revival style in the 1920s & 1930s.
-09778	George Robert Ewart Residence 2350 and 2370 Nu‘uanu Avenue	National Register Nomination Form 1995	Built in 1906, it is significant for its architecture and its association with Ewart, who was the manager of several large plantations and also knowledgeable in locomotive engineering.
-09790	Clinton Briggs Ripley Homestead (52, 54, 56 and 58 Robinson Lane	National Register Nomination Form 1996	Four houses designed in different yet compatible styles, which share a large, sloping yard

SIHP # (50-80-14-)	Nature of Site	Source	Comment
-09825	Tennent Art Foundation Gallery, 203 Prospect Street	Historic Hawai‘i Foundation Web Site	Built in 1954 and significant as the only site and built environment that is clearly associated with Madge Tennent, one of the best known artists in Hawaii. The building was designed by noted Hawaii architect Vladmir Ossipoff.
-09842	Richards/Goodale/Carter Residence, 247 Dowsett Avenue	National Register Nomination Form 2003	Built in 1921 in Nu`uanu. It is significant as the best known example of a house associated with Catherine Jones Richards, a successful and renowned landscape architect of Hawai`i and the mailand.
-09848	Kyoto Gardens of Honolulu	Historic Hawai‘i Foundation Web Site	The three-tiered Pagoda, the Kinkaku-ji Temple, and the Mirror Gardens located within the Honolulu Memorial Park are significant for being among the best examples of Japanese traditional-style structures and gardens built outside of Japan.
-09904	Queen Emma Summer Palace	Gould 1972	Hānaiakamalama, nominated to National Register in 1970
-09909	Royal Mausoleum	Ota 1980, Silva 1984, Yent 1985, Abad 1997, Nagata 2000	Human remains and traditional and historic artifacts found in trenches along exterior walls
-09916	Historic House Site	Yent 1983	House built by Jack Waldron in 1910-1911
-09983	H. Alexander Walker Residence, 2616 Pali Highway	National Register Nomination Form 1972	One of the few intact estates that were built in the upper Nuuanu Valley around the turn of the 20th century.
-09994	Isabelle Jones Residence, 71 Dowsett Avenue	National Register Nomination Form 1993	A two story wooden Colonial Revival house built in 1924 by Isabelle Jones, the widow of Edwin Austin, the son of Peter Cushman Jones, founding partner of C. Brewer, co-founder of the Bank of Hawaii, treasurer of Punahou School and Minister of Finance under Queen Liliuokalani

SIHP # (50-80-14-)	Nature of Site	Source	Comment
No SIHP assigned	Historic bridge (Pelekane Drive Bridge-Nu‘uanu Stream)	MKE Associates LLC and Fung Associates, Inc. 2013	See discussion under Section 6.1.2.1 of this study
No SIHP assigned	Historic bridge (Wyllie Street Bridge-Waolani Stream	MKE Associates LLC and Fung Associates, Inc. 2013	See discussion under Section 6.1.2.2 of this study
No SIHP assigned	Historic bridge (Nu‘uanu Avenue Arch Bridge-Nu‘uanu Stream)	MKE Associates LLC and Fung Associates, Inc. 2013	See discussion under Section 6.1.2.3 of this study
No SIHP assigned	Historic bridge (Lā‘imi Road Bridge-Nu‘uanu Stream)	MKE Associates LLC and Fung Associates, Inc. 2013	See discussion under Section 6.1.2.4 of this study

It may be that most of the *heiau* mentioned by Raphaelson were hill forts rather than ceremonial *heiau*. There are several corroborating accounts of a number of *heiau* at the mouth of the Waolani Valley (Section 3.1.2). Kawaluna (Section 5.1.2) was specifically identified as a significant *heiau* by other sources.

5.1.1 Waolani Complex

An important religious center was located on the northern ridge overlooking Waolani Valley. It may have been the site of several related *heiau*. According to Kamakau, the *heiau* at Waolani were the first *heiau* in the Hawaiian Islands built by Wākea:

> 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]

J. Gilbert McAllister (1933:86) identified two *heiau* in Nu‘uanu Valley. Their names were not known. Both were probably associated with the Waolani complex (Dixon et al. 1994). McAllister (1933:86) gave their locations as near 2290 Liliha Street (near ‘Ekekela Place, *mauka* of St. Francis Hospital) and 2712 Nu‘uanu Street (near Moana Wai Place). As street numbers have changed since 1933, these give only a very rough approximation of their location.

5.1.2 Kawaluna Heiau and Pōhaku-a-‘ume‘ume

Kawaluna Heiau was located in Waolani. Thrum (1906:56) recorded that Kawaluna was of *luakini* class *heiau*, a place of human sacrifice. It was important enough that only a *mō‘ī* could consecrate the site. In 1685, Chief Kūali‘i claimed the right to consecrate it as a demonstration of his authority. His claim ignited a war with the Kona chiefs who had dominion over Nu‘uanu and Kawaluna Heiau. Following the consecration, Kūali‘i engaged the Kona forces set to stop him. He emerged victorious and was recognized as the undisputed *mō‘ī* (king, sovereign) of O‘ahu (Fornander 1969:2:280).

The large mythological boulder Pōhaku-a-‘ume‘ume guarded the entrance to Kawaluna. It served as a *piko* (navel) stone for the Kākuhihewa line of chiefs (Sterling and Summers 1978:303). A large stone outside the entrance to the O‘ahu Country Club has been identified as Pōhaku-a-‘ume‘ume. McAllister (1933:86) described the stone as approximately 10 ft in length and 4.5 ft high, with “innumerable small cavities, which are said to be the finger prints of the menehunes of Nuuanu and Waolani.” In the Legend of Pupuhuluena, 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.

Traditions describe Kawaluna Heiau as a refuge for the physically and mentally unwell. J.D. Tucker (1916) said Kawaluna “was a Poohonua [*puuhonua*] or City of Refuge, for the sick and infirm, and today the older Hawaiians use the following expression or term of derision and contempt for one who is a cripple by saying, ‘Kela kanaka o Waolani’ [That is a man of Waolani].”

W.D. Alexander (1891:45) talked of a *heiau* that was sacred to fugitives and the sick. John Cummins said that “At Waolani was the heiau and a sort of insane asylum, [where] the patients were tied to posts.” Jacques Arago, who visited the Islands in 1818, supposedly saw this “asylum.”

This association between Waolani and pariahs is echoed by Kamakau’s description:

> Waolani in Nu‘uanu was a land for ‘different’ people—*no ka lāhui kānaka ‘e‘epa*. It is said in tradition that ‘the red-eyed are at Waolani; the deformed are at Waolani; the crippled are at Waolani; the bald are at Waolani; the hunchbacked are at Waolani.’ [Kamakau 1991:30]

5.1.3 Makūkū Heiau

Thrum (1906:44) mentioned a second *heiau* in Nu‘uanu, Makūkū, associated with rituals to propitiate rain. He did not locate the site. Kamakau says of Makūkū, “In Nuuanu there was a rain-bringing heiau called Makuku, but its duties were not so important as those of other *heiaus*, it had only to send rain” (Sterling and Summers 1978:309). There is a peak and stream called Makūkū near the upper Nu‘uanu Reservoir and this may be the general location for Makūkū Heiau.

5.1.4 The Waolani Hōlua

McAllister (1933:86) mentions there was once a *hōlua* slide in Waolani. His informants told him that it was “at the end of the ridge dividing Waolani and Nuuanu valleys,” but nothing remained of it. 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.

5.1.5 Nu‘uanu Petroglyph Site

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 figures 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 was 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. The site is unique in its fine collection of dog petroglyphs. There are numerous traditions concerning dogs in Nu‘uanu, including stories about *kupua* (demigod) dogs and Kaupē. Although not given a site designation, McAllister (1933:86) also mentions 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.

5.2 Modern Archaeological Studies

5.2.1 The Royal Mausoleum (Ota 1980, Abad 1997; Nagata 2000; Silva 1980, 1984; Yent 1985)

Trenching at the Royal Mausoleum, Mauna ‘Ala (SIHP # -9909), was monitored by the State Parks Division in 1979 (Ota 1980). Several additional projects have been monitored at the Mausoleum up to the present time (Abad 1997; 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.

5.2.2 Clent Heath Estate (Yent 1983)

The Division of State Parks (Yent 1983) conducted historic research and a reconnaissance survey of the Clent Heath estate (SIHP # -9916). The house was 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). In her book on her childhood and early married life, Else Waldron (1967) talks about the extensive landscaping of the estate carried out by the couple. Yent found evidence of these landscaping features on the property.

5.2.3 620 Jack Lane (Dagher 1993)

The SHPD was contacted in April 1993 for the discovery of a historic burial at 620 Jack Lane (Dagher 1993). A small cemetery was discovered in an orchid nursery. The burial area was enclosed by a low concrete slab wall measuring 3 m by 2.78 m by 0.10 m and 0.15 m wide. One historic grave marker was present, however, the cemetery was large enough for two burials. The headstone was intact and in excellent condition with the following inscription: “ MAMA KAULANA/HANAU/MA KAUPO MAUI/MAKE/MA HONOLULU OAHU/MAY 31, 1894.”

5.2.4 Nu‘uanu Stream (Leidemann 1989, 1991)

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. Three features were recorded on the west bank, including Lapalapakea ‘Auwai (SIHP # -4195), a stone foundation (SIHP # -4196), and a terrace (SIHP # -4201). Historic artifacts were

collected from the ground surface and from subsurface testing. Identified sites included terraces. An additional parcel (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. Bishop Museum archaeologists also surveyed the east bank (Leidemann 1989). Features identified on the east bank (TMK: [1] 2-2-031:012) included a C-shaped structure (SIHP # -4197), a stone alignment (SIHP # -4198), post-Contact stone walls (SIHP #s -4199 and -4200), and a modified outcrop (SIHP # -4202). Leidemann et al. (1998) conducted additional work in the area, and documented the remains of a historic house site on the east side of Nu‘uanu Stream along the western slopes of the ridge that leads up to Pacific Heights (SIHP # -2464). The majority of features at this site indicate post-Contact habitation. Lithic debris and agricultural terracing were discovered suggesting a possible late pre-Contact activity area.

5.2.5 Pacific Heights Road (Hoffman et al. 2003)

In 2003, CSH (Hoffman et al. 2003) presented an assessment of a 3-acre parcel at 3180 Pacific Heights Road containing a house and many landscape features including rock walls, terrace retaining walls, walkways, stairs, and a fishpond. Historic background research indicated the area was awarded during the Māhele to Joseph Booth (LCA 273), 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.

5.2.6 Eastern Ridge of Nu‘uanu Ahupua‘a (Moore et al. 2006)

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 # -6767, were recorded “along the crests of narrow finger ridges” on the subject property. They were interpreted as probably post-Contact ranching walls.

5.2.7 Judd Street Bridge and Nu‘uanu Avenue Bridge (Hammatt and Chiogioji 2008)

In 2008, CSH conducted an archaeological inventory survey investigation for the proposed construction of a new 24-inch water main from its Kalihi Pump Station near the intersection of Houghtailing Street and North King Street to the intersection of Magellan Avenue and Alapai Street near the Board of Water Supply Beretania Complex (Hammatt and Chiogioji 2008). During the survey, two historic properties were identified: a masonry arch bridge crossing Waolani Stream on Judd Street; and a second masonry arch bridge crossing Nu‘uanu Stream approximately 61 m east of the intersection of Pauoa Road and Nu‘uanu Avenue. Both historic properties were recommended for the Hawai‘i Register, however, no SIHP numbers were assigned.

5.2.8 Craigside Place (de Leeuw et al. 2012)

CSH conducted an archaeological assessment of 15 Craigside Place in 2008 (Runyon and Hammatt 2008). No historical properties were identified within the 1.57-acre project area. In 2012, CSH completed the archaeological monitoring report for 15 Craigside Place (de Leeuw et al. 2012). No cultural deposits were identified within the project area and no human burials were encountered during the course of monitoring fieldwork.

5.2.9 Kalihi/Nu‘uanu Sewer Rehabilitation (Hunkin et al. 2012)

CSH conducted archaeological monitoring for Phase I of the Kalihi/Nu‘uanu Sewer Rehabilitation project in Kalihi, Kapālama, Nu‘uanu, Pauoa, and Makiki Ahupua‘a (Hunkin et al. 2012). No cultural deposits were identified during monitoring in the 1,028-acre project area across 58 streets. However, a single isolated human bone fragment was discovered in fill material during excavation. The skeletal fragment was transferred to SHPD who carried out the treatment of the fragment under the department’s authority.

5.2.10 DOT Pali Highway Resurfacing/Improvements Project (Inglis et al. 2014)

Inglis et al. (2014) identified sites that are potential historic properties within the project area. These include two large basalt and mortar “Nu‘uanu” gateway signs that were erected in 2001. The *makai* sign is located at the interchange between the Pali Highway and Wyllie Street (on the right-hand side of the Kailua-bound lanes). The *mauka* sign is located at the junction with Waokanaka Street (on the right-hand side of the Honolulu-bound lanes). Low basalt and mortar walls of indeterminate age were observed alongside the sidewalks throughout Nu‘uanu.

Section 6 Results of Fieldwork

6.1 Pedestrian Inspection Results

CSH completed the fieldwork component for the Dowsett Highlands Sewer Relief project area under archaeological permit numbers 14-04 and 15-03, issued by the SHPD pursuant to HAR §13-13-282. Fieldwork was conducted on 11 November 2014 by CSH archaeologists Scott Belluomini, B.A., and David W. Shideler, M.A., and again on October 8 2015 by CSH archaeologists Si-Si Hensley, M.A., and David W. Shideler under the general supervision of Principal Investigator Hallett H. Hammatt, Ph.D. This fieldwork consisted of a 100% coverage field inspection of the project area to verify or confirm existing sites, to identify any potential new archaeological site areas, and to investigate and assess the potential for impact to such sites. Two archaeologists conducted a pedestrian inspection of both sides of the roadways within the project area.

The project area surveyed including a number of roads centering on portions of the Pali Highway and Nu‘uanu Avenue. The following roads (or road segments) and associated rights-of-way are included in the project area (in a general north to south order).

- Pali Highway: beginning at the Nu‘uanu Pali Drive until Coelho Way
- Nu‘uanu Pali Drive: from the Pali Highway to the first turn off on the *makai* side
- Dowsett Avenue: the entirety of the Dowsett Avenue loop from the northern intersection with the Pali Highway to the southern intersection with the Pali Highway
- Lā‘imi Road: from the Pali Highway to the intersection of Henry Street and Lā‘imi Road
- Dow Street
- Henry Street: from Lā‘imi Road until Henry Street dead ends at Puiwa Road
- Jack Lane: from the Pali Highway to where Jack Lane splits off into Luakini Street and Jack Lane
- Wyllie Street: from Nu‘uanu Avenue to the Liliha Street Intersection
- Liliha Street: from the intersection of Liliha Street and Wyllie Street until the unnamed lane extending southeast from Liliha Street
- An unnamed lane extending southeast from Liliha Street
- Kawānanakoa Place: from Nu‘uanu Avenue to the Chinese Buddhist Association
- Robinson Lane: from Nu‘uanu Avenue to the rear end of Oahu Cemetary
- South Judd Street
- Nu‘uanu Avenue: from Coelho Way to School Street

CSH archaeologists identified potential historic properties within or near the vicinity of the project area during the pedestrian inspections. These potential historic properties include basalt stone curbs, *‘auwai* (ditches), historic bridges, manhole covers, street markers, cemeteries and parks. Figure 40 and Figure 41 show the locations of previously identified historic properties within the project area as well as the potential historic properties identified during fieldwork.

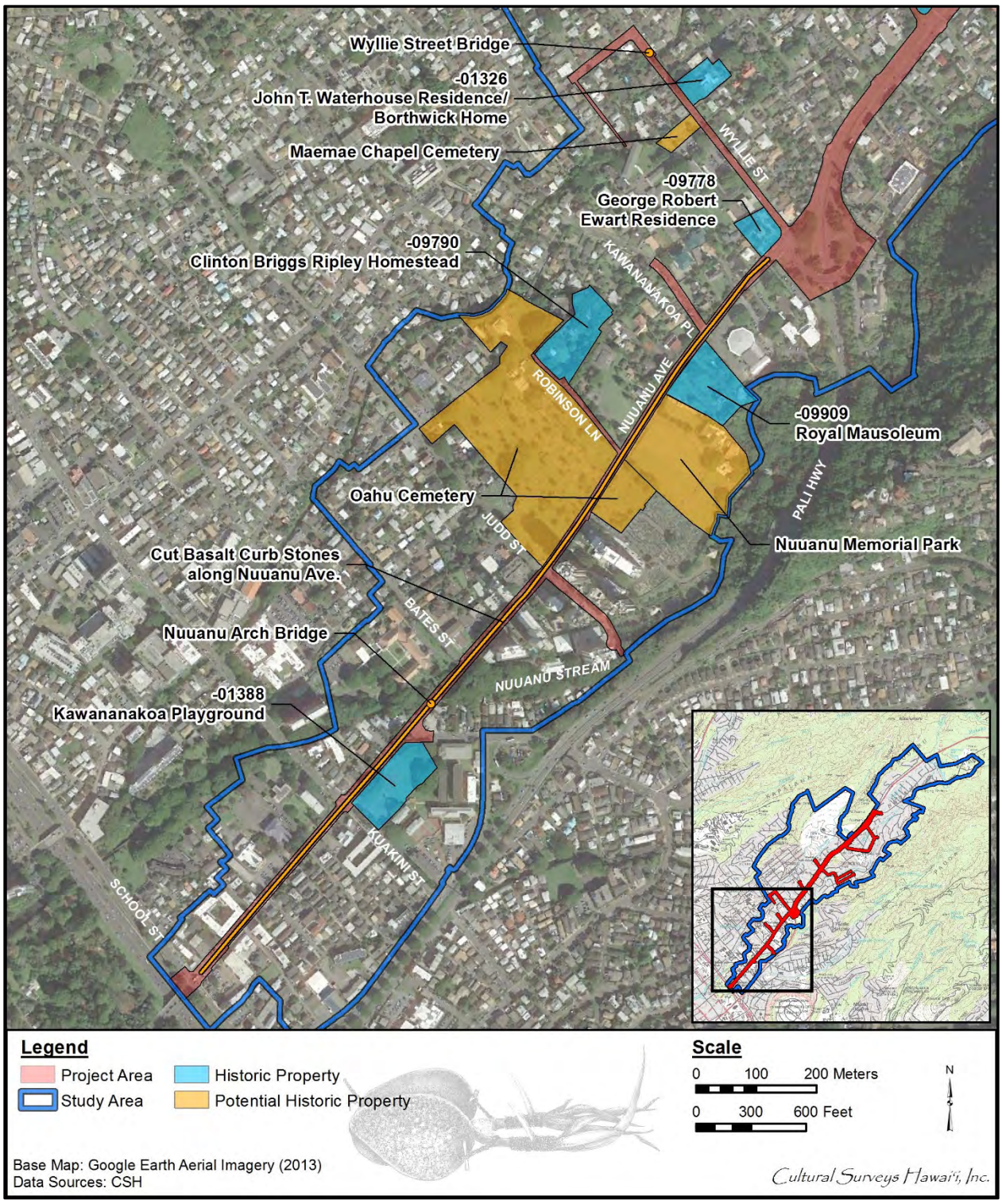

Figure 40. 2013 aerial photograph showing the lower portion of the project area with the locations of known and potential historic properties (Google Earth 2013)

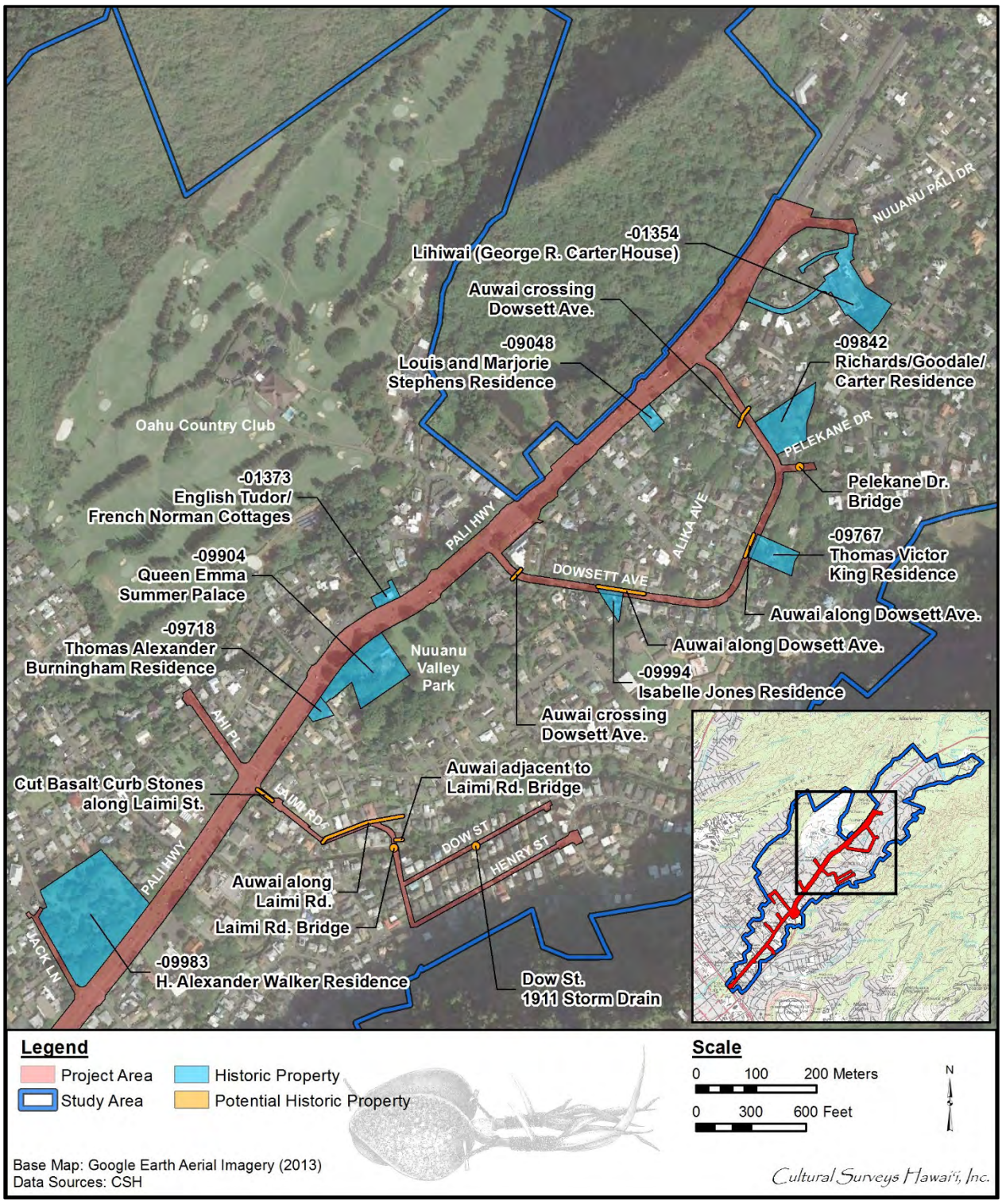

Figure 41. 2013 aerial photograph showing the upper portion of the project area with the locations of known and potential historic properties (Google Earth 2013)

6.1.1 Basalt Curbstones

Cut basalt curbstones were observed to be extant along major portions of the project area. The curbstones range in size from small “spacers” to curbstones over 1.0 m long and are typically 15-20 cm in height and width. Due to more recent construction, however, the height of the basalt stones was as little as 5 cm when covered by modern roads. The basalt has been rough-hewn and squared along its edges. The basalt curbstones appear similar to other curbstones in the Honolulu area known to be a typical construction style during the late 1800s and early 1900s. The curbstones are present on portions of Nu‘uanu Avenue, Liliha Street, Robinson Lane, and Lā‘imi Road.

On Lā‘imi Road basalt curbing is present from the intersection with Pali Highway to the first cross street. The curbing occurs on both the *makai* and *mauka* sides of the street. On the *mauka* side, the curbing wraps around to continue on Park Street. On the *makai* side, the basalt curbing terminates at the end of the first intersection with the Park cross street. The basalt curbing in this region of the project area was approximately 72 cm in length, 17 cm wide, and approximately 5 cm tall. The exact height of the curbstones may be taller, however, due to the recent construction and pavement of La‘imi Road; a portion of the basalt curbing may be subsurface (Figure 42).

The basalt curbstones on Liliha Street starts approximately 40 m *makai* of Wyllie Street up until the unnamed alley that intersects the road. Different from the basalt curbstones found elsewhere in the project area, some of the curbstones here have been painted red for their designation as emergency vehicle parking. Also, the curbstones continue across the unnamed alley entrance, which is atypical for the basalt curbstones found in the rest of the project area (Figure 43).The approximate measurement for the basalt curbstones on Liliha Street is 120 cm long by 17 cm wide.

On Robinson Lane, there is a small alignment of basalt curbing adjacent to the Oahu Cemetery and opposite the existing historic home properties. They occur adjacent to a side entrance road to the cemetery that stems off Robinson Lane.

The basalt curbstones are present on Nu‘uanu Avenue from Bates Street until School Street. The basalt curbstones extend almost the entire length on the ‘Ewa side and from Bates Street to Hialoa Street on the Diamond Head side. Some curbstones had been removed from several portions of Nu‘uanu Avenue, especially within or near driveways, most likely associated with new construction. The southernmost portion of Nu‘uanu Avenue near School Street does not have any basalt curbing, most likely due to the construction of the new Walgreens on the corner of School Street and Nu‘uanu Avenue. These areas now have cement curbstones as observed in the other portions of the project area (Figure 44 and Figure 45).

6.1.2 *‘Auwai* (Ditches)

Ditches were observed on Lā‘imi Road and the surrounding areas, seemingly related to distributing water from the nearby stream to the taro agriculture in its immediate vicinity. The ditch observed on Lā‘imi Road begins at the the first 90 degree turn of the street toward the northwest. The ditch, which is on the west side of the street, crosses under Lā‘imi Road and presumably ends as indicated by a manhole cover, perhaps associated with some sort of sewer collection system. The ditch extends north on Lā‘imi Road and continues onto Easy Street in a northeasterly direction as Lā‘imi turns toward to the southeast. The ditch is constructed of mortared stone. Figure 46 shows the Lā‘imi Road *‘auwai* as it flows in a southwesterly direction, with an archaeologist in the background to give general scale.

Figure 42. Cut basalt curbstones along both sides of Lā‘imi Road, view to southeast

Figure 43. Basalt curbstone on Liliha Street and the entrance to the unnamed alley, view to southwest

Figure 44. Cut basalt curbstones along Nu‘uanu Avenue near Wyllie Street, view to southwest

Figure 45. Cut basalt curbstones along Nu‘uanu Avenue near Bates Street, view to southwest

Figure 46. *‘Auwai* on Lā‘imi Road, view to southwest

As the Lā‘imi Road ditch stretches northeast, there are two 90 degree turn offs toward Pali Highway. The first of these occurs approximately 50 m north of the bend of Lā‘imi Road and is nestled between two home lots (Figure 47). The second turn off occurs at the transition between Lā‘imi Road and Easy Street. The only modifications made to the ditches is capping the ditch for the driveways adjacent to homes.

Adjacent to the Lā‘imi Road Bridge on the ‘Ewa side, another ditch was observed (Figure 48). There is currently no running water in this ditch (unlike the others), but its proximity to the current stream suggests it too was used to siphon water from the main stream.

Comparing what was observed during fieldwork to historic maps of the area, Lā‘imi Road is a particularly interesting portion of the project area. Looking to the 1888 historic Bishop map (see Figure 49) the *‘auwai* seems to line up with the *‘auwai* observed during field work. The Palikea ‘Auwai, shown in Figure 49, appears to be the *‘auwai* adjacent to Laimi Road Bridge and the stream; the other, west of Palikea ‘Auwai, appears to be the *‘auwai* observed on Lā‘imi Road that continues onto Easy Street. While the 90 degree turn offs are not observed on the historic map, the presence of *lo‘i* patches adjacent to the *‘auwai* on the historic map suggests a need for some type of irrigation. Since the bridge was constructed in 1920 it is understandable why it is not presented on this map.

Several ditches were encountered within the Dowsett Avenue area. Ditches were observed running along Dowsett Avenue approximately 0.5-1.0 m from the sidewalk. These ditches often run intermittently underground. The form of the ditches often varies from property to property. The ditches are often lined with mortared stones or concrete, while in other portions they appear modified to resemble stream beds (Figure 50 and Figure 52). Two ditches were observed extending in a northeasterly direction and appear to cross under Dowsett Avenue and through the project area (Figure 51 through Figure 53).

6.1.1 Relationship of the Project Area(s) to Historic Cemeteries

Many historic cemeteries are located along Nu‘uanu Avenue and the Maemae Chapel cemetery was noted on Wyllie Street. The Oahu Cemetery and Crematory, established in 1844, is located on both sides of Nu‘uanu Avenue. The plots within the cemetery appear to extend slightly askew from Nu‘uanu Avenue. Several gravestones are located right next to the wall along Nu‘uanu Avenue in the west section of the cemetery, suggesting burials may be located below Nu‘uanu Avenue (Figure 54 and Figure 55). The Nu‘uanu Memorial Park and Mortuary was incorporated in 1949 and is located on the southeast side of Nu‘uanu Avenue, between the Royal Mausoleum and the Oahu Cemetery and Crematory. The plots within the cemetery extend parallel to Nu‘uanu Avenue, reducing the likelihood of burials associated with this cemetery being located below this portion of Nu‘uanu Avenue. The Royal Mausoleum is located along Nu‘uanu Avenue, adjacent to the project area. A cemetery previously associated with the Kaumakapili Protestant Church’s Maemae Chapel on the parcel is still to be seen on the corner of Wyllie and Maemae streets adjacent to the project area (Figure 56).

The Oahu Cemetery and Crematory is also adjacent to Robinson Lane on the *makai* side. There is approximately a 1 m break in grade from the surface of the cemetery to the surface of the road that is filled by a retaining pile of stone. The closest gravestone is approximately 1.65 m from the street, however, many gravestones border the side of the cemetery adjacent to Robinson Lane. Toward the rear of the Robinson Lane project area on the opposite side from the cemetery are

Figure 47. Ninety degree turn off from Lā‘imi Road ditch, view to west

Figure 48. Lā‘imi Road ditch adjacent to existing stream and Lā‘imi Road Bridge, view to northeast

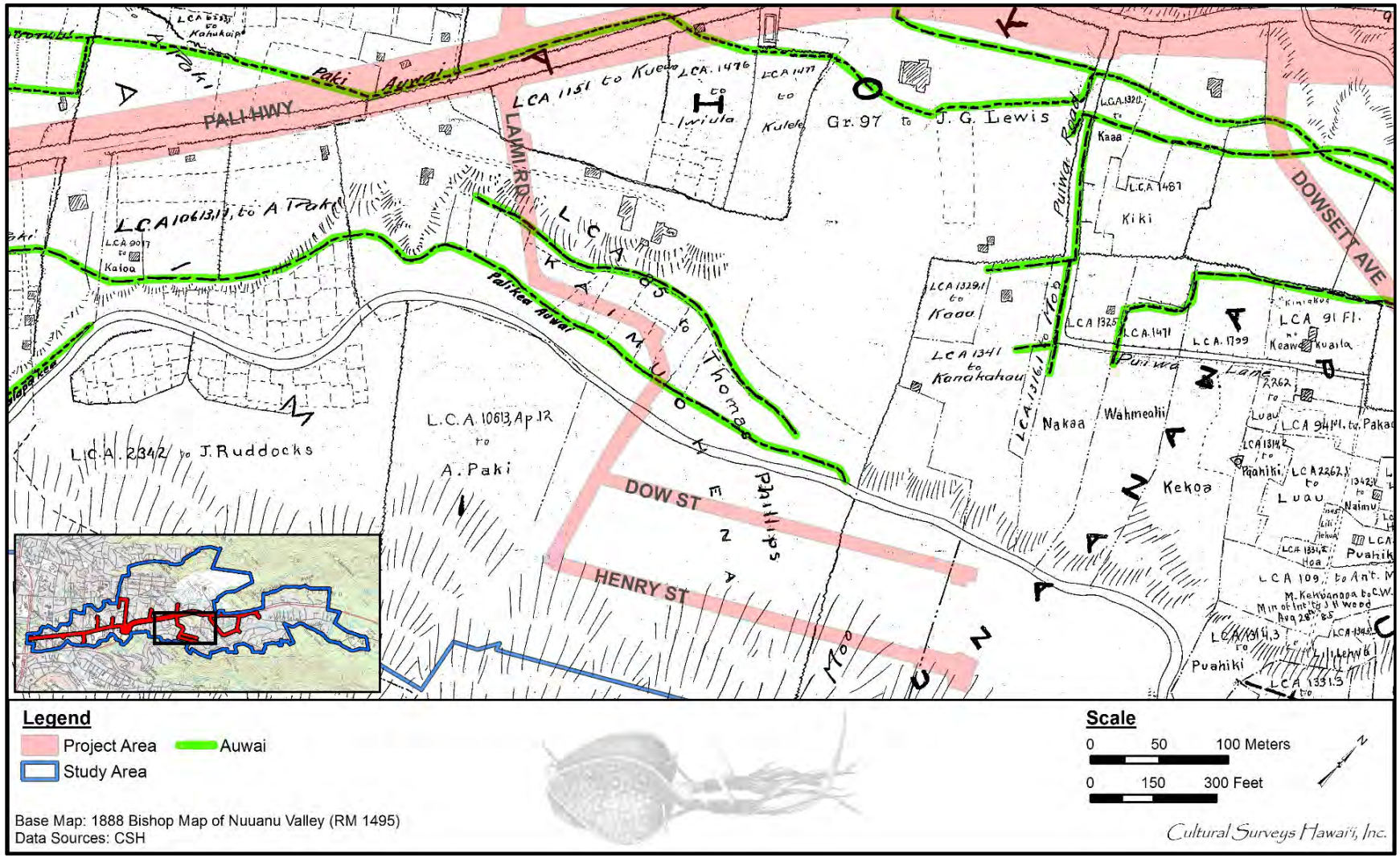

Figure 49. Portion of 1888 Bishop map of Nu‘uanu Valley showing the Lā‘imi Road section and the associated *‘auwai* in the area

Figure 50. Ditch extending along Dowsett Avenue, which has been modified, view to northeast

Figure 51. Ditch observed extending under Dowsett Avenue between the Pali Highway and Lopeka Place, view to north

Figure 52. Close-up view of concrete-lined ditch extending in a northeastern direction and crossing Dowsett Avenue between the Pali Highway and Lopeka Place, view to northeast

Figure 53. Ditch observed extending under Dowsett Avenue near Alika Avenue, view to south

Figure 54. Oahu Cemetery and Mortuary located along Nu‘uanu Avenue, view to southwest

Figure 55. Gravestones located along wall in the Oahu Cemetery and Mortuary on Nu‘uanu Avenue, view to southwest

Figure 56. Maemae Chapel Cemetery located at Wyllie and Maemae streets, view to southwest

Figure 57. Pelekane Street bridge east of the Dowsett Avenue loop, view to northeast of northeast side of bridge

four houses already registered as historic properties. These homes, built in 1895, 1919, 1920, and 1921 by C.P Ripley Architects, are Italianate, bungalow, craftsman, and neoclassical in style respectively. Across from these historic homes at a side entrance to the Oahu Cemetery and Crematory, there is some basalt curbing similar to that found on Nu‘uanu Avenue, however, it is not present anywhere else on Robinson Lane.

6.1.2 Bridges

Four historic bridges were observed at the ends of the present project area.

6.1.2.1 Pelekane Drive Bridge-Nu‘uanu Stream

At the east end of a short Pelekane Drive spur (see Figure 57) extending east of the north portion of Dowsett Street is the Pelekane Drive Bridge-Nu‘uanu Stream crossing Nu‘uanu Stream. Built in 1930, this concrete T-beam type bridge with a concrete open arched parapet/railing is not listed on the National/Hawai‘i Registers of Historic Places but has been determined as eligible on the basis of the following character-defining features (significance):

- Associated with early developments in concrete bridge construction in Hawaii
- Good example of 1920s reinforced concrete bridge
- Associated with historic Nu‘uanu residential development [MKE Associates LLC and Fung Associates, Inc. 2013:4-26]

The narrative description of the bridge is as follows:

> The Pelekane Drive Bridge carries Pelekane Drive across Nuuanu Stream. This single-span reinforced concrete multigirder bridge is in its original location, is generally in good condition, and its materials remain intact. The bridge has concrete panel parapets with caps and panel detail concrete end posts with caps flank the approaches of the parapet. The concrete deck is supported by concrete abutments. The workmanship of the bridge has not been obscured by additions or repairs. [MKE Associates LLC and Fung Associates, Inc. 2013:4-423]

The significance statement is as follows:

> This bridge is eligible under Criterion C for its association with early developments in concrete bridge construction in Hawaii. It is a good example of the 1930’s reinforced concrete bridge that is typical of its materials, method of construction, craftsmanship, and design. It is also associated with historic Nuuanu residential development. [MKE Associates LLC and Fung Associates, Inc. 2013:4-424]

6.1.2.2 Wyllie Street Bridge-Waolani Stream

At the northeast end of the Wyllie Street project spur is the Wyllie Street Bridge-Waolani Stream crossing Waolani Stream (Figure 58). Built in 1931, this concrete T-beam bridge type with a concrete open arched parapet/railing is not listed on the National/Hawai‘i Registers of Historic Places but has been determined as eligible on the basis of the following character-defining features (significance):

Figure 58. Wyllie Street Bridge, view to north of northeast side of bridge

- Associated with early developments in concrete bridge construction in Hawaii
- Good example of 1923s reinforced concrete bridge [MKE Associates LLC and Fung Associates, Inc. 2013:4-27]

The narrative description of the bridge is as follows:

> The Waolani Stream Bridge carries Wyllie Street across Waolani Stream. This single-span reinforced concrete girder bridge is in its original location, is generally in good condition, and its materials remain intact. The bridge has solid concrete capped parapets with arched voids and decorative end posts. The concrete deck is supported by concrete abutments. The workmanship of the bridge has not been obscured by additions or repairs. [MKE Associates LLC and Fung Associates, Inc. 2013:4-450]

The significance statement is as follows:

> This bridge is eligible under Criterion C for its association with early developments in concrete bridge construction in Hawaii. It is a good example of a 1930's concrete tee-beam bridge that is typical of its period in its use of materials, method of construction, craftsmanship, and design. [MKE Associates LLC and Fung Associates, Inc. 2013:4-451]

6.1.2.3 Nu‘uanu Avenue Arch Bridge-Nu‘uanu Stream

At the south end of the project area on Nu‘uanu Avenue, just southwest of Bates Street is the Nu‘uanu Avenue Arch Bridge-Nu‘uanu Stream where Nu‘uanu Avenue crosses Nu‘uanu Stream (Figure 59). Built in 1904, this masonry arch-type bridge with a masonry rock with cap parapet/ railing is not listed on the National/Hawai‘i Registers of Historic Places but has been determined to have “ High Preservation Value.” on the basis of the following character defining features (Significance):

- Arch bridges are an uncommon bridge type,
- Excellent example of 1900’s masonry arch construction and is one of nine of type left in Hawaii,
- Notable for use of vernacular building materials from the islands: local basalt rock/’lava rock’,
- Associated with early public works efforts by Territory of Hawaii, and for contributions to commercial and residential development of urban Honolulu, and
- Representative of work of a master: Louis M. Whitehouse, a prolific contractor from that era [MKE Associates LLC and Fung Associates, Inc. 2013:4-25]

The narrative description is as follows:

> The Nuuanu Avenue Bridge carries Nuuanu Avenue over the Nuuanu Stream. The bridge, located in one of Honolulu’s oldest residential neighborhoods, is a rare remaining example of a masonry arch built from local basalt, known as ‘lava rock’. The Nuuanu Avenue Bridge’s original residential setting has been altered by the intensive development of nearby Honolulu in the 1960s-80s. Commercial development and high-rise construction have replaced the older single family homes that once flourished in this area. The bridge’s original design, a single-span masonry arch with a concrete-finished vault, remains intact. The bridge’s parapets are continuous along this section of Nuuanu Avenue, due to the skew of the stream in relation to the roadway, and are difficult to discern from the roadway due to their low height. The original basalt has not received any major repairs, although one of the cap blocks was replaced in-kind. The inverts were reconstructed in concrete in 1937. The quality of workmanship on the bridge, particularly the massive basalt blocks with dressed margins, is extremely high. The bridge’s association with the residential development of urban Honolulu is apparent to the informed observer. The bridge’s historic feeling is evident due to the large size and skillful detailing of the basalt (‘lava rock’) blocks, a once common vernacular building material. In 2013, the bridge will undergo rehabilitation to increase the railing height via cap alteration to meet code. [MKE Associates LLC and Fung Associates, Inc. 2013:4-417]

Figure 59. View of Nu‘uanu Avenue Nu‘uanu Stream Bridge, view to southeast of southeast side

The significance statement is as follows:

> The Nuuanu Avenue Bridge is significant in the areas of engineering and transportation in Hawaii. The bridge is an excellent example of masonry arch construction in Hawaii. Arch bridges are also an uncommon bridge type. The Nuuanu Avenue Bridge is eligible under Criterion A for its associations with early public works efforts by the Territory of Hawaii and for its contributions to the development of urban Honolulu. It is eligible under Criterion C as a rare remaining example of a once common bridge type constructed with vernacular materials (cut basalt or ‘lava rock’). Moreover, it is representative of the work of a master: Louis M. Whitehouse, the prolific contractor who built many other roads and bridges in this era.
>
> At the time of its initial construction in 1904, the bridge served as a vital transportation link to downtown Honolulu, aiding in the commercial and residential development of Honolulu. Nuuanu was one of the earliest residential developments on the outskirts of urban Honolulu. After annexation by the United States in 1898, the Territory of Hawaii made road building in urban areas a high priority. The road to Nuuanu would have been among the first to be paved.
>
> The Nuuanu Avenue Bridge is an excellent example of a masonry arch bridge, displaying the skill and artistry of Hawaii’s stone masons. It is one of nine remaining masonry-arch bridges in the state and one of the last masonry arch bridges built in Hawaii. The bridge is notable for its use of vernacular building materials. The local basalts which compose the lava-rock used in the bridge’s

construction are unique to Hawaii and the islands of the Pacific; (1) thus these masonry arch bridges may be the only examples of this type in the United States.

The county estimates the construction date of this bridge to be 1937, however a photograph of the bridge, dated ‘June 1904’, was found in the Hawaii State Archives. The 1902 SPW annual report makes a reference to funding for the ‘Nuuanu Avenue Bridge’ and the establishment of a basalt quarry in Nuuanu. The builder was previously identified as ‘D. W. Whitehouse’, (2) however, it was most likely built by Louis M. Whitehouse. A search through the city directories for the years 1902 through 1934 reveal only a ‘Whitehouse, L. M.’ (3) Further, Whitehouse’s obituary states that ‘in 1903, he . . . built Nuuanu dam and reservoir’ and may have been responsible for this bridge as well. (4)

(1) Dr. Jane Tribble, personal conversation, School of Ocean and Earth Sciences, University of Hawaii, Honolulu, HI, June 30, 1994.

(2) Bethany Thompson, Historic Bridge Inventory: Island of Oahu, prepared for the State of Hawaii Department of Transportation Highways Division in cooperation with the U.S. Department of Transportation Federal Highway Administration (Honolulu: 1983), IV-23.

(3) Husted’s Directory of Honolulu and the Territory of Hawaii, (Honolulu: 1902), 545; Polk-Husted City Directory (Honolulu, 1931/1932), 505; Polk-Husted City Directory (Honolulu: 1933/1934), 497.

(4) ‘Whitehouse, Head of Land Office Dies,’ Honolulu Star Bulletin (November 25, 1942).

[MKE Associates LLC and Fung Associates, Inc. 2013:4-418]

6.1.2.4 Lā‘imi Road Bridge-Nu‘uanu Stream

The Lā‘imi Road Bridge-Nu‘uanu Stream carries Lā‘imi Road across Nu‘uanu Stream. Built in 1920, this concrete-girder type bridge with a concrete solid panel with cap parapet railing is not listed on the National/Hawai‘i Registers of Historic Places but has been determined as eligible on the basis of the following character-defining features (significance):

- Associated with early developments in concrete bridge construction in Hawaii
- Good example of 1920s reinforced concrete bridge
- Associated with historic Nuuanu residential development [MKE Associates LLC and Fung Associates, Inc. 2013:4-23]

The bridge also consists of an added pedestrian walkway on the *mauka* side of the bridge that was added in 1976. The insignia detail on the center of both the *mauka* and *makai* sides of the bridge indicates its construction per the City and County of Oahu in the year 1920 (Figure 60). Although image date seems to read 1820, cross reference to MKE Associates LCC and Fung Associates, Inc. (2013) confirms the 1920 date of the bridge construction.

The narrative description of the bridge is as follows:

> The Laimi Road Bridge carries Laimi Road across Nuuanu Stream. This single-span reinforced concrete two-girder bridge is in its original location, is generally in good condition, and its materials remain intact. The bridge has concrete panel parapets with cap s and panel detail concrete end posts with caps flank the approaches of the parapet. The concrete deck is supported by concrete abutments over a channeled stream. The workmanship of the bridge has not been obscured by additions or repairs however, a pre-stressed tee-beam pedestrian footbridge was added in 1976 to one side of the bridge. [MKE Associates LLC and Fung Associates, Inc. 2013:4-369]

The significance statement is as follows:

> This bridge is eligible under Criterion C for its association with early developments in concrete bridge construction in Hawaii. It is a good example of the 1920's reinforced concrete bridge that is typical of its materials, method of construction, craftsmanship, and design. It is also associated with historic Nuuanu residential development. [MKE Associates LLC and Fung Associates, Inc. 2013:4-370]

Figure 60. Medallion detail at the center of Lā‘imi Road bridge, view to north-northeast

6.1.3 Other Potential Historic Properties Noted (Street Marker and Manhole Covers)

Common features of Honolulu ca. 1900 were concrete obelisk-shaped street markers set up at street intersections. Few remain today. Such a marker for Dowsett Avenue/Nu‘uanu Avenue was observed at the northern intersection of the streets but presently appears to be on private property (Figure 61).

Other features commonly encountered were a series of manhole covers and one sewage drain cover. These features were observed on Lā‘imi Road, Dow Street, and Henry Street. The manhole covers are associated with water line covers and do not have a date printed on the cap. The sewage drain cover observed on Dow Street, however, reads “Public Works, 1911” which would indicate it is a historic feature.

Figure 61. Dowsett Avenue/Nu‘uanu Avenue concrete obelisk on north side of Dowsett Street loop, view to north

Section 7 Summary and Recommendations

7.1 Summary

At the request of Fukunaga & Associates, Inc., CSH has prepared this literature review and field inspection (LRFI) for the Dowsett Highlands Relief Sewer project Nu‘uanu Ahupua‘a, Honolulu (Kona) District, O‘ahu. This project encompasses the Pali Highway from Nu‘uanu Pali Drive to Nu‘uanu Avenue at the Wyllie Street Interchange, concluding near School Street. The proposed project involves identification of alternatives for a new relief sewer line, which may be constructed by trench and/or trenchless technologies, depending on the geotechnical survey results.

This LRFI study was completed for use as a planning document. The proposed project is subject to Hawai‘i State environmental and historic preservation review legislation (HRS §343 and HRS §6E-8/HAR §13-275, respectively). While this investigation does not fulfill the requirements of an archaeological inventory survey investigation (per HAR §13-276), it serves as a document to facilitate the proposed project’s planning and supports historic preservation review compliance by assessing if there are major archaeological concerns within the project area and developing data on the general nature, density, and distribution of archaeological resources.

Background research shows the Nu‘uanu area has had a rich history during both the pre-Contact and post-Contact periods. Land Commission Awards show the area was used for agriculture as well as for habitation during the mid-nineteenth century in a pattern that may well have extended back in time for many centuries. Nu‘uanu Valley has long been the main connection point between windward O‘ahu and Honolulu. In the mid- to late 1800s the lands adjacent to the project area held homes of many of the leading families of O‘ahu including Queen Emma, Robert Creighton Wyllie, John H. Paty, and F.A. Schaefer. Extensive archaeological work has been undertaken in the Nu‘uanu Valley over the last century. Most of this work has been concentrated in lower Nu‘uanu Valley, nearest to the urban areas of Honolulu. Many historic properties have been identified adjacent to the project area

CSH completed the fieldwork component of this LRFI under archaeological permit numbers 14-04 and 15-03, issued by the SHPD pursuant to HAR §13-13-282. Fieldwork was conducted on 11 November 2014 by CSH archaeologists Scott Belluomini, B.A., and David W. Shideler, M.A., under the general supervision of Principal Investigator Hallett H. Hammatt, Ph.D. In general, fieldwork included 100% pedestrian inspection of the project area, which included GPS data collection.

During the field inspection, CSH archaeologists identified potential historic properties within or near the vicinity of the project area listed below:

- Cut basalt curbstones were observed to be extant along major portions of Nu‘uanu Avenue *makai* (southwest) of the Pali Highway, Nu‘uanu Avenue, and the Wyllie Street cloverleaf (see Figure 40, Figure 44, and Figure 45).
- Several ditches (traditional Hawaiian *‘auwai*) were encountered within the Dowsett Avenue area (see Figure 41 and Figure 50 through Figure 53). Two ditches were observed extending in a northeasterly direction and appear to cross through the project area under Dowsett Avenue (see Figure 41 and Figure 51 through Figure 53).

- Historic cemeteries are located along Nu‘uanu Avenue and Wyllie Street (see Figure 40, Figure 54, and Figure 55). The Oahu Cemetery and Crematory, established in 1844, is located on both sides of Nu‘uanu Avenue. The plots within the cemetery appear to extend slightly askew from Nu‘uanu Avenue. Several gravestones are located right next to the wall along Nu‘uanu Avenue in the west section of the cemetery (see Figure 55), suggesting the possibility that burials may extend into present day Nu‘uanu Avenue. Similarly, the Maemae Chapel cemetery located at Wyllie and Maemae streets may extend beyond its present boundaries into Wyllie Street (see Figure 56).
- The project area appears to include four bridges; three are at the immediate ends of the project area including the Pelekane Drive bridge (dating to 1930, see Figure 57), the Wyllie Street Bridge (dating to 1931, see Figure 58), and the Nu‘uanu Arch Bridge (dating to 1933, see Figure 59) and the Laimi Road Bridge dating to 1920 is traversed by a Laimi Road portion of the project area..
- Low basalt and mortar walls are found alongside the sidewalks throughout Nu‘uanu. These walls are typically cement-capped and consist of one to three courses of irregular vesicular basalt stones. Their ages often are indeterminate but in most cases are believed to be post-Contact but more than 50 years old. It would appear unlikely that the present project would impact these walls on adjacent private parcels.

7.2 Recommendations

This LRFI documented existing historic properties and identified potential historic properties within or adjacent to the current project area that may or may not be affected by the proposed construction activities of the Dowsett Highlands Sewer Relief project (show in Figure 39 through Figure 41, see Table 3). It is recommended that the Dowsett Highlands Sewer Relief project be designed to avoid adverse impact to the bridges, the cut basalt curb stones on Nu‘uanu Avenue, and the traditional Hawaiian *‘auwai* noted along Lā‘imi Road and the Dowsett Avenue area.

Because the project area traverses a former traditional Hawaiian landscape of *lo‘i kalo*, *‘auwai* and home sites (see Figure 12) and lies adjacent to a large number of previously idemntified historic properties, it is recommended that an archaeological monitoring program consistent with the standards of HAR §13-279 be developed, beginning with the preparation of an archaeological monitoring plan for the review and acceptance of the SHPD in advance of project related work. The archaeological monitoring plan will consider areas appropriate for on-site and on-call archaeological monitoring in light of specific information on the project-related subsurface impacts.

It is also recommended that documentation of the potential historic properties identified during the LRFI be completed during the archaeological monitoring program, to include a written description, location maps, an assessment of significance, and mitigation recommendations.

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APPENDIX C

Transportation Management Plan

TRANSPORTATION MANAGEMENT PLAN - DOWSETT HIGHLANDS RELIEF SEWER

HONOLULU, OAHU, HAWAII

DRAFT

May 5, 2017

Prepared for:

Fukanaga & Associates,Inc.
1357 Kapiolani Boulevard, Suite 1530
Honolulu, Hawaii 96814

Austin, Tsutsumi & Associates, Inc.
Civil Engineers • Surveyors
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817-5031
Telephone: (808) 533-3646
Facsimile: (808) 526-1267
E-mail: atahnl@atahawaii.com
Honolulu • Wailuku • Hilo, Hawaii

TRANSPORTATION MANAGEMENT PLAN – DOWSETT HIGHLANDS RELIEF SEWER

Honolulu, Oahu, Hawaii

DRAFT

Prepared for

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Prepared by

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Civil Engineers • Surveyors
Honolulu • Wailuku • Hilo, Hawaii

May 5, 2017

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AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

TERRANCE S. ARASHIRO, P.E.
ADRIENNE W.L.H. WONG, P.E., LEED AP
DEANNA M.R. HAYASHI, P.E.
PAUL K. ARITA, P.E.
ERIK S. KANESHIRO, L.P.L.S., LEED AP
MATT K. NAKAMOTO, P.E.
GARRETT K. TOKUOKA, P.E.

DRAFT

TRANSPORTATION MANAGEMENT PLAN FOR DOWSETT HIGHLANDS RELIEF SEWER Honolulu, Oahu, Hawaii

1. INTRODUCTION

This Transportation Management Plan (TMP) provides recommendations to reduce and minimize the traffic impacts resulting from lane closures on Pali Highway, Nuuanu-Pali Drive, Dowsett Avenue and Nuuanu Avenue for Dowsett Highlands Relief Sewer (hereinafter referred to as the "Project").

According to criteria in the Hawaii Department of Transportation, Highways Division (HDOT) "Determination of a Significant Highway Project" flow chart, this project was determined to be a Level 2 "Project". Refer to the TMP Determination in Appendix A.

1.1 ROLES AND RESPONSIBILITIES

TMP Manager:	City and County of Honolulu DDC - Wastewater Division & Contractor, To be determined
Author:	Austin, Tsutsumi & Associates, Inc. (ATA)
Stakeholders/Review Committee:	To be determined
TMP Monitor:	City and County of Honolulu DDC - Wastewater Division & Contractor, To be determined
Emergency Contacts:	To be determined

REPLY TO:
501 SUMNER STREET, SUITE 521 • HONOLULU, HAWAII 96817-5031
PHONE (808) 533-3646 • FAX (808) 526-1267
EMAIL : atahnl@atahawaii.com

OFFICES IN:
HONOLULU, HAWAII
WAILUKU, MAUI, HAWAII
HILO, HAWAII

2. PROJECT DESCRIPTION

2.1 Project Background

The City and County of Honolulu is proposing to construct a new relief sewer line along Nuuanu Avenue, Wyllie Street, Pali Highway, Nuuanu-Pali Drive and Dowsett Avenue. See Figure 2.1 for the Project Location Map. The primary focus of the TMP will be on the planned temporary roadway and lane closures along Nuuanu Avenue, Pali Highway, Nuuanu-Pali Drive and Dowsett Avenue.

2.2 Project Type

This improvement Project is funded by the City and County of Honolulu.

2.3 Project Area/Corridor

The Project is located along Nuuanu Avenue from School Street to Coelho Way, Wyllie Street from Nuuanu Avenue to Burbank Street, Pali Highway from Coelho Way to Dowsett Avenue (South), the full length of Dowsett Avenue, Pali Highway Annex Road from Dowsett Avenue (North) to Nuuanu-Pali Drive and the beginning (approximately 300 feet) of Nuuanu-Pali Drive. Both residential and commercial land uses are located within the vicinity of the Project. In addition, Kuakini Hospital, Nuuanu Fire Station, Oahu Country Club and several churches, schools and foreign consulates are located in the Project area.

2.4 Project Goals and Constraints

2.4.1 Goals

- Construct a new relief sewer line with minimal traffic disruption.
- Provide favorable work times for lane closures at each segment.

2.4.2 Constraints

- Project is constrained by the allotted construction funding
- Lane widths along Honolulu-bound Pali Highway will be reduced to 10 feet as part of an earlier project.
- Full lane closures will be limited to hours when traffic volumes do not exceed available capacity.
- Project construction is limited to allowable working hours by noise variance.

2.5 Proposed Construction Phasing/Staging

The sewer lines along Pali Highway from the Country Club Road/Puiwa Road intersection to the Coelho Way intersection will be constructed by open trench and/or trenchless pilot-tube microtunneling (PTMT). The remaining sewer lines will be constructed exclusively by open trench excavation. During construction, barricades and portable barriers will be used to restrict traffic from entering construction and staging areas.

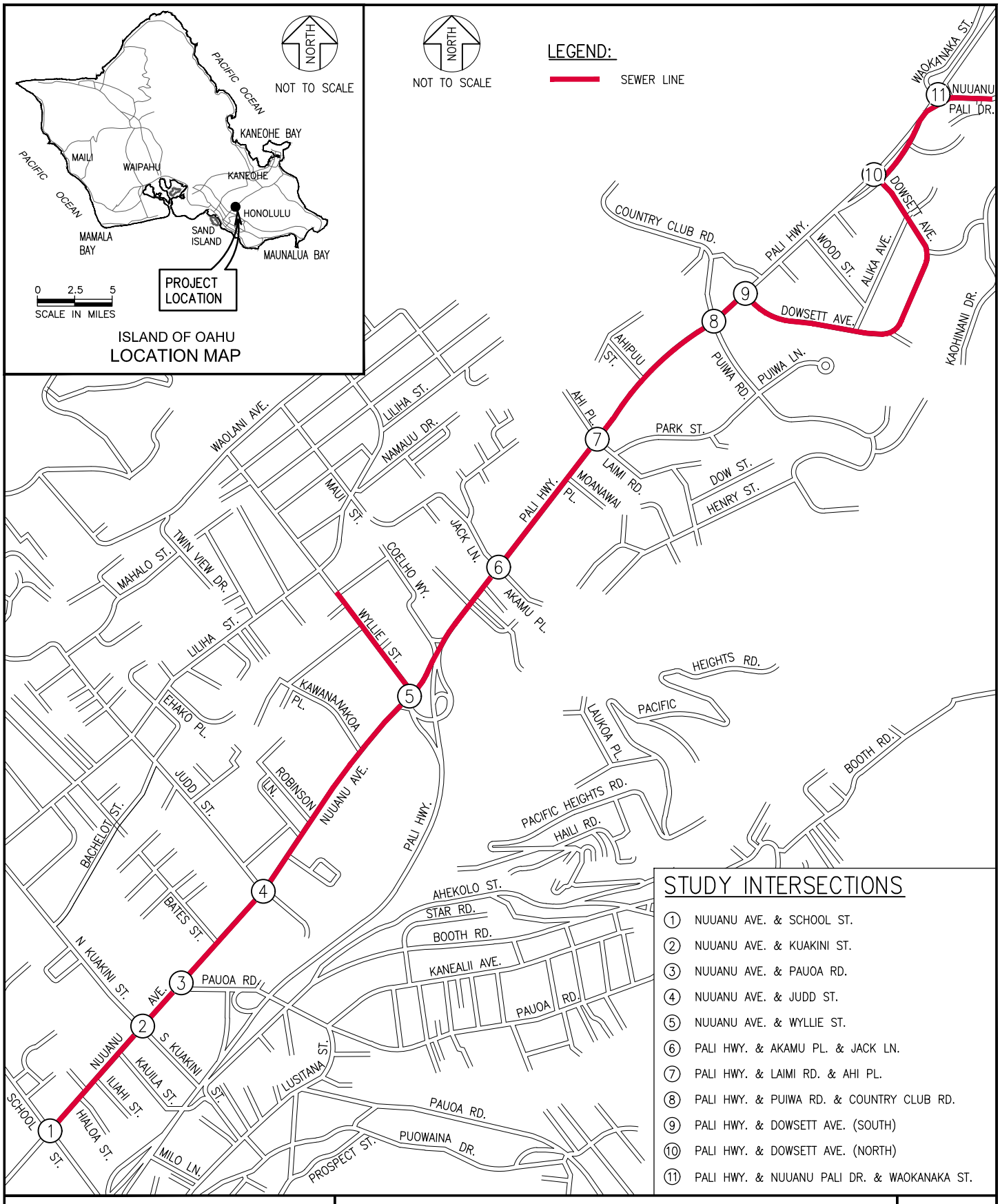
2.6 General Schedule and Timeline

The construction will start in the summer 2018 and must be completed by June 30, 2020, as required by the Global Consent Decree (GCD).

2.7 Related Projects

The Project lane/roadway closures should be coordinated with all projects scheduled with the same timeframe. Below is a list of known projects that may affect the Project:

- Pali Highway Resurfacing, Waokanaka Street to Kamehameha Highway and Pali Highway Lighting Replacement, Vineyard Boulevard to Kamehameha Highway (Federal Aid Project Number NH-061-1(035)) – Scheduled to start on September 2017 and finish May 2019. Overlap of construction is expected during the first 12 months of the Project. Pali Highway will be temporarily widened during this project in coordination with the Project.
- Pali Highway Resurfacing, Vineyard Boulevard to Waokanaka Street (Federal Aid Project Number NH-061-1(036)) – The construction schedule for this project has not yet been set. However, construction is expected to occur after completion of the Project.
- Complete Streets and road rehabilitation projects by the City and County of Honolulu – Construction along Nuuanu Avenue and other roadways that overlap with the proposed relief sewer alignments will be scheduled to coordinate with or follow the completion of the Project.



STUDY INTERSECTIONS

1. NUUANU AVE. & SCHOOL ST.
2. NUUANU AVE. & KUAKINI ST.
3. NUUANU AVE. & PAUOA RD.
4. NUUANU AVE. & JUDD ST.
5. NUUANU AVE. & WYLLIE ST.
6. PALI HWY. & AKAMU PL. & JACK LN.
7. PALI HWY. & LAIMI RD. & AHI PL.
8. PALI HWY. & PUIWA RD. & COUNTRY CLUB RD.
9. PALI HWY. & DOWSETT AVE. (SOUTH)
10. PALI HWY. & DOWSETT AVE. (NORTH)
11. PALI HWY. & NUUANU PALI DR. & WAOKANAKA ST.

DOWSETT HIGHLANDS
RELIEF SEWER TMP

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

LOCATION MAP

FIGURE
2.1

3. EXISTING AND FUTURE CONDITIONS

3.1 Roadway Characteristics

Below are descriptions of the existing roadways in the vicinity of the Project. These roadway conditions reflect the existing conditions at the time of this report.

Pali Highway – In the vicinity of the Project, this roadway is generally a two-way, six-lane, divided principle arterial with a posted speed limit of 35 miles per hour (mph). Pali Highway is a State roadway and is part of the National Highway System (NHS). This roadway serves as the main connection between Kailua to Honolulu. Pali Highway provides access to Nuuanu residential areas, schools, churches and foreign consulates.

Waokanaka Street – This roadway is generally a two-way, two-lane, undivided County roadway with a posted speed limit of 25 mph. This roadway provides access to residential areas.

Nuuanu-Pali Drive – This roadway is generally a two-way, two-lane, undivided County roadway with a posted speed limit of 25 mph. This roadway provides access to residential areas.

Dowsett Avenue – This roadway is generally a two-way, two-lane, undivided County roadway with a posted speed limit of 25 mph. This roadway provides access to residential areas. On-street parking is allowed along the roadway. Dowsett Avenue has two connections with Pali Highway. For the purposes of this report Dowsett Avenue (North) will refer to the northernmost connection and Dowsett Avenue (South) will refer to the southernmost connection.

Pali Highway Annex Road – This roadway runs parallel to Pali Highway and is generally a one-way, two-lane County roadway with a posted speed limit of 25 mph. Pali Highway Annex Road branches off of Pali Highway at Homelani Place and reconnects with the highway between Kepola Place and Nuuanu-Pali Drive. Between its intersections with Dowsett Avenue (North) and Kepola Place, this roadway becomes a two-way, one-lane undivided roadway. This roadway provides access to residential areas.

Country Club Road – This roadway is generally a two-way, two-lane, undivided County roadway with no posted speed limit. This roadway provides access to Oahu Country Club and residential areas.

Puiwa Road – This roadway is generally a two-way, two-lane, undivided County roadway with a posted speed limit of 25 mph. This roadway provides access to residential areas and Nuuanu Elementary School. On-street parking is allowed at various locations along the roadway.

Ahi Place – This roadway is generally a two-way, two-lane, undivided County roadway with no posted speed limit. This roadway provides access to residential areas. On-street parking is allowed along the roadway.

Laimi Road – This roadway is generally a two-way, two-lane, undivided County roadway with a posted speed limit of 25 mph. This roadway provides access to residential areas.

Jack Lane – This roadway is generally a two-way, two-lane, undivided County roadway with no posted speed limit. This roadway provides access to residential areas.

Akamu Place – This roadway is generally a two-way, two-lane, undivided County roadway with no posted speed limit. This roadway provides access to residential areas. On-street parking is allowed along the roadway.

Nuuanu Avenue – In the vicinity of the Project, this roadway is generally a two-way, four-lane, undivided County collector with a posted speed limit of 25 mph. This roadway provides access to residential and commercial areas, schools and cemeteries. On-street parking is allowed at various locations along the roadway.

Niolopa Place – This roadway is generally a two-way, two-lane, undivided County roadway with no posted speed limit. This roadway provides access to residential areas.

Coelho Way – This roadway is generally a two-way, two-lane, undivided County roadway with a posted speed limit of 15 mph. This roadway provides access to residential areas.

Wyllie Street – This roadway is generally a two-way, two-lane, undivided County roadway with a posted speed limit of 25 mph. This roadway provides access to the Nuuanu Fire Station, Maemae Elementary School and residential areas.

Wyllie Interchange – This roadway is generally a two-way, two-lane, divided County collector with a posted speed limit of 25 mph. This interchange connects Nuuanu Avenue to both Kailua-bound and Honolulu-bound Pali Highway. Wyllie Interchange provides access to Hawaii Baptist Academy High School.

Judd Street – This roadway is generally a two-way, two-lane, undivided County roadway with a posted speed limit of 25 mph. This roadway provides access to residential areas. On-street parking is allowed at various locations along the roadway.

Pauoa Road – This roadway is generally a two-way, four-lane, undivided County distributor with a posted speed limit of 25 mph. This roadway provides access to residential areas and Kawananakoa Middle School. On-street parking is allowed at various locations along the roadway.

Kuakini Street – This roadway is generally a two-way, two-lane, undivided County collector with a posted speed limit of 25 mph. This roadway provides access to Kuakini Medical Center and residential and commercial areas. On-street parking is allowed at various locations along the roadway.

School Street – To the southeast of the Nuuanu Avenue/School Street intersection, this roadway is generally a two-way, three-lane, undivided County collector with a posted speed limit of 25 mph. Northwest of the Nuuanu Avenue/School Street intersection, this roadway temporarily transitions to a one-way, two lane roadway. West of the H-1 Freeway on ramp, the roadway transitions into a two-way, four-lane, undivided County collector. School Street provides access to residential and commercial areas and on-ramps and off-ramps for the H-1 Freeway.

3.2 Existing and Historical Traffic Data

Manual peak hour turning movement counts collected by ATA were used to determine the impacts from turning lane closures along Pali Highway, Nuuanu Avenue and Dowsett Avenue.

Turning movement counts for the weekday morning (AM), midday (MD) and afternoon (PM) peaks were collected in 2009 and 2014. An annual growth rate was determined using overlapping intersection data between years 2009 and 2014. The growth in traffic volumes at these intersections between these two years was used to predict 2017 traffic conditions at the Project intersections. Additionally, turning movement counts for the weekend midday (WE) peak for Pali Highway/Jack Lane/Akamu Place, Pali Highway/Dowsett Avenue (South) and Pali Highway/Dowsett Avenue (North) were collected on January 14, 2017. WE counts were compared to the AM, MD and PM counts at Pali Highway/Jack Lane/Akamu Place to predict AM, MD and PM turning movement counts at Pali Highway/Dowsett Avenue (South) and Pali Highway/Dowsett Avenue (North). The peak hour turning movement volumes are shown in Figure 3.1. The manual turning movement count data are included in Appendix B.

In addition to turning movement data, 24-hour traffic count data was used to determine potential lane closure hours. Counts along Wyllie Street and Pali Highway were collected in 2014 and 2015, respectively, by HDOT, and counts along Nuuanu Avenue and Dowsett Avenue were collected in 2017 by ATA. The 24-hour counts are discussed further in Section 3.5. The 24-hour count data are included in Appendix C.

3.3 Transit Impact

Oahu Transit Services (OTS) operates TheBus, which services the most populated areas of the island. TheBus is the primary form of public transit on Oahu. The following bus routes provide service in the Project area and have bus stops along Pali Highway and Nuuanu Avenue:

- 4 University – Moiliili
- 10 Alewa Heights
- 55 Honolulu – Ala Moana Center
- 56 Honolulu – Ala Moana Center
- 57 Honolulu – Ala Moana Center
- 57A Honolulu – Ala Moana Center
- 65 Downtown – Bishop Street

The time between buses averages approximately 5-10 minutes during the midday.

Care should be taken to preserve bus bays and pedestrian accessibility/routes. The City should coordinate with OTS to temporarily modify bus routes while the Project is ongoing.

See Figure 3.1 for the location of bus stops within the study area.

3.4 Pedestrian Impact

The Project area serves a mix of residential and commercial land uses. In addition, several schools are located along the Project corridors. The following are major trip generators in the Project area:

- Prince David Kawananakoa Middle School
- Hawaii Baptist Academy Elementary School

- Maemae Elementary School
- Hawaii Baptist Academy High School
- Nuuanu Elementary School

Because there is a significant number of schools in the area, peak pedestrian volumes are likely to coincide with school start and end times. The start and end times for the schools in the vicinity of the Project are listed in Table 3.1 below.

Table 3.1: Nearby Schools Start and End Times

	Prince David Kawananakoa Middle School		Hawaii Baptist Academy Elementary School		Maemae Elementary School		Hawaii Baptist Academy High School		Nuuanu Elementary School	
	Start	End	Start	End	Start	End	Start	End	Start	End
Monday	7:55 AM	1:55 PM	7:55 AM	2:30 PM	7:50 AM	2:15 PM	7:45 AM	2:45 PM	8:00 AM	2:15 PM
Tuesday	7:55 AM	1:55 PM	7:55 AM	2:30 PM	7:50 AM	2:15 PM	7:45 AM	2:45 PM	8:00 AM	2:15 PM
Wednesday	7:55 AM	2:00 PM	7:55 AM	2:30 PM	7:50 AM	12:45 PM	7:45 AM	2:45 PM	8:00 AM	1:25 PM
Thursday	7:55 AM	1:55 PM	7:55 AM	2:30 PM	7:50 AM	2:15 PM	7:45 AM	2:45 PM	8:00 AM	2:15 PM
Friday	7:55 AM	2:15 PM	7:55 AM	2:30 PM	7:50 AM	2:15 PM	7:45 AM	2:45 PM	8:00 AM	2:15 PM

Pedestrian volumes are high at the Nuuanu Avenue intersections, most notably at Nuuanu Avenue/Kuakini Street. 188(87)[123] pedestrians were observed at the Nuuanu Avenue/Kuakini Street intersection during the AM(MD)[PM] peak hour of traffic. Because school end times generally fall between the MD and PM peak hours of traffic, pedestrian volumes will likely be near AM peak hour pedestrian volumes during the period of 2:00 PM – 3:00 PM.

Care should be taken to preserve pedestrian crossing routes and sidewalks in the Project area. In the event that sidewalks or crosswalks must be closed, alternative pedestrian routes must be provided. The TMP Manager should provide adequate signage if pedestrian detours are required.

See Figure 3.1 for the location of the schools in the Project vicinity and for the pedestrian volumes at the study intersections.

LEGEND

AA(AA)[AA] – AM(MD)[PM] PEAK HOUR OF TRAFFIC VOLUMES

Y – SIGNALIZED INTERSECTION Y

X – UNSIGNALIZED INTERSECTION X

##(##)[##] – AM(MD)[PM] PEAK HOUR OF TRAFFIC, PEDESTRIAN CROSSINGS

– BUS STOP

DATE OF COUNTS:
OCTOBER 20, 2009
OCTOBER 22, 2009
FEBRUARY 5, 2014
FEBRUARY 27, 2014
JANUARY 14, 2017

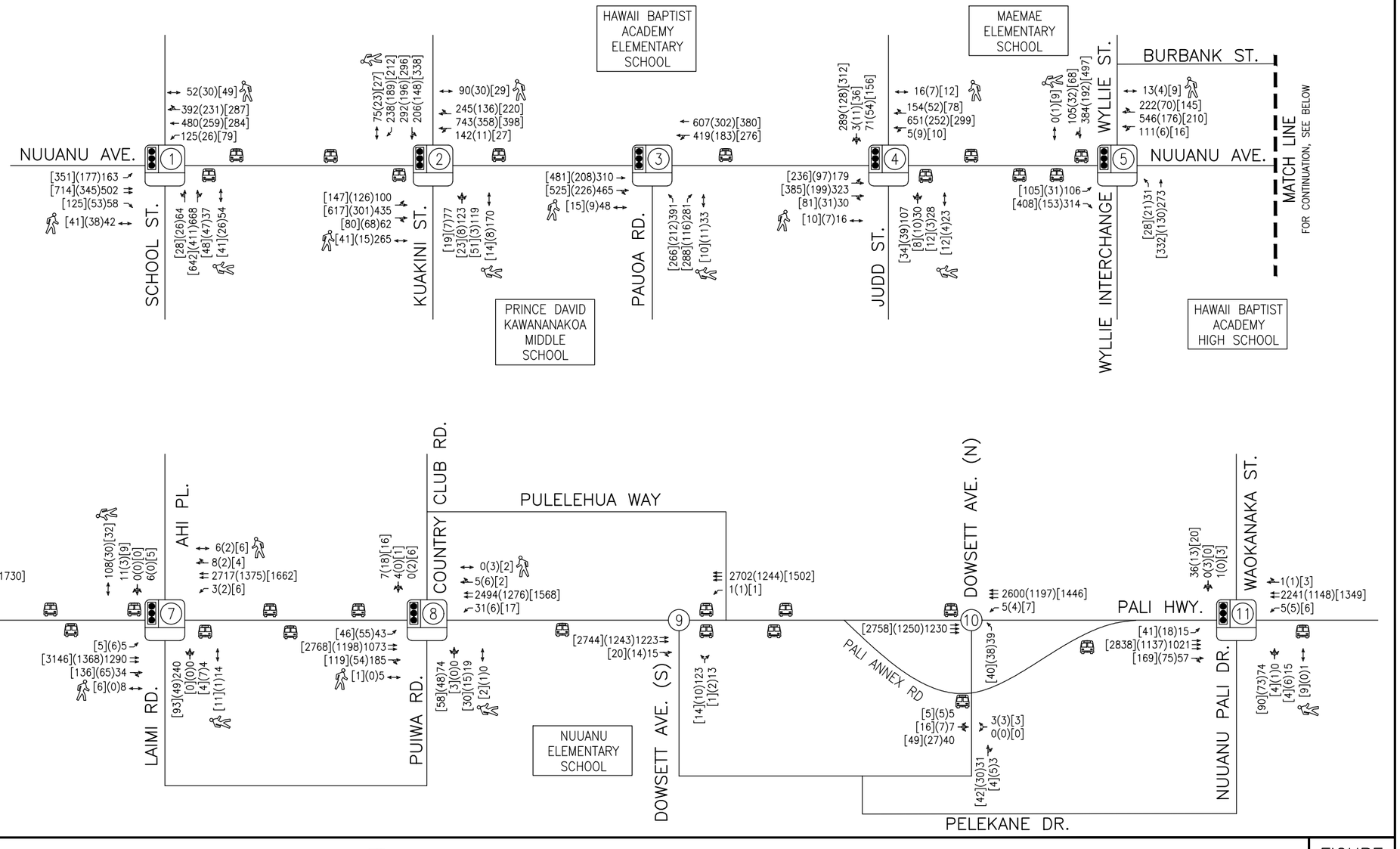
AM PEAK HOUR:
7:00 AM – 8:00 AM

MD PEAK HOUR:
11:30 AM – 12:30 PM

PM PEAK HOUR:
4:30 PM – 5:30 PM

NOTE:
THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

NORTH
NOT TO SCALE



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EXISTING LANE CONFIGURATION AND VOLUME

FIGURE
3.1

3.5 Existing Traffic Operations

There are nine (9) traffic signals in the Project vicinity. The traffic signals are located at the following intersections:

- Pali Highway/Nuuanu-Pali Drive/Waokanaka Street
- Pali Highway/Country Club Road/Puiwa Road
- Pali Highway/Ahi Place/Laimi Road
- Pali Highway/Jack Lane/Akamu Place
- Nuuanu Avenue/Wyllie Street
- Nuuanu Avenue/Judd Street
- Nuuanu Avenue/Pauoa Road
- Nuuanu Avenue/Kuakini Street
- Nuuanu Avenue/School Street

Through the Study Area, Pali Highway widens from 4 lanes across to 6 lanes across and has four signalized intersections. During the AM peak period of traffic through the study area, Pali highway experiences congestion in the southbound direction due to the heavy traffic demand; travel speeds range between 7 and 10 mph and at times, queues from the signalized Nuuanu Avenue/Wylie Street intersection can extend onto southbound Pali Highway, blocking its rightmost terminal lane. Traffic decreases significantly after 9:00 AM, as is shown in Figures 3.6 and 3.7.

All signalized Pali Highway intersections are coordinated and run with a 210 second cycle length during the AM peak hour of traffic, a 100 second cycle length during the MD peak hour of traffic and a 200 second cycle length during the PM peak hour of traffic. Additionally, all signalized Pali Highway intersections provide exclusive left-turn phasing for the major approaches.

Nuuanu Avenue mainly experiences congestion at three main intersections: School Street, Kuakini Street and at Pauoa Road. The School Street intersection congestion is mainly due to the large volumes, however most vehicles are typically able to clear within one cycle. At the Kuakini Street intersection there is a constant congestion during all peak hours of traffic. Minor approach congestion at this intersection can be attributed to high frequency of turning vehicles conflicting with opposing vehicle or pedestrian movements. Finally, at the Pauoa Road intersection mainline left-turns from Nuuanu Avenue onto Pauoa Road experience significant queuing during the peak hours of traffic as a result of high opposing conflicting through movements. Traffic decreases significantly in the Honolulu-bound direction after 9:00 AM, as is shown in Figures 3.3 through 3.5.

3.6 Incident and Crash Data

Accident report data was obtained from HDOT for the five (5) most recent years of data from 2008 to 2012 along Pali Highway and from 2007 to 2011 along Nuuanu Avenue. A summary of the data is shown in Appendix D.

Three casualties were reported along Pali Highway from 2008 to 2012. The first occurred at the Pali Highway/Coelho Way intersection due to a collision with the curb. The remaining two occurred at the Pali Highway/Dowsett Avenue (South) intersection due to collisions with pedestrians crossing within an unsignalized crosswalk.

One casualty was reported along Nuuanu Avenue from 2007 to 2011. The accident occurred at the Nuuanu Avenue/Kauila Street unsignalized intersection due to a collision with a pedestrian crossing within a marked crosswalk.

3.7 Traffic Predictions During Construction

The 24-hour count data collected in 2014 and 2015 by HDOT and in 2017 by ATA were used to determine potential lane closure hours along Pali Highway, Nuuanu Avenue, Dowsett Avenue and Wyllie Street. The 24-hour count locations are shown in Figure 3.2.

In the 24-hour count data analysis, a threshold was used to determine the capacity of the roadways. According to criteria in the 2007 HDOT Transportation Management Plan Guidelines and the Work Zone Safety and Mobility Process, a significant project for the HDOT would be where the existing traffic volume exceeds 1,000 passenger cars per lane per hour (pc/ln/hr) during the normal working hours. Therefore, 1,000 pc/ln/hr was used as a threshold guideline to determine the most favorable work hours to implement lane closures for the Project.

The analysis of the 24-hour count data is discussed by roadway below.

Pali Highway

As part of the Pali Highway Resurfacing, Waokanaka Street to Kamehameha Highway and Pali Highway Lighting Replacement, Vineyard Boulevard to Kamehameha Highway (Federal Aid Project Number NH-061-1(035)) project, the Pali Highway Honolulu-bound lanes will be temporarily realigned and narrowed. For detailed roadway and traffic impacts and recommendations regarding the temporary realignment/narrowing, reference the Pali Highway Resurfacing Project TMP Supplement.[1]

With the temporary realignment/narrowing, Pali Highway will have three (3) lanes and a shoulder lane in the Honolulu-bound direction. The shoulder lane will be closed throughout the construction period, except at existing bus stops, while the three (3) lanes will be open during the peak hours of traffic. During off-peak hours, the right-most lane will be closed to allow for construction vehicles and material hauling. No roadway changes will be made to Pali Highway in the Kailua-bound direction.

[1] Austin, Tsutsumi & Associates, Inc., *TMP Supplement for Pali Highway Resurfacing, Waokanaka Street to Kamehameha Highway Lighting Replacement, Vineyard Boulevard to Kamehameha Highway*, January 31,2017.

Sewer line construction between Dowsett Avenue (South) and Coelho Way will be done in the Honolulu-bound direction. During construction, the right-most Honolulu-bound lane will be closed, and only two (2) lanes will be utilized for traffic. Based on the 1,000 pc/ln/hr threshold, during this time, Pali Highway will have a capacity of 2,000 pc/hr or 500 pc/15-minute interval in the Honolulu-bound direction. The 24-hour count data were plotted by 15-minute increments against this threshold. As shown in Figures 3.7, 3.8 and 3.11, traffic volumes along Honolulu-bound Pali Highway only exceeded the threshold during the AM commuter peak hour.

Sewer line construction between Dowsett Avenue (North) and Nuuanu-Pali Drive will be done in the Kailua-bound direction. During construction, the right-most Kailua-bound lane will be closed, and only two (2) lanes will be utilized for traffic. Based on the 1,000 pc/ln/hr threshold, Kailua-bound Pali Highway cannot exceed 500 pc/15-minute interval. As shown in Figure 3.11, traffic volumes along Kailua-bound Pali Highway do not exceed this threshold.

A single-lane closure in the Honolulu-bound direction (Dowsett Avenue (South) to Coelho Way) and in the Kailua-bound direction (Dowsett Avenue (North) to Nuuanu-Pali Drive) was found to be acceptable between the hours of 9:00 AM and 7:00 PM.

Nuuanu Avenue

During open trench construction along Nuuanu Avenue, either one or two lanes will be closed along the roadway. The lane closures will occur in the Honolulu-bound and/or the Kailua-bound direction of Nuuanu Avenue. In the event that both Honolulu-bound lanes must be closed, one lane in the Kailua-bound direction may be contraflowed to provide a lane in the Honolulu-bound direction. On-street parking will not be allowed along the roadway during the construction period.

Assuming the worst case scenario of two lane closures, Nuuanu Avenue will have one lane operational in each direction. Based on the 1,000 pc/ln/hr threshold, Nuuanu Avenue vehicle traffic cannot exceed 250 pc/15-minute interval in each direction of traffic. The 24-hour count data were plotted by 15-minute increments against this threshold. As shown in Figures 3.3 – 3.5, traffic volumes along Nuuanu Avenue exceeded the threshold during the AM commuter peak hour of traffic. Traffic volumes also exceeded the threshold during the PM commuter peak hour between Muliwai Lane and Pauoa Road as shown in Figure 3.4. Therefore, lane closures shall avoid the AM and PM commuting hours.

A two-lane closure along Nuuanu Avenue was found to be acceptable between the hours of 8:30 AM and 4:30 PM. Similarly, a one-lane closure would also be acceptable during this time frame.

Dowsett Avenue

During open trench construction on Dowsett Avenue, the roadway will be reduced to a two-way, one-lane operation. Because the roadway provides exclusive access to residences, it cannot be fully restricted during construction. During two-way, one-lane operations the roadway will require flaggers to direct traffic.

Based on the 1,000 pc/ln/hr threshold, Dowsett Avenue vehicle traffic cannot exceed a combined volume of 250 pc/15-minute interval in both directions during construction. The 24-hour count data were plotted by 15-minute increments against this threshold. As shown in Figures 3.9 – 3.10, traffic volumes along Dowsett Avenue will not exceed this threshold due to

the low volumes along the residential roadway. Although two-way, one-lane operations will not be limited by roadway capacity, construction hours should fall within the acceptable noise variance range. Additionally, construction hours should avoid, if possible, the commuter peak hours of traffic to minimize the negative effects of lane closures on residents.

Two-way, one-lane operations along Dowsett Avenue were found to be acceptable between the hours of 9:00 AM and 5:00 PM. However, the contractor should regularly monitor traffic and queue lengths at the Dowsett Avenue accesses to verify that spillback from Dowsett Avenue operations does not affect Pali Highway.

Wyllie Street

During open trench construction on Wyllie Street, the roadway will be reduced to a two-way, one-lane operation. Because the roadway provides exclusive access to residences, Nuuanu Fire Station and Maemae Elementary School, it cannot be fully restricted during construction. During two-way, one-lane operations the roadway will require flaggers to direct traffic.

Based on the 1,000 pc/ln/hr threshold, Wyllie Street vehicle traffic cannot exceed a combined volume of 250 pc/15-minute interval in both directions during construction. The 24-hour count data were plotted by 15-minute increments against this threshold. As shown in Figure 3.6, traffic volumes along Wyllie Street exceeded the threshold during the PM commuter peak hour of traffic and came close to exceeding the threshold during the AM peak hour. Therefore, lane closures shall avoid the AM and PM commuting hours.

Two-way, one-lane operations along Wyllie Street were found to be acceptable between the hours of 7:30 AM and 3:30 PM. However, the contractor should regularly monitor traffic and queue lengths at the Wyllie Street access to verify that spillback from Wyllie Street operations does not affect Nuuanu Avenue.

Recommended Closure Times by Roadway

- Pali Highway:
  - A single-lane closure in the Honolulu-bound direction (Dowsett Avenue (South) to Coelho Way) and in the Kailua-bound direction (Dowsett Avenue (North) to Nuuanu-Pali Drive) was found to be acceptable between the hours of 9:00 AM and 7:00 PM.
- Nuuanu Avenue:
  - A two-lane closure along Nuuanu Avenue was found to be acceptable between the hours of 8:30 AM and 4:30 PM. Similarly, a one-lane closure would also be acceptable during this time frame.
- Dowsett Avenue:
  - Two-way, one-lane operations along Dowsett Avenue were found to be acceptable between the hours of 9:00 AM and 5:00 PM.
- Wyllie Street:
  - Two-way, one-lane operations along Wyllie Street were found to be acceptable between the hours of 7:30 AM and 3:30 PM.

3.7.1 Turning Movement Restrictions

All turning movements should be maintained where possible. If it is not possible to maintain existing turning movements, the TMP manager shall provide acceptable detour routes for

affected vehicles, if not already provided in this section. Due to the relatively low volume of vehicles likely to be impacted by turning movement restrictions, traffic operations in the study area are expected to remain at acceptable levels during allowable work hours.

All turning movement restrictions should be coordinated with all nearby health and emergency services (fire, police and ambulance services) prior to implementation. Special provisions should be made to allow emergency vehicles to travel through the construction area unimpeded and without lengthy delays. Provisions may include the temporary removal of a restriction (if possible) or allowing emergency vehicles to travel in opposing traffic lanes. These provisions shall be provided by the TMP manager depending on construction conditions throughout the Project area.

During construction of the Project, the following turning lanes will be temporarily closed.

Honolulu-bound Pali Highway left-turn into Laimi Road

The left-turn lane will be temporarily closed during construction on Pali Highway. During the lane closure, vehicles can access residential areas via Kailua-bound Pali Highway. In order to prevent additional traffic to residential areas, vehicles will be rerouted to the Pali Highway/Jack Lane/Akamu Place intersection where they can complete a U-turn onto Kailua-bound Pali Highway. Once on Kailua-bound Pali Highway, vehicles can make a right-turn onto Laimi Road. Additionally, vehicles may take the earlier left-turn onto Puiwa Road and reroute through the local streets vial Puiwa Road and Park Street. The reroute will add approximately 0.56 miles to the existing trip. Figure 3.12A illustrates the proposed reroute path.

Currently, 3(2)[6] vehicles make the left-turn during the AM(MD)[PM] peak hours. Because the turning volume is low, the reroute is not expected to have a significant impact to traffic patterns. Complete turning movement volumes are shown in Figure 3.1.

Honolulu-bound Pali Highway left-turn into Puiwa Road

The left-turn lane will be temporarily closed during construction on Pali Highway. During the lane closure, vehicles can access residential areas via Kailua-bound Pali Highway. In order to prevent additional traffic to residential areas, vehicles will be rerouted to the Pali Highway/Laimi Road intersection where they can complete a U-turn onto Kailua-bound Pali Highway or make a left-turn and reroute through local streets via Laimi Road and Park Street. The reroute will add approximately 0.56 miles to the existing trip. Figure 3.12A illustrates the proposed reroute path.

Currently, 31(6)[17] vehicles make the left-turn during the AM(MD)[PM] peak hours. Because the turning volume is low, the reroute is not expected to have a significant impact to traffic patterns. Complete turning movement volumes are shown in Figure 3.1.

Pali Highway left- and-right turns into Dowsett Avenue (South)

The Honolulu-bound left-turn lane and the Kailua-bound right-turn lane will be temporarily closed during open trench construction on Pali Highway and Dowsett Avenue. During the closures, vehicles can access residential areas via the Pali Highway/Dowsett Avenue (North) intersection. Vehicles on Honolulu-bound Pali Highway will be rerouted to take the earlier left-turn onto Dowsett Avenue (North). The reroute will add approximately 0.06 miles to the existing trip. Vehicles on Kailua-bound Pali Highway will be rerouted to take the later right-turn onto

Dowsett Avenue (North). The reroute will add approximately 0.64 miles to the existing trip. Note that the additional reroute distances may be shorter or longer depending on the vehicle's destination. Figure 3.12A illustrates the proposed reroute paths.

Based on projections, approximately 1(1)[1] vehicles make the Honolulu-bound left-turn and approximately 15(14)[20] vehicles make the Kailua-bound right-turn during the AM(MD)[PM] peak hours. Because the turning volumes are low, the reroutes are not expected to have a significant impact to traffic patterns. Complete turning movement volumes are shown in Figure 3.1.

Pali Highway left- and-right turns into Dowsett Avenue (North)

The Honolulu-bound left-turn lane and the Kailua-bound right-turn lane will be temporarily closed during open trench construction on Dowsett Avenue. During the closures, vehicles can access residential areas via the Pali Highway/Dowsett Avenue (South) intersection. Vehicles on Honolulu-bound Pali Highway will be rerouted to take the later left-turn onto Dowsett Avenue (South). The reroute will add approximately 0.70 miles to the existing trip. Vehicles on Kailua-bound Pali Highway will be rerouted to take the earlier right-turn onto Dowsett Avenue (South). The reroute will add approximately 0.12 miles to the existing trip. Note that the additional reroute distances may be shorter or longer depending on the vehicle's destination. Figure 3.12B illustrates the proposed reroute paths.

Based on projections, approximately 5(4)[7] vehicles make the Honolulu-bound left-turn and approximately 40(27)[49] vehicles make the Kailua-bound right-turn during the AM(MD)[PM] peak hours. Because the turning volumes are low, the reroutes are not expected to have a significant impact to traffic patterns. Complete turning movement volumes are shown in Figure 3.1.

Pali Highway left- and right-turns into Nuuanu-Pali Drive

The Honolulu-bound left-turn lane and the Kailua-bound right-turn lane will be temporarily closed during open trench construction on the Kailua-bound side of Pali Highway and Nuuanu-Pali Drive. During the closures, vehicles can access residential areas via the Pali Highway/Dowsett Avenue (North) intersection. Vehicles on Honolulu-bound Pali Highway will be rerouted to take the later left-turn onto Dowsett Avenue (North). Once on Dowsett Avenue, vehicles can make a left-turn onto Pelekane Drive, a second left-turn onto Kaohinani Drive and a final left-turn onto Ala Kimo Drive. From there, vehicles can make a right or left-turn onto Nuuanu-Pali Drive depending on their destination. The reroute will add approximately 0.50 miles to the existing trip. Vehicles on Kailua-bound Pali Highway will be rerouted to take the earlier right-turn onto Dowsett Avenue (North). Once on Dowsett Avenue, vehicles can reroute as described above for the Honolulu-bound detour. The reroute will add approximately 0.32 miles to the existing trip. Note that the additional reroute distance may be shorter or longer depending on the vehicle's destination. Figure 3.12B illustrates the proposed reroute path.

Currently, 5(5)[6] vehicles make the Honolulu-bound left-turn and 57(75)[169] vehicles make the Kailua-bound right-turn during the AM(MD)[PM] peak hours. The volume of turning vehicles is significant during PM peak hour for the Kailua-bound right-turn because of the large number of residences Nuuanu-Pali Drive serves. However, the reroute is not expected to significantly impact traffic patterns because of the low volumes currently using the proposed reroute roadways. Complete turning movement volumes are shown in Figure 3.1.

Nuuanu Avenue Off-Ramp from Pali Highway

The Nuuanu Avenue Off-Ramp will be temporarily closed during open trench construction along Pali Highway and Nuuanu Avenue. During the closure, vehicles can access Nuuanu Avenue by turning onto Coelho Way and traveling on Burbank Street and Wyllie Street. This reroute will add approximately 0.40 miles to the existing trip. However, it should be noted that this detour utilizes residential streets and cannot support large vehicle volumes. Alternatively, vehicles can avoid the closure by continuing on Pali Highway and exiting at School Street to connect to Nuuanu Avenue. Because this alternative bypasses approximately one mile of Nuuanu Avenue, this reroute option is recommended for vehicles with destinations closer to School Street. This reroute will add approximately 0.75 miles to the existing trip. Note that the additional reroute distances may be shorter or longer depending on the vehicle's destination. Figure 3.13 illustrates the proposed reroute paths.

Currently, 879(252)[371] vehicles use the Nuuanu Avenue off-ramp during the AM(MD)[PM] peak hours. Because volumes are high, construction work should be limited to off-peak hours of traffic. Additionally, residences along Coelho Way and Burbank Street should be given sufficient notice of increased traffic on the roadways due to the reroute. The roadways should be monitored to verify that the reroute does not adversely affect traffic operations in the area. Complete turning movement volumes are shown in Figure 3.1.

Kailua-bound Nuuanu Avenue left-turn into School Street

The left-turn will be temporarily restricted during construction of the underground connection of the sewer line to the existing sewer tunnel under School Street. During the restriction, vehicles will be rerouted to take the earlier left-turn onto Vineyard Boulevard and the next right-turn onto Aala Street to take them to School Street. The reroute will add approximately 0.23 miles to the existing trip. Figure 3.13 illustrates the proposed reroute path.

Currently, 163(177)[351] vehicles make the left-turn during the AM(MD)[PM] peak hours. Because the turning volume is high, construction work should be limited to off-peak hours of traffic. Additionally, traffic at the Nuuanu Avenue/Vineyard Boulevard intersection should be monitored to verify that the reroute does not adversely affect the intersection. Complete turning movement volumes are shown in Figure 3.1.

3.7.2 Roadway Closures

During Project construction, access to driveways and intersections should be maintained where possible. Roadways that provide exclusive access to business and residences cannot be fully restricted during construction. Additionally, access to businesses and residences that have driveways connecting directly to Project roadways will need to be maintained during Project construction.

Pali Highway

Roadways along Pali Highway that provide exclusive access to residences and cannot be fully restricted during construction include, but are not limited to, Jack Lane, Akamu Place, Kepola Place, Niolopa Place, Moanawai Place, Ahi Place and Ahipuu Street.

Nuuanu Avenue

Roadways along Nuuanu Avenue that provide exclusive access to businesses and residences and cannot be fully restricted during construction include, but are not limited to, Kawananakoa Place, Robinson Lane, Craigside Place, Judd Street (eastern approach), Bates Street, Muliwai Lane, Iliahi Street, Kaena Lane and Hialoa Street.

Dowsett Avenue

Roadways along Dowsett Avenue that provide exclusive access to residences and cannot be fully restricted during construction include, but are not limited to, Allan Place, Holona Place and Lopeka Place.

Wyllie Street

Roadways along Wyllie Street that provide exclusive access to residences and cannot be fully restricted during construction include, but are not limited to, Wyllie Place, Maemae Lane and Pikake Place.

LEGEND

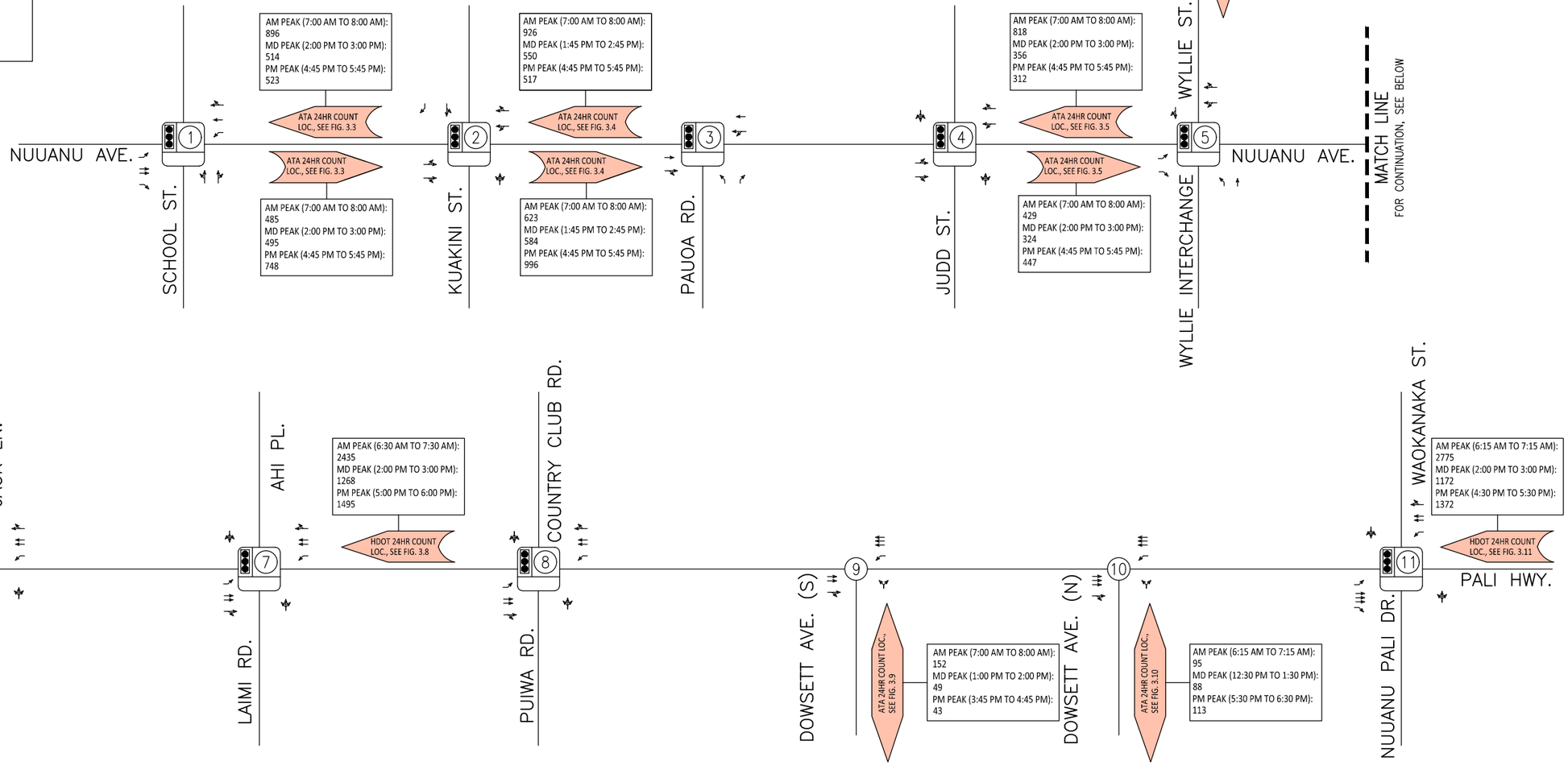
(Y) – SIGNALIZED INTERSECTION Y

(X) – UNSIGNALIZED INTERSECTION X

NOTE:
THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

NORTH

NOT TO SCALE



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24-HOUR COUNT LOCATIONS

FIGURE
3.2

Figure 3.3
24-Hour Plot - Nuuanu Ave. between Iliahi St. and Kauila St.

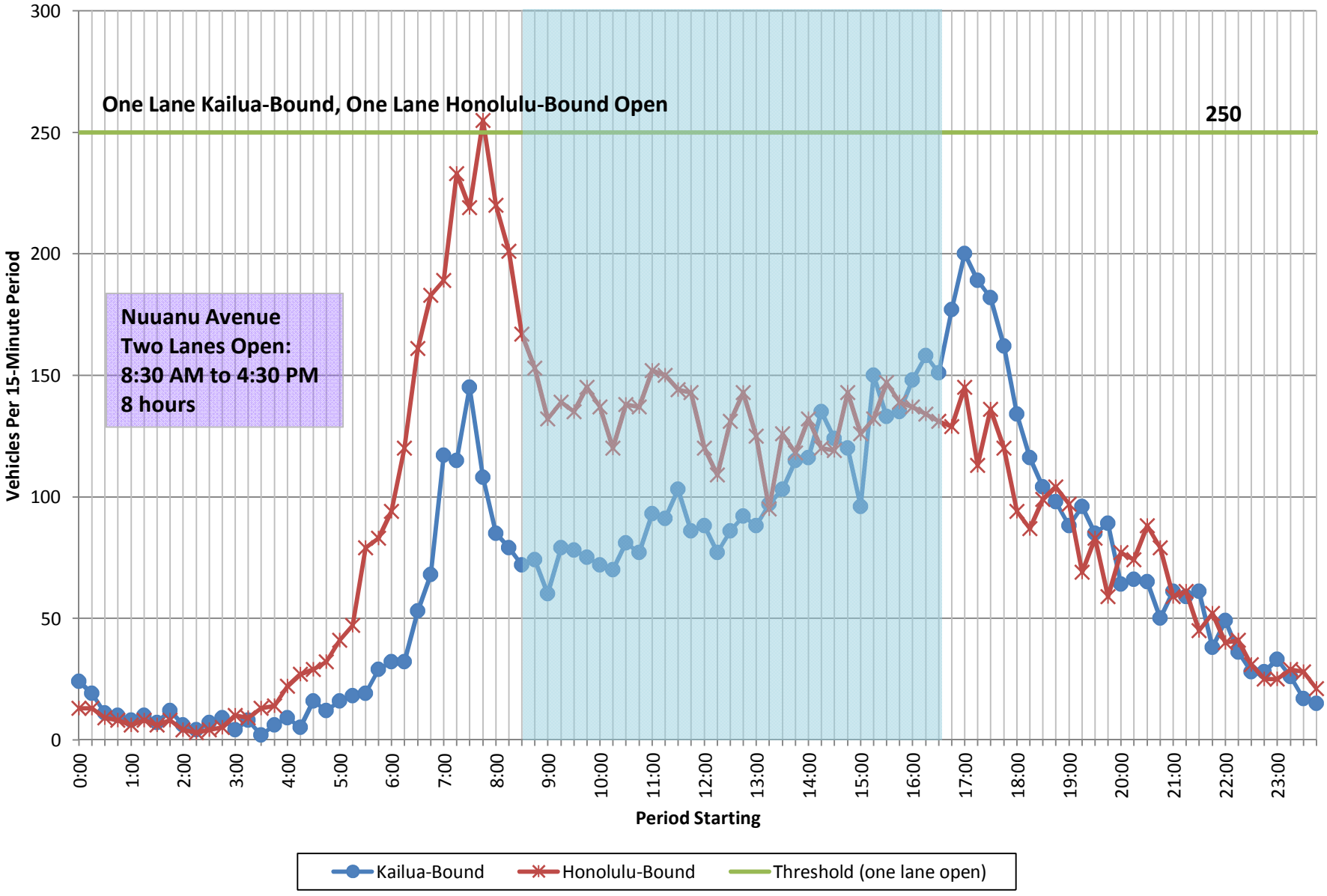


Figure 3.4
24-Hour Plot - Nuuanu Ave. between Muliwai Ln. and Pauoa Rd.

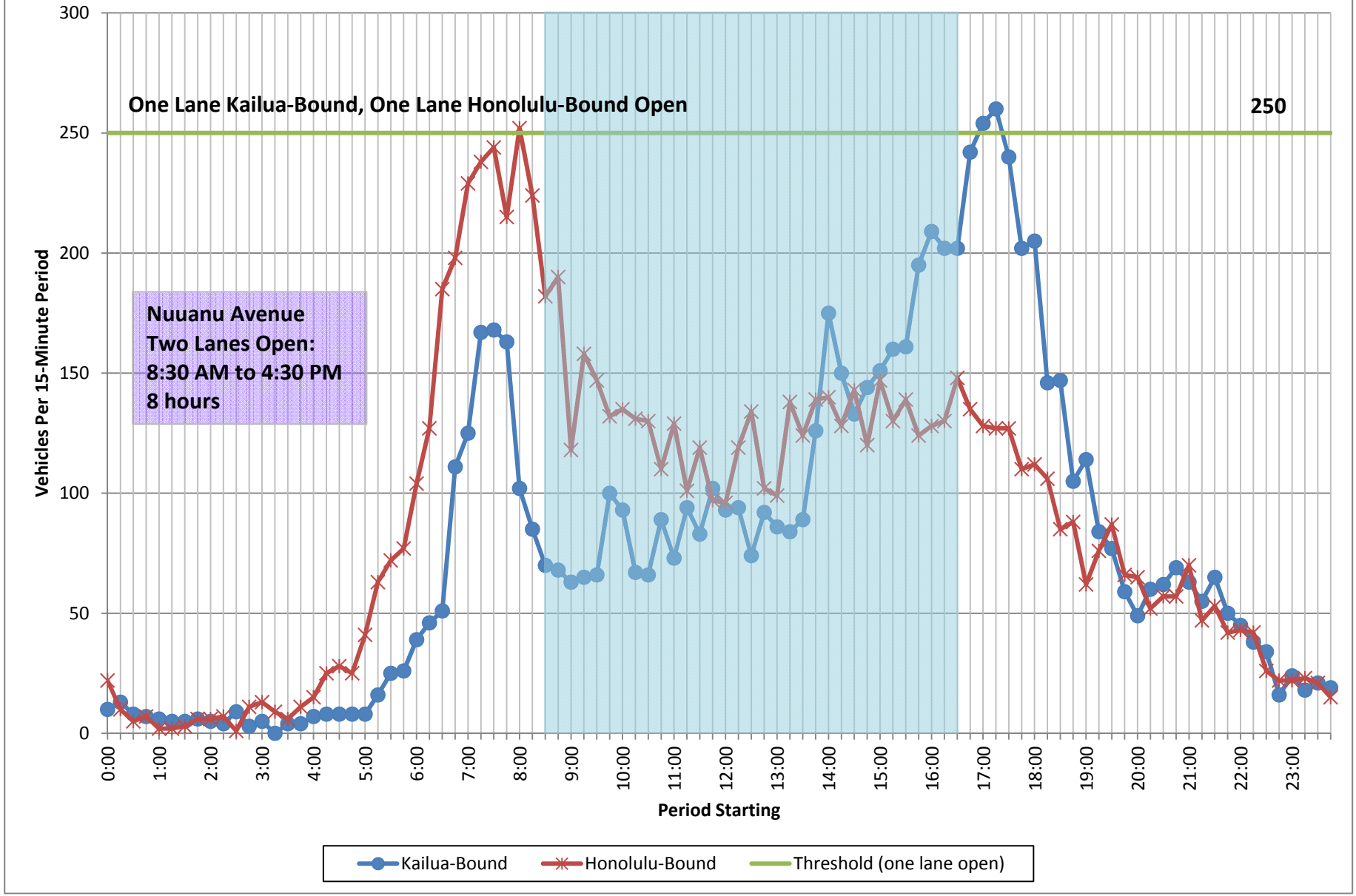


Figure 3.5
24-Hour Plot - Nuuanu Ave. between Robinson Ln. and Kawananakoa Pl.

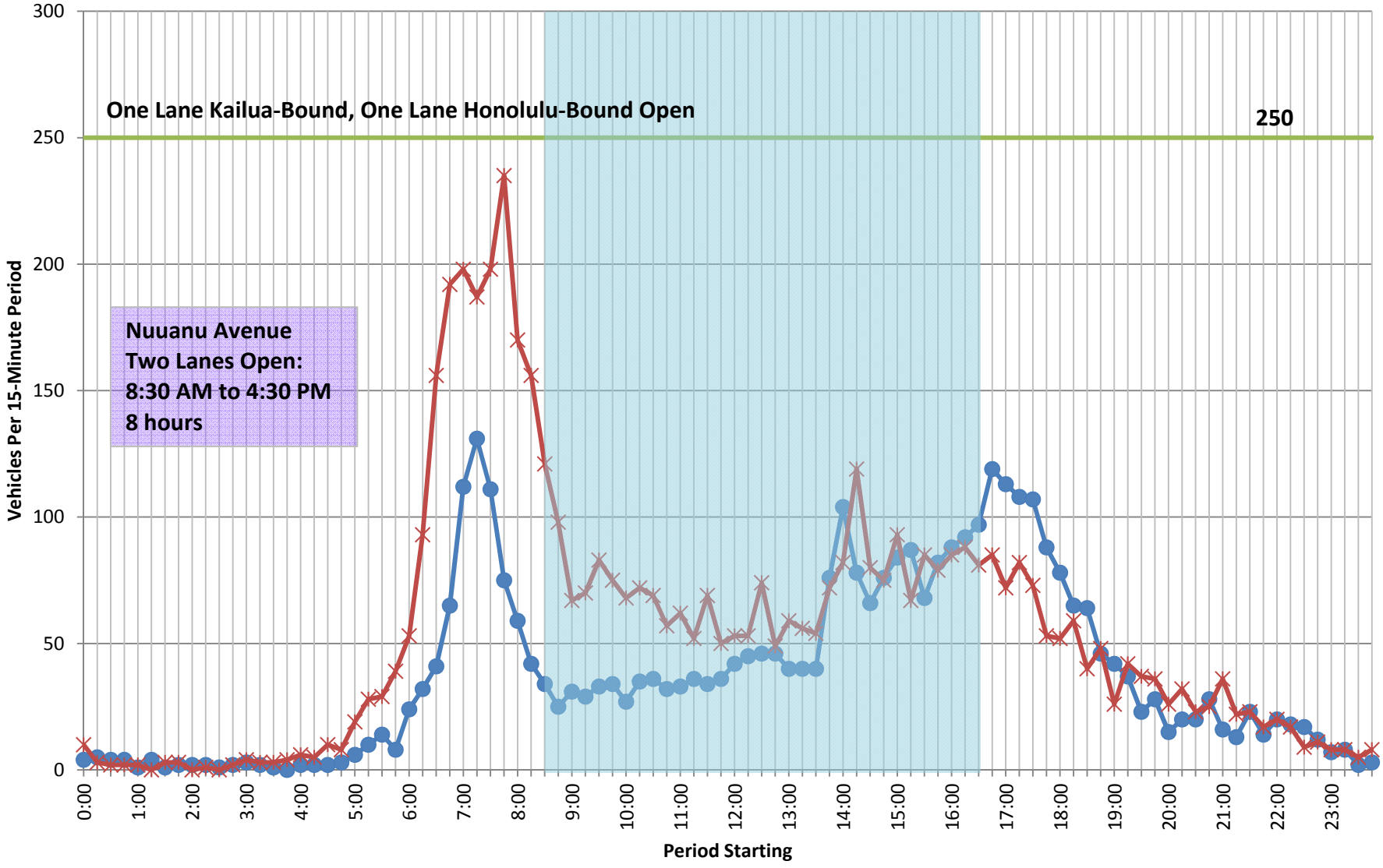


Figure 3.6
24-Hour Plot - Wyllie St. between Wyllie Pl. and Pikake Pl.

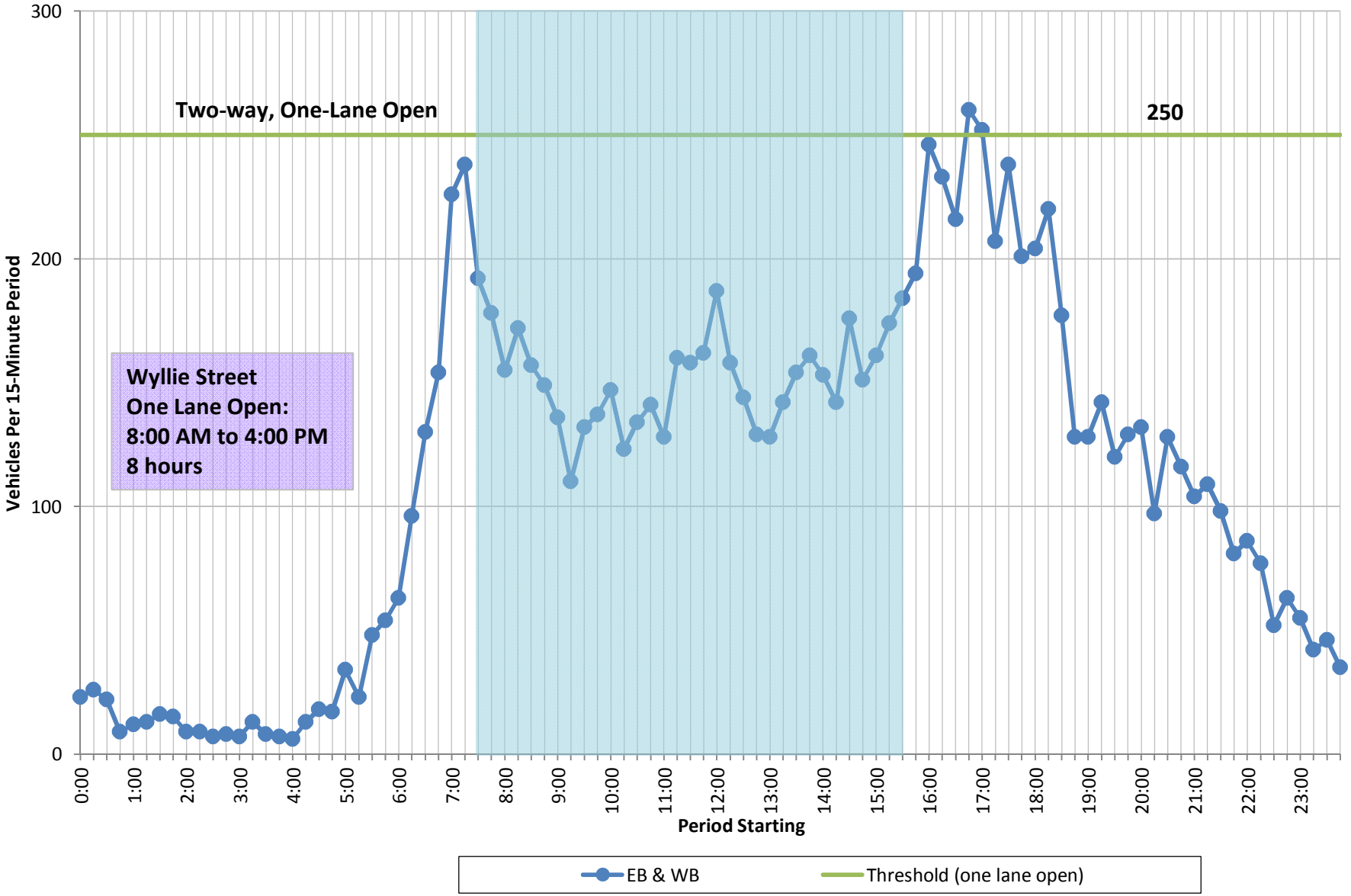


Figure 3.7
24-Hour Plot - Pali Hwy. between Coelho Way and Niolopa Pl. (Honolulu-Bound)

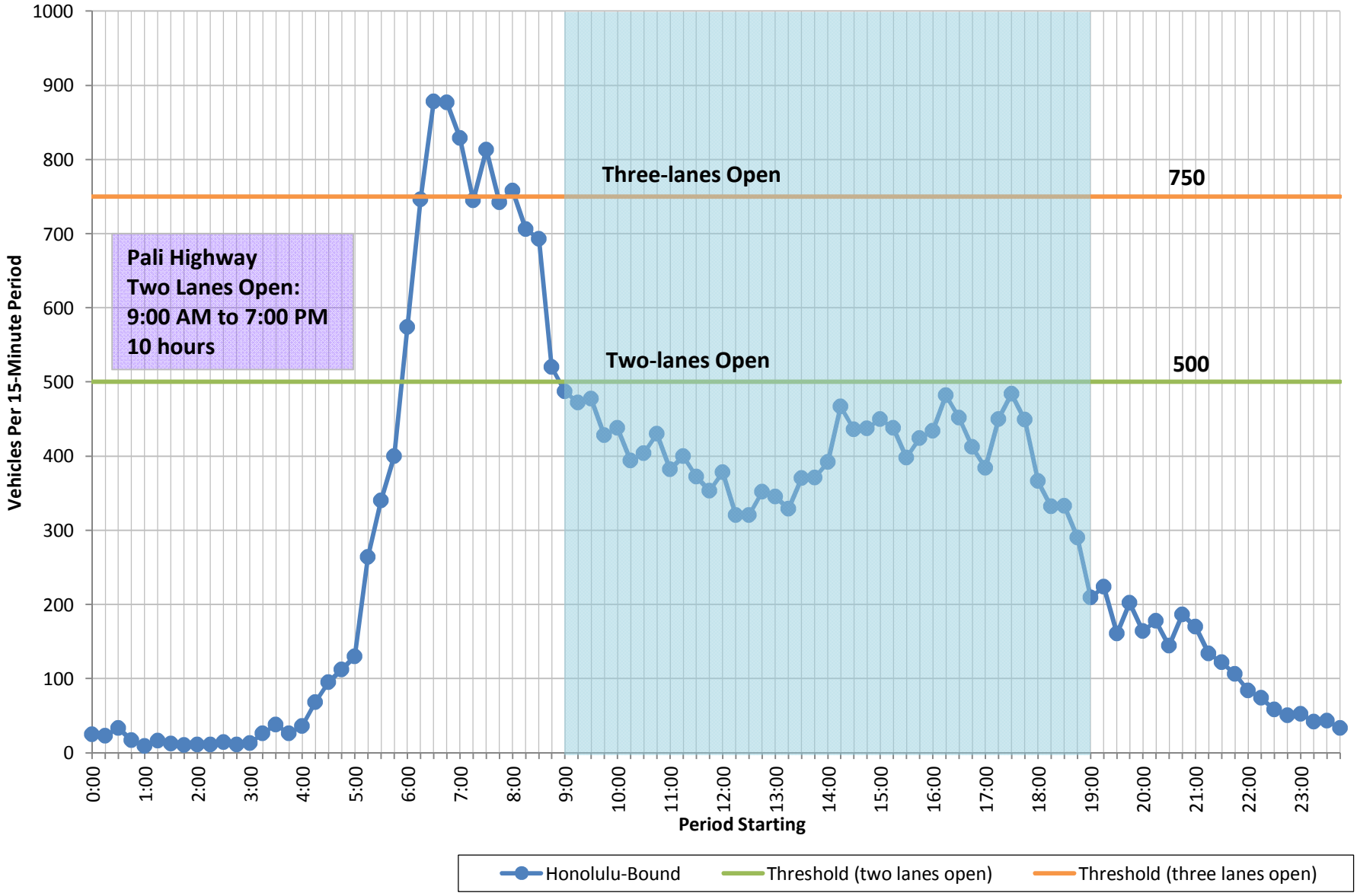


Figure 3.8
24-Hour Plot - Pali Hwy. between Ahipuu St. and Country Club Rd./Puiwa Rd. (Honolulu-Bound)

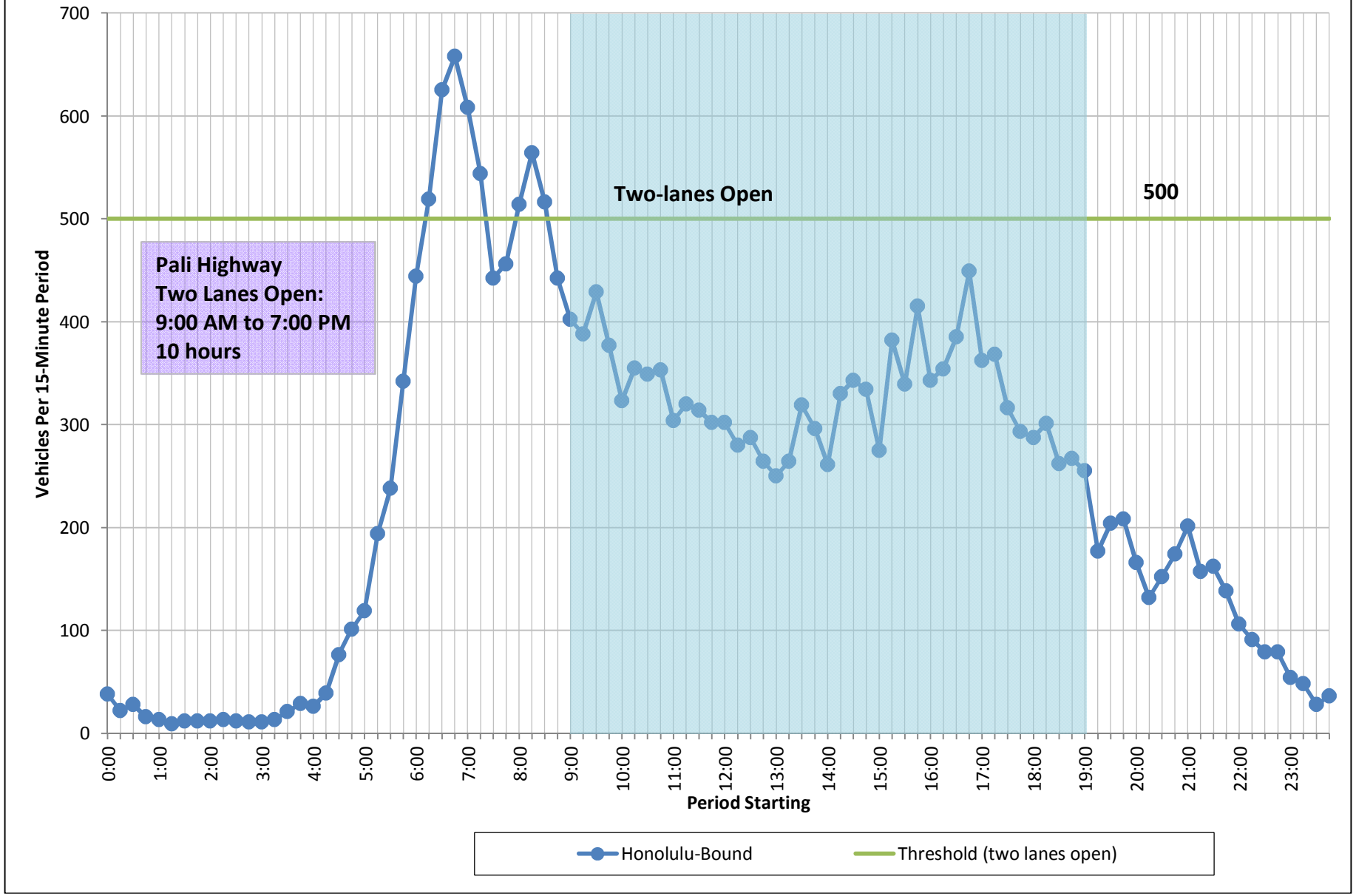


Figure 3.9
24-Hour Plot - Dowsett Ave. (South)

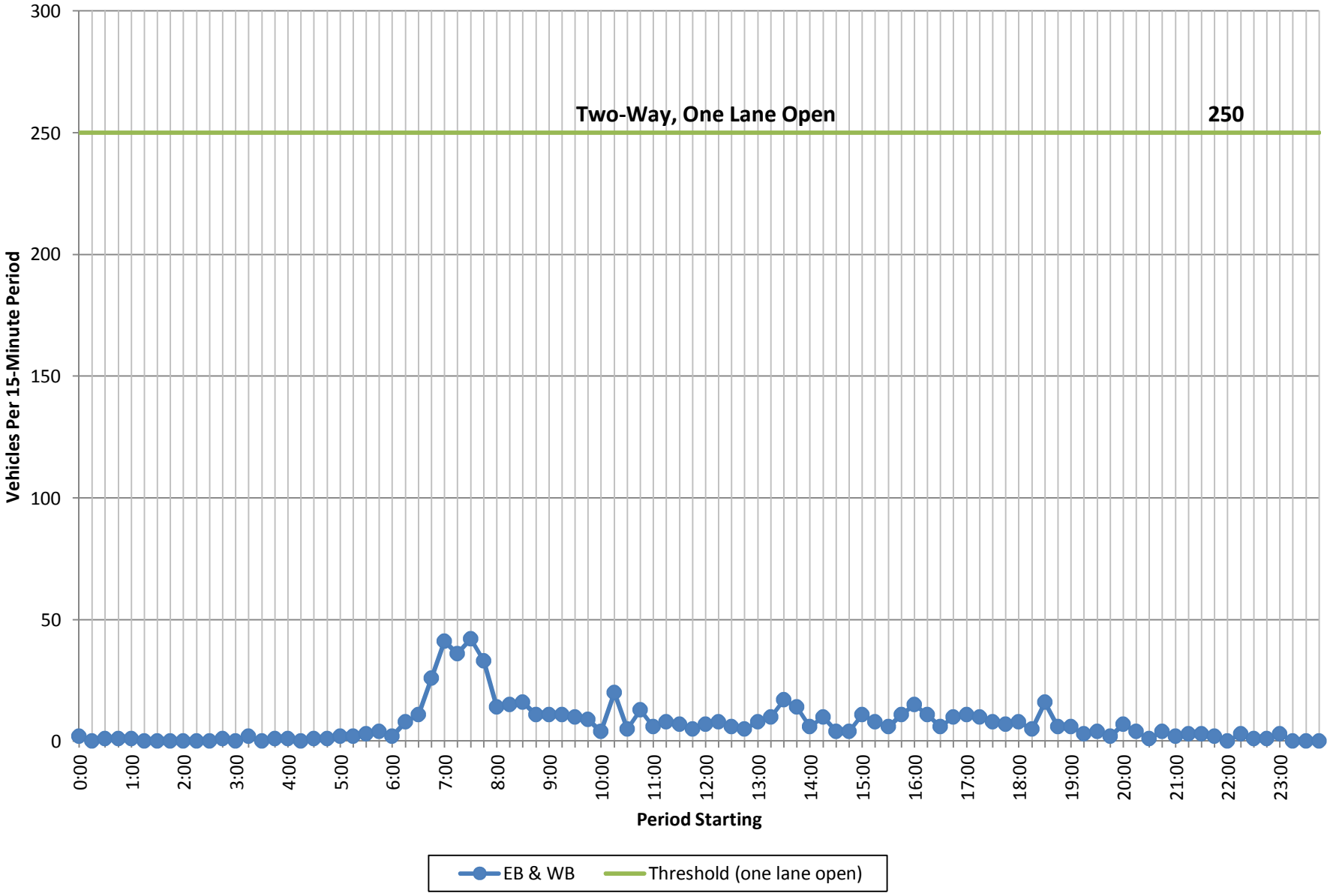


Figure 3.10
24-Hour Plot - Dowsett Ave. (North)

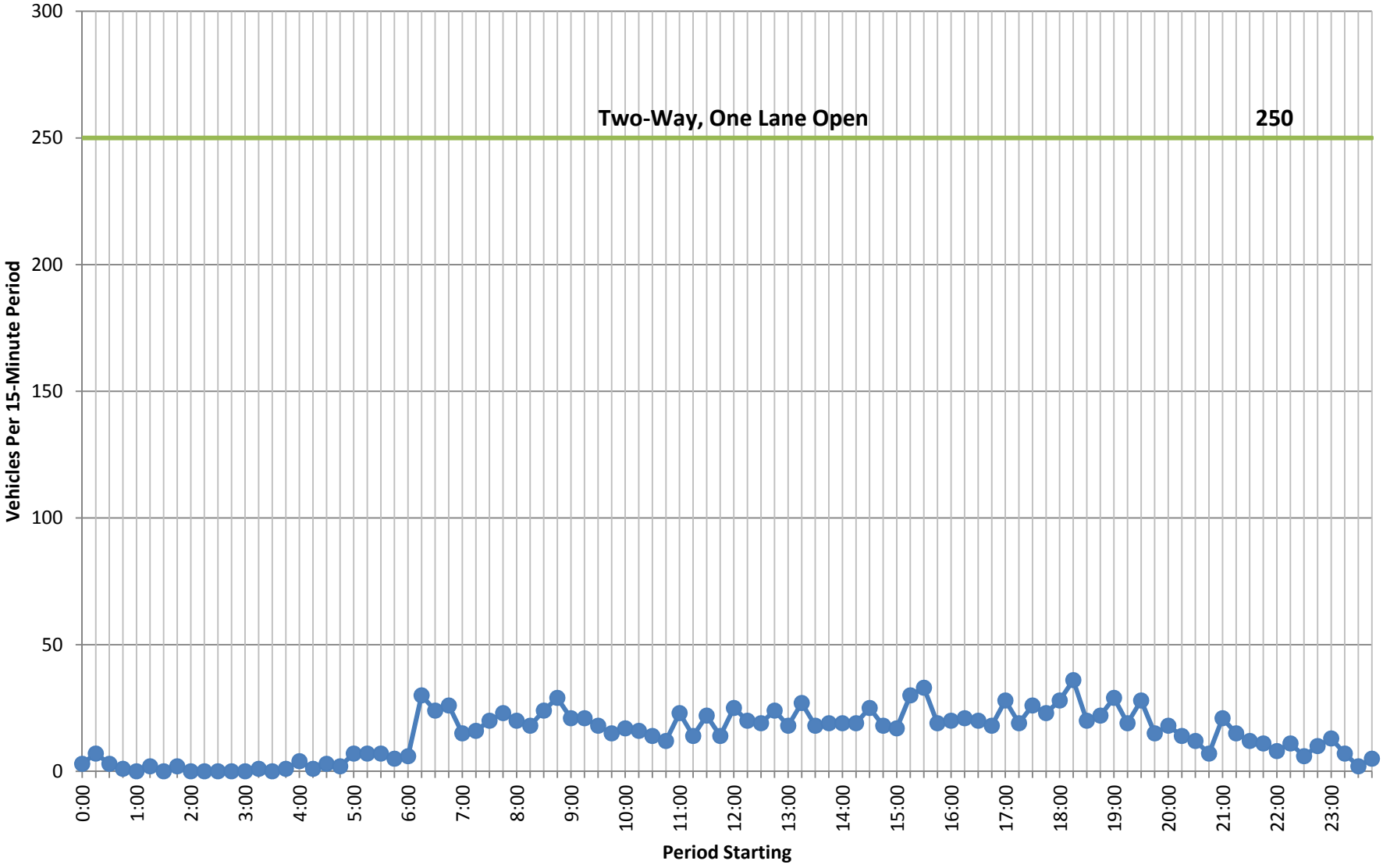
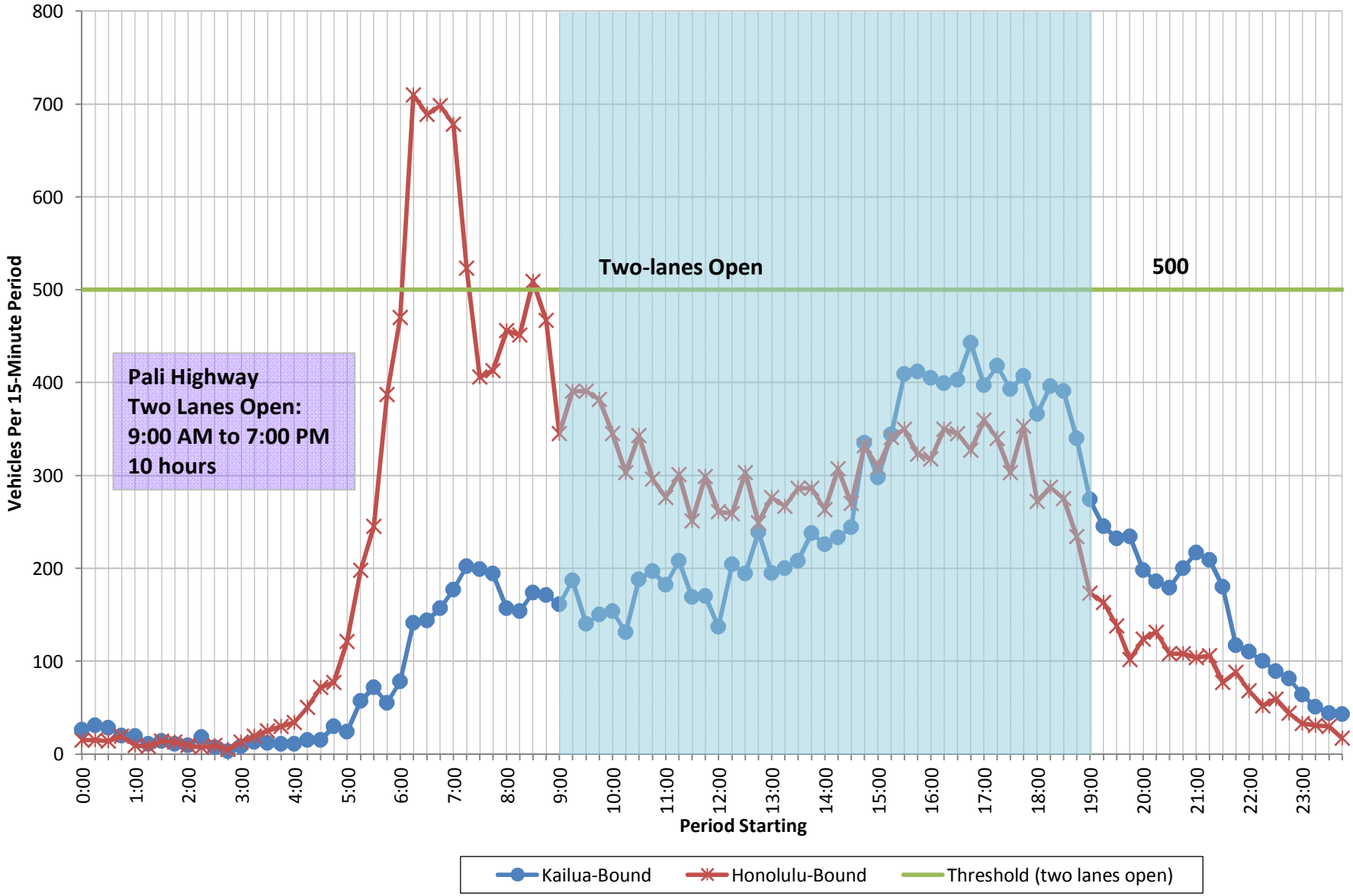
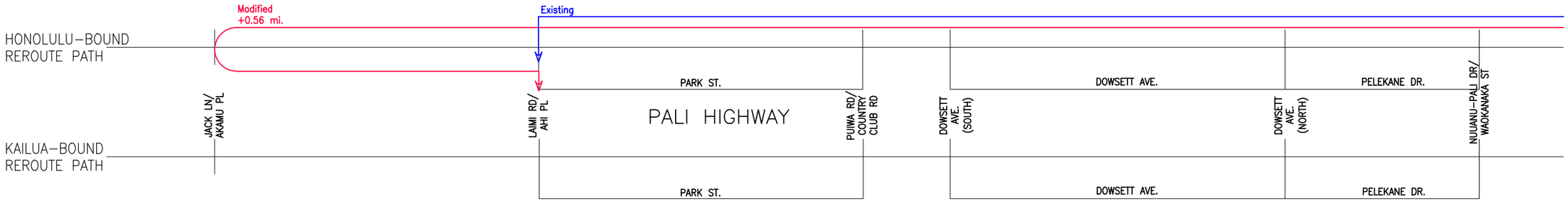


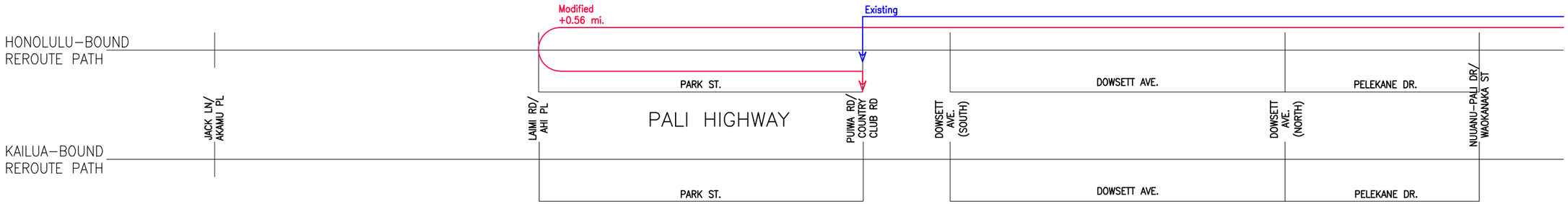
Figure 3.11
24-Hour Plot - Pali Hwy. between Nuuanu Pali Dr. (South) and Nuuanu Pali Dr. (North)





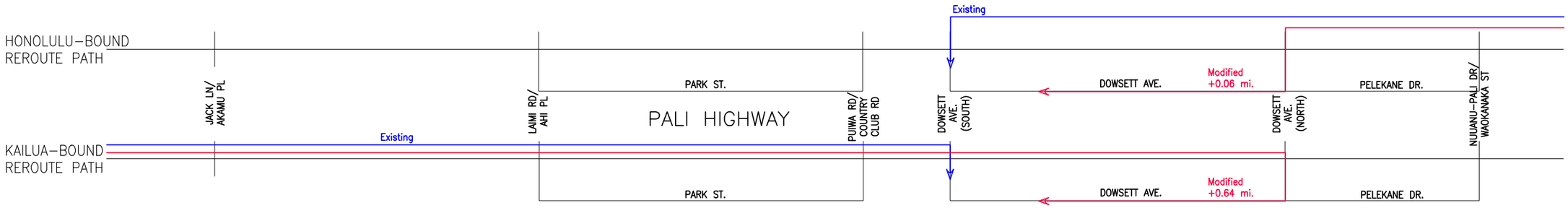
LAIMI ROAD CLOSURE REROUTE COMPARISON

SCALE: 1"=500'



PUIWA ROAD CLOSURE REROUTE COMPARISON

SCALE: 1"=500'



DOWSETT AVENUE (SOUTH) CLOSURE REROUTE COMPARISON

SCALE: 1"=500'

LEGEND

Modified +X mi. – AVERAGE DISTANCE "X" INCREASE OVER EXISTING CONDITIONS.

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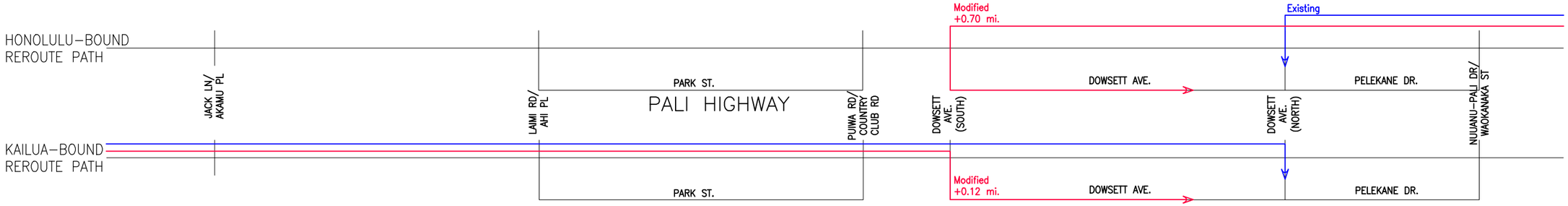
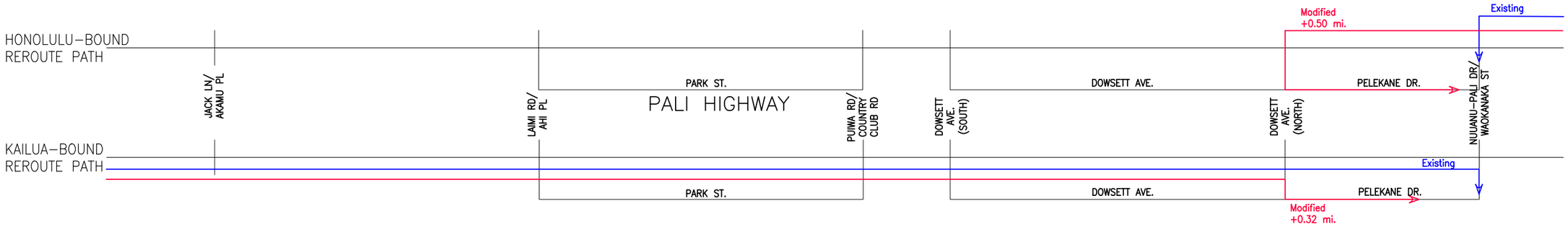
PALI HIGHWAY REROUTE COMPARISON

FIGURE
3.12A



DOWSETT AVENUE (NORTH) CLOSURE REROUTE COMPARISON

SCALE: 1"=500'



NUUANU–PALI DRIVE CLOSURE REROUTE COMPARISON

SCALE: 1"=500'

LEGEND

Modified +X mi. – AVERAGE DISTANCE "X" INCREASE OVER EXISTING CONDITIONS.

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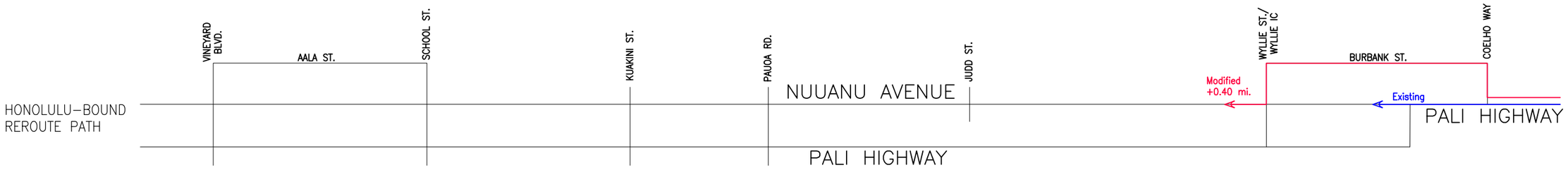
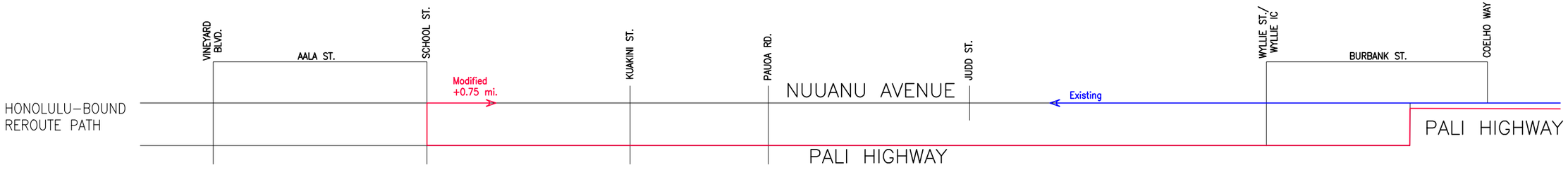
PALI HIGHWAY REROUTE COMPARISON

FIGURE
3.12B



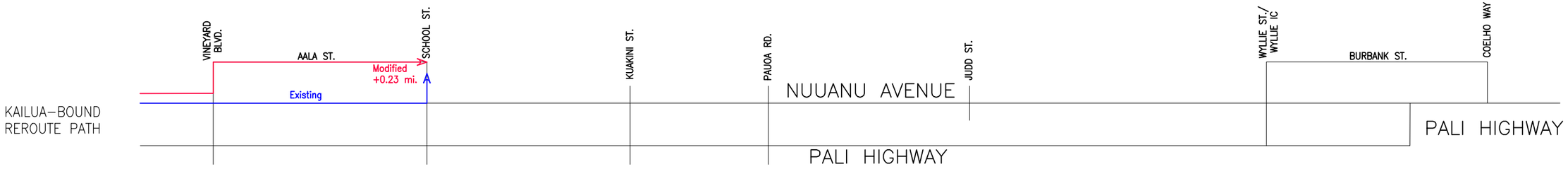
NUUANU AVENUE OFF-RAMP CLOSURE REROUTE COMPARISON (OPTION 1)

NOT TO SCALE



NUUANU AVENUE OFF-RAMP CLOSURE REROUTE COMPARISON (OPTION 2)

NOT TO SCALE



SCHOOL STREET CLOSURE REROUTE COMPARISON

NOT TO SCALE

LEGEND

Modified +X mi. – AVERAGE DISTANCE "X" INCREASE OVER EXISTING CONDITIONS.

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NUUANU AVENUE REROUTE COMPARISON

FIGURE 3.13

4. WORK ZONE IMPACTS ASSESMENT REPORT

4.1 Qualitative Summary of Anticipated Work Zone Impacts

Construction of the Project will require lane closures along Pali Highway, Nuuanu-Pali Drive, Dowsett Avenue and Nuuanu Avenue. These lane closures are anticipated to create delays along the major corridors due to a decrease in available capacity. Additionally, because of necessary roadway closures and restrictions along local roadways, construction is expected to reroute residential traffic throughout the Project area. Following the lane closure recommendations and proposed reroute paths as outlined in Section 3.5 will minimize the traffic impacts of the Project.

4.2 Impacts Assessment of Alternative Project Design and Management Strategies

With the temporary median modifications to Pali Highway in the Honolulu-bound direction, the corridor will continue to operate with three Honolulu-bound lanes during the AM commuter peak hour of traffic. When a lane is closed during construction hours, the traffic volume is not expected to exceed the 1,000 pc/ln/hr threshold for free flowing traffic.

During construction along Nuuanu Avenue, either one or two lanes will be closed in the Kailua-bound direction. In the event that two lanes are closed, Nuuanu Avenue will be contraflowed to provide one lane each in the Honolulu-bound and Kailua-bound directions. When two lanes are closed during construction hours, the traffic volume is not expected to exceed the 1,000 pc/ln/hr threshold for free flowing traffic.

During construction along Dowsett Avenue, the roadway will operate under two-way, one-lane conditions. Because Dowsett Avenue is a residential roadway, the number of vehicles using the roadway is low, and the traffic volume is not expected to exceed the 1,000 pc/ln/hr threshold for free flowing traffic. However, flaggers should be utilized during closure hours to prevent confusion along the roadway and allow for smooth operation.

During construction along Wyllie Street, the roadway will operate under two-way, one-lane conditions. When a lane is closed during construction hours, the traffic volume is not expected to exceed the 1,000 pc/ln/hr threshold for free flowing traffic. Flaggers should be utilized during closure hours to assist with traffic operations.

Proposed hours for lane closures along Pali Highway, Nuuanu Avenue, Dowsett Avenue and Wyllie Street are discussed in Section 3.5.

Specific lane closures and restrictions will only be implemented when construction is ongoing in the immediate vicinity of the necessary closure. Because the residential areas that are expected to be affected have limited traffic volumes, vehicles rerouted throughout the Project area are not expected to have a significant impact on existing traffic.

4.3 Measures of Effectiveness

Capacity and volume as described in Section 3.5 were the measures of effectiveness used for the analysis.

4.4 Analysis Tool Selection Methodology and Justification

The traffic analysis was based on analysis of 24-hour traffic patterns and peak hour turning count data. Recommended construction work hours were determined to coincide with lower traffic volumes.

5. SELECTED WORK ZONE IMPACTS MANAGEMENT STRATEGIES

5.1 Temporary Traffic Control Devices

This section provides an overview of strategies that will be employed to improve the safety and mobility of work zones and reduce the work zone impacts on communities and businesses.

Table 5.1 provides a summary of the various work zone management strategies that will be used for this Project.

Table 5.1 - Additional Traffic Management Strategies

Temporary Traffic Control	Needed
Traffic Control Devices	
1. Temporary signs	✓
2. Electronic message boards	✓
3. Channelizing devices	✓
4. Flaggers and uniformed traffic control officers	✓
5. Barricades	✓
6. Portable barriers	✓

5.2 Public Information

5.2.1 Public Awareness Strategies

All public communication will be handled by Hastings and Pleadwell LLC

The public awareness strategies include:

- Community Outreach
  - Neighborhood boards
  - Public hearings
- Resident Notification
  - Can include direct mail, flyers and electronic newsletters
  - Collect contact information for those interested in Project notifications
- News Media
- Website

5.2.2 Motorist Information Strategies

The motorist information strategies include:

- Electronic message boards
- Place electronic message boards out two (2) weeks prior to the start of construction so motorists are aware of Project.
- Regularly update electronic message boards to minimize confusion.

5.3 Transportation Operations

1. Early planning and coordination with the following agencies required by contractor:
    - Oahu Transit Services
    - Honolulu Police Department
    - Honolulu Fire Department
    - Hawaii Transportation Association
    - City and County of Honolulu Department of Emergency Management
    - Emergency Services
    - Other affected agencies
2. Coordinate the Project lane/roadway closures with other known projects, such as:
    - Pali Highway Resurfacing, Waokanaka Street to Kamehameha Highway and Pali Highway Lighting Replacement, Vineyard Boulevard to Kamehameha Highway
    - Pali Highway Resurfacing, Vineyard Boulevard to Waokanaka Street
    - City and County of Honolulu Complete Streets and roadway rehabilitation projects within the Project area

6. TMP MONITORING DURING CONSTRUCTION

The TMP Manager shall monitor all phases of the construction work and shall document any problems, issues, or recommendations for use by future projects.

7. REFERENCES

1. State of Hawaii Department of Transportation Highways Division, Work Zone Safety and Mobility Process, October 2007.
2. Federal Highway Administration (FHWA), Traffic Analysis Tools Volume IX: Work Zone Modeling and Simulation, December 2000.
3. Wesley R. Segawa & Associates, Inc., Pali Highway Resurfacing, Waokanaka Street to Kamehameha Highway and Pali Highway Lighting Replacement, Vineyard Boulevard to Kamehameha Highway Transportation Management Plan, September 2016.